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Part I
Human Performance

Enhancement Effects of Tongkat Ali (*Eurycoma longifolia*) Supplementation on Performance Functions Following Strength Training in Middle-Aged Women

Sarina Md. Yusof, Zaiton Zakaria, Aminuddin Abd. Hamid Karim, Suhana Aiman and Zulkifli Kadir

Abstract The purpose of the study was to evaluate the effect of strength training and Tongkat Ali (*Eurycoma longifolia*) supplementation on muscular strength and performance functions in middle-aged women. Thirty-one middle-aged women successfully participated in this study. Participants were screened, matched, and assigned randomly to either experimental (n = 17) or control group (n = 14). Both groups followed a supervised strength training program twice a week for 12 weeks. Experimental group was given 100 mg of Tongkat Ali (*Eurycoma Longifolia*) for 12 weeks while the control group was given placebo. Participants completed five performance measures: 6-m walk, stair climb, chair rise, lift and reach, and 8 RM leg and chest press. Measurements were conducted pre- and postintervention. Strength was assessed using 8 RM leg and chest press. Mixed between-within ANOVA was utilized to determine the significance change (at a 95 % confidence level ($p < 0.05$)) of the outcome measures from pre- to post-test and between groups. The results demonstrated statistically significant changes in all the outcome measures in both groups. Significant difference between groups ($p < 0.05$) was observed only in stair climb. In conclusion, strength training counteracted the age-related decline in muscle strength, while Tongkat Ali supplementation did not enhance muscle strength gain in middle-aged women following a strength training program.

Keywords Strength training · Strength · Performance functions · Tongkat Ali

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1 Introduction

Aging is usually related to increase in body weight, body mass index as well as decrease in physical abilities such as strength [1–4]. Among factors which influenced middle-aged women's body composition are diet, lifestyles, metabolic variables, and hormones [5–7]. Previous studies have shown that physical training either aerobic or resistance training conducted among the elderly, have provided positive results [8, 9]. It has been proven in previous studies that strength training among elderly women resulted in muscle hypertrophy and an increase in muscle strength [10] and that it was safe [10, 11]. Many studies have also shown that Tongkat Ali extracts have been used to measure libido among animals [12–15]. After series of testing conducted on this herbs, it was found that Tongkat Ali has the potential to be an antiglycemic agent when used in high dosage. Currently, there are not many studies on the consumption of Tongkat Ali extracts among humans. A study [16] reported the ergogenic effects of Tongkat Ali among male athletes where they participated in a strength training program and were given Tongkat Ali extract supplements for 8 weeks. Results showed there were increment in strength and muscle mass. Present study examined the effect of 12-week strength training and supplementation of Tongkat Ali on muscle strength and lipid profile among middle-aged women.

2 Methodology

2.1 Participants

A total of 60 participants who fulfilled the criteria were initially recruited through advertisements via pamphlets at UKM Medical Centre and nearby areas. Invitations were also extended to known groups. Participants were middle-aged women volunteers between 45 and 59 years of age and underwent two screening processes. Criteria for inclusion in the present study were females with no history of bone and cardiovascular disease, diabetes mellitus (fasting blood glucose < 6.1 mmol/l) or high blood pressure (> 160 mmHg systolic or > 90 mmHg diastolic), not on HRT, not involved in any other physical training program over the last 6 months, ambulatory and non-smokers. Exclusion criteria included (i) pregnant women, (ii) exercise-limiting non-cardiac disease (arthritis, peripheral vascular disease, or cerebral vascular disease), (iii) persons who had recently dieted for weight loss, (iv) body mass fluctuation >2 kg in the past year, and (v) those on medication that would affect bone metabolism.

After passing the Physical Activity Readiness Questionnaire (PAR-Q), health status examination and ECG tests were conducted by doctors involved in the study. A total of 31 participants successfully completed the intervention (experimental n = 17, control n = 14). Participants' baseline characteristics are as shown in

Table 1 Baseline physical characteristics

	Experimental (n = 17)	Control (n = 14)
Age (years)	53.7 + 4.8	51.6 + 4.4
Weight (kg)	60.4 + 8.4	64.5 + 10.3
Height (m)	1.51 + 0.05	1.56 + 0.06
BMI (kg/m^2)	26.3 + 3.7	26.3 + 3.4

Table 1. Participants' dropouts were due to the inability to commit to the 12 weeks of training, family problems, and need to accompany their children overseas. There were no cases of injuries due to training or side effects from consuming the supplements.

2.2 Anthropometric and Body Composition

Height and weight were measured using stadiometer and weighing machine (Tanita). Body mass index is calculated using mass formula (kg) divided by height × height (m^2).

2.3 6MW

Participants were instructed to walk along 32-m hallway at their own pace and attempt to cover as much ground as possible within 6 min. Motivation and support were given at 2nd and 4th minute. Pathway was marked every 5 m, and the distance covered is measured to the nearest meter. Fifteen minutes before time, researcher informed the participant and stopped with the sign "Stop" [17].

2.4 Stair Climb

Participants were required to ascend and descend 9 stairs (height 20 cm; width 27 cm) with railing on left and right at a safe and comfortable pace [18]. Railing can be used if required. The side used (left/right) is recorded. Time commenced soon as the foot moved to ascend and stop as both feet touch the floor. Two trials were given, and time was recorded to the nearest 0.01 s.

2.5 Chair Rise

An armless chair with a height of 43 cm, hard-seated, straight back was used to evaluate chair stand performance. Participant began from a seated position with arms folded across the chest. Participant performed 5 chair stands. Participant was to stand fully and completely sit with the back touching the back rest to be considered as one repetition. Investigators monitored visually to ensure that the chair stands were properly performed. The time after completing the fifth repetition as the participant was at standing position was recorded. Three minutes was given as rest interval between trials [19].

2.6 Lift and Reach

Participants were seated in front of a table with a rack of 32 cm height from the table in front of them. Participants were instructed to transfer a box (22.5 × 22.5 × 22.5 cm) from the table to the rack and back to the table as frequent as possible in 30 s. Movement from the table to the rack and back to the table is counted as one. Half count will also be counted. Weight of the box for women is 2 kg and additional 2 kg for men [19].

2.7 Leg and Chest Press

Lower body muscle strength was measured using 8 RM bilateral leg press test. Both feet were placed on the platform with the toes pointing upward. Legs were placed shoulder width apart or according to comfort with the knees bent at a 90°. Back of the body leaned against the pad. Hands can be placed on the handle at the side of the leaning pad. Upper body muscle strength was measured using 8 RM chest press. Participants lie with the shoulder 3–4 in. from the supporting shelf and the feet placed flat on the floor so as to have balance during the chest press. The handle is held using the overhand grip, and the arms are placed 4–6 in. wider than the shoulders with the elbows pointing outward. Before starting the test, participants did the warm-up with one set of 5–8 repetition presses using 50 % maximum. Three to four trials were done to obtain the 8 RM load with 3–5-min rest between each trial. The correct technique and full range of motion are needed for a successful trial. No injuries were reported.

2.8 Procedure

Both groups underwent the same strength training conducted by qualified trainers for 12 weeks, twice a week for 60 min per session involving 24 sessions on alternate days. Compliance with the study was 100 % of the programmed sessions.

The strength training program is comprised of seven exercises designed to increase muscle strength and physical function among the participants. Each training session consisted of warming-up phase (10 min); conditioning phase (45 min); and cooling-down phase (10 min). The warming-up and cooling-down activities involved stretching, walking, and/or stationary cycling. To provide overload effects to the upper and lower body muscle groups as well as the torso, the strength training included activities such as *chest press* (which focuses on the pectoralis major, anterior deltoid, triceps); *lat pull-down* (latissimus dorsi, biceps); *leg press* (quadriceps, gluteus maximus); *leg extension* (quadriceps); *leg curl* (biceps femoris, hamstring); and *calf raise* (gastrocnemius) on a multi-station (performance trainer gym examination 1500 s). The exercises were selected based on safety aspects, effectiveness, and the ability to perform the exercise. The upper and lower body exercises were conducted alternately to avoid muscle fatigue. To ensure overall effects of resistance training, *curl-up* (abdominal) and *planking* (lower back) were performed using one's body weight and holding it for as long as possible progressively.

Prior to the program, the participants underwent three familiarization sessions of strength training to familiarize with the type of exercise and to ensure correct techniques performed. After familiarizing with the equipment and the proper techniques, participants did the 8 RM test for each activity (chest press, leg press, lat pull-down, leg curl, leg extension, calf raise). For the first two weeks, participants did two sets of 8–10 repetitions for every exercise based on 60 % of estimated 1 RM. The following two weeks and subsequent weeks until the 12th week, participants did two sets of 8–10 repetitions with the weight progressively increased every two weeks. During training, participants were required to perform through the full range of motion and with a tempo of 2, 1, and 2 s. One-minute rest was allocated between sets.

For the experimental group, participants were given capsules containing 100 mg water-based *Eurycoma longifolia* extracts (22 % peptide) 7 days a week for 12 weeks. The control group was given placebo capsules containing 350 g maltodextrin 7 days a week for 12 weeks.

2.9 Statistical Analysis

Data are presented as mean ± standard deviation (SD). Distribution of score was tested for normality and homogeneity before the hypothesis testing was conducted. Mixed between-within ANOVA statistical approach was used to determine the effect of the intervention. Results obtained are represented as mean $\pm$ SD. Partial η^2 was used to indicate treatment effect size subscribing to [20] guidelines. Alpha level was set at 0.05 ($p < 0.05$). The SPSS statistical software program version 16 was used to analyze the data.

3 Results

3.1 *Participants' Characteristics*

Both groups showed no significant difference in physical characteristics (Table 1), at preintervention stage. Physical characteristics of the participants by age group are presented in Table 1.

3.2 *Performance Functions*

3.2.1 6MW

Significant difference was found between pro- and postintervention in 6 MW in both groups (Wilk's lambda = 0.412, F (1, 29) = 41.312, $p < 0.05$, partial eta-squared = 0.588). Experimental group exhibited significant changes in 6 MW [483.29 (±50.5) to 554.76 (±52.2) m, t (16) = −4.823, $p < 0.05$), eta-squared = 0.60]. Significant change was also noted in the control group [491.71 (±51.0) to 543.35 (±53.7) m, t (13) = −4.702, $p < 0.05$, eta-squared = 0.62]. However, no significant difference was found between groups [t (29) = 1.227, $p > 0.05$].

3.2.2 Stair Climb

Significant improvement from preintervention in stair climb was seen in the intervention group (Wilk's lambda = 0.715, F (1, 29) = 11.554, $p < 0.05$, partial eta-squared = 0.28). Intervention group showed significant improvement [8.11 (±2.26) to 6.94 (±1.16) s, t (16) = 3.238, $p < 0.05$, eta-squared = 0.39]. However, no significant difference was found in control [7.78 (±1.56) to 7.18 (±1.22) s, t (13) = 1.622, $p > 0.05$, eta-squared = 0.17]. Intervention group recorded time reduction of 14 % from the control (Fig. 1).

3.2.3 Chair Rise

Significant difference was seen from preintervention (Wilk's lambda = 0.447, F (1, 29) = 35.914, $p < 0.05$, partial eta-squared = 0.553). Intervention showed significant improvement [10.10 (±2.15) to 8.08 (±2.11) s, t (16) = 5.034, $p < 0.05$), eta-squared = 0.61]. Significant improvement was also found in control group [10.96 (±1.67) to 9.25 (±2.24) s, t (13) = 3.541, $p < 0.05$, eta-squared = 0.49]. However, no significant difference between two groups was noted.

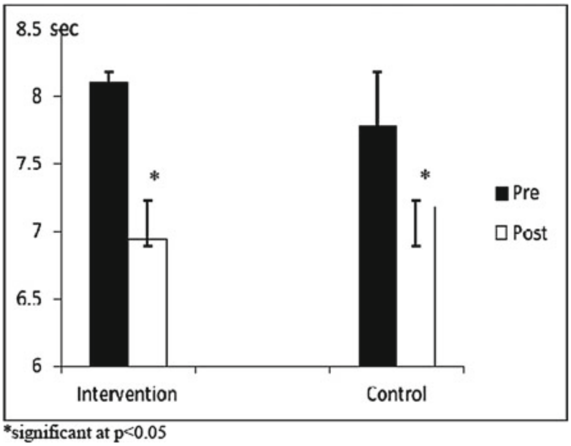

Fig. 1 Stair climb performance

3.2.4 Lift and Reach

Significant difference was noted in lift and reach during post-test (Wilk's lambda = 0.338, F (1, 29) = 56.854, p < 0.05, partial eta-squared = 0.662). Intervention group showed significant improvement [14.82 (±3.22) to 18.35 (±3.08), t (16) = −5.353, p < 0.05), eta-squared = 0.64]. Significant improvement was also found in the control [15.07 (±2.3) to 18.71 (±3.2), t (13) = −5.387, p < 0.05, eta-squared = 0.69]. No significant difference was found between the groups.

3.3 Strength

3.3.1 Chest Press

Chest press in the experimental group showed a significant increase [31.78 (±9.9) lbs. to 53.14 (±11.9) lbs., t (16) = −7.994, p < 0.05]. The effect size for this group was large at 0.8. The control group also showed a significant increase in the chest press [36.55 (±7.2) to 57.57 (±10.0) lbs., t (13) = −6.768, p < 0.05]. The effect size in this group was also large at 0.8. However, the effects of consuming *E. longifolia* for the chest press were not significant when compared to the control at t (29) = 1.505, p > 0.05.

3.3.2 Leg Press

There was no significant difference in the measurement of leg press for both the groups before intervention. Adaptation to strength training showed a significant increase in leg press for the experimental group (111.76 (±38.4) to 148.52 (±51.0), t = −3.878, df (16), p < 0.05) as compared to before intervention. The effect size from intervention was large at 0.48. The control group also showed a significant increase [122.14 (±41.7) to 155.71 (±42.6), $t = -3.954$, df (13), $p < 0.05$]. The effect size from intervention for this group was large at 0.54. The effects of consuming Tongkat Ali did not show much significant difference as compared to the control group at t (29) = 0.420, $p > 0.05$.

4 Discussion

The purpose of this study was to determine the effect of strength training and Tongkat Ali supplementation in middle-aged women. Results from this study showed that strength training twice per week increases muscle strength. The findings support their previous studies which showed that sufficient training intensity improves muscle strength even among the elderly [21–25]. Both groups experienced an increase in muscle strength with huge effect size due to adaptations impacted by the effects of strength training which contributed to enhanced neural responses and adaptations [26]. The benefits obtained with the increase in strength can be noted in the improvements in physical performance and thus reduce the risk of falling and injuries. Increase in strength directly influences improved functional activities.

The present study shows that progressive moderate-intensity strength training is able to improve functional performance in middle-aged women. These findings supported by [27] in which it was found that strength training protocol strength or power specific could increase performance function. In another study, apart from increasing muscular strength and balance, strength training was found to improve performance function by reducing chair rise time [28].

Improvement in performance functions occurred due to adaptation to strength training contributed by improvement in physical capacity that is strength [28–30]. Improvement which occurs is related to increment of type II muscle fiber cross sectional area due to adapatation to strength [31] which increases muscular strength. Upper and lower extremities strength are required in conducting Activities of Daily Living-(ADL) to increase individual functional independence [32]. It is clear that neuromuscular functional adapatation allows easier execution of functional activities [29].

Improvement in lower extremity strength is related to mobility ability. This is confirmed by [33] which shows that the elderly who have better strength require less maximal strength in executing daily activities which caused less fatigue, and thus, they are able to live independently. Apart from increment in strength, strength training is also able to improve patella strength which contributes to less stretch to the tendon which allows faster motor movement in performance function [34].

Tongkat Ali extracts have been rarely tested to increase physical strength apart from being used as an aphrodisiac [35] and is rarely tested for its effectiveness on humans. There was, however, a study conducted on humans, using young male athletes [16]. The findings from the present study did not support the findings of

[16] which showed that consuming Tongkat Ali supplements can enhance the effects of strength training. This suggests that the ergogenic characteristics of Tongkat Ali are not as effective when given to middle-aged women as compared to young male athletes. The findings from this study also showed that the consumption of Tongkat Ali supplement has no influence on performance functions.

The research design, controlled random study, and the high compliance among the participants provide credibility to the present study. There is a possibility that the time frame of 12 weeks was too short for consumption of Tongkat Ali to exert real influence on strength among the middle-aged women. A longer time frame could have provided a more obvious effect.

Our results confirm those of previous reports suggesting that decline in power and strength is age-related. Reference [24] indicated significant reduction in Type II muscle fiber area with aging which will influence force production. Type II fibers are characterized by larger size, more force, and less endurance capacity. In elderly persons atrophy of type II fiber are associated with the decline of specific fiber satellite cells content which accompanies the skeletal muscle loss with increasing age [25]. There was a tendency of delay in muscle fiber conduction velocity due to aging [26]. Reference [28] suggested that improvement in power in the lower limb may increase strength which also required in performing daily activities.

It is concluded that moderate-intensity strength training for 12 weeks was able to increase muscle strength; however, the consumption of Tongkat Ali extract did not enhance strength gain nor the performance function gains. Similar study with male participants and a longer consumption period is needed to ensure its effectiveness.

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‘PIM’ Training with e-Putting Imagery Script Helps to Improve Putting Scores and Moods of the Golfers, Is This Really True?

Mazlan Ismail

Abstract The aim of the study was to investigate the effectiveness of using e-putting imagery script in PIM training to evaluate putting scores and moods of the golfers. Sixty-three male golfers aged 18–25 years with 1- to 3-year experience (M = 1.40, SD = 0.58) participated in this study. Three groups were randomly assigned (i.e., PIM group, traditional imagery group, and control group), and three assessments were conducted. The findings demonstrate that the PIM group improved putting performance and positive mood and were able to control negative mood better compared to the traditional imagery group and control group. Coaches also recommended using e-putting imagery script during the PIM training program. Future studies should focus on female, elite and golfers of different age groups.

Keywords e-putting imagery script · PIM training · Putting distance · Moods

1 Introduction

Previous studies clearly suggest that Practice in Mind (PIM) training program which emphasized the seven PETTLEP components helps to improve skills of athletes [1, 2]. All the PETTLEP components are also beneficial in sports performances particularly in golf [1, 3–8]. For instance, previous researcher found that bunker shot of the golfers was improved for PETTLEP imagery group [6]. Furthermore, the post-test results also showed that all groups improved including physical practice when combined with PETTLEP imagery. But, no improvement showed for both groups using PETTLEP imagery alone or only physical practice. According to [1],

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PIM training program that consists of three times per week combination of mental and physical practice within six weeks span will also help in improving golf putting performance. In fact, the stimulus and responsive emotions, as well as facilitative direction imagery, help golfers in the PETTLEP group [1].

Imagery is unpredictable and associated with the mood of athletes [9]. In golf, health could be improved by walking, but performance is reduced if unpleasant mood exist [10].

Previous researchers have suggested that technical training aids such as video, audio, and written script can be used by the athletes during imagery practice [1, 8]. For instance, previous study tried to examine 40 male amateur golfers with different training aids such as written script, video, and audio [8]. Also clear evidence found [1] that audible device helps golfers when practicing imagery at the putting green. Furthermore, mobile device for PDA or smartphones seems to be useful for golfers to use during imagery practice, also need further research. Hence, the aim of this study was to investigate the effectiveness of using e-putting imagery script in PIM training particularly to evaluate putting performance and moods of the golfers.

2 Methodology

2.1 Participants

Sixty-three male golfers aged between 18 and 25 years (M = 20.83, SD = 1.94) participated in this study. All golfers were considered beginners who had between 1 and 3 years of playing experiences (M = 1.40, SD = 0.58) [5, 12]. For the selection of participants, MIQ-R was used to identify the imagery ability of the golfers before they engage with the intervention program [13, 14]. A one-way ANOVA results indicated that all participants had equal imagery ability before the intervention program. Next, all participants were randomly assigned into three groups: Practice in Mind group, PIM; traditional imagery group, TI; and control group.

2.2 Instrumentation

PIM intervention guides. For the purpose of the study, the researcher developed e-putting imagery script for android electronic device that will help the participants practice their imagery (see Fig. 1). The PIM training program was based on seven PETTLEP components [1, 2]. For instance, *physical component* such as golf clothing, *emotion component* such as feel like a real putting task, and *timing component* such as imagine from walking to the green until to get a birdie. The *environment component* such as participants performed putting on the standard indoor putting mat in a standing position by holding the putter 10 m from the

Fig. 1 e-Putting imagery script

putting green. *Task component* such as they were asked to perform consistent with an actual task and *perspective component* such as to read their own imagery scripts. Lastly, for *learning component,* participants were asked to modify their own script after each and every imagery session they partake.

Putting task performance and scoring

Golfers were provided five standard golf balls. They were advised to use their own putter to perform the task. The golfers were performed 10 putting strokes at the standard indoor putting mat. They were scored based on scoring suggested by the previous study [8] (see Fig. 2).

Brunel Mood Scale

BRUMS [15] was used to assess mood of the participants prior to putting performance. This questionnaire considers a 24-item mood adjective checklist, with four items relating to each of six transitory mood states: anger, confusion, depression, fatigue, tension, and vigor. Each subscale contains four items; for example, the Anger Scale includes items such as *annoyed*, *bitter, angry,* and *bad tempered,* i.e., items no: 7, 11, 19, and 22 and the Vigor Scale includes items such as *lively, energetic, active,* and *alert,* i.e., items no: 2, 15, 20, and 23. Respondents indicate whether they have experienced such feelings on a 5-point scale, i.e., 0 = not at all, 1 = a little, 2 = moderately, 3 = quite a bit, and 4 = extremely. When responses from the four items in each subscale are summed, a subscale score in the range 0–16 is obtained. In this study, the Cronbach alpha coefficient for the scale was 0.86.

2.3 Procedure

During the initial meeting, all golfers completed the BRUMS questionnaire. Next, they were asked to perform the 10 putting strokes from a 6-ft distance [11]. For the

Fig. 2 The shape and position of the scoring system

purpose of the study, golfers have to complete three training sessions per week for six-week training program. As suggested by [1, 6], such combination of imagery and physical practice improved athletes' performance. Also similar amount of imagery and physical practices should be performed in a week [1, 5]. Hence, golfers in PIM group performed 10 physical practices right after 10 imagery practices which are in-line with the previous putting study [1]. The practice sessions in the test were performed 10 meter away from the putting green. It should be similar session as per test, beside to avoid any disruption to the club members to practice [1, 16].

In the PIM group, e-putting imagery script was provided to each golfer. All golfers were also advised to do some modification on the script based on their own personal putting skill right after each of the sessions. Next, golfers read and mentally perform 10 successful putting strokes, followed by 10 physical practices at the putting mat 10 m away from the putting green [1]. Overall, 20 min was taken to practice imagery including physical practices.

The golfers in traditional imagery group also completed 10 imagery practices and 10 physical practices at the indoor putting mat inside the club building. The imagery script used is considered as a standard procedure for conventional imagery method [4, 5]. This written script was printed for each of the golfer, compiled together in their individual file. They were also instructed to record all the activities regarding the program and practices in a diary including the total number of sessions and places where imagery was being practiced. Meanwhile, only 10 physical practices were performed by the golfers in the control group, also for 3 times per week in 6 weeks of training program. Golfers in this group were also advised to write everything regarding the training in a diary given by the researcher. The second assessment was conducted after 4 weeks followed by a third assessment after 6 weeks of intervention program.

3 Results

Preliminary assumption testing was conducted and the scores are normally distributed. The results of one-way repeated measures ANOVA were performed for putting performance and moods across three assessments, namely pretest, second test, and post-test in the PIM group, traditional group, and control group, respectively. Table 1 shows the descriptive statistics followed by pairwise score in Tables 2, 3, and 4

PIM group: There was a significant effect on the three assessments (Wilks' Lambda = 0.35, F (2, 19) = 17.33, p = 0.000, multivariate partial eta-squared = 0.65). Table 2 shows that the pairwise for putting scores increase from the pretest to the second test (M = 28.86, SD = 3.25 vs. M = 31.48, SD = 3.63, respectively) was statistically significant (p = 0.001). There was a statistically significant increase from the second test to the post-test (M = 34.52, SD = 0.97, p = 0.002). Finally, there was a statistically significant increase from the pretest to the post-test (p = 000).

For positive mood, the result shows that there was a statistically significant effect in the three assessments (Wilks' Lambda = 0.678, F (2, 19) = 4.52, p = 0.03, multivariate partial eta-squared = 0.32). The pairwise for positive mood in Table 3 indicates that the PIM group increase from the pretest to the post-test (M = 11.90, SD = 2.28 vs. M = 13.52, SD = 1.57, respectively) was statistically significant

Table 1 Descriptive statistics for putting performance, positive mood, and negative mood in pretest, second test, and post-test in PIM group, TI group, and control group

IV	Pretest		Second test		Post-test		DV
	Mean	SD	Mean	SD	Mean	SD	
PIM	28.86	3.25	31.48	3.63	34.52	4.42	PT
TI	27.14	4.51	27.19	2.25	27.00	3.15	
CG	27.38	4.31	24.71	3.96	24.95	2.85	
PIM	11.90	2.28	12.38	2.04	13.52	1.57	PM
TI	10.90	1.90	11.71	1.74	12.43	2.11	
CG	12.57	3.40	12.62	2.78	12.19	2.16	
PIM	8.74	2.21	7.87	1.31	7.91	1.42	NM
TI	9.51	1.77	8.32	1.22	8.92	1.61	
CG	7.80	2.22	7.73	2.37	6.96	2.56	

Note: *PIM* practice in mind group, *TI* traditional imagery group, *CG* control group, *P* putting, *PM* positive mood, *NM* negative mood

Table 2 Pairwise for putting scores in PIM group and control group

(I)	(J)	Mean dif (I–J)	Std. error	Sig.[a]	95 % confidence interval for difference	
					Lower bound	Upper bound
PIM group						
1	2	−2.62*	0.60	0.001	−4.185	−1.053
	3	−5.67*	0.95	0.000	−8.141	−3.193
2	1	2.62*	0.60	0.001	1.053	4.185
	3	−3.05*	0.74	0.002	−4.985	−1.110
3	1	5.67*	0.95	0.000	3.193	8.141
	2	3.05*	0.74	0.002	1.110	4.985
Control group						
1	2	2.67*	0.75	0.006	0.706	4.628
	3	2.43	1.07	0.102	−0.362	5.219
2	1	−2.67*	0.75	0.006	−4.628	−0.706
	3	−0.24	0.86	1.000	−2.489	2.013
3	1	−2.43	1.07	0.102	−5.219	0.362
	2	0.24	0.86	1.000	−2.013	2.489

*The mean difference is significant at the 0.05 level
[a]Adjustment for multiple comparisons: Bonferani

Table 3 Pairwise for positive mood scores in PIM group

(I)	(J)	Mean dif (I–J)	Std. error	Sig.[a]	95 % confidence interval for difference	
					Lower bound	Upper bound
PIM group						
1	2	−0.48	0.51	1.000	−1.821	0.868
	3	−1.62*	0.55	0.024	−3.055	−0.183
2	1	0.48	0.52	1.000	−0.868	1.821
	3	−1.14	0.49	0.095	−2.434	0.148
3	1	1.62*	0.55	0.024	0.183	3.055
	2	1.14	0.49	0.095	−0.148	2.434

*The mean difference is significant at the 0.05 level
[a]Adjustment for multiple comparisons: Bonferani

(p = 0.024). Meanwhile, there was no statistically significant difference from the pretest to the second test (M = 12.38, SD = 2.03) and from the second test to the post-test, respectively. Finally, the results revealed that there was no statistically significant difference in the three assessments for negative mood (Wilks' Lambda = 0.864, F (2, 19) = 1.49, p = 25, multivariate partial eta-squared = 0.14).

Traditional group: There was no statistically significant effect in the three assessments for putting performance (Wilks' Lambda = 0.176, F (2, 19) = 2.024, p = 0.16, multivariate partial eta-squared = 0.18). Additionally, there was no

Table 4 Pairwise for negative mood scores in TI group

(I)	(J)	Mean dif (I–J)	Std. error	Sig.[a]	95 % confidence interval for difference	
					Lower bound	Upper bound
TI group						
1	2	1.19	0.46	0.055	−0.022	2.403
	3	0.59	0.54	0.860	−0.819	2.000
2	1	−1.19	0.46	0.055	−2.403	0.022
	3	−0.60	0.35	0.310	−1.519	0.319
3	1	−0.59	0.54	0.860	−2.000	0.819
	2	0.60	0.35	0.310	−0.319	1.519

*The mean difference is significant at the 0.05 level
[a]Adjustment for multiple comparisons: Bonferani

statistically significant effect for positive mood in the three assessments (Wilks' Lambda = 0.176, F (2, 19) = 2.024, p = 0.16, multivariate partial eta-squared = 0.18). For negative mood, the result shows that there was a statistically significant effect in the three assessments (Wilks' Lambda = 0.705, F (2, 19) = 3.984, p = 0.03, multivariate partial eta-squared = 0.29). The pairwise for negative mood is shown in Table 4 indicates that the TI group decrease from the pretest to the second test (M = 9.51, SD = 1.77 vs. M = 8.32, SD = 1.22, respectively) was statistically significant (p = 0.05).

Control group: There was a statistically significant effect in the three assessments for putting performance (Wilks' Lambda = 0.61, F (2, 19) = 6.01, p = 0.009, multivariate partial eta-squared = 0.39). Table 2 shows that the pairwise for putting performance decrease from the pretest to the second test (M = 27.38, SD = 4.30 vs. M = 24.71, SD = 3.96, respectively) was statistically significant (p = 0.006). There was no statistically significant difference in putting performance in the post-test (M = 24.95, SD = 2.85) from the pretest (p = 0.102) and the second test (p = 1.000). Meanwhile, there was no statistically significant effect for positive mood in the three assessments (Wilks' Lambda = 0.979, F (2, 19) = 0.205, p = 0.82, multivariate partial eta-squared = 0.02). Finally, there was no statistically significant effect for negative mood in the three assessments (Wilks' Lambda = 0.853, F (2, 19) = 1.63, p = 0.22, multivariate partial eta-squared = 0.15).

4 Discussion

Results of the present study indicated that the improvement in putting performance by the PIM group is consistent across the three assessments compared to traditional imagery group. Indirectly, PIM training program was more functionally equivalent to physical performance than traditional imagery practice method. Similarly, as discussed by [16], the physiological responses experienced during physical performance were simulated during the imagery. The present study also highlights that there was no significant difference for putting performance across the three assessments in the traditional imagery group. However, the performance in traditional imagery group was better than the control group (Only physical practice).

The present study also confirmed that the mood of the golfers is unpredictable while performing the task [17, 18]. For instance, the effectiveness of PIM training with PETTLEP imagery components helped to control the negative mood and increased the positive mood of the golfers. The present study has shown that the negative mood is significantly observed in traditional imagery group and there was no improvement in the positive mood.

Clear evidence was provided in the study that practicing 10 m away from actual environment or putting green is also an effective way to improve golf putting performance [1]. The study also suggested that the e-putting imagery script was also considered as one of the technical training aid that is easy to use by the coaches or golfers during imagery practice at the putting green. The findings revealed from this study cannot be taken to represent low handicap golfers. Future studies should also compare between e-putting imagery script and video or audio training aids.

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Effects of Age on Physical Activity Level, Strength and Balance Towards Fall Risk Index Among Women Aged 20–73 Years

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Abstract Falls was the leading cause of injury deaths among people aged 65 years and above. Those who were experienced falls and fall-related injury incidences such as fracture and the most serious form of osteoporotic fractures will result in prolonged or permanent bedridden in aged individual. Therefore, this study was conducted to investigate the effects of age on physical activity level, strength and balance towards fall risk index (FRI) among women, as well as identifying the main contributing factors towards FRI test performance. Two-hundred healthy women participated and were divided into five age groups (A: 20–29, B: 30–39, C: 40–49, D: 50–59, and E: 60–73). Physical activity level was measured using 7-day International Physical Activity Questionnaire (IPAQ), and strength was measured using the handgrip dynamometer test while balance and FRI were measured using Biodex Balance Machine SD. Pearson's correlation and regression were used for statistical analysis ($p < 0.05$). Results indicate that participants were moderately active at the age of twenties to thirties, $M = 2148.495$, SD = 1712.862, and highly active at the age of forties to seventies, $M = 3671.956$, SD = 2400.216. Strength factors was at peak during thirties $M = 21.89$, SD = 3.75 and lowest level of strength recorded during seventies $M = 15.81$, SD = 4.84. Balance reaches the peak at thirties, $M = 0.39$, SD = 0.1937, and continues dropping significantly at forties to fifties, $M = 0.74$, SD = 0.434. There was a strong positive correlation between age and FRI, $r = 0.693$, and medium positive correlation between balance and FRI, $r = 0.428$, and small positive correlation between physical activity level and FRI, $r = 0.271$. Age was the main contributing factor (53.9 %), followed by strength (19.7 %), balance (18.2 %) and lastly, physical activity (8.2 %) towards FRI. To conclude, this study suggested that women aged 20–73 years were found to associate with FRI and four important aspects: age, strength, balance and physical activity.

Keywords Fall risk index · Women · Ageing · Strength · Balance

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1 Introduction

Health care and pharmaceutical industries are improving its products and service each year, and this phenomenon is contributed by the current trend of health conscious generation. It subsequently increases the life expectancy, and a number of older people were drastically increased in the developing countries. At the moment, numbers of Malaysians at the age of 60 years and above were recorded to be about 1.4 million; however, based on projection, it will keep on increasing each year as it increased from 5.7 % in 1990 to 6.3 % in 2000 [1]. This number is expected to increase in 2020, at 9.8 % rate of the population which is equal to 3.3 million, and it is about 10.0 % of total world population, 32 million [2]. Malaysian scenario indicated that male gender life expectancy had increased from 65 years (1990) to 70 years of age (2000), while female life expectancy had increased from 68 years in 1990 to 76 years of age in 2000 [3]. Therefore, women were predicted to live longer than men, because according to Malaysian Statistic Department [1] in 2020, life expectancy of female will increase to 80.4 years of age compared to male, 75.4 years, resulting in the disproportion in the number of men and women. As the life expectancy was higher, the risk factor revolves around this ageing population also increasing and it has drew an attention of the society, government, non-government organisation and media to cater this specific group needs [2].

Literature indicates that risk of falling is so prevalent, with such a high rate of recurrence and may lead to other fall-related injuries such as fracture [4–6]. There were limited studies that focus on falls incident among elderly in Malaysia. Statistics from Kuala Lumpur government hospital show that the falls prevalence at least once in the previous 12 months of data collected is about 32.9 % and in women it is higher (40.2 %) compared to men, only 17.4 % [5]. To our knowledge, few studies have indicated that falls was the sixth leading cause of death in older people and between 20 and 60 % of them suffer from falls-related injuries each year [6, 7].

Among major factors that lead to increase the fall risk are age, physical activity, strength and balance [8–10]. Generally, ageing process seems to portray an inevitable loss of physical fitness component [11]. There are few effects identified as the results of ageing, which are motor neurons functions, muscle component, maximal oxygen consumptions and wear and tear of the joint [11]. Physical activity can offset some of the effects; however in this biological ageing process going on, the neurons will die regardless of the person's physical fitness level. It is best to maintain an appropriate stimulus in the motor pathways even though in elderly to avoid excessive physical impairment [12]. When the age increased, balance functions decline, but some studies show that it was not the prime reason for the cause of falls in the older people [13]. However, there were also studies that show that dynamic balance particularly under multitask conditions and in reactive balance represents important intrinsic fall risk factors among elderly [14]. According to the previous research, strength, muscle size, balance and ability to perform physical activity tasks reach a peak in a person's early thirties and somehow decline with age regardless of amount of training or physical fitness [15]. Therefore, this study will fixated on the women from the age of 20 until 73 to understand effects of age towards fall risk index (FRI) among women. It is important to identify the main contributing factors to this problem because it may lead to effective preventive measure that will minimise the risk of falls.

2 Purpose of the Study

The purpose of the study is to acquire data effects of ageing on twofold, which is muscle strength and balance among women in Klang Valley. It allows researcher to investigate relationship of age, physical activity level and balance towards FRI. Hence, the acquired data will provide fall risk indicator specifically for healthy women using different methods to measure FRI other than clinical setting.

3 Methodology

A random sample of two-hundred (N = 200) volunteers aged 20–73 years who are independent to perform daily living activity and healthy in Klang Valley participated in this study. Exclusion criteria were individuals who have visual problem, auditory deficiency, using walking aid, on medication and have critical illness history. All participants were assigned into five different groups: Group A (20–29 years old), Group B (30–39 years old), Group C (40–49 years old), Group D (50–59 years old) and Group E (60–73 years old). The study was approved by UiTM Research Ethics Committee. All subjects gave signed informed consent.

3.1 Tests

There are four tests conducted in this study; physical activity level was obtained using short International Physical Activity Questionnaire (IPAQ) and Biodex Balance Machine SD programme was used to obtain balance and FRI score.

3.2 Fall Risk Index Test

FRI programme was used to identify person's risk of falling based on age. Participants were required to position themselves with support handless protocol with sole placement on the platform recorded. Participants then completed basic information in the system, such as name, age, and height and foot placement grid. Participants also required positioning themselves at the centre of the grid based on the displayed cursor on the screen. The platform was set at eight, and it represents neutral value of difficulties to maintain the platform. The test trial time was set at 20 s per set of three sets with 10 s of rest interval. The test began when the activate button of FRI test button was pressed on the screen and the screen provides a three-second countdown before beginning the first of three test trials. Participants were required to hold on to static position for 20 s and referred their performance based on displayed cursor on the screen. When the first trial is finished, the screen will display "Trial 1 Complete", and the platform returned to the locked position and a 10-s rest countdown began for the second trial. The test continues in the same manner to complete trials two and three. After completing the test, a "Test Complete" message is displayed. Result of the test is displayed on the screen as FRI and printed out for data recording purposes. The test results reports provide comparison of score according to the age bracket norm of the programme.

3.3 Strength Test

This test was used to measure the maximum isometric strength of the hand and forearm muscles using Takei Digital Hand Grip dynamometer. Participants were required to hold the dynamometer in the dominant hand to be tested, with the arm at right angles and the elbow by the side of the body. The handle of the dynamometer is adjusted if required—the base should rest on first metacarpal (heel of palm), while the handle should rest on middle of four fingers. Participants were asked to squeezes the dynamometer with maximum isometric effort, which is maintained for about 5 s. During the contact, no other body movement is allowed. The participants were strongly encouraged to give a maximum effort. A total of three trials were made and final score being recorded on the data sheet based on the average of three trials.

3.4 Balance Test

Static balance programme was used to measure static balance of individual. Participants were required to position themselves with support handless protocol with sole placement on the platform recorded. The test trial time was set to 20 s per set of three sets with 10 s of rest interval. The test began when the activate button of static postural programme button was pressed on the screen and the screen provides a three-second countdown before beginning the first of three test trials. Participants were required to hold on to static position for 20 s and referred their performance based on displayed cursor on the screen. When the first trial is finished, the screen will display "Trial 1 Complete," and a 10-s rest countdown began for the second trial. The test continues in the same manner to complete trials two and three. After completing the test, a "Test Complete" message is displayed. Result of the test is displayed on the screen as static postural test results and printed out for data recording purposes. The test results reports provide comparison of bilateral performance.

3.5 International Physical Activity Questionnaire (IPAQ)

The items in the short IPAQ form were structured to provide separate scores on walking, moderate intensity and vigorous intensity activity. Computation of the total score for the short form requires summation of the duration (in minutes) and frequency (days) of walking, moderate intensity and vigorous intensity activities. Subjects were then classified into three groups of physical activity level: low (less than total of 600 MET-min/weeks), moderate (at least total of 600 Met-min/week) and high (at least total of 3000 MET-min/week).

3.6 Data Analysis

The significant difference of age, physical activity and balance was assessed using one-way analysis of variance (ANOVA) to compare mean observations among groups. However, this does not indicate which group is different between each pair of groups, and therefore, post hoc test was conducted to determine which group was significantly different from one another. Relationships among physical activity level, balance and age towards FRI were analysed using Pearson's product correlations. Regression analysis was later applied to predetermine for all comparison purposes as a whole and the relative contribution of each of the variables that make up the model as individual subscales. All statistical data analysis was performed using statistical package for the social sciences (SPSS) version 17 with significance level set at $p < 0.05$.

4 Results

Characteristics of the study population are shown in Table 1. Age, BMI, balance and physical activity profiling show as age increased, BMI and balance score increasing even in physically active sample. Significance rate of balance differed during twenties and thirties (8.23 %), followed by 6.02 % during thirties and forties. The statistics drop significantly during the fourth decade, which is 25.42 % during the forties and fifties and 10.30 % difference in fifties and sixties.

Table 1 Subject characteristics

Group	Age (years)	BMI (kg/m^2)	Strength (kg)	Balance	Physical activity (min/week)
A	23.25 ± 2.21	21.69 ± 3.32	21.21 ± 5.01	0.46 ± 0.30	2106.71 ± 1895.06
B	33.37 ± 1.82	26.32 ± 4.38	21.89 ± 3.75	0.39 ± 0.19	2190.22 ± 1539.65
C	45.20 ± 2.82	30.83 ± 6.28	19.86 ± 6.35	0.44 ± 0.23	4083.90 ± 2624.67
D	52.82 ± 2.73	25.44 ± 2.11	16.82 ± 3.21	0.74 ± 0.43	3665.02 ± 1813.21
E	65.10 ± 3.42	27.16 ± 5.44	15.81 ± 4.84	0.91 ± 0.41	3266.95 ± 2762.76

One-way ANOVA was used to compare the effects of age on each variable, which are FRI, balance and physical activity. There was a statistically significance difference of strength and FRI at $p < 0.05$ level in strength performance for five different groups: F (4,195) = 14.902, $p < 0.05$, the effect size calculated at 0.02. Next, the change in age and balance was significantly small at F (4,195) = 18.87, $p < 0.05$ and there was also statistically significant difference between age and physical activity level performance for five different groups: F (4,195) = 6.575, $p < 0.05$. There was a statistically significant difference of age and FRI at $p < 0.05$ level in strength performance for five different groups: F (4,195) = 70.038, $p < 0.05$. Despite reaching statistical significance, the actual difference in mean score between the groups was quite small (Table 2).

Significant correlations are observed in Fig. 1 and there was medium positive correlation between balance and FRI, $r = 0.428$, and weak negative correlation between strength and FRI, $r = -0.172$.

Based on the regression analysis that was carried out, it showed a significant result for the relationship between age, physical activity and balance on FRI. These data suggest that the model contributed towards FRI characteristics. Due to this, there was significant relation between these three variable characteristics across FRI as displayed in Fig. 2. A coefficient test has been conducted in order to seek the variable that contributed most towards FRI. Age was the main contributing factor (53.9 %), followed by strength (19.7 %), balance (18.2 %) and physical activity (8.2 %) towards FRI.

Table 2 Analysis of variance

Source	Group	Mean square	F ratio	P
Strength	Between groups Within groups	337.80 22.668	14.902	0.000
Balance	Between groups Within groups	2.049 0.109	18.874	0.000
Physical activity	Between groups Within Groups	3.122 4748.01	6.575	0.000
Age	Between groups Within groups	27.234 0.389	70.038	0.000

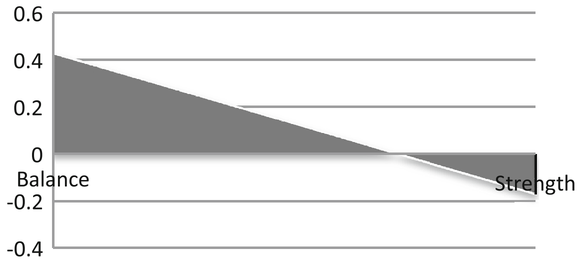

Fig. 1 Fall risk index

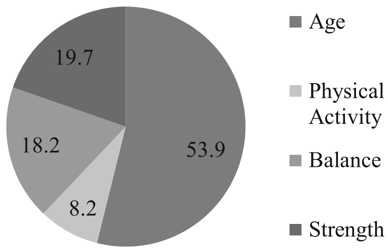

Fig. 2 Contributing factor towards fall risk index

5 Discussion

This study identified the effects of age on FRI, physical activity, strength and balance. Age was identified as the main contributing factor towards FRI among women in Klang Valley (53.9 %). To discuss this matter in detail, age bracket needs to be defined, young adulthood, referring the age of 20–35 years and all the bodily function developing until reach it peaks at that particular age bracket [16]. The second category is the middle age, referring to someone age of 35–45 years. In this particular decade, sedentary population will gain 5–10 kg accumulation of fat as their main interest is the career and family building. The middle-age groups were divided into two, which are young middle age and later middle age for those in their age of 45–65 years. At this stage, women will reach their menopause and men also experience in reduction of sex hormones; therefore, the decline in physical condition and ability continues and may accelerate [16]. Following group was the old-age group, where it can be divided into three, early old age (65–75 years), middle old age (75–85 years) and lastly the very old-age group which is over the age of 85 years. The transformation in this stage was from the modest physical activity which is normally due to an attempt to fill free time resulting from retirement and slowly developed some physical disability such as visual impairment and to become totally dependent [16].

The finding of the handgrip strength and postural balance for this study (19.7 %) is also in line with what has been reported by the previous study [14]. The consistency of two variables shows that the peak performance of handgrip test and postural balance is developing in the early twenties and reaches the peak at the age of thirties and then decreased with increasing age.

Previous literature by Stenholm et al. [16] has support the results that come out which examine handgrip test according to the age bracket also have the same findings. Zenoni et al. [17] also reported the relationship between the age and the postural balance performance that is similar to this study. Therefore, it is proven that handgrip test that is widely used to predict the total body strength is reliable due to accessibility and mobility of the measuring tools. However, as suggested by Granacher et al. [16] on his qualitative review on balance and strength performance in healthy older adult regarding testing and training, it would be advisable to conduct a lower body strength test compared to the balance component as most of balance tests were fully utilised total body aspect, especially in a lower limb. Finding from previous research stated that maximal concentric lower extremity was reduced in older group compared to young- and middle-aged group, which is similar to the finding of the present study [18], and it is due to biological response of muscle strength towards the age and highly related to the specific strength exercise programme [19].

This study shows that balance contributes 18.2 % towards the FRI, with the significant different rate of 8.23 % during twenties and thirties, followed by 6.02 % differed during thirties and forties. The statistics drop significantly during the fourth decade, which is 25.42 % during the forties and fifties and differed 10.30 % in fifties and sixties. Referring to the similar study that investigates the effects of age on balance, the finding was contradicting as the previous study find that physical activity has a greater influence towards the balance performance compare to the age factors. The high physical activity group demonstrated a significantly higher balance score than the medium and low physical activity group [9]. However, this finding is similar to the previous study conducted in Thailand in identifying the effects of age and physical activity level among elderly Thai women, according to that study, ability to maintain balance was found to be more influenced by physical activity level as compared to age. It is because high physical activity group shows positive balance score regardless of their age group [9].

Based on the present study, physical activity contributed a small portion which is 8.2 % towards FRI. This is because overall participant's physical activities were at moderate level for each decade, and therefore, the finding was slightly different from the previous study that has a variation level of physical activity. This finding is similar with the cross-sectional physical performance, and age effects indicate the curvilinear decline of mean in sports performance with age, and this curve is similar between men and women. The average difference in 1-year performance increased with age in the group of subjects aged 20–80 years and above. This difference at 40 years was twice as at age 20 years and increases significantly at the age of 80 [11]. Different age groups of subjects may influence the findings of this study ranging from 20–73 years, whereas in the previous study, it was 60–89 years. Finding of this study is also influenced by the subjects' physical activity in total; it is because overall subjects were moderately active with total physical activity of 600–1500 min per week. This moderate level of physical activity was derived from participants' lifestyle as most of the subjects live in urban setting and they are working or pensioner, and therefore, their awareness towards healthy and active lifestyle affects their daily living activities.

6 Conclusion

This study indicates that there is a significant difference of age, physical activity level, strength and balance towards FRI. To conclude, all variables assumed as significant contributor to influence FRI. However, the age factor was the main contributing factor, followed by strength, balance and physical activity level. Proper training programme should be administered in order to cope with this problem in continuous event. By maximising this variables, associated problem such as increased fall incidence or injury rate that threaten quality of life among fall prone individuals can be reduced through proper physical activity, strength and balance training programme. This data can help personal trainers, physiotherapist, physician, geriatrics and neurologist to reduce neuromuscular fall risk factors. Potential researchers who interested in specific population such as women or ageing population can use the findings from this study to develop and design effective intervention programmes that have the potential to counteract the fall risk factors by ultimately reducing the number of falls in healthy elderly women.

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Gender Differences on the Sources of Anxiety and Level of Sport Performance Among Malaysian Athletes

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Abstract A few factors have been identified as the sources of anxiety, among them are high hope, fear of lose, perceived sport event as very important, negative evaluation, fear of injury, knowledge of the opposition team, uncertainty, past unpleasant experience, audience present, and playing at the opposition's place. However, the precise sources of anxiety are still not determined among athletes. Since perception of anxiety is different according to individuals, the sources of anxiety may also vary according to the individuals. The aim of this research was to identify the factors contributing to the level of anxiety by focusing on male and female athletes. Besides that, this research also evaluates the performance of athletes. The sample consisted of 908 athletes, male (N = 502) and female athletes (N = 406). The sample was drawn from athletes who competed in MASUM (sport between universities), MSSM (sport between schools), and Sukan Olimpik Muda (Young Olympic athletes Sport). The present study revealed that high hope as the highest, and playing at the opposition's place as the lowest source of anxiety among athletes. Results revealed that female athletes reported more sources of anxiety than male athletes. Results also showed that high-performance athletes experience low sources of anxiety. Sport psychologists, sport counselors, or coaches should use this research to recommend coping strategies, which is related to the source of anxiety to female athletes, to enhance their performance.

Keywords Anxiety · Sources · Sport performances

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1 Introduction

Anxiety, as a negative emotion, affects perceptions in sport competitions, where a large majority of athletes consider anxiety to be debilitative toward performance, which may result in decreases in performance [1, 2]. According to [3], sports psychologists have long believed that high levels of anxiety during competition are harmful, worsening performance and even leading to dropout.

A few factors have been identified, as the sources of anxiety, of both cognitive and somatic. Initial evidence suggest among the sources of anxiety are fear of injury, presence of audience, past unpleasant experiences, fear of lose, negative evaluation, knowledge of the opposition team, uncertainty, playing at the opposition's place, high hope, and perceived sport events as very important, and specifically, these factors have been identified as the source of anxiety among athletes. Fear of injury has been the main factor which causes high level of anxiety among athletes [3, 4], especially on football and rugby [5]. Many athletes have dropped out of sport because fear of injury [6–8]. According to the drive theory, the level of anxiety depends on the audience. The presence of an audience can increase noise in arena sports, which can contribute to the levels of anxiety among athletes [9, 10].

Besides audience presence, fear of losing, as the cognitive component, can be the factor of increasing the level of anxiety [3, 11]. Past unpleasant or bitter experience also can be the source of anxiety among athletes [12–14]. Research shows that past loss increased the level of anxiety and wins or victories lowered the level of anxiety [15]. Negative evaluation and thoughts also has been one of the main factors for contributing to the levels of anxiety, especially the cognitive anxiety [16–18]. The knowledge of the opposition team also can increase one's level of anxiety [19]. The more athletes knew about the opposition's ability, the higher the level of anxiety [4, 20].

Ambiguous situations in sport are associated with both uncertainty and anxiety [2, 21]. Uncertainty in sports event has a tendency for negative thoughts, fear of punishment, physical injury, loss, and doubts, which can increase anxiety [22–25], especially the level of cognitive anxiety [26]. Playing sports at the opposition's place or in another country has the tendency to increase the level of anxiety [27, 28]. Many research showed that athletes perform better when playing on the team's place rather than the opposition's or other countries [28–30].

Research showed that athletes with high hope, especially from parents, coaches, fans, and teachers, have the tendency to increase their levels of anxiety [23, 31, 32]. A number of research showed that the level of anxiety increases when athletes perceived sports event as very important [1, 21, 23, 33].

Researches on sources of anxiety among athletes are very limited. Most probably fear of injury can be one of the sources which increase the levels of anxiety among athletes, but to date, no research has determined it [34]. The model of sources of anxiety done by [21] is a notable exception; however, it requires additional research before accepting as an instrument to predict anxiety. Moreover, the precise sources of anxiety are still not determined among athletes [35]. Since perception on anxiety is different according to individuals, the sources of anxiety may also vary according to the individuals [35]. This might make the sources of anxiety also different on gender. In order for a clearer understanding of the sources of anxiety and the effect of performance in sport, it would be important to identify the factors, which determine the level of anxiety among athletes.

The aim of this research was to identify the sources of anxiety among athletes. The present study sought to explore potential sources of anxiety, by focusing on gender. Besides that, this research also correlates the sources of anxiety and the level of sport performance on athletes.

2 Methods

2.1 Sample

The sample consisted of 908 athletes, of male (N = 502) and female athletes (N = 406). The sample was drawn from athletes who competed in MASUM (sport between universities), MSSM (sport between schools), and Sukan Olimpik Muda (Young Olympic athletes Sport). The highest level of participation of an athlete becomes his or category.

2.2 Instrument

Sources of Anxiety Questionnaire were used which comprised of high hope, fear of loss, perception of sport events as very important, negative evaluation, fear of injury, knowledge of the opposition team, uncertainty, past unpleasant experiences, presence of audience, and playing at opposition's place. Furthermore, Level of Sport Performance Questionnaire was used to determine the level of sport performance among athletes.

3 Results

3.1 Source of Anxiety

Results revealed that high hope (M = 2.57) is the highest source of anxiety among athletes, followed by fear of loss (M = 2.49), perception of sport event as very important (M = 2.49), negative evaluation (M = 2.38), fear of injury (M = 2.37), knowledge of the opposition team (2.34), uncertainty (M = 2.29), past unpleasant

Table 1 Sources of anxiety according to gender

Gender	Mean	Value-*t*	Value-*p*
Male	22.2824	5.429*	0.000
Female	24.7468		

*$p < 0.01$

Table 2 The relationship between the sources of anxiety and the level of sport performance

Subject	Sport performances
The sources of anxiety	−0.710* (0.000)

*$p < 0.01$

experiences (M = 2.26), presence of audience (M = 2.10), and playing at the opposition's place (M = 2.04).

3.2 Gender

Independent t-test indicated significant gender effect ($p < 0.01$), with female athletes, having higher sources of anxiety than males (Table 1).

3.3 The Sources of Anxiety and the Level of Sport Performance

The correlation coefficient of −0.071 was noted between the sources of anxiety and the level of sport performance in the evaluation of 908 athletes, which is significant ($p < 0.01$) (Table 2).

4 Discussion

4.1 Source of Anxiety

The purpose of this study was to identify the potential sources of anxiety, which enhance the level of anxiety. The result revealed that high hope is the main factor causing anxiety among Malaysian athletes. A few previous researches supported this result. High hope on athletes, especially on successful athletes, has a great tendency to increase the level of anxiety [23, 31, 32]. In an interview, Alex Baumann, champion of Canada Olympic Sport 1984, revealed that higher hope on him increased his anxiety and stress levels, which resulted in low performance [36]. Most of the higher hopes on athletes come from parents, coach, and teachers [23].

4.2 Gender

The present study reveals that females had reported more sources of anxiety than male athletes. A number of researches support this result. Research of [37, 38] showed that females have a higher tendency to fear than males. This research supported the above result. Fear of loss (M = 2.49) stand as the second highest source of anxiety in this research. One possible explanation for this finding is that in general, females tend to be more sensitive and emotional and this is not a surprising matter as they easily cry, get angry, nervous, and feel fear. In Malaysian culture, females are still not allowed to be involved in outdoor activities [39], especially sports. There exist myths that female will lose their virginity and femininity, if they were involved in sports, and certain people still believe this [40, 41]. This kind of fear can increase females' anxiety in sport. Culture plays an important role on fear among females [37, 38].

4.3 Performance

Results showed that high-performance athletes experience low sources of anxiety. This result supported research of [15, 35, 42] that fear of loss tends to deteriorate performance among athletes. Athletes, who fear, tend to interpret physiological responses wrongly, which can increase their anxiety and affect their performance [1]. Athletes who fear that others might evaluate them negatively experience disturbances in concentration and this deteriorates their performance [1, 17, 18]. Furthermore, pressure of high hope of others tends to deteriorate performance [23, 32, 36].

5 Conclusions

As the conclusion of this study, it is found that sources of anxiety among male and high-performance athletes are less or low. The findings emphasize the importance of using coping strategies based on their sources of anxiety. The use of coping strategies impacts on anxiety and improves athletes' performance. Sport psychologists, sport counselors, or coaches should use this research to recommend coping strategies, which is related to the source of anxiety, and also promote this strategy to less successful and female athletes, to enhance their performance. For example, [43] stated that thought stopping and goal setting are effective coping strategies for athletes fear of losing and high hope. Since this research has identified the factors which contribute anxiety, it can be used to predict the level of anxiety.

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The Effect of Enhanced Sensorymotor Feedback on Balance Among Football Players

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Abstract The ability to maintain balance was highly dependent on the complex set of sensorimotor control systems that include information from the eyes, vestibular system and soles of the feet. Due to that, an increase in information to the brain will result in a better postural adjustment of balance. It has been suggested that the implementation of textured insole can provide enhancement of the balance control system. Therefore, the purpose of this study was to determine the effects of textured insoles on balance among football players. Twenty footballers (M = 20.85, SD = 0.933) participated in this study. Participant's static balance was measured through balance error scoring systems (BESS). Meanwhile, dynamic balance was determined through star excursion balance test (SEBT). A significant difference was noted ($p < 0.05$) as the result showed superior performance with used of textured insole compared to normal insole in both static and dynamic balance. This finding indicated that the textured insoles can significantly increase the balance ability by increasing the feedback of plantar cutaneous receptor located at the feet.

Keywords Static balance · Dynamic balance · Textured insole · Sensorymotor feedback

1 Introduction

Balance is the most important element in dictating movement strategies in order to prevent falls. Falls epidemiology reported that about 50 % of the falls occurred during some form of gait such as when avoiding obstacles (which needed us to alter the step length), changing the direction of step or stepping over the objects [1]. Football athletes with balance deficits had almost four times the number of ankle

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injuries compared to a player with a normal balance [2]. This finding was supported by a previous finding on the relationship of balance ability and ankle sprain injury among basketball players [3]. It stated that athletes with poor balance had about seven times more ankle sprains compared to the good balance athletes. In line with the previous study, athletes with good balance ability were two to seven times less prone to injury compared to the athletes with poor balance ability [4]. Previous studies found that there was a relationship between balance and the risk of injury [2–4].

Balance is the ability to perform a task, such as walking while maintaining the center of gravity (COG) within the body's base support [5, 6]. Unable to position the COG over its base support may increase the risk of falls and may cause injury. Due to that, maintaining the COG within its base support was essential in preventing injuries. Loss of balance was a result from inability to sense the position of COG within its base of support [7]. This is because positioning of the COG over its base of support or balance was stimulated by the complex set of sensorimotor control systems (vestibular, visual and somatosensory) information [5]. Another studies stated that the sensory inputs from the feet will send information to the brain to integrate and sorts the sensory information before delivering to motor impulses to make the postural adjustments and maintain the balance of the body [8]. Previous researchers have attempted to alter the balance system in a large number of ways in order to quantify human responses. There were some studies that used a multiple exercise such as balance board training [9] and computer games based training [10] in order to improve balance control systems. However, this type of method was difficult to be administered [11].

To overcome balance deficits, some studies have used sub-sensory mechanical vibration devices to enhance the somatosensory system feedback at the foot and ankle. However, this vibrating insoles device was costly to produce and maintain [12, 13]. In order to overcome the costing issue of the device, researchers have used textured insole as an alternative device in their study [14]. The result showed that by using textured insoles, participants have better movement discrimination score compared to when using smooth insoles (as found in athletic shoes). This cheap material has also proved that it was also useful to enhance balance among older people [15]. Textured insoles were also proven to give a significant effect on balance and it covers various populations ranging from the older adults, multiple sclerosis patients and Parkinson disease patients [15–17]. In addition, other study has suggested that perceptual-motor performance can be improved by using this textured material [18]. Even though some of the previous studies had proven the beneficial effects of textured insole on balance, there is still limited evidence regarding the effect of textured shoe insoles on balance among athletes and more research is needed [14, 16].

Therefore, the purpose of this study was to determine the effect of textured insoles on balance among football players. As there was evidence that decline in postural control effect on the athlete's performance and increase the risk of injuries, it is important to identify the effect of added texture in order to enhance athlete's balance. Both static and dynamic balance was investigated in this study because the nature of football requires the athletes to have higher balance ability during the game.

2 Method

2.1 Participants

Twenty male footballers aged between 19 and 22 years old (M = 20.85, SD = 0.933) participated in this study. Participants recruited were in healthy condition, free from any past surgeries, injuries in lower limb, and any neuromuscular diseases that may affect their balance ability. The procedures of the study were approved by the Research and ethic Committee of Universiti Teknologi MARA (UiTM), Malaysia. All of the participants signed an informed consent approved by the institutional review board. However, participants were permitted to withdraw at any point in the proceeding.

2.2 Instruments

This study requires participants to use their own football boots that already have smooth insoles inserted (found in all football boots). The textured insole was made of polyvinyl chloride embedded with small round peaks. The height of the point shape was 3 mm with width between each was 5 mm. All insoles were cut based on the participants' shoe sizes.

2.3 Static Balance

The modified balance error scoring systems (BESS) test was used to measure participant's static balance [19, 20]. This test has been reported to have good reliability score (r = 0.63 – 0.82) [20, 21]. Participants were requested to stand in the area of 10 in. × 10 in. box and performed three different standing stability tests, (a) double limb stance, (b) single leg stance and (c) tandem stance [19]. Double leg stance test requires the participants to stand with both feet close together on the ground and hand lies on the hip (refer to Fig. 1) and single leg stance requires the participants to stand on area ground surface with non-dominant leg and lift the dominant leg approximately at 45° knee flexed and 35° hip flexed (refer to Fig. 2). As for tandem stance, the participants were required to stand with heel to toe on a firm surface with the non-dominant foot at the back of the dominant foot

Fig. 1 Double limb stance

Fig. 2 Single leg stance

(refer to Fig. 3). Each standing stability test requires the participants to place their hands on the hips and stand for 20 s before proceeding to the next standing stability test. Subjects have to perform three trials in each test in two conditions (with insoles and no insoles). Subjects were given 60 s rest between the trials. Five types of errors that contributed to the BESS test has been outlined in this study (moving the hands of the hip; steps; stumble of fall; abduction or flexion of the hip beyond 30°; lifting the forefoot or heel off the testing surface; remaining out of the proper testing

Fig. 3 Tandem stance

position for greater than 5 s). The maximum total number of errors for any single condition was ten [19–21]. If the participants make errors of more than ten, the test will be ended immediately and the error score is recorded.

2.4 *Dynamic Balance*

The dynamic balance ability was measured using the star excursion balance test (SEBT) [22]. Previous studies had reported that this SEBT have moderate to excellent reliability score ($r = 0.67 - 0.97$). Eight lines (anterior; anterolateral; lateral; posteromedial; medial; posterior; posterolateral; posteromedial; anteromedial) with 45° apart from each lines been made on the ground (refer to Fig. 4). Dominant leg

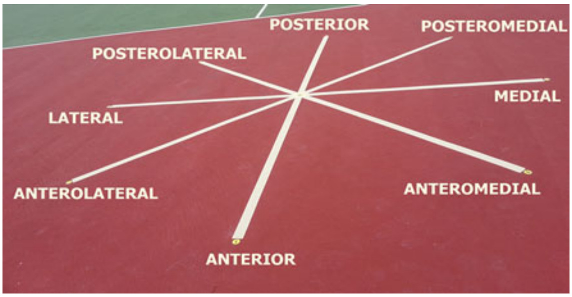

Fig. 4 SEBT eight lines

Fig. 5 Reaching medial line with left leg

in this study referred to a leg that the participants used to kick the ball. SEBT measured the percentage of normalized distance reached by the subjects. Therefore, to determine the percentage of the normalized distance reached by the subject, the length of the leg need to be measured. The length of the leg was measured from the anterior superior iliac spine (ASIS) to the medial malleolus of the leg while subjects were lying on the ground. SEBT requires subjects to reach all eight directions as far as possible from the center by using their dominant leg, but, they have to control their non-dominant leg to not lose their base of support (refer to Fig. 5). The reached leg were marked soon after the subjects taps the ground. Subjects were not allowed to make a heavy touch and lose their base of support on the non-dominant leg at the center. If this occurred, subjects need to repeat this test. The reached distance that has been marked was then measured with a measuring tape and the values were recorded to the nearest centimeter. This study involved three trials in two conditions of test. Firstly, the subjects have to perform three trials without the textured insoles inserted and the other three trials with textured insoles inserted in their boots. Subjects have to reach all eight directions in each trial with 120 s rest period between the trials. All trials were tested while wearing their football boots with no socks included.

2.5 Statistical Design

In order to determine the effect of textured insole in static and dynamic balance, a paired-sample t-test was used. All statistical analysis in this study were analyzed with Statistical Package for the Social Sciences for Windows 7 (version 21; SPSS Inc., Chicago, IL). Means and standard deviation (SD) were calculated for all data. A prior alpha level was set at $p < 0.05$.

3 Results

3.1 Static Balance

There was a statistically significant difference between the static balance with and without textured insoles at p level < 0.05 (p = 0.004). The mean error score for balance without textured insoles was (M = 8.35, SD = 0.95) while with textured insoles was (M = 7.81, SD = 0.83). Results showed that there was a statistically significant decrease in error balance score with and without textured insoles (refer to Table 1), p = 0.004 with eta squared 0.37. The mean decrease in static balance errors score was 0.53 with 95 % confidence interval ranging from 0.19 to 0.87 (Fig. 6).

3.2 Dynamic Balance

There was a statistically significant difference between the static balance with and without textured insoles at p level < 0.05 (p = 0.000). The mean error score for balance without textured insoles was (M = 705.39, SD = 3.87) while with textured insoles was (M = 709.21, SD = 16.78). Results showed that there was a statistically

Table 1 Differences in BESS error scores with and without textured insoles

Differences in balance error scoring systems with and without textured insoles					
Variables	Mean	SD	P (2-tailed)	t	Mean difference
Balance error systems scores (no insoles)	8.35	0.95	0.004	3.31	0.53
Balance error systems score (insoles)	7.81	0.83			

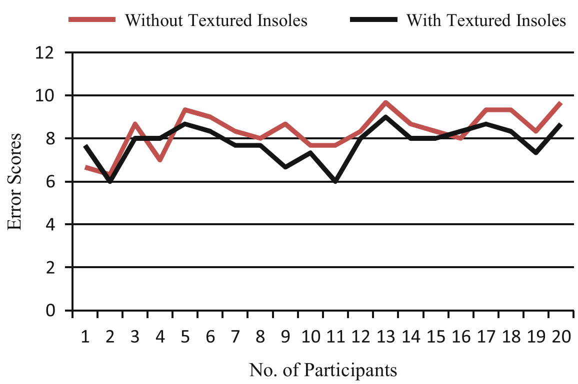

Fig. 6 Comparison between with and without textured insoles on BESS error scores

Table 2 Differences in SEBT scores between with and without textured insoles

Differences in star excursion balance test before and after wearing textured insoles					
Variables	Mean	SD	*P* (2-tailed)	*t*	Mean difference
Star excursion balance test (no insoles)	705.39	17.29	0.000	−4.303	−3.822
Star excursion balance test (insoles)	709.21	16.78			

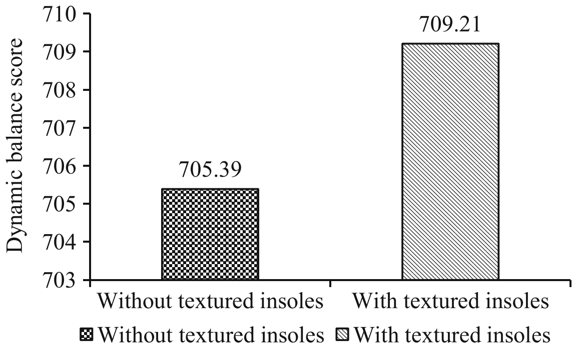

Fig. 7 Comparison between with and without textured insoles on SEBT scores

significant decrease in error balance score with and without textured insoles (refer to Table 1), $p = 0.000$ with eta squared 0.47. The mean decrease in static balance errors score was −3.822 with 95 % confidence interval ranging from −5.68 to −1.99. Table 2 shows the mean differences (Fig. 7).

4 Discussion

The purpose of this study is to determine the effect of textured insoles on balance among football players. The finding of this study revealed that textured insoles gave a significant effect on balance among football players. Based on the analysis of paired sample *t*-test, results showed that there was a significant difference of error score in static balance with ($M = 8.35$, SD = 0.95) and without textured insoles ($M = 7.81$, SD = 0.83) $p = 0.004$ which was lower than 0.05. The mean of error score decreased by 6.47 % which indicated the increase in balance performance among the athletes. BESS was a test that measure the error that may occur while performing three conditions (double leg stance, single leg stance and tandem stance) in static balance. Therefore, increasing in error scores indicates that the participants had poor balance in static balance. Meanwhile, lower BESS error scores showed that the participants had lesser balance deficits. This finding was in agreement with data reported by previous studies that showed a significant effect on static balance when the participants were using the facilitated insoles [12]. However, the vibrating insoles used in their studies may be too complex and expensive for use in everyday life compared to textured insoles which are an inexpensive way of improving postural stability and balance. The finding of this study was in line with previous studies [15, 16]. Their studies had proven that healthy older adults could decrease medial-lateral sway while standing on a textured surface. Although the studies revealed that there were a significant effect of textured insoles on static balance, it is important to note that those researches did not use textured insoles but in fact, they were using a textured surface. Despite that, studies that been conducted on the effect of textured sandals on static balance also showed a significant difference in static balance. But, the sandals evaluated in the study were not suitable for footballers and other athletes [23]. Meanwhile, other researchers that studied the effect of textured insoles on balance and gait in healthy young participants showed a significant immediate effect of the textured insole in the outcome measures of static balance tests as well as in gait [24]. Similar to this finding, the outcome of the previous studies had demonstrated that using a textured insole significantly improves the static balance among football players [23, 24].

On the other hand, for dynamic balance the increased mean score indicated a better dynamic balance because the SEBT test measured the reach distance in eight directions. Therefore, increased in scores indicated the participants have good balance while, lower SEBT score showed the participants have a balance deficit. Similar to previous studies, this finding showed that textured insole did affect the postural stability and dynamic balance control [25]. The study had suggested that textured insoles were effective in improving the postural stability or dynamic balance in older people [25]. As stated, their effectiveness was suggested towards a specific group which was on older populations. Another studies had shown significant differences in dynamic balance and postural stability after wearing textured insoles for two weeks [26]. However, the study stated that textured insoles had no significant immediate effects on balance among multiple sclerosis groups. Contradict from this current study, the textured insoles had proven to increase the postural stability and dynamic balance among athletics populations. In accordance to static balance, textured insoles have shown a positive effect among healthy younger populations [24]. The textured insoles have been proven to increase the plantar cutaneous afferent receptor activity. In fact, sensory inputs from the feet or the proprioceptive touch of the skin, which is the plantar cutaneous mechanoreceptors, will send information to the brain and then the brain stem will integrate and sorts the sensory information before delivering to motor impulses to make the pastoral adjustments to maintain balance of the body [8]. Therefore, a lot of literature regarding the intervention of textured insoles on balance had proven on a significant effect.

Textured insoles were introduced to the older population on the basis that it can stimulate the components of somatosensory systems as this system was proven to be deteriorating in line with ageing. Thus, when the textured insoles were introduced to an athletic population, it would give a small to moderate effect size due to the none to lesser deficits of somatosensory systems. Previous studies had stated that the largest and most reliable effects size of interventions this textured insoles among young, healthy individuals was (0.28) [26]. However, other researchers had also stated that textured insoles study would have the largest effect size (0.55) if the reliance of somatosensory information was deducted from the visual information [18]. Those results might explain the lower effect by the textured insoles among balance as the participants in this study were young, healthy athletes and both tests were done with eyes open. Therefore, textured material effects, here, support the notion that interaction with texture improves body awareness and specifically the spatial representation of the pressure distribution at the foot sole.

5 Conclusions

Balance ability is vital to athletic performance and injury prevention. This study provided clear evidence that textured insoles have a significant effect towards athlete's balance performance. Hence, research findings may suggest that textured insoles enhance the athlete's performance and reduce the risk of injuries. Finding from this study may serve as a strong basis for future work among athletics population. In conclusion, this study had proven that a textured insole which is inexpensive provided simple approach that could improve balance performance among football players.

Acknowledgment The authors are grateful to those participants who gave so generously of their time and helped to make this research possible.

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Development of Portable Biofeedback Devices for Sport Applications

Zulkifli Ahmad and Tan Choon Mong

Abstract The purpose of this project was to propose a portable low-cost ECG and EMG devices that play the role of continuous monitoring of the user heart rate and muscle activity. Collecting and analysis of biological signal like Electrocardiography (ECG) and Electromyography (EMG) are important in the field of healthcare and sports which enable to assess the physiological state and training progress of athlete. Heart rate can reflect individual natural fitness, whereas the EMG signal indicates muscle activation and fatigue level, thus determining the performance. However, most of the EMG and heart rate measuring tools are expensive and large in size. The process of data collection also often confined to hospital or biomechanics laboratory. Therefore, this monitoring system is capable to provide an immediate feedback on physiological data due to the small size and portable for outdoor activities especially for athlete and trainers. The monitoring system is merging together between pulse and muscle sensors which function to measure the heartbeat and muscle activity respectively. Arduino Uno acts as microcontroller to analyze the collected signal and then transmits the data via Bluetooth to Android-based smartphone; laptop through Processing software; or LCD screen. Processing software was used to perform an obtained data in the graphical views.The pulse sensor applies photoplethysmography (PPG) technique to measure the heart rate in beats per minute (bpm). On the other hand, the EMG signal will be collected by passive electrode which allows the monitoring of user muscle stress. In order to validated the result, the pulse sensor result collected via Coolterm application was compared to radial pulse and Treadmill. The result showed that the error rate of the device is negligible and promising.

Keywords Electrocardiography (ECG) · Electromyography (EMG) · Microcontroller · Athlete

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1 Introduction

Basically, electrocardiography (ECG) and surface electromyography (EMG) are noninvasive technique and monitoring tools for the detection and measurement of heartbeat and EMG signal. Biosignals of ECG and EMG not only play an important role in patient health monitoring but also assess the physiological state of athlete in training progress.

ECG is used to evaluate the cardiac abnormalities and detect how fast your heart is beating [1], whereas EMG is used to analyze the muscle activity by recording the electrical activity produced by skeletal muscle during muscle contraction and relaxation cycle [2]. In modern life, both techniques have increasing importance in sports for biomechanical analysis. The data heart rate capable provide good indicators of exercise intensity and fitness respectively by inform athlete about his healthy and effective exercise behavior [3]. Surface EMG can help to understand the muscle activation in specific movement which may lead to healthy training by improving the utilization of muscle and preventing the risk of injury [2].

The conventional ECG and EMG tools were expensive and bulky. Therefore, the experiment was confined in hospital or biomechanical laboratory. Besides this, both measurement methods were using conductive electrodes which directly attached to the skin with the help of gel. These kind of method was not reusable and troublesome where not optimal for long term used as a result of surface degradation of the electrode and require the cleaning of target muscle [4].

Such situation has led to certain need for lower-cost, user-friendly, and portable heart rate detector and muscle activity detector in order to achieve the purpose of continuously monitoring the athlete physiological information [5]. In the sport domain, there is a trend to personal monitoring. Thus, there is a growing need for solution to record and analyze the biosignal on mobile devices. Hence, with the help of Bluetooth module, the data collected were transmitted to Android-based smartphone for further analysis.

2 Device Development

Figure 1 shows an overview of the device system monitoring. This project is proposed to develop a system by using Arduino Uno as microcontroller to perform analog-to-digital (A/D) process. It is compatible for both pulse and muscle sensors to detect and measure the heartbeat and muscle activity, respectively.

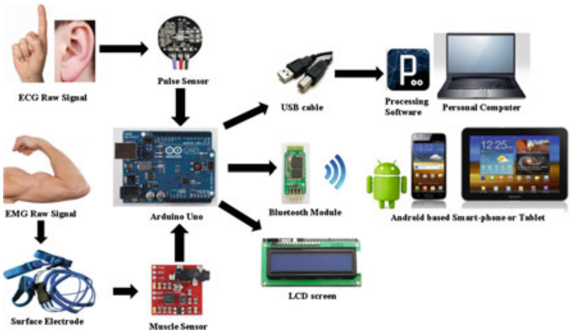


Fig. 1 An overview of the device system

2.1 *Electrocardiography (ECG)*

For ECG application, the pulse sensor was chosen which applied the photoplethysmography (PPG) technology to measure the heartbeat. Basically, PPG is an inexpensive and less power-consuming optical technique which measures the blood volume change in the vascular tissue [6]. PPG is preferred in the portable design due to small size and without precise positioning the sensor on subject body compared with conventional ECG. Pulse sensor is in reflectance mode where the photodetector sensor and LED are placed on the same side of the tissue. The pulse sensor work by green light shining into veins and a light source measure the reflected light and convert into an analog voltage. The size of the pulse sensor is small with a diameter of 15 mm only.

2.2 *Electromyography (EMG)*

In contrast, muscle sensor was applied as EMG system. The muscle sensor include surface electrode which attach on target muscle will collect the raw EMG signal to muscle sensor shield. The electrode measures the voltage difference which is generated by muscle activation. The muscle sensor then amplifies, filters, and rectifies the raw signal from human muscle and sends it to Arduino Uno. In the application of muscle sensor, the strength of muscle contraction corresponds to the amount of voltage output, which means the voltage output depends on the amount of activation in the targeted muscle.

There are three platforms to display the collected data. Firstly, it can be displayed in personal computer (PC) via Processing and Simplot programming interface. Second, with the help of Bluetooth module, the data are transmitted to Android-based smartphone wirelessly via Blueterm app. Lastly, the data also can be displayed in LCD directly after connecting with the Arduino Uno.

The systems have considerable portability due to low weight and small size of component. Moreover, the battery of lithium–polymer (Li-Po) was chosen to act as a power source for the system due to consist rechargeable feature. Furthermore, the Arduino Uno is chosen as microcontroller because it is a device with compact size that has the capability of high-speed analog-to-digital conversion as well as low cost. For wireless technology of communication, the Bluetooth module was used in the transmission of heartbeat and muscle activity data due to its low cost and small size. Meanwhile, the Processing software and Simplot were used to display the data from Arduino serial monitor in a graphical way. There are about five main components in the development of the system. The most expensive part is muscle sensor of the current device. However, this device is still low cost compared to the traditional ECG and EMG device from clinic or hospital whose are too expensive and cannot to be as portable.

3 Experimental Data

After setting up the connection of pulse sensor and muscle sensor to Arduino Uno, it then needs to create a platform to display the collected signal. The data which is displayed by LCD screen is same as displayed by serial monitor of Arduino board. It displays the digital value of both pulse sensor and muscle sensor data as shown in Fig. 2. Next, Processing and Simplot are open source programming language which serves as visual context by plotting the data from the microcontroller as shown in Fig. 3. Lastly, Bluetooth module is attached, which acts as a bridge between the

Fig. 2 LCD screen displaying heart rate and EMG

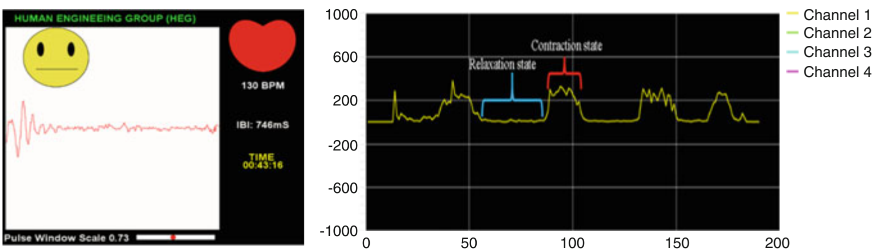


Fig. 3 Displaying heart rate (*left*) and muscle activation (*right*) via processing Programming interface

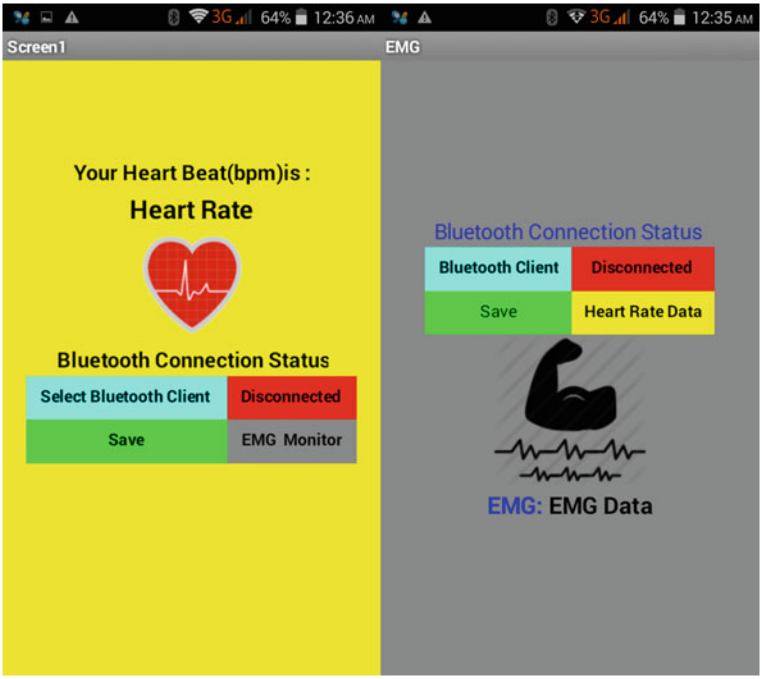


Fig. 4 Displaying EMG and heart rate data on Android phone via Blueterm app

microcontroller and Android-based smartphone. The data from microcontroller will transmit to phone wirelessly by Bluetooth module and display through Blueterm as shown in Fig. 4.

3.1 Effectiveness Test of Pulse Sensor

The pulse sensor is attached in finger or in earlobe to perform the measurement. Moreover, the pulse sensor does not require skin preparation as it is placed directly in contact with the skin. According to [6] stated that PPG are often attached to ear or fingertip which are single site measurement where the pulse can easily be detected. Therefore, in order to maximize the utilization of pulse sensor, the comparison between the fingertip and earlobe was conducted to identify which sites of measurement are more reliable. As shown in Fig. 5, the pulse sensor was sewing on the index finger position of glove in order to ease the user to wear the pulse sensor instead of strap it with finger. Next, a sticker is pasted on the surface of pulse sensor in order to prevent the sweaty or oily fingers affecting the signal collection. On the other hand, the second experiment was used hot glue for atttached pulse sensor on the ear clip for further measurement.

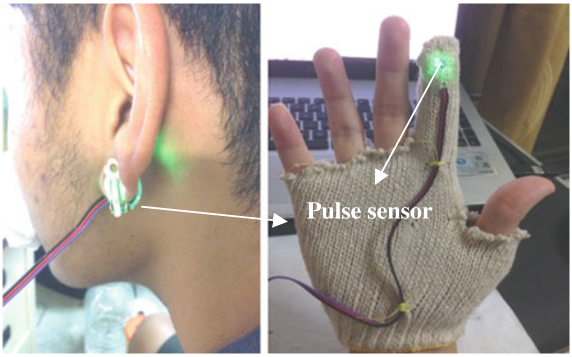


Fig. 5 Pulse sensor is clip on earlobe (*left*) and sew on glove (*right*)

3.2 Effectiveness Test of Muscle Sensor

There are two types of electrodes compatible with muscle sensor, which were gel surface electrode and passive electrode as shown in Figs. 6 and 7. The gel surface electrode is disposable electrode which means the electrode has limited lifetime and cannot be reused. The advantage of this electrode is can conduct under body grounding or ungrounded condition. Furthermore, gel electrode is capable of producing good quality signal and can be attached to any targeted muscle which needs to be measured. Figure 6 shows the placement of gel electrode on bicep by placing the reference electrode (black electrode) on electrically neutral tissue like bone area to ground the signal. Another two electrodes are placed on the target muscle by placing at two different points on the muscle. It was provide the point of reference for muscle activity to compare with the signal of muscle relaxation [7].

On the other hand, the passive electrode is the product of Olimex-EKG-EMG-PA. The advantage of the passive electrode is it is reusable after the measurement, but make sure that the body is in grounded condition. It means that the result will affect if the subject leg is not in land. But the passive electrode is only limited to the upper arm measurement. For the placement of

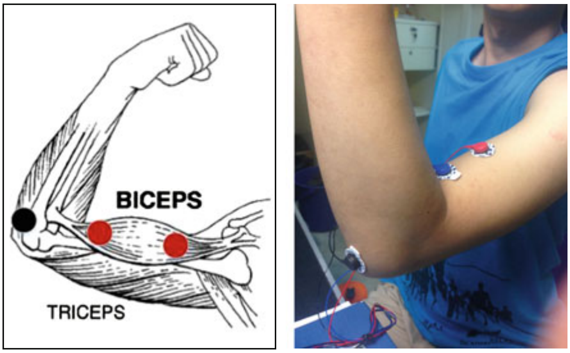


Fig. 6 EMG gel electrode placement on bicep brachii

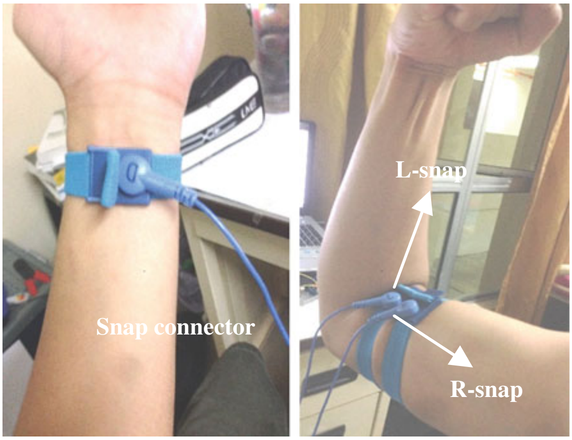


Fig. 7 Passive electrode placement on bicep brachii

passive electrode, the R snap connector is placed on the target muscle, while L snap connector is placed slightly off the center to give a point of reference for muscle activity compared to the signal of muscle relaxation. Lastly, the DLR snap connector is placed in another hand wrist to ground the signal.

4 Results and Discussion

Biofeedback device's heart rate measurement accuracy is evaluated by comparing the signal given by the sensor in finger and earlobe with manually counting the user's radial pulse. During the experiment, the user remains at sitting rest condition. Then the circuit power is switched on whereby the pulse sensor is attached on user finger. The user is requested to count their own radial pulse rate for a minute during the experiment and the signal collected from pulse sensor is save in laptop via Coolterm software. After 60 s, the simulation result which record from the Coolterm software are taken to calculate the average of heart rate value and compared with the user's final count radial pulse. The experiment procedure is repeated for ten times. After finish taking the result on fingertip, the pulse sensor was shift to user earlobe and repeated the same procedure as above The recorded result was shown in Tables 1 and 2. The error rate is calculated as equation below:

$$E = [100x|A - M|] \div A \tag{1}$$

where
E Error rate
A Actual heart rate
M Measured heart rate from pulse sensor

Table 1 Measurement of biofeedback device on fingertip and radial pulse

Test	Radial pulse (bpm)	Biofeedback device (bpm)	Error rate (%)
1	83	84.23	1.46
2	71	67.67	4.92
3	64	63.93	0.11
4	91	91	0.00
5	79	79.6	0.75
6	78	78	0.00
7	85	83.77	1.47
8	78	80.78	3.44
9	82	82.13	0.16
10	90	90.83	0.91

Table 2 Measurement of biofeedback device on earlobe and radial pulse

Test	Radial pulse (bpm)	Biofeedback device (bpm)	Error rate (%)
1	75	76.73	2.25
2	70	72	2.78
3	67	70.75	5.30
4	68	70	2.86
5	81	82.43	1.73
6	78	77.42	0.75
7	80	80.82	1.01
8	87	85.87	1.32
9	86	85.7	0.35
10	84	85.07	1.26

The comparison shows that the pulse sensor attached to fingertip has the accuracy with a mean of 1.32 and standard deviation of 1.64, while the pulse sensor attached to earlobe has the mean 1.96 and standard deviation 1.43. After the comparison of result, it was shown that the accuracy of pulse sensor attached to earlobe and finger was only slightly different, but earlobe attachment provided more reliable result.

Commercial reference pulse sensor (Spot Vital Signs Device, Welch Allyn, US) was used to test the performance of biofeedback device as shown in Fig. 8. Five subjects were tested, and simultaneous reading was taken from both devices. Average reading of 10 data is calculated as shown in Table 3.

The second experiment of running task was performed to obtain continuously changing heart rate. The subject were indicated to test on the treadmill (932i, Precor, and US) for ten minutes. Basically, the treadmill consist the feature of detect subject heart rate and are electrocardiogram accurate. The test was start by gradually increased the speed (2, 4, 6, 8 km/h) and then sharply decrease to rest [8]. The recorded results were shown in Tables 4 and 5. Measurement of pulse sensor on fingertip in running condition.

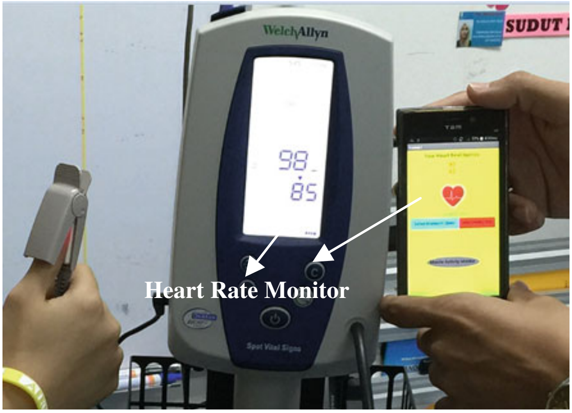


Fig. 8 Comparison of Spot Vital Signs Device and biofeedback device

Table 3 Comparison of Spot Vital Signs Device and biofeedback device

Subject	Spot Vital Signs Device (bpm)	Biofeedback device (bpm)	Error rate (%)
1	74.5	75.8	2.26
2	77.8	78.5	1.41
3	79	78	2.51
4	76.5	75.5	1.31
5	81	83	2.47

Table 4 Measurement of pulse sensor on fingertip in running condition

Speed (km/h)	Heart rate monitor (bpm)	Pulse sensor (bpm)	Error rate (%)
2	89	85	4.71
4	94	97	3.09
6	108	101	6.93
8	123	115	6.96

Table 5 Measurement of pulse sensor on earlobe in running condition

Speed (km/h)	Heart rate monitor (bpm)	Biofeedback device (bpm)	Error rate (%)
2	82	83	1.20
4	94	92	2.17
6	104	107	2.88
8	121	116	4.13

The accuracy of pulse sensor on fingertip has a mean of 5.42 and standard deviation of 1.88. On the other hand, the accuracy of pulse sensor attached to earlobe has a mean of 2.60 and standard deviation of 1.23. By gradually increasing the running speed, the heart rate also became faster.

Basically, the result is logical due to the active muscle cell require more oxygen and energy delivered from blood which pumped from the heart during the increase of body movement. In other hand, the accuracy of heart rate by placing the pulse sensor on earlobe is much better than on finger. This phenomena may due to the sensor attach on earlobe has no significant muscle movement compare to finger. In addition, the ear has high temperature stability and no sweat.

The effectiveness of muscle activity detector was evaluated by EMG signal which is produced by the subject. The objective of this experiment is to investigate the relationship between the weight handled by the subject and the muscle signal produced [9]. Before the experiment, the EMG gel electrode is attached to the subject's bicep. During the experiment, the subject was indicated to work out of bicep curl with different set weight of dumbbell which were 5, 7.5 and 9.5 kg. The muscle signal received is recorded by using Coolterm software and is being tabulated. The time-domain graph is plotted from the data collected as shown in Figs. 9, 10 and 11. The experiment is repeated by using passive electrode. The burst moment is the muscle contraction moment which is easily noticed by the sudden break in the baseline, while silence moment is when no contraction is occurring, and therefore, the signal is maintained in baseline close to zero. This occurs due to the ups and downs of bicep curl workout where lifting the dumbbell form a higher EMG signal and release the dumbbell form a silence moment.

As mentioned earlier, the output signal of muscle sensor depends on the muscle contraction. The increase of muscle activation, the increase of output signal by muscle sensor was collected as shown in Fig. 12. Therefore, the 7.5 kg weight result a highest EMG signal due to larger strength is produced from the muscle while

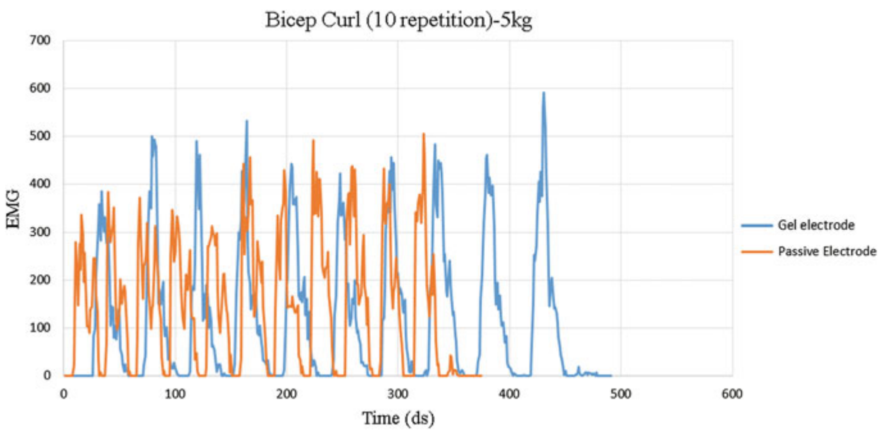


Fig. 9 Time domain when the dumbbell weight is 5 kg

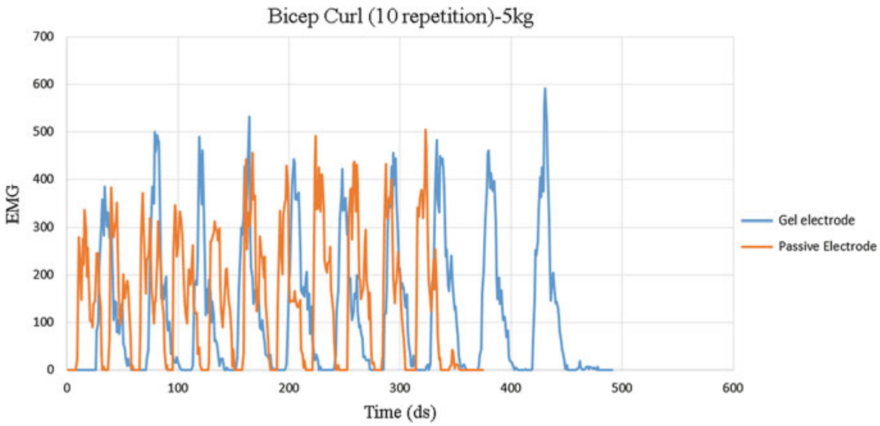


Fig. 10 Time domain when the dumbbell weight is 7.5 kg

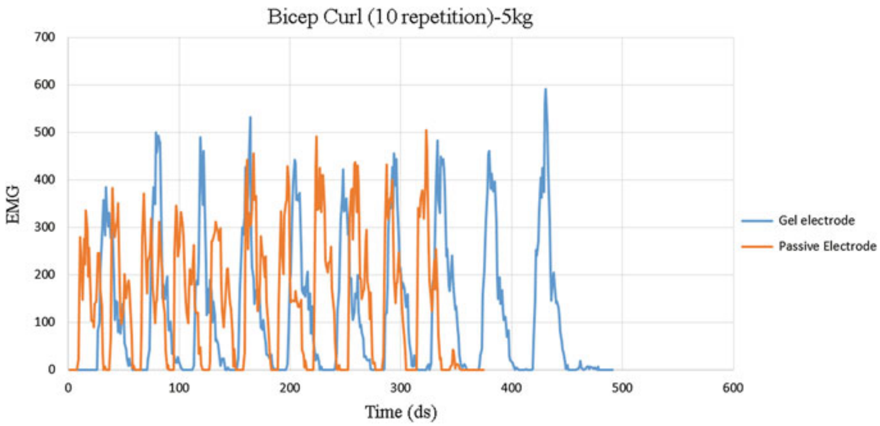
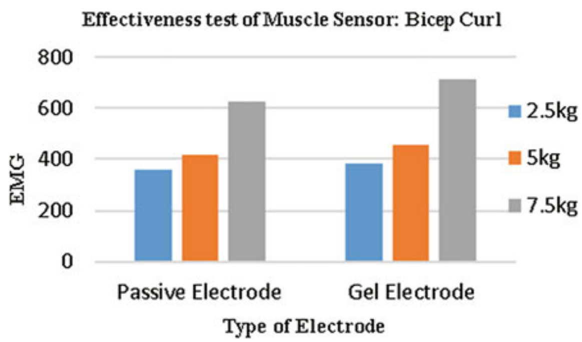


Fig. 11 Time domain when the dumbbell weight is 9.5 kg

Fig. 12 The effectiveness test of muscle sensor



taking control of the weight. The first experiment of 2.5 kg was result a similar waveform pattern; the second and third experiment of 5 and 7.5 kg, it was observed that EMG signal was getting increase; this is due to the muscle get tired and the bicep begin stressing and used more strength to lifting the dumbbell. As the weight of the work out getting increase, the strength also rises in order to accomplish the workout increase.

5 Conclusion

A continuous reading of heart rate and muscle activity is able to provide more realistic and accurate data to indicate athlete performance. With the completion of ECG and EMG system, several experiments have been conducted to ensure its reliability and stability. From the testing result, we can conclude that pulse sensor attach on earlobe to record the heartbeat due to high stability while using passive electrode to record EMG signal for long term used.

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Predicting the Physical Fitness Level Among Students with Hearing Impairment

Nagoor Meera Abdullah, Wahidah Tumijan, Vincent Parnabas, Mohamed Nizam Mohamed Shapie, Norlizah Abdul Hamid, Mawarni Mohamed and Amirullah Ahmad

Abstract Physical fitness is defined as his or her ability to perform in physical activities without fatigue. Children with disabilities including with hearing impairment indicate lower physical fitness than their hearing peers and place them at risk for non-communicable diseases (NCD). Deafness or hearing impairment is referred as sensory disability with hearing loss exceeding than 55 dB. Almost children indicated hearing impairment have demonstrated lower physical fitness levels than their hearing peers. The objective of the study is to compare between physical fitness levels and gender among students with hearing impairment. The demographic data consist of age group, gender, health status concerning the diseases, and physical fitness of health-related and skill-related fitness using the convenient sampling. The total of hearing impairment students from a primary and a secondary school is n = 170 (males 122, females 48). Demographic data were collected by questionnaire. Physical fitness test batteries carried out 10-m shuttle run, standing vertical jump, sit-ups, handgrip strength, sit-and-reach test, and cardiorespiratory fitness. Significant differences were found in body composition, sit-and-reach vertical jump, and handgrip strength between age–gender groups. In evaluation of health-related fitness, males are better in primary school compared to females in the same age. However, females performed better than males in fitness variable of flexibility, abdominal strength, and endurance in secondary school. In cardiovascular endurance, females achieve higher result than males. Meanwhile, skill-related fitness in agility, females are significantly better than males in both schools, while in muscle leg power and handgrip strength, the findings illustrate that males were significantly greater than females in both age groups. The findings in terms of physical fitness revealed variations in body composition, flexibility,

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cardiovascular function, and muscle power between the two groups. The findings of this study may enhance the identification of fitness level of hearing impairment children which may improve health outcomes in children.

Keywords Physical fitness · Health-related fitness · Skill-related fitness · Hearing impairment · Gender differences

1 Introduction

The fitness levels of school-age children are influenced by healthy lifestyle including physical activity participation and physical education settings [1]. Therefore, each individual needs to maintain at least minimal levels of physical fitness prior to experience the many benefits associated with adequate fitness. In recent years, children may be fatter, less fit, and more susceptible in chronic disease, because in these early adolescences and middle adolescent years, it may be important in maintaining their fitness level during adulthood. Healthy lifestyle is assumed to have regular physical activity, and enhanced dietary habits are beneficial for health in terms of reduced risk of morbidity and mortality from a number of chronic diseases [2]. Children with disabilities typically have decreased activity as well as fitness levels. This statement has supported by Fragala-Pinkham [3], and the children and youth with disabilities typically have decreased fitness which normally prevents them to participate, with their peers, in any activity that leads them to increase risk of secondary health problem. Unhealthy lifestyles will results in obesity and low psychological factors such as depression, anxiety, and stress.

Deafness refers to the severe hearing impairment that lead impaired in processing linguistic information through hearing with or without hearing aids (complete loss of ability to hear from one or both ears) WHO [4]. According to Palmer [5], the meaning of deafness is an etiologically heterogenous trait with many recognized genetic and environmental cause. Deafness can be classified as syndromic and non-syndromic deafness. Deafness refers to the group of deaf people who used American Sign Language plus people who are categorized as deaf and hearing impaired that mix and socialized in deaf culture [5]. Most of the researchers have investigated the factor/s that influence the physical fitness on persons with disabilities that expose lower physical fitness level and their association with participation in physical activity. The physical fitness of children with hearing impairment is similar to children who do not have loss of hearing. However, it is still unclear why deaf children generally score lower on physical fitness tests than hearing children. A valid and reliable modified version of the popular fitness test battery was used to assess physical fitness. Test items included percent body fat (skinfolds and weight and height scale), cardiorespiratory endurance, abdominal strength/endurance (curl-ups), and flexibility (sit-and-reach).

According to [3], the percentage of school-age children with disabilities typically have decreased fitness which normally avoid them to participate, with their peers, who involve in any activity that results in less of psychological aspect such as less self-esteem and metabolic syndrome (diabetes).

The importance of physical fitness to children with hearing impairment is same for those children who do not have hearing losses. Deaf students have lower fitness scores than their same age peers.

The Special Olympics is for athlete who have problem with mental disabilities such as cerebral palsy, and the Paralympics are for athlete with physical disabilities such as paraplegia [5]. The importance of physical fitness toward children with hearing impairment in order of long-term benefits of fitness is to decrease any prevalence that leads to cardiovascular disorders and capable of coping with stress, depressions, and anxiety which can be classified as psychological problems [6]. Maintaining appropriateness, fitness levels increase quality of life among deaf or hearing impairment children physically and psychologically.

People with disability were recognized to be associated with a deterioration of various physiological capacities, such as endurance, muscle strength, flexibility, and agility. Decline in physiological capacity is also partly due to lack of physical fitness that will further decrease muscle strength, physical function, and socialization [7]. About 70 % of hearing impaired children did not involve in physical activity and have lower physical fitness levels than students without disabilities Ellis [8]. According to Goodman and Hopper [9], deaf children need a healthy lifestyle behavior, which the general consensus in this group has demonstrated lower physical fitness levels than their hearing peers. According to [1], physical fitness is defined as a person has in regard to his or her ability to perform in physical activities. The objective of the study is to verify and determine the fitness profile of students with hearing impairment. Many researchers have studied a lot of deaf–blind physical fitness and comparisons of non-hearing impairment, blind and deaf students. The reasons are unknown why deaf students have lower physical fitness scores. However, few studies mentioned that their fitness can be improved by increasing their physical activity level. The reason of this study is to focus on physical fitness of school-age children with hearing impairment. There are very little data or information about the quality and quantity of the various services and related fitness of school-age deaf or hard of hearing students. Therefore, the objective of the study is to compare between physical fitness levels and gender among students with hearing impairment.

2 Methodology

2.1 Sample

The study design can be characterized as an experimental group which has been categorized as convenient sampling, and the participants already have been categorized within a certain group through natural selection prior to the study.

Independent variables consisted of gender and age. Dependent variables included physical fitness test measure of BMI (weight in kilogram (kg)/height in meters (m^2)), cardiorespiratory endurance, handgrip strength and muscle flexibility, muscle strength or endurance, power, and agility. The influence of independent variables on the dependent variables was determined through group comparisons.

2.2 Instrumentation

The total of 170 (n = 170) subjects (males 122, females 48) voluntarily participated in the study. They are from special school setting and were represented from the state school for students with hearing-impaired. The subjects are ranged from 7 to 12 years old from an elementary school and 13 to 17 years old from a secondary school participated in this study.

The instrument used was a questionnaire and fitness test battery. Demographic data consist of age and gender; race and medical history were collected by questionnaire. The physical fitness was evaluated using fitness test battery which included body composition (BMI), cardiorespiratory endurance, abdominal muscular strength and endurance, flexibility (sit-and-reach test), agility or running speed (shuttle run), explosive strength or power (vertical jump), and static strength (arm pull and handgrip strength).

Fitness tests were administrated to measure the fitness component among group of hearing impairment. Physical fitness was evaluated using fitness test battery which consists of cardiorespiratory endurance, handgrip strength and muscle flexibility, muscle strength or endurance, power and agility, and body composition. Test–retest reliability of the fitness test in children ranged from $r = 0.61$ to 0.94 [2].

This study will use seven (7) tests, which are sit-and-reach test, sit-up test, 10-m shuttle run test, 600-m run test, vertical jump test, and handgrip strength test. The entire test has been conducted to the subjects. Before starting the test, the permission has been granted by the team manager and the coaches. The subjects need to fill in the personal detail form, the consent form, and also briefed about the tests. A demonstration session also has been conducted by the test administrators. The entire test was conducted for a day. The subjects had been given two (2) trials to complete the tests.

Standing height was recorded to the nearest half cm with the subject barefoot and with the back against a vertical wall. Body weight was measured to the nearest 0.5 kg with shoes and sweaters (SECA model 841). Body mass index (BMI) was defined as body mass (kg, measured using an electronic weighing scale to the nearest 0.1 kg) divided by height (m, measured to the nearest 0.1 cm) squared (kg/m^2).

Sit-and-reach test is used to measure the flexibility of the hamstrings, buttocks, and lower back [10]. The subjects were instructed to reach as far as possible from a sitting position (Acuflex model 1).

Sit-up test is used to measure muscular endurance of the abdomen. The subjects need to lie down on the exercise mat, with both their leg bend at 90º. Upon receiving the signal “Go,” the subjects need to perform sit-up with their chest touching their leg as many as they can within 1 min. The score will be recorded.

10-m agility shuttle run test is to measure agility. Mark two lines 10 m apart using marking tape or cones. The two blocks are placed on the line opposite the line they are going to start at. On the signal “ready,” the subjects place their front foot behind the starting line. On the signal “go!” the subjects sprint to the opposite line, pick up a block of wood, and run back and place it on or beyond the starting line. Then, turning without a rest, they run back to retrieve the second block and carry it back across the finish line. Two trials are performed.

1600-m endurance run test is to measure cardiovascular endurance. Subjects need to run a distance of 1600 m in a 400-m synthetic track.

Coaches often use vertical jump to measure athlete’s lower body muscular power [3]. The vertical jump (countermovement jump with 90º knee flexion before the extension of the knee in jumping phase). The jump was performed on a hard and flat surface using the “Vertec equipment” adjusted to each of the participants. The subjects were asked to do a countermovement jump in which they began in a standing position, dropped into the semi-squat position, and immediately jumped as high as possible. The jump height was given automatically by the Vertec. Two tests were performed with five minutes of rest between them. The best jump was used for analysis.

Grip strength is an important prerequisite for good performance of the upper limb. In the study, handgrip strength was measured using a standard adjustable handgrip strength test (Takei model TKK5401). Maximum handgrip forces for dominant hand were recorded in kilograms as the highest of two trials. Before testing the subjects individually, the researcher gave a brief orientation to the entire group. The dynamometer was adjusted to the size of the hand of participant. The arm, the hand, and the body position were standardized according to the suggestion of the American Society of Hand Therapists. Subjects were sitting with shoulder adducted and neutrally rotated, elbow flexed at 90º resting on the table surface, and the forearm in neutral and wrist in 0º–30º extension. The test was performed by squeezing calibrated hand dynamometer as forcefully as possible with the dominant hand. Static strength was assessed.

2.3 Data Collection and Data Analysis

The data had been collected at Sekolah Kebangsaan Pendidikan Khas, Seksyen 18, and at Sekolah Menengah Kebangsaan Pendidikan Khas, Seksyen 17, Shah Alam. Beginning of data collection session, students were introduced to the chief investigator and his team that will explain the procedures using the sign interpreter, teaching cues, directions and demonstrations. Students who wish to participate in this study get the informed consent from investigator for their guardian or parents. Specific date and times were arranged in the schools, and those parents who gave consent to their children participate in this study.

Before starting the physical fitness test, all the students lined up for stretching and warm ups. Then, the students will divided be into 7 groups of administration of the fitness test batteries to complete sit-and-reach test, sit-up, 10-m shuttle run, 1-mile run (secondary school) and 600-m run (primary school),vertical jump, handgrip strength, and height and weight measurement. Therefore, appropriate communication during the briefing and demonstrations that include sign language from sign interpreters to ensure all the subjects were understand the proper information. The children name being address in order to ease the instructions. Giving encouragement and positive feedback to the subjects was to give them support to show best performance.

The data were analyzed by using descriptive statistic and inferential statistic. The descriptive statistic showed the frequency, percentage, mean, and standard deviation of respondents in the demographic data. The independent *t*-test was used to compare group means for anthropometric, health-related fitness (cardiovascular endurance, abdominal strength, and flexibility), and skill-related fitness (agility, muscle power, and handgrip), among genders. Significance was established with ($p < 0.05$). All statistical calculations were conducted using the SPSS (version 18) package software program.

3 Results

Table 1 shows the demographic characteristics of study population which included the gender, level of school and races. Table below shows the subjects in primary school (7–12 years of age) are female students with hearing impairment (n = 23) with percentage of 14.71 % and male students (n = 45) with percentage of 26.47 % compare to secondary female students (n = 22) with percentage of 11.76 % and male students (n = 78) with percentage of 47.06 % which is aged from 13 to 19 years old.

Among 170 subjects from special school that located in Shah Alam, Malays represented the biggest percentage of both female (21.76 %) and male (60.59 %)

Table 1 Demographic characteristic of the students with hearing impairment based on gender and races

Variables		Gender (n = 170)	
		Female (n = 45)	Male (n = 125)
		n (%)	n (%)
Level of school	Primary	25 (55.6 %)	45 (36.0 %)
	Secondary	20 (44.4 %)	80 (64.0 %)
Races	Malay	38 (84.4 %)	102 (81.6 %)
	Chinese	3 (6.7 %)	12 (9.6 %)
	Indian	2 (4.4 %)	8 (6.4 %)
	Others	2 (4.4 %)	3 (2.4 %)

Table 2 Descriptive data of the anthropometric properties of male and the female of primary and secondary school children with hearing impairment

Variables	Male (n = 125)		Female (n = 45)	
	Primary (n = 45)	Secondary (n = 80)	Primary (n = 25)	Secondary (n = 20)
Height (m)	1.36 ± 0.14	1.39 ± 0.12	1.39 ± 0.12	1.38 ± 0.92
Weight (kg)	32.84 ± 14.26	43.07 ± 9.97	33.71 ± 7.87	38.81 ± 6.73
BMI	17.25 ± 4.64	21.85 ± 2.78	16.50 ± 3.99	20.20 ± 2.99

children with hearing impairment, followed by Chinese male with 6.47 % subjects compare with Indian male only 4.71 %. Chinese female is the second highest percentage involves in this fitness test with 2.35 % and followed by Indian female students with only 1.72 %. Both other race of female (0.59 %) and male (1.765) presented the smaller percentage.

Table 2 represents the mean and standard deviation of body height and body weight, where males in primary and secondary school are highest and heavier than females in both schools. This also seems that total body mass among males in both schools is greater than females (17.62 ± 4.36 and 21.84 ± 2.78 vs. 16.50 ± 2.82 and 20.19 ± 2.99). Height and body weight will be increased as increase of age. Both females and males in both schools can be classified as lean body mass index as mention by WHO (1980) in BMI classification.

The Table 3 shows the descriptive data of the overall fitness components of the male and the female of the primary and the secondary school. The findings show that males (25.27 ± 87.16) are greater than females (22.20 ± 8.00) in primary school, but in secondary school as maturation and growth development, the result has been shown that females in secondary school (29.25 ± 7.01) are superior to males (27.73 ± 4.51) in abdominal sit-up test.

The sit-and-reach test is to measure the back and lower thigh flexibility. The finding revealed that the male subjects (22.22 ± 7.28) shows improvement than the female subjects (20.08 ± 4.43) in primary school children, but the female subjects

Table 3 Descriptive data of the fitness level of male and the female of primary and secondary school children with hearing impairment

Fitness Tests	Male (n = 125)		Female (n = 45)	
	Primary (n = 45)	Secondary (n = 80)	Primary (n = 25)	Secondary (n = 20)
Sit-up test	26.02 ± 8.32	27.70 ± 4.52	20.08 ± 6.08	29.25 ± 7.02
Sit-and-reach test	22.22 ± 7.28	14.40 ± 1.81	20.08 ± 4.43	15.20 ± 2.10
600-m run test	3.38 ± 0.36	7.99 ± 3.66	3.48 ± 0.20	7.96 ± 0.85
10-m shuttle run test	14.95 ± 2.05	30.30 ± 4.70	14.58 ± 3.39	32.04 ± 4.55
Vertical jump test	137.96 ± 50.60	15.19 ± 3.45	130.92 ± 58.05	13.48 ± 2.95
Handgrip strength test (left)	14.64 ± 11.82	21.36 ± 9.80	12.56 ± 3.89	17.12 ± 9.25
Handgrip strength test (right)	14.19 ± 7.30	20.06 ± 9.71	12.32 ± 3.85	16.47 ± 8.96

(15.20 ± 2.10) show better performance in flexibility test compare to the male subjects (14.40 ± 1.81) in secondary school. Table 3 shows the results of the cardiovascular endurance comparison in both schools. The mean and the standard deviation that been display in primary school (3.48 ± 0.20) and secondary school (7.96 ± 0.85) show the female subjects are superior compare to the male subjects with hearing impairment in both schools (3.38 ± 0.36 and 7.99 ± 3.66). 10-m shuttle run test result indicates that the female subjects are superior compare to the male subjects in primary school (15.17 ± 1.76 vs. 14.99 ± 1.94) and in secondary school (32.04 ± 4.55 versus 30.30 ± 4.70). The male subjects in primary and secondary school perform better in left and right handgrip test compare to the female subjects in both schools. Left handgrip in primary school among males is 14.31 ± 7.33 and secondary school is 20.06 ± 9.71, females in primary school is 12.11 ± 3.62, and female in secondary school is 16.47 ± 8.95. Nevertheless, in right handgrip, the score in male is 13.22 ± 6.34 and female is 12.25 ± 3.63 of primary school is and in secondary school of male is 21.36 ± 9.80 and female is 17.12 ± 9.25.

The vertical jump test is to assess muscle leg power has been shown in the table above. Primary school subjects in both schools showed good result compare to the secondary school subjects. The findings revealed that the male subjects in primary school perform better (139.07 ± 51.96) than the female subjects (128.92 ± 55.47) in same age. It also can be seen in secondary school that the male subjects perform better (15.19 ± 3.44) than the female subjects (13.48 ± 2.95) in the same age of secondary school. Therefore, in explosive muscle power were significantly show ($p < 0.05$) the male subjects are superior than the female subjects.

Table 4 shows the independent *t*-test between genders on the fitness test. Abdominal sit-up, sit-and-reach, and cardiovascular endurance were classified as health-related fitness. The outcome of the fitness test for deaf students revealed that

Table 4 Independent *t*-test of physical fitness level among gender

Fitness tests	Gender	Mean ± SD	*t*	*df*	*p* value
Sit-up test	Male	27.10 ± 6.18	2.53	168	0.012
	Female	24.16 ± 7.91			
Sit-and-reach test	Male	17.22 ± 5.92	−0.718	168	0.474
	Female	17.91 ± 4.32			
600-m run test	Male	6.33 ± 3.67	1.45	168	0.148
	Female	5.48 ± 2.32			
Vertical jump test	Male	24.77 ± 8.39	1.61	168	0.110
	Female	22.34 ± 9.60			
Handgrip strength test right	Male	59.39 ± 66.46	−1.63	168	0.105
	Female	78.72 ± 72.97			
Handgrip strength test left	Male	17.95 ± 9.33	2.49	168	0.014
	Female	14.16 ± 6.86			
10-m shuttle run test	Male	18.94 ± 11.01	2.47	168	0.014
	Female	14.59 ± 7.10			

$p < 0.05$

the independent t-test indicate that there is a significant differences between fitness variables and health-related fitness among gender. Significant differences were found in sit-up test between genders (0.012; $p < 0.05$), handgrip strength test (left) (0.014; $p < 0.05$), and 10-m shuttle run test (0.014; $p < 0.05$), where as there is no significant difference in fitness test among genders in sit-and-reach test (0.474; $p > 0.05$), 600-m run test (0.148; $p > 0.05$), vertical jump test (0.110; $p > 0.05$), and handgrip strength test (right) (0.105; $p > 0.05$).

4 Discussion

The study was conducted with the purpose is to compare between physical fitness level and gender among deaf students. Growth maturation and body composition are the factors likely to influence and affect the results of fitness testing in schools [10]. Poor physical fitness among children with hearing impairment population is associated with lack of active physical activity lifestyle. Besides that, lack of motivation can give affect on the physical activity as well as physical fitness. According to the Zwierzchowska [11], the speech abilities regulate physical movements since it replaces direct stimulation that affects children through particular sense, in which relations are created between word and sensation. Therefore, it leads to permanent relation between sensory and verbal stimuli. There are few published reports on physical fitness in a large sample of Asian children with hearing impairment. A comparative analysis of physical fitness on hearing impairment student has been limited in literature.

Height and weight indicator is required while to assess the body composition together assessing the BMI of the subjects, that is positively related with age for children from 7 years onwards. The height of children in secondary school was found to be significantly higher than primary school children. Females in secondary school were also taller than males in primary school children. In the present studies, male students in primary and secondary school are taller than females. On the other hand, the studies found that females are heavier and taller than boys because they are thought to be in their period of rapid growth. According to another literature, obesity has higher prevalence and incidence that occurs in female than male.

Among the deaf children, studies showed that BMI of male is higher than female students. Reference [8] supported the statement saying that boys have the larger percentage of overweight (24.7 %) compared to girls (20.4 %). The prevalence of overweight deaf children aged 6–11 years was above the national percentage for same age and gender. However, girls after aged of 8 years showed a consistent decrease in BMI with increasing age but not for the boys.

The factors of flexibility are associated with physical characteristics of skeletal muscle, tendons and fibrous tissue, and also related neuromuscular activation of related muscle groups. The flexibility of children remains constant between 5 and 8 years of age. The peak declination of flexibility is at 12–13 years of age with advancing age. It is because muscle elongates during preadolescence in response to increased bone length and a decrease in flexibility during period of rapid development. During flexibility, some static contraction could be involved in order to increase joint range of motion because both viscoelastic and functional changes are engaged [12]. In the study, the declination in flexibility among males secondary school is because the persistent tightness in their hamstrings and lower back. This is due to the lack of exercise and flexibility training among the subjects.

The handgrip strength among school-age children in this study showed that handgrip strength is greater in males. Previous studies found out in the same way that female students with hearing impairment shows the lowest result compare to blind girls and also to the male in the same age groups [13]. The main reason why the female subject expose lower result in handgrip strength test compare to the male subjects in most of the studies, is because they lack sustained isometric handgrip strength that can be certified to limit blood flow by intramuscular pressure in stronger men contracting at a greater absolute force but similar relative contraction intensity are lack in women [14].

Abdominal strength and endurance defined as the ability of a muscle, or a group of muscles, to sustain repeated contractions measured by the number of sit-ups . It been shown that the level of muscular endurance significantly lower in female primary school subjects, but as age increase the male secondary school subjects perform lower than female in the same age. According to Janz [15], revealed that the results of poor abdominal muscle strength and endurance are because the subjects usually perform exercise that targeted only the certain part of the body and yet they compromise trunk stability during many gross motor skills, and that makes more difficult during the skill acquisition and performance thus lead to musculoskeletal problem such as lower back pain.

The important in performing vertical jump is the strength of the knee extensor. The study found that the male muscle leg power in both age groups performs greater than female and significantly ($p < 0.05$) in gender differences. It is because male may be able to utilize the stored elastic energy to a greater extent than female when performing countermovement vertical jumps.

Cardiovascular fitness level of the male subjects in primary and secondary school were lower than their female counterpart (3.401 ± 0.32 and 7.610 ± 1.25 vs. 3.446 ± 0.28 and 7.964 ± 0.84) and this according to age and gender.

In conclusion, hard of hearing or also known as hearing impairment that occurs among school-age children always has been assume to have lower physical fitness in all batteries test which reduced their interest in participating to involve in physical activity. Deaf individual is associated with sensory impairment which effects in balance and motor development. The entire physical fitness test conducted should adapt with their disabilities by modifying the instruction and demonstration for measuring the test. Communication among this population normally need interpreter to communicate with them if other professionals such as physical therapist, instructor fitness, or coaching desire involve in this community. Therefore, hearing impairment children can increase their physical activity and thus enhance their physical fitness that leads to increase in quality of life.

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Effects of Periodized Small-Sided Training on Physical Fitness Performance Among Young Male Football Players

Zulkhairi Azam, Sufyan Zaki, Hanifa Sariman, Wan Norsyam, Nurul Nadiah Shahudin and Muhammad Noor

Abstract The aim of this study was to investigate the effects of periodized small-sided game training programs on physical fitness performance (aerobic performance and maximal sprint performance) in young football players. Twenty male young football players (age: 14 ± 0.4 years, weight: 51.42 ± 5.6 kg, and height: 163 ± 5.3 cm) from a sports school, Kuala Lumpur were randomly selected and assigned to two groups that are small-sided game group (SSGG) and control group (CG). Both groups completed training twice per week for a period of four-week training program. SSGG performed 7 different small-sided game sessions (4 vs. 4) in which each games lasted for a 4-min duration with added 2-min for active recovery. First session started with 4 games and on every sessions another extra one game were added until the seventh session with maximum 10 games (ranged from 4 to 10) over the intervention period. Meanwhile, CG completed 7 sessions based on coach training programs with same progression overload in SSGG. For measuring the above physiological variables, 20-m shuttle run test and 30-m sprint test were used, respectively. Data analysis of paired *t*-test and independent *t*-test was used, and the level of significance in all statistical analyses was set at $p \leq 0.05$. The result showed that 4-week training in small-sided games displayed significant improvement in aerobic performance ($p \leq 0.00$) and maximal sprint performance ($p \leq 0.00$) for SSGG. Besides, CG also showed significantly increased maximal sprint performance ($p \leq 0.03$). Meanwhile, there is no significant improvement in aerobic performance ($p \leq 0.054$). Moreover, result also displayed a significant difference between SSGG and CG in aerobic performance ($p \leq 0.03$) and maximal sprint performance ($p \leq 0.05$). In short, the present study demonstrates that implementing a periodized small-sided game training intervention during 4-week in-season competition is capable of improving physical fitness performance and greatly applicable in young football players.

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Keywords Football · Small-sided games · Aerobic capacity · Sprint performance

1 Introduction

Generally, football is a sport that requires a lot of physical components. These include cardiovascular fitness, muscle strength, flexibility, agility, endurance, speed, and coordination [1–3]. Besides that, tactical and technical part also plays an essential element in producing a quality performance. Previous studies reported that all the elite players will run 10 km at an achievable average intensity close to the anaerobic threshold (80–90 %) of maximal heart rate during the whole 90-min game [4]. This allegation proves that football game not only uses 100 % aerobic capacity as an energy source, but it involves a highly intermittent game. It is used combination of ATP-PC, glycolysis, and oxidative energy system [2, 5].

The most important element in the application of football is physical fitness. Basically, there are some training designs that can be used in handling a team to improve physical fitness. In the world of football, there have been several physical fitness training programs such as generic and specific methods. Both fitness training programs provide highly efficient impact and are cost-effective. In the generic method, most coaches use exercises such as long slow distance (LSD), Fartlek training, and high-intensity interval training (HIIT). These three training methods are valuable to boost cardiovascular fitness of football players [6–10]. HIIT is the most training regime that always been used of the entire sportsman to improve cardiovascular endurance. HIIT can also be defined as the short burst of vigorous activity with intermittent exercise requires players to perform high-intensity close-to-maximal oxygen consumption (VO_2 max) [11].

In recent years, football game has reached a new dimension of quality in terms of training. Most of coaches often use small-sided games in football drills instead of generic training in order to develop the technical skill, tactical play, and physical performance at the same time. These training programs provide high-intensity activities and require players to make the repeated short sprint, quick sudden changes, and limited recovery period [12]. Studies on small-sided game stated that this game can improve aerobic capacity [13]. The increase of research on this topic is coincident with the increase of popularity obtained by specific football conditioning, which involves training players to deal with football match situations. Studies on small-sided games stated that this training can improve aerobic capacity. Moreover, it also significantly increases the player's sprint time and running economy.

Several studies have compared the movement patterns encountered between small-sided games and full-sided game. Obviously, the main difference between full-sided match and small-sided games is the work rate of the players. According to [14], playing in the small-sided area requires players to have a greater involvement. Hence, the smaller number of players could increase the probability of each player being directly involved during attacking and defending. Moreover, [14, 15] also reported that playing small-sided games such as 3 versus 3 game will have greater impact on work rest ratio, the player workload per minute, and exertion per minute rather than play in full-sided match.

To further strengthen the advantages of SSGG, previous studies have made comparisons between HIIT and SSGG. A small-scale study by [7] reaches the same improvement between SSGG and HIIT. Both types of training have shown an increase in aerobic capacity and intermittent running. They took about 6 weeks to test the effectiveness of both training methods. As a result, HIIT increased by 5 % and SSGG increased by 7 % for aerobic fitness test. In addition, the intermittent running tests also recorded good growth between both the training programs.

In Malaysia, SSGG is considered as a new training regime. Most of the coaches or players are not familiar to use this method, although many studies have been conducted. In practice, small-sided games produce many advantages and benefits. The objective of this study was to examine the effectiveness of periodized small-sided games in 4-week training intervention on physical fitness performance between male young football players.

2 Methodology

2.1 Subject

Twenty male young football players (n = 20) that represented Titiwangsa Sports School Kuala Lumpur team were used in this study (mean ± SD; age: 14 ± 0.4 years, weight: 51.42 ± 5.6 kg, and height: 163 ± 5.3 cm). All players and their parents were fully informed of the experimental procedures and associated risks before giving informed consent. The study was approved by the appropriate university research ethics committee. The subjects were free to withdraw from the study at any time without needing to give a reason.

2.2 Design

The study was designed as an experimental study and conducted during the competitive season over the 4-week period (August to September). About twenty players were randomly selected and assigned to two groups which are small-sided game group (SSGG) (n = 10) and control group (CG) (n = 10). Both groups completed training twice per week (Monday and Wednesday) for a period of four-week training programs. All the practice session was performed at the same time of day (from 4.00 to 6.00 PM) on field grass.

2.3 Methodology

Before and after training intervention, all the players completed two physiological parameters. All measurements were performed on different days because the intensity is high. The sprint test was performed on Mondays, and maximal oxygen uptake assessments were finished on Tuesday.

2.3.1 Day 1

Sprint Test The players performed 20-min specific warm-up before start of the sprints. Due to the lack of equipment, the sprint time was recorded by manual assessment (stopwatches). The subjects performed three maximal attempts at the distances of 30 m. Only the best (e.g., the shortest time) times were used in the subsequent analysis. Each player started from a standing position, with his front leg on the starting line.

2.3.2 Day 2

Aerobic Capacity (VO_2 max) Players should do appropriate warm-up to avoid injury from 12 to 15 min prior to beginning of the test. When conducting the test, players should run 20 m in time with a beep from a CD recording. The players must place one foot on or beyond the 20-m marker at the end of each shuttle. If the athlete arrives at the end of shuttle before the bleep, the athlete must wait for the beep and then resume running. If the athlete fails to reach the end of the shuttle before the beep, they should allow 2 or 3 further shuttles to attempt to regain the required pace before being withdrawn. The assistant was recording the level and number of shuttles completed at that level by the athlete when they are withdrawn.

2.4 Training Program

The SSGG performed seven different sessions (4 vs. 4) in which games lasted for a 4-min duration for the selected numbers of games (ranged from 4 to 10) increasing over the intervention period with added 2 min of active recovery in every game. Meanwhile, CG completed seven sessions based on coach training programs with same progression overload (4 min activity + 2 min of active recovery) like SSGG.

Table 1 SSGG intervention training program (7 sessions)

Session progression	Progression overload	Dimension size of filed	Total SSGG duration (time)
SSGG 1	4 × 4 min + 2 min recovery	30 m length × 25 m wide	24 min
SSGG 2	5 × 4 min + 2 min recovery		30 min
SSGG 3	6 × 4 min + 2 min recovery		36 min
SSGG 4	7 × 4 min + 2 min recovery		42 min
SSGG 5	8 × 4 min + 2 min recovery		48 min
SSGG 6	9 × 4 min + 2 min recovery		54 min
SSGG 7	10 × min + 2 min recovery		60 min

2.5 Statistical Analysis

The data were analyzed by using the Statistical Package for Social Science version 20.0 (SPSS version. 20.0), and data are reported as mean ± SD. The normal distribution of the data was checked using Kolmogorov–Smirnov test. After confirming normal distribution, paired sample t-test was used to compare the difference score before intervention and after intervention while independent t-test was used to compare the difference score from 2 different groups (SSGG and CG). The level of significance was set at $p < 0.05$ (Table 1).

3 Results

All subjects successfully completed the 4-week training intervention. The mean age of the subjects was 14.0 ± 0.4 years, and they managed to finish all the required training intervention and physical fitness test without any complication or injuries (Table 2).

Table 2 The characteristics of the subjects

n = 20	(mean ± SD)
Age	14 ± 0.4
Weight (kg)	51.42 ± 5.6
Height (cm)	163 ± 5.3

Table 3 Pre-test and post-test between SSGG and CG

Test	SSGG		CG	
	Pre	Post	Pre	Post
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
VO_2 max	48.5 ± 4.4	53.75 ± 4.2*	48.4 ± 3	49.94 ± 2.8
30 m sprint	4.87 ± 0.06	4.67 ± 0.08*	4.84 ± 0.13	4.76 ± 0.11*

*Differences are statistically significant $p < 0.05$

Table 4 SSGG and CG in 30-m sprint test

Group training		n	Mean ± SD	Sig. (2-tailed)
Pre-test	SSGG	10	4.87 ± 0.06	
	CG	10	4.84 ± 0.13	0.533
Post-test	SSGG	10	4.67 ± 0.08	
	CG	10	4.76 ± 0.11	0.046

Table 5 SSGG and CG in VO_2 max

Group training		n	Mean ± SD	Sig. (2-tailed)
Pre-test	SSGG	10	48.51 ± 4.4	
	CG	10	48.4 ± 3.0	0.949
Post-test	SSGG	10	53.75 ± 4.2	
	CG	10	49.94 ± 2.8	0.029

3.1 Pre- and Post-test Between SSGG and CG

SSGG showed significantly improved aerobic performance ($p \leq 0.00$) and maximal sprint performance ($p \leq 0.00$). Besides, CG also showed significantly increased maximal sprint performance ($p \leq 0.03$). Meanwhile, there is no significant improvement in aerobic performance ($p \leq 0.054$) (Table 3).

There was significant difference between SSGG and CG in 30-m sprint test and aerobic capacity. Significant value indicated $p = 0.05$ for 30-m sprint test and $p = 0.03$ for VO_2 max (Tables 4 and 5).

4 Discussion

The aim of the present study was to investigate the effects of 4-week small-sided game training intervention on physical fitness performance in male young football players during the competitive season. The main findings revealed that the training intervention significantly improved players' sprint performance and VO_2 max. It appears from our findings that the periodized small-sided game training intervention could have a positive effect on both anaerobic and aerobic systems during the competitive season. The findings from the present study have identified small-sided games as an alternative training modality to generic training (e.g., interval training) capable of improving physical fitness performance in young football players.

In this study, sprint test has been taken into account to see the effectiveness of the SSGG training method on sprint performance among young players. Reference [16] demonstrated that almost 96 % of sprint bouts exits in shorter distance less than 30 m during a 90-min game. Besides that, from the studies of the physical demand on different positions in the English Premier League (EPL) [17–19] also found that about 10 to 20 times of repeated sprints occurred every 70 seconds during matches. Moreover, a player will score a goal after struggling effective dribble and quick run [20, 21]. Clearly, the rate of acceleration is needed in giving excellent stimuli in the game tactical, and indirectly it is a critical element in the football game.

On the question of the effectiveness of small-sided game training, this study found that the sprint performance furnishes significant improvement after giving 7 sessions (4 weeks) of SSGG training. The SSGG showed almost 4 % increment better than CG with just only 2 % increase compared between the pre-test and post-test. This result is in agreement with previous studies examining the effect of small-sided games on physical conditioning and performance in young football players [15, 22, 23]. These researchers have conducted studies to make a comparison between the uses of the different players. As a result, the concept of using a 3 versus 3 game provides a better impact than 6 versus 6 game in a 30-m sprint test. This shows the total number of players able to influence the physical fitness of the players. In contrast to earlier findings, [20] reported no evidence could be detected from the 30-m sprint test against the effectiveness of SSGG training. These researchers have used a total number of players almost the same as [5] did, but made additional goalkeeper.

However, when analyzed more deeply, the intensity of the game (work ratio) was perceived differently by [24] using 5 × 4 min compared to [5] who use 10 × 4 min. It demonstrates that the time interval playing greatly affects the ability of the player performance in a 30-m sprint test. By using the concept of periodized, this current study is more relevant in maintaining and improving the maximal velocity of the players. In addition, the test was successful as it was able to identify player's maximal velocity.

As long as it was called intermittent sport, it cannot be escaped from having sufficient aerobic energy system. In reality, [4] reported that elite football players ran almost 10 km during a full 90-min game and directly show the rate intensity of the exercise is close to an anaerobic threshold (80–90 % of maximal heart rate). Furthermore, within this endurance category, several intense activities are needed such as jumping, kicking, tackling, turning, sprinting, changing pace, and maintaining the body balance against opponent pressure [4]. Without having a good cardiovascular endurance, a player may not be able to sustain quick recovery and maintain the momentum of performance within 90 min of the game.

In achieving a great aerobic base, physical fitness test that involves the use of the aerobic energy system has been used [9]. Based on the hypothesis finding, the predicted VO_2 max (PVO_2 max) capacity revealed significant improvement after

4-week (seven sessions) SSGG training intervention as p values are less than 0.05. The percentage increments for PVO_2 max showed great differences in pre-test and post-test between SSGG and CG. SSGG indicated 10 % increment better than CG with just only 3 % increase.

These findings actively engage with previous research that examines physiological and performance effects of generic versus specific aerobic training in football players [25–27]. The researchers made the comparison between generic training and specific training. The training program for both groups is equal to avoid bias and took 12-week period, two times per week. Both studies did set four minutes time period for each game and three minutes of active recovery between bouts and encouragingly had shown similar improvements to the current study. VO_2 max increased respectively in both groups by approximately 8 % and 7 %. These findings further support the idea from [13, 15] that did the investigation about a comparison of SSGG and interval training on same selected physical fitness factors in amateur football players. By using a 6-week training period and also 4-min bouts of interval time, small-sided game group points out significant raise in VO_2 max.

However, the findings of the current study do not support the previous research. As noted by [28], SSGG training intervention failed to improve VO_2 max in both groups. Although, the researchers use the same training design, it is still not able to achieve a good improvement. The researchers have changed the number of players involved by using the concept 6 versus 6. Definitely the involvement of many players will have an impact on movement pattern. Hence, not only the time interval of the game affects the level of increment VO_2 max capacity, but the number of players involved and the size of the field also have a huge impact on the improvement of VO_2 max capacity [24, 29]. By using the concept of periodized, recent study is more relevant in maintaining and improving the VO_2 max of the players. Moreover, the test was successful as it was able to identify player's aerobic capacity. Therefore, it can be inferred that the improvement of physical fitness performance is closely related to the influence of small-sided game training interventions.

5 Conclusion

In conclusion, the aim of assessing the effectiveness of periodized small-sided games on physical fitness performance between male young football players was achieved. Moreover, this study clearly demonstrates that 4-week small-sided games can be used as an alternative training mode to enhance aerobic fitness and maximal sprinting in young football players. Furthermore, it can be beneficial, especially for young players, as the essential part to develop sport specific motor skill that relates to the practical session. In fact, this training modality may increase player's motivation, generate team cohesion, avoid boring during training, and mimic to the real game situation (high-intensity activity).

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The Relationship Between Rider's Body Posture and Horse Speed During Rising Trot in Equestrian Sports

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Abstract This study was carried out to observe the changes in horse speed with respect to the rider's body posture during rising trot in equestrian sports. This research used purposive sampling technique with six participants recruited. All riders were asked to trot their horse in one straight line for a 6-m distance. Reflective markers were placed on the rider's anatomical landmark as well as on the lower limb joint of the horse. A video camera was located 10 m from the sagittal plane of the horse's straight line pathway. Lean forward rising position appeared to provide the fastest horse speed followed by upright rising and lean back rising position. Horse speed results were consistent with the horse's stride length where the upright rising position provides the longest stride length. It showed that the rider's hip angle does influence the horse speed, and as a result, it also showed that there was a strong correlation between horse speed and its stride length. Therefore, we can conclude that there was a relationship between rider's body posture and speed of the horse.

Keywords Equestrian · Speed · Rising trot · Posture

1 Introduction

In every sport, body posture plays an important role in order to make sure it can help to improve performance. In equestrian sports, asymmetrical posture will have a significant effect on the performance of the horse [1]. Since horseback riding resembles a sitting position in daily activities, it helps in improving the posture of the body. Different countries propose different ways of proper sitting from slumped

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to upright position [2]. Still horseback riding proposes the upright sitting position in order to avoid lots of pressure been put on the horse back while riding.

In horseback riding, basic biomechanics of human joints involved are the hips as the centre of movement and spine as the supporter of horse movement. Every movement involves gravity which can increase the force as the acceleration increases according to the mass [3]. In riding, human movement is achieved through a complex and highly coordinated mechanical interaction between bones, muscles, ligaments and joints within the musculoskeletal system. Any injury to, or lesions in, any of the individual elements of the musculoskeletal system will change the mechanical interaction and cause degradation, instability or disability of movement. On the other hand, proper modification, manipulation and control of the mechanical environment can help prevent injury, correct abnormality and enhance speed healing and rehabilitation [4].

It therefore can also decrease the performance of the horse which influences less contact from the rider.

In horseback riding, especially in dressage events, the judge gives marks to the rider according to their consistency of rhythm but not high speed momentum. Generally in equestrian sports, sitting or standing on the stirrup gives a different load on the horse's back [5]. Here is where the position really takes an important role in order to control the speed of the horse. This is because the main load is situated on the hip, and it is also the centre of movement while on the horse. This study was carried out to observe the changes in horse speed with respect to the rider's body posture during rising trot in equestrian sports, which will educate riders that the horse's inconsistent performance is also the result of the postures.

2 Methodology

2.1 Participant

The selected study area was at the Malaysian Armed Forces Equestrian Centre (MAFEC). In this study, six horse riders and six horses participated. Every rider rides their own particular horse. The riders were among the MAFEC team which includes the coaches. The sampling technique was purposive sampling as we already set a characteristic based on the purpose of the experiment. All the riders were in the age range of 30 to 38 years old with a body weight range of 60–80 kg and height of 167–177 cm. They have had 10–13 years of experience in the equestrian industry. They have also already competed at the international level.

The horses which have been used in the study have an age range of 5–22 years old. Their body weight was in the range of 450–600 kg and height in the range of 15–16 ½ h. The breed of horses used during this study were thoroughbreds, Anglo Arab, selle francais (France warm blood), and Australian breeds (appaloosa). They horses also had experience in participating in national horse shows, international horse shows, eventing leagues and endurance international rides.

2.2 Data Collection

The data were recorded using a Sony Handycam HDR-PJ660VE video camera. The frame rate of the camera was 25 FPS. The results were analysed using the Kinovea software version 0.8.21. The distance used for the testing was measured using a measuring tape. It was then marked using a cone on both ends. A reflective marker was placed on the rider's joint (shoulder, hip, knee and ankle) and also on the horse's knee joint. The reflective marker was used to ensure that the rider and horse joint can easily be spotted during video analysis. The obtained data were then imported to the Statistical Package for Social Science (SPSS) for statistical analysis. The hip angle of the rider, measured between shoulder and knee joint and angle of knee, was measured between the hip joint and knee joint (Fig. 1). When in the upright position, shoulder, hip and heel of the rider should be in one straight line. When in lean forward position, the rider's shoulder joint will be placed in front from the straight line, whereas in lean back position the shoulder joint will be placed behind the straight line.

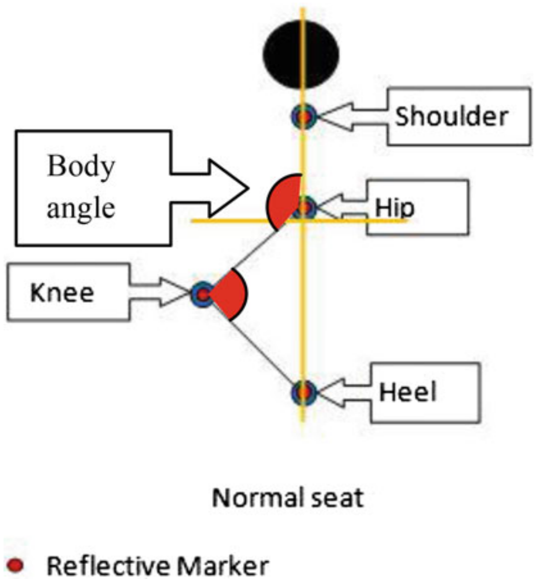

Fig. 1 Marker position and angle of measurement

2.3 Statistical Analysis

The data were collected through video recording of the subject and were then analysed using Kinovea. Kinovea was used to analyse the video to obtain the subject's body angle (hip joint angle and knee joint angle), the horses knee joint angle, the horse's stride length and speed. The obtained data were then been imported to the Statistical Package for Social Science (SPSS).

The obtained data were then analysed using correlation coefficient method. The Pearson correlation coefficient (stride length and speed) was used to find the correlation of the result.

3 Result

3.1 The Relationship Between Rider's Body Posture and Horse Speed

The data in Table 1 show the results obtained from this study. Figures 2, 3 and 4 show a representation of the data collected in this study.

The widest hip angle of the rider was during lean back position with an angle of 142.8. It was then followed by the upright position with an angle of 142.5 and the lean forward position with an angle of 136.7. The widest knee angle for the rider was during lean forward position with an angle of 130.1. This was then followed by the lean back position with an angle of 127.7 and the upright position with an angle of 127.3. The widest knee angle of the horse was during the upright position with an angle of 166.8. This was then followed by the lean forward position with an angle of 166.5 and the lean back position with an angle of 165.8.

The longest stride length of the horse was during the lean forward position with a length of 2.4 m. This was followed by the lean back and upright positions with a length of 2.2 m. The fastest speed of the horse was during the lean forward position with 2.6 m/s. This was then followed by the upright position with a speed of 2.4 m/s and the lean back position with the speed of 2.3 m/s.

Table 1 Mean (±standard deviation) for measured parameters

	Rider's hip angle (°)	Rider's knee angle (°)	Horse's knee angle (°)	Horse's stride length (m)	Horse's speed (m/s)
Upright rising	142.5 (8.4)	127.3 (8.3)	166.8 (1.9)	2.2 (0.2)	2.4 (0.1)
Lean forward rising	136.7 (11.3)	130.1 (11.1)	166.5 (2.2)	2.4 (0.2)	2.6 (0.2)
Lean back rising	142.8 (10.8)	127.7 (7.3)	165.8 (3.8)	2.2 (0.2)	2.3 (0.1)

Fig. 2 Upright riding position

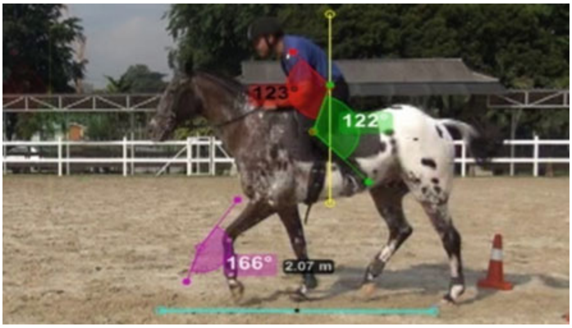

Fig. 3 Lean forward riding position

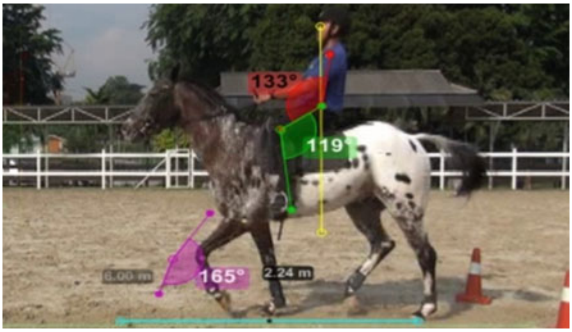

Fig. 4 Lean back riding position

3.2 Pearson Correlation Between the Horse Stride Length and Speed

The results of correlation analysis between the horse's stride length and the horse's speed for all three positions are shown in Table 2.

Table 2 Pearson correlation for all three positions

		Stride length		
		Pearson correlation	Sig. (2-tailed)	*N*
Upright	Speed	0.584	0.224	6
Lean forward		0.804	0.054	
Lean back		0.860*	0.028	

*$p < 0.05$

4 Discussion

This research was conducted to investigate the relationship between rider's body posture and speed of the horse in equestrian sports among Malaysian riders. The results showed that the speed of the horse was greatest during the lean forward riding position followed by the upright riding position and the lean back riding position.

The angle of the hips of each rider was different as well as the angle of the knee joint. This is because the rider's hip joint and knee joint depend on the rider's stirrup length. The stirrup length also depends on the rider's height and the type of event that the rider is involved. The speed of the horse is influenced by the rider's hip angle, and as the angle is narrowing, the horse will tend to go faster compared to the wider hip joint angle. The horse's stride length influences the horse's speed as shown in the data. However, the correlation analysis in this study showed that the stride length was significantly influenced by the speed in the lean back riding position as shown in Table 2. This result contradicts with earlier findings where the lean back riding position produced the shortest stride length and the lowest average horse speed. This was because the horse's knee angle in the lean back position was the narrowest compared to the other body positions. The horse's speed was also influenced by the rider's body weight since this gives an impact towards the horse's back. The upright position is suggested while riding a horse as the body alignment of the rider is in a straight line between shoulder, hip and ankle. Proper body alignment is important as it gains trust from the horse to ensure that the rider is able to get along with the horse especially in finding the rhythm [6]. The upright position is also able to provide a good balance for the rider. A good rider is able to ride with light seat and relaxed legs, while their body is balanced without rocking the body forward and backward, and having a supple seat which in return will have a better control and help the horse to be more relaxed throughout the training [7]. The performance of the horse and rider is dependent on the rider's body position [8]. Having a correct position while riding is able to give an effect on the horse's movement such as straightness [9].

In the lean forward position, the angle of the rider is usually narrower than in the upright position. The position of the rider's upper body should be in front of the vertical line. The lean forward position is where the rider's body position is ahead of the horse's centre of gravity [10]. However, the angle might have gone greater if the rider is carrying the legs behind the vertical line. Usually, the stride length of the horse is longer compared to the upright position as shown in this study. Rider's seat position is important in controlling the stride size of the horse [6]. In horseback riding, especially in dressage events, the judge gives marks to the rider according to their consistency of rhythm but not high speed momentum. The higher the speed of the horse will result in an increase of difficulty level to handle the horse [11].

In the lean back position, the rider's body angle is usually wider than the upright position. The position of the rider's upper body is behind the vertical line. The lean back position is where the rider's body position is behind the horse's centre of gravity [10]. However, the angle of the rider's hip joint might be narrower as the rider tends to carry their leg in front of the vertical line. Usually, the speed of the horse will decrease in this position as the load that been put on their back is high and this causes difficulty in moving forward. In addition to the extra weight been applied during the lean back position, it also increases the force applied on the horse's back during rising trot.

5 Conclusion

There are a few events in equestrian sports. The events include jumping, dressage and eventing. In dressage, posture and speed are very important aspects to be practiced in order to achieve high points. The rider's position should not disturb the horse's movement as it should encourage the movement of the horse to go forward in a proper manner. Therefore, the upright position really needs to be practised as it is able to make sure that the horse moves forward easier without much disturbance placed on their lower back and also their shoulders. This position also ensures that the horse and rider are in a balanced position. It also helps in reducing injury that might occur to the horses which can reduce their performance in the future. Based on the results, there was a positive and negative correlation regarding the stride length and speed. The stride length and the speed are influenced not only by the rider's body position, but also by the rider's muscle activity and body weight distribution on the horse's back. Negative correlation happens when there is strong muscle activity of the rider while on the horse which encourages the horse to open up their stride which in return results in increase in speed although the rider is in the lean back position. It also can happen when the rider's body weight distribution is not correct; for example, the horse moves slower in the lean forward position compared to the upright position. This situation happens when the rider happens to crouch their back and place it on the horse's withers which results in the horse having extra weight on their fore legs. Negative correlation also happens when the horse is actually an experienced horse, where the horse turns up to support the rider's position without having to change their speed–stride length. Positive correlation is when the rider's muscle activity and applied weight distribution are correct and the horse is able to accept it.

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Kinematic Parameters of Golf Putting

**Shariman Ismadi Ismail, Ahmad Fadzril Ahmad Rauf,
Norasrudin Sulaiman and Rahmat Adnan**

Abstract Putting is an important aspect in any golfers' game. Putting has always been associated with a kind of 'special feel' that golfers sense while performing the act. However, the special feel is quite abstract and difficult to measure. This study focuses on observing the putting kinematic properties among Malaysian amateur golfers. Results from this study were then compared to similar types of studies that have been conducted in Europe. Thirty local amateur golfers were selected in this study. Putting stroke from each subject was recorded using a high-definition camera at 50 Hz from anterior view. The recorded videos were then analyzed using Kinovea Motion Analysis Software. Selected kinematic parameters are stance width, sternum–floor height, sternum–ball position, and ratio of stance width with sternum–floor height. For the stance width, the recorded values ranged between 6 and 39 cm with a mean of 24.73 cm. The values for sternum–floor height were 100–130 cm, with a mean of 114 cm. For the sternum–ball position, the minimum was 1.5 cm, with a maximum of 4.8 cm with mean values at 3.24 cm recorded, while the percentage ratio for stance width divided by sternum–floor height was 21.65 %. The highest correlation between parameters that have been observed was the correlation between the sternum–ball position and stance width. There was no significant difference between the stance width and sternum–floor height although both have a weak positive correlation. The sternum–floor height and sternum–ball position parameters showed no significant difference as well. The study also indicated that Malaysian amateur golfers' kinematics properties are comparable with European golfers.

Keywords Golf · Putting · Biomechanics · Kinematics

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1 Introduction

Putting is an important aspect in any golfers' game. Putting has always been associated with a kind of 'special feel' that golfers sense while performing the act [1, 2]. However, the special feel is quite abstract and difficult to measure. Previous studies have shown that the putting distance can be influenced by many factors, which include, but not limited to, skill, kinematics, shaft, and club head characteristics [3]. This study focuses on observing the putting kinematic properties among Malaysian amateur golfers. Results from this study were then compared to similar types of studies that had been conducted in Europe.

2 Method

Thirty local amateur golfers (n = 30), aged between 20 and 50 years, were selected for this study. All golfers that participated in this study held handicaps of between +3 and 12. Putting stroke from each subject was recorded using one high-definition camera with 50 frames per second from the subject's anterior plane (Fig. 1). Each golfer performed 10 trials of putting stroke. The recorded videos were then analyzed by Kinovea Motion Analysis Software (v 0.8.15) as shown in Fig. 2. Joint positions and displacements were tracked by the motion analysis software, based on 5 reflective markers worn by the subject during the stroke. The markers, with 16 mm diameter, were located at the center of the clavicle (2 markers), center of the sternum (1 marker), and at the center of the distal phalanges of the feet (2 markers). Every stroke completed by the golfers was performed at the exact same location on the green to reduce the contour effects on the stroke. However, in this study, all golfers used their own putter for all of their strokes. Selected kinematic parameters were stance width, sternum–floor height, sternum–ball position, and ratio of stance width with sternum–floor height. Results obtained from the Kinovea measurement were then analyzed by SPSS package (v 16) for statistical analysis.

Fig. 1 Research setup

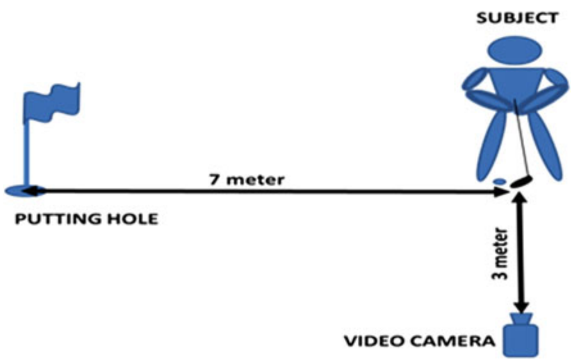

Fig. 2 Analysis using KINOVEA

3 Results and Discussion

The results are shown in Table 1. For the stance width, the recorded values ranged between 6 and 39 cm with a mean of 24.73 cm. The values for sternum–floor height were 100–130 cm, with a mean of 114 cm. For the sternum–ball position, the minimum was 1.5 cm, with a maximum of 4.8 cm with mean values at 3.24 cm recorded, while the percentage ratio for stance width divided by sternum–floor height was 21.65 %. The highest correlation between parameters that have been observed was the correlation between the sternum–ball position and stance width (r = 0.652, $p < 0.01$) as shown in Table 2. There was no significant difference between the stance width and sternum–floor height although both have weak

Table 1 Study results

	n	Min. (mm)	Max. (mm)	Mean (mm) (Std. Error)	Std. Dev.
Stance width	30	6	39	24.73 (1.175)	6.438
Sternum–floor height		100	130	114.20 (1.143)	6.26
Sternum–ball position:		1.5	4.8	3.24 (0.127)	0.693
Stance width and sternum–floor height		–		21.65 (%)	–

Table 2 Correlation between parameters

		Stance width	Sternum–floor height	Sternum–ball position
Stance width	Pearson's correlation Sig. (2-tailed)	–	0.323	0.652**
Sternum–floor height		0.323	–	0.304
Sternum–ball position		0.652**	0.102	–

**Correlation: significant at the 0.01 level positive correlations. The sternum–floor height and sternum–ball position parameters showed no significant difference as well. Overall, the results indicated that subjects that participated in this study had achieved similar results as golfers from Europe [1]. In terms of the stance width aspect, Malaysian amateur golfers achieved similar results when compared to the European amateurs. In terms of the sternum–floor height aspect, Malaysian amateur golfers performed the putting stroke with a lower sternum position. This result is not surprising if we consider that average height of European men would normally be higher than an average height of Malaysian men. However, the interesting part was in terms of the stance width and sternum–floor height ratio aspect, where Malaysian amateurs produced a ratio number that was closer to the European professional golfers, rather than the European amateur golfers. This was because although Malaysian amateur golfers performed the putting stroke with a lower sternum height, their stance width of 24.73 mm can be considered as ‘big,’ considering that their average height is assumed to be lower than average European men. On the aspect of sternum–ball position, Malaysian amateurs positioned the ball slightly further from their sternum line, when compared with the European counterparts.

4 Conclusion

The ‘special feeling’ that golfers sense when performing a shot should be linked with kinematic parameters. This study indicates that Malaysian amateur golfers' kinematic properties are comparable and possessed similarity with European golfers. However, the transition of the kinematics knowledge toward the performance output needs to be applied in order to obtain the fullest advantage from the quantification process of a motion study. Continuous monitoring on the technical aspects of putting is important to ensure progress in skills acquisition and development.

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Relationship Between Selected Anthropometrics and Rowing Performance Among Malaysian Elite Rowers

Norasrudin Sulaiman, Nurfatinsyahirah Mohammed Hashim, Rahmat Adnan and Shariman Ismadi Ismail

Abstract The purpose of this study was to investigate the relationship between selected anthropometric and rowing performance among Malaysian elite rowers. Twenty subjects (n = 20) (age (mean ± SD), 21.33 ± 1.23 years; height, 175.65 ± 3.80 cm; weight, 69.27 ± 4.15 kg) were willing to participate in this study. Anthropometric variables measured in this study included arm length, arm span, standing height, sitting height, and weight. Rowing performance was measured using an ergometer in a 2000-m rowing test. Accredited personnel measured all the anthropometric variables. All subjects performed the rowing test in the same day after anthropometric measurements were completed. Finding from this study shows the significant correlation between arm span ($r = 0.840$, $p = 0.001$, $p < 0.05$), arm length ($r = 0.739$, $p = 0.001$, $p < 0.05$), standing height ($r = 0.843$, $p = 0.001$, $p < 0.05$), and weight ($r = 0.640$, $p = 0.001$, $p < 0.05$). However, arm length showed no significant correlation with rowing performance ($r = 0.370$, $p = 0.054$, $p > 0.05$). Knowledge of the significant anthropometric measurement for prediction of rowing performance is important to coaches in identifying talent in rowing.

Keywords Anthropometrics · Elite rowers · Rowing performance

1 Introduction

Rowing is different from other sports; it is a sport that requires both upper and lower body movements. From the initial rowing movements, rowers use the combination of upper body and lower body to pull the oars back in order to move the boat forward. As it is a long-distance race, this cycle is repeated many times during

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rowing in race competitions. Basically, the movement requires total body involvement including the core to perform this action.

Physical ability plays important roles in contributing to the success of athletes in sports regardless of individual or team sports [1, 2]. Rowers who have great physical characteristics are usually able to perform well during the competition. Most sports have their own physical characteristics that determine the successfulness of athletes. One of the vital factors is the physical characteristic.

Coaches are often elapsed and overlook the physical characteristics of the athlete. Basically, the selection process is based on skills of the athlete. Thus, athletes who have good physical characteristics with fewer skills are not selected. The identification of talent should identify the suitable anthropometric type that gives advantages especially in sports such as rowing. Coaches should know the primary elements, which contribute to the rowing performance before designing and implementing the training program for their athletes. Rowers with suitable seizing of physical characteristics should have no problem in achieving better performance in rowing.

Rowing is an activity that involves both the upper body and lower body, making it a total body exercise [3]. The movements in rowing itself consist of both the legs and hands in performing a stroke and recovery phase. Each cycle of rowing involves the coordination of both the legs and hands and also core to swing the oar and balance the boat. There is not much difference on how rowing is defined in all the previous studies. Most of the studies defined the word “rowing” somewhat similarly and always support each other.

On top of that, rowing involves more skillful techniques to cope with the balancing of the boat and also the crew in the boat. This is especially true for bigger boats, such as quads, fours, and eights; with distinct phases for each stroke, all rowers have to be combined in an effective manner to ensure maximum power output and acceleration of the boat through the water [4]. All this coordinated with one objective, which is “All-Out” performance to move the boat forward in the water. Each component of the technique and movement needs to contribute with maximum force in order to have an efficient and effective rowing stroke, in addition to the direction or order from the coxswain.

Rowing has high levels of demand on strength and endurance because the competition takes place on a 2000-m course and lasts from six to seven minutes [5]. Thus, this sport requires a well-conditioned body to operate at high-performance levels during periods of training and competition [6]. The rowers should have enough muscle strength and endurance to last until the end of the race. The rowers perform repetitive cyclic motions with different directions repeated approximately 220–240 times during the 2000-m race [7, 8].

The research design determines the variability of the anthropometric characteristics that are able to predict the rowing performance. There were a total of 20 subjects (10 males and 10 females) who contributed to this study, and all rowers were selected from the Malaysian rowing team. All rowers were measured for all the variables. This study involved the collecting and analyses of the data to identify the data that can be used to predict the rowing performance. The study was conducted at the University Technology Mara (UiTM) rowing training center.

2 Method

2.1 Sample

Ten male rowers and ten female rowers participated in this study. All subjects were randomly selected from the national rowing team. All subjects selected had at least one year of experience representing Malaysia in international rowing championships. All subjects were actively involved in high-level competition at the moment the data were collected. All subjects were free from any injuries that could affect their performance during data collection.

2.1.1 Anthropometric Measurement

The anthropometric measurements determined during this test included (i) weight, (ii) standing height, (iii) sitting height, (iii) arm length, and (iv) arm span. All the measurements were based on ISAC anthropometric measurement procedure.

2.1.2 Rowing Ergometer

The rowing machine was used to simulate the action of rowing for the purpose of exercise or training for rowing. The rowing machine used during this test was Concept2 ergometer (Vermont, USA). This machine was used to measure the amount of work performed. The indoor rower was regulated to measure the amount of energy the rower generated and used to measure the rowing performance.

3 Data Collection Procedure

Permission letters were sent to the subjects before one week prior to testing. After permission had been granted, informed consent waiver was distributed and signed by the subjects before they participated in this study. The subjects were informed of their right and responsibilities during the study. All personal data of rowers were collected on the first day. The selected anthropometrics were tested including standing height, sitting height, and weight of rowers. The main anthropometric measurements determined were arm length, arm span, and sitting height.

Body weight was determined using the weight scale. This equipment was calibrated prior to use. The subjects were required to remove shoes and excess clothes while standing on the weight scale. The measurement was recorded while in static position when the reading scale was constant.

Standing height was measured by taking the maximum distance at the highest point (at head) from the floor. The subjects were required to stand facing forward straight with feet together and arms at the sides. The posterior body including heels, buttocks, and back should be in contact with the wall when the measurement was taken.

The sitting height was measured as the distance from the highest point on the head to the base sitting surface. The subject sits with both feet on the ground and the lower back and shoulders against the wall. The subjects were required to look straight ahead while the measurement was taken.

Arm length was recorded from the point of the shoulder to the tip of the little finger. It is important for subjects to fully stretch out the fingers to get the maximum length. The measurement was carried out using a measurement tape. The length of both hands was recorded. The average of the left and right lengths was used in the analysis.

Arm span is the distance between the tips of the middle fingers with both arms stretched out. The subjects were required to face away from the wall, with back and buttocks touching and the arms stretched out horizontally. The arms of the subjects were fully stretched, when the distance between the two middle fingers was measured.

After the completion of anthropometric test, all subjects performed the rowing ergometer test. The 2000-m rowing ergometer test was a timed test to measure muscle endurance. Participants were examined for the completion of the 2000 m distance in the shortest time possible. Participants worked with a setting of three on the Concept2 ergometer. The completion time was then recorded.

4 Data Analysis Procedure

In performing the analysis, the variables were identified into independent and dependent variables. The independent variables were anthropometric variables include standing height, sitting height, arm length, arm span, and body weight. And the dependent variable in this study was the 2000-m rowing ergometer time records.

The Statistical Packages for Social Science (SPSS version 17.0) was used to analyze the data. The key analysis for this study was simple linear regression. Pearson's correlation coefficients (r) were used in this study to establish relationships between the dependent variable and the independent variables. Significance level was set at $P \leq 0.05$.

5 Result

5.1 Demographic Data

The demographic data of subjects are presented in Table 1.

Table 1 shows the descriptive analysis of the twenty (20) subjects involved in this study. The descriptive analyses show result including age (mean ± SD) (21.16-year-old ± 1.16), weight (63.65 cm ± 8.24), standing height (166.58 cm ± 9.97), sitting height (82.76 cm ± 6.47), arm length, $n = 20$ (68.85 cm ± 7.41), arm span (168.30 cm ± 12.63), and rowing time for the 2000-m trial (8.63 ± 0.83).

5.2 Inferential Statistics

The correlation table shows that all variables had significant correlation with rowing performance, except for sitting height (Table 2). Arm span ($r = -0.840$, $p = 0.001$, $p < 0.05$) and arm length ($r = -0.739$, $p = 0.001$, $p < 0.05$) of subjects showed the significant correlations with rowing performance. However, sitting height showed no correlation with rowing performance ($r = -0.370$, $p = 0.054$, $p > 0.05$). Sitting height ($r = -0.843$, $p = 0.001$, $p < 0.05$) and weight of subjects ($r = -0.640$, $p = 0.001$, $p < 0.05$) also showed significant correlations with rowing performance.

Table 1 Demographic data of subjects

	Mean	Median	Std. deviation
Age (Years)	21.16	21.41	1.16
Weight (kg)	63.65	66.25	8.24
Standing height(cm)	166.58	165.50	9.97
Sitting height (cm)	82.76	83.20	6.47
Arm length (cm)	68.85	70.38	7.41
Arm span (cm)	168.30	168.00	12.63
Rowing 2000 m (min)	8.63	8.80	0.83

Table 2 Correlations

	Rowing performance		
	Pearson correlation (r)	Sig. (1-tailed)	N
Arm span (cm)	−0.840	0.000**	20
Arm length (cm)	−0.739	0.000**	
Sitting height (cm)	−0.370	0.054	20
Standing height (cm)	−0.843	0.000**	20
Weight	−0.640	0.001**	20

** $p < 0.01$

6 Discussion

The result showed that height of the rowers was important and gave a direct influence on their performance. Previous researchers had also suggested that rowers who are tall and have high lean body mass possess an advantage over their smaller and lighter peers [9]. Based on mechanical principles, the taller rower is able to use the longer leverage effect.

People who are taller usually come with the package of longer leg length than shorter rowers. This height advantage allows the rowers to have longer strokes. The greater height allows for their long legs to give them an extra dimension while pushing. The rowers are also capable of reaching the maximal range of motions during rowing. In addition, larger rower retains a larger cross-sectional range of muscle and a greater absolute metabolic capacity [7].

Studies conducted elsewhere also support the fact that height was one of the important factors used by experts to predict success in rowing performance. During the 1997 International World Junior Rowing Championship, the finalists were taller than the non-finalist [10]. Gold medal winners were consistently taller than national champions in any single event.

Many studies have shown that typically open-class rowers are taller and leaner and have high percentage of lean body mass [3]. The advantages of rower anthropometrics can give extra body dimension when executing the movements on the boat. It was supported by the fact that body mass was correlated with 2000-m rowing performance time. The rowers with weight are influenced by the composition of muscle mass of the body.

Previous research [11] had noted that successful lightweight rowers possess more muscle mass and less body fat than their less successful counterparts. More muscle in the rowers' body mean that the rowers have an advantage to produce more force while performing the rowing stroke. Based on these results, the rowers should avoid from becoming too thin as it can prevent the body from producing a lot of force. In the current study, weight improved the prediction of 2000-m rowing performance by 23.4 % [3].

Another variable that was tested in this study was sitting height of the rowers. However, the results showed that sitting height did not have a significant relationship with the 2000-m rowing performance.

Based on these results, we can conclude that sitting height was not really important for predicting the rowing performance. The sitting height may provide advantages to the rowers while doing the back extension movement. Back extension is the last action after leg movement and the hand drive before recovery for the next cycle.

A greater sitting height may help the rowers to reach further during the pre-stroke action. This sitting height can be seen from the position of the rower on the boat. The results may not be significant as the back extension movement may contribute a bit to rowing performance. The leg and hand movements are more important and have a greater contribution to the rowing performance.

7 Conclusion

The result from the present study showed that arm length and arm span can be used to predict the 2000-m rowing performance of national rowers. These anthropometric variables provide useful information for the coaches when selecting potential rowers for their team. These variables should be used to allow the rowers to reach maximum performance with the same high-intensity training. The physical characteristics might be helpful in this case. The present study focused on the physical variables that could be measured to predict the rowing performance among Malaysian elite rowers. Generally, rowing is non-contact sports same as swimming, running, and walking. The rowers only try to beat the time as they only compete in their own lane. As for training, the rowers will train to improve themselves and try to beat their personal best time. Hence, identification of the key physical factors is important in order to gain an advantage.

The results of this study can be suggested to be used for rowing talent identification (TID) purposes. Identification of the suitable physical characteristics through anthropometric measurements can help a coach or trainer to identify talent among Malaysians. The entire physical components that have high relationship with rowing performance should be the focus of coaches when they want to select rowers. The key performance factor should also be a major focus during training by coaches and the athletes. Focusing on the factors would help to maximize their performance in upcoming competitions.

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Part II
Sports Industry and Management

The Effectiveness of Outdoor Recreation Activities on Adults' Fitness Level

Tan Chee Hian, Tham Yin Choong and Ong Swee Ling

Abstract This study was mainly venture into effectiveness of outdoor recreation activities on adults' fitness level. Total of 28 males and 13 female adults involved voluntarily. Various technique skills, such as kayaking; abseiling; trekking and navigating or compasses; and survival skills as well as recreational managing skills, were performed as intervention of this study in the duration of 14 weeks. The adults were undergone various hands-on practices for 3 hourly per session and per week. The final result showed descriptively all adults increased in their fitness level throughout 14-week outdoor recreation activities that ran by the course's instructor. Thus, the hypotheses of Ho1 and Ho2 have been failed to reject with statistically of each composition: chest: (t (28) = 1.76; $p > 0.05$; abdomen: t (28) = 0.10; $p > 0.05$; thigh: t (28) = 0.15; $p > 0.05$, and t (28) = 1.88, $p > 0.05$), respectively, accepted iliac crest and thigh measurement of females after 14 weeks of intervention (female iliac crest with t (13) = 2.24; <0.05; thigh t (13) = 4.32; <0.05), whereas Ho3 and Ho4 have been rejected by paired sample t-test resulted that there was significant differences in mean score before and after the intervention (body weight: t (41) = 6.72; $p < 0.05$, 2.4-km results showed male with statistically t (28) = 25.30, $p < 0.05$; female: t (13) = 26.75; $p < 0.05$), respectively. In addition, this study had justified that the activities planned as intervention were relevance and appropriate for outdoor recreation activities in order to increase level of adults' fitness, and at the same time, multiple linear regression ran that predicted factors that could be most influenced to one's physical fitness level were gender, weight, chronological age, and height of adults, and this was fulfillment of the outcome-based education perspective.

Keywords Outdoor recreation activities · Technique skills · Body composition · Effectiveness · Physical fitness level

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1 Introduction

People have always needed nature. Perhaps the most significant aspect of nature is that people are part of it. All the nature's laws and principles apply to us in essentially the same way as they apply to all other elements of the world. In our highly civilized environment, many people viewed nature as a foreign place; however, wisdom and nature were complementary. Never does one contradict the other, nature teaches us that change is both constant and vital.

In the society, work traditionally has been associated with more than material accomplishment; it has been a source of personal satisfaction as well as social and moral recognition. Modern values do not minimize the importance of work but allow for a greater appreciation of leisure and recreation. People today generally recognize that wholesome outdoor recreation contributes to one well-rounded personality and fitter life.

An early definition of outdoor recreation is recreation that occurs in the outdoor, since 1962 the Outdoor Recreation Resources Review Commission (ORRRC) [1–4] reported that there were interrelated elements or activities within leisure and recreation especially involvement of various resources as well as educational resources toward the definition of the outdoor until the recent era.

As far as experiences of people who involved pursuing outdoor activities, a number of terms are closely related to outdoor recreation and need clarification. Thus, the Outdoor and Recreational Management (hence, Outdoor) [1] here is the intervention which attended by the group of adults whereby consisted adults. There were having lesson or gone through the process of learning with laboratories method used which conducted by the researcher with not solely on theory but hands-on practicing/training for several techniques in Outdoor to make sure comprising fulfillment of the requirements such as technique skills—kayaking; abseiling; trekking and navigating or compasses; survival skills as well as recreational managing skills throughout 14 weeks [1–5].

2 Methodology

2.1 Research Design

Outdoor conducted with 3 hourly in a role for a week and continuous 14 weeks which were equal to 42 hours throughout the whole intervention. This appearance of training was appropriate in using the laboratory method in conducting the process of learning/practices. Outdoor activities here those involved various activities were ran in laboratory method, and all adults would hands-on for handling the canoe, type of canoe, and paddling skills including T-rescue and H-rescue had been exposed during the practice or training. Concurrently, water safety was applied in swimming pool rather than in open water trials [2–4].

Experiences of adults been exposed to navigating with compass on land exploring, there were interesting subjects to know about compass, notation of the map concerned, the map reading, direction and judgment involved.

After laboratory, hands-on practicing and instruction were conducted within the adults and researcher by mutually or 14 weeks which equivalence approximately 39 hours of training and practicing even highly physically involved throughout the whole intervention.

As far as abseiling was concerned, management of rope, harness safety, knots involved, types of knots and rope, safety of respondents seriously considered, as well as various ways of abseil could be practiced, but the most basis was practicing by them under supervision of an expert of outdoor who worked together with the researcher.

Survival skills that the adults' progress or practiced with were mainly based on the principle of "self-survive" which with limited sources that adults had in this case, for example, food and shelters during the survival's laboratory.

After laboratory, hands-on practicing and instruction were conducted within the adults and researcher by mutually or 14 weeks which equivalence approximately 39 h of training and practicing even highly physically involved throughout the whole intervention.

The instrument used to finalize adults' fitness level was body weight work sheet which is manually calculated such as adults' skinfold measurement (mm) especially body composition between males and females, respectively, percentage of body fat, and the scale concerned [6]. The cardiovascular fitness level was tested with the 2.4-km run to finalize adults' cardiovascular fitness through the intervention constructed by researcher [7].

2.2 Sampling and Population

A total of 28 male and 13 female adults involved voluntarily. Various technique skills such as kayaking; abseiling; trekking and navigating or compasses; survival skills as well as recreational managing skills were performed as intervention of this study in the duration of 14 weeks. The adults were undergone various hands-on practices for 3 hourly per session and per week [2].

2.3 Theory Based of the Study

Experiential education is an educational philosophy started by John Dewey as part of the progressive education movement at the beginning of the twentieth century. It seeks to engage students through meaningful activities that will result in learning. Its students-centered approach emphasizes that students' social and physical environment are important to students learning and that physical activity is an important component of the education [1].

Experiential education could occur either in classroom settings, as well as outdoors. Contrary to popular belief, experiential education is not merely learning by doing rather the key is to guide in learning or the understanding that followed the experience. All varieties of outdoor activities are based on the experiential education principles and to be even hands-on practices with more interaction within all adults in the method used as far as laboratory concerned [7].

2.4 Process of Learning

Laboratory exploration method designed prior to exposure to the hands-on various techniques—kayaking; abseiling; trekking and navigating or compasses; survival skills as well as recreational managing skills. The manual is compatible with texts emphasize on technique skills and exercises may be completed within 2- or 3-h laboratory session [1, 7].

The numbers of training features to enhance adults learning process are as follows:

1. Each exercise begins with objective that outlines the minimal learning responsibilities of the adults.
2. Numerous illustrations facilitate the adults' understanding and laboratory procedures.
3. Key terms are emphasized in helping adults' vocabulary.
4. Essential background material is provided in each exercise/training so that an adult has the information required to successfully complete the laboratory activity.
5. The adult is required to demonstrate an understanding of the background by labeling the equipments used in the process of learning.
6. Laboratory procedures are followed.
7. The laboratory reports guide and reinforce and serve a convenient means of assessing adults' understandings.

The manual also offers a number of benefits for the instructors [8]:

1. The exercises are basically self-directing which eliminates the need for lengthy explanation by the instructor.
2. The exercise uses standard equipment and materials that they are typically available to instructors at most colleges/universities.
3. Required materials are listed for each section of the exercise and facilitate laboratory preparation.
4. The exercise and the major subunits (if needed) of most exercises that are self-contained to that instructor may arrange the sequence of exercise to suit the emphasis of the course.

3 Results

In this quantitative study with title: The Effectiveness Outdoor Recreation Activities on Adults Fitness, it was divided into descriptive and inferential statistical results in order to determine the end result.

Tables 1 and 2 below were showing gender and age group of adults for this study with the interpretation of it, respectively.

3.1 Demographical Results

There were total of 41 adults who took part in skinfold measurement as the body composition measurement and 2.4-km run test on how fit were the adults after the intervention of outdoor recreation activities by researcher. Out of 41 adults whereby consisted 68 % males and the rest of 32 % was females.

In terms of age group, the age of 21-year-old adults consisted the highest percentage among them which was equivalent to 73.2 % overall percentage and this was about 30 of them. The youngest adult was age of 20 with 4.8 % and eldest was 24 years old and only one. This figure concluded that they were all adults. Adults are supposedly energetic and creative as well as internal curiosity on outdoor pursued especially in sense of equipped self-readiness to face the actual world out there (job market) (Table 3).

Overall weight among these adults, the range of 47–59 kg was consisting of higher percentage contributed among 41, there were 15 and was contributed 36.6 % overall. There was one adult in the range of 99–111 kg who was obese and at the same time there were 4 adults with 34–46 kg who were considered lightweight (Table 4).

Table 1 Genders (n = 41)

Gender	Freq	Percent
Male	28	68
Female	13	32
Total	41	100

Table 2 Age of adults (n = 41)

Age	Freq	Percent
20	2	4.8
21	30	73.2
22	4	9.8
23	4	9.8
24	1	2.4
Total	41	100

Table 3 Overall weight of adults (n = 41)

Body weight (kg)	Freq	Percent
34–46	5	12.2
47–59	15	36.6
60–72	13	31.7
73–85	3	7.3
86–98	4	9.8
99–111	1	2.4

Table 4 Overall height of adults (n = 41)

Height (cm)	Freq	Percent
150–155	7	17.1
156–161	7	17.1
162–167	7	17.1
168–173	15	36.6
174–179	3	7.3
180–185	2	4.8
Total	41	100

Thus, the height of adults 15 of them was in the range of 168–173 cm who contributed 36.6 % overall adults where else only 2 of them with 180–185 cm tall. They were in nation average height that pursues the outdoor recreation activities.

By the way, when overall fitness of these adults concerned, Table 5 showed descriptively males' chest skinfold measurement of minimum of 6 mm to maximum of 33 mm where else the mean score was 13.59 mm; Abdomen with 5 mm for minimum to 38 mm for maximum which score mean of 15.33 mm; Male's thigh with mean score 11.59 mm among 27 adults.

Moreover, females showed result with different parts of body composition measured as far as skinfold was tricep with minimum of 1 mm to maximum score of 28 mm which came to average 13.76 mm among 14 female adults; thigh with 18.71 mm in mean score; iliac crest of females showed minimum of 6 mm and maximum of 34 mm, respectively.

Table 5 Overall descriptive statistic on body composition and fitness level (n = 4)

	N	Min	Max	Mean	Std. dev
Male skinfold-chest	28	6	33	13.59	7.164
Male-abdomen	28	5	38	15.33	9.340
Male-thigh	28	2	44	11.59	9.932
Female skinfold-tricep	13	1	28	13.76	6.940
Female-thigh	13	5	29	18.71	7.269
Female-iliac crest	13	6	34	19.64	8.015
2.4-km endurance test	41	10.37	20.00	14.42	2.814

As far as fitness components which endurance test with 2.4-km run of 41 respondents concerned, overall result showed minimum time score was 10.37 min and maximum of 20 min to complete the 2.4-km distance where else the mean score was 14.42 min.

3.2 Inferential Results

In this study, there were four hypotheses constructed and tested with inferential statistic concerned which were stated as follows:

Ho1: There are no significant differences in mean score of body composition (chest, abdomen, and thigh) among male adults after 14 weeks of intervention.
Ho2: There are no significant differences in mean score of body composition (tricep, thigh, and iliac crest) among female adults after 14 weeks of intervention.
Ho3: There are no significant differences in mean score of physical fitness level among male and female adults after 14 weeks of intervention.
Ho4: There is no significant predicted factors that influence the most on adults' fitness.

Table 6 showed inferential results of paired sample t-test of 41 adults before and after the intervention. Thus, the hypotheses Ho1 and Ho2 have been failed to reject statistically with each composition: chest: (t (27) = 1.76; $p > 0.05$; abdomen: t (28) = 0.10; $p > 0.05$; thigh: t (28) = 0.15; $p > 0.05$ and t (28) = 1.88, $p > 0.05$), respectively, accepted iliac crest and thigh measurement of females after 14 weeks of intervention (female iliac crest with t (13) = 2.24; <0.05; thigh: t (13) = 4.32; <0.05), where else Ho3 has been rejected by paired sample t-test resulted that there was significant difference in mean score before and after the intervention (body weight: t (41) = 6.72; $p < 0.05$, 2.4-km results showed male with statistically t (28) = 25.30, $p < 0.05$; female: t (13) = 26.75; $p < 0.05$), respectively.

In addition, this study justified that the recreation activities were relevance and appropriate for training purpose in order to increase level of adults' fitness and

Table 6 Paired sample t-test results of adults' body composition and fitness level (n = 41)

Skinfold measurement	Mean	SD	t	Sig (2-tailed)
Male-chest	2.44	7.21	1.76	0.090
Male-abdomen	0.15	7.47	0.10	0.919
Male-thigh	0.30	9.71	0.15	0.875
Female-tricep	3.87	6.23	2.24	0.045
Female-thigh	2.15	4.14	1.88	0.084
Female-iliac crest	4.77	3.99	4.32	0.001
2.4 km-male	12.26	2.52	25.30	0.000
2.4 km-female	14.58	1.97	26.75	0.000

Table 7 Multiple linear regression results of selected factors on the fitness level of adults (n = 41)

Variables	*b*	Beta	*t*	*p*
Gender	5.97	0.706	5.26	0.000
Weight	0.12	0.459	3.44	0.002
Age	20	0.736	5.34	0.000
Height	0.30	0.067	4.43	0.000

moreover, multiple linear regression was applied which Ho6 stated that which predicted factors that could be most influenced to one's physical fitness level were gender, weight, chronological age, and height of adults (Table 7), and this was fulfillment of the element of training.

4 Conclusion

This study finding was contributing to practice aspect, especially in delivering knowledge and fitness training with technique skills of outdoor recreation activities, the laboratory exploration method [1, 6, 8, 9] was highly recommended for the 14-week duration of study especially sports science was concerned.

Upon the above contribution, this study was contributing to the fitness and wellness, the body of knowledge which was taken part in the testing process was happening from adults generally as well as on how effective and efficiency of the researcher to handle the method of training, teaching and learning in long run [9].

The results of this study showed that the outdoor recreation activities were considered relevance and highly effective to improve all adults' fitness level throughout practices by hands-on method and this method was fulfillment of the emphasizing outcome-based education overall at the end of each training especially within 14 weeks.

However, in this study also showed that male adults did not gain much of the effect from this intervention especially on body composition, this could be caused by the insufficient principles of specificity in training applied especially on part of physic. By the way, this intervention was sufficient to gain improvement of adults' cardiovascular fitness level before and after the intervention comparatively overall without gender, age, height, and weight biases of adults.

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Participation Motivation in Muay Thai Among Malaysians

Tah Fatt Ong and Wan Ilham bin Wan Ruzmin

Abstract Although the martial arts industry is rapidly evolving into a mature and highly competitive marketplace, there remains a paucity of studies conducted to understand why people participate in Muay Thai. The purpose of this study was to examine the motivation factors that influence an individual's participation in Muay Thai among Malaysians. A survey was conducted on one hundred and twenty (120) participants, utilizing questionnaires adapted from the martial arts motivation scale (Ko et al. in Int J Sports Mark Spons 11:100–113, 2010 [5]). The data were collected from four Muay Thai's gymnasium in Klang Valley, Kuala Lumpur. Based on ERG theory, the four main motivation factors examined were existence factor, relatedness factor, growth factor, and sports-characteristics factor. Independent sample t test was used to compare the motivation factors for Muay Thai participation between genders. The result indicated that there is a significant difference ($t = 3.215$, $p = 0.002$) in motivation factors for Muay Thai participation between male and female participants. The findings revealed that both genders of Muay Thai participants were highly motivated by existence-related factor (physical fitness and self-defense). However, the second-ranked motivation factor for male practitioner was growth-related factor. On the other hand, the second important motivation factor for female was relatedness. This study provides helpful information and insights for marketers to better understand their consumers, in order to design more effective planning, management, and promotion strategies to achieve higher participation rate to the sports. In turn, this may also help to enhance the participation of Muay Thai sports in the country.

Keywords Muay Thai · Motivation · ERG theory

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1 Introduction

Muay Thai is a type of martial art, which existed in Thailand over hundreds of years ago. It promotes both physical and mental development, in which many instructors placed great emphasis on discipline, respect, and spirituality. In addition, being a battlefield fighting technique used in ancient warfare, Muay Thai was also a sport in which the opponents fought in front of spectators who went to watch for entertainment. Later, it became an integral part of local festival and celebrations.

Muay Thai, often translated into English as 'Thai boxing,' is the national sport of Thailand [1]. It is renowned for its aggressive fighting system known as the 'science of eight limbs,' which incorporates the use of hands, elbows, knees, and legs [2]. In the last two decades, Muay Thai became widespread internationally as its practitioners have successfully defeated notable practitioners of other martial arts. These achievements in the Western-ruled boxing and mixed martial arts competitions have inevitably made Muay Thai as one of the popular martial arts training around the globe.

As a form of martial arts, Muay Thai has grown to become an integral part of sports and physical activity culture that expresses lifestyles and values of education and entertainment. The increased number of Muay Thai practitioners, products, organizations, and events reflected that it is a fast-developing global cultural product. Now, it is a sport with inclusion in Sports Accord, with full recognition by the Olympic Council of Asia, and inclusion in many multi-sports games such as the Asian Indoor and Martial Arts Games, the Southeast Asian Games, Arafura Games, and the Sports Accord World Combat Games, under patronage of the International Olympic Committee. At the same time, the sport has been generalized to public from professional fighting clubs to studio fitness classes for workouts in all ages with different fitness levels [3]. As reported by the International Muay Thai Kickboxing Federation (IAMTF), the rapidly increasing popularity of the sports has successfully attracted an estimated one million participants worldwide.

Today, Muay Thai has also become one of the popular martial arts in Malaysia. More and more people are practising Muay Thai for general fitness, as well as competing in professional bouts. The growth of Muay Thai in Malaysia has been encouraging and rapidly gaining popularity. This development has resulted the opening up of many specialized gym for Muay Thai practitioners. It was reported that the Youth and Sports Minister of Malaysia, Khairy Jamaluddin, has urged the Muay Thai Association of Malaysia (PMM) to take the initiative and put more efforts to popularize the sport in the country [4]. Looking at the present trend and the future prospect of Muay Thai sport, systematic analysis of Muay Thai participants in the martial arts industry needs to be conducted. It is essential for sports marketers to obtain relevant information on these new mainstream consumers. As the emerging Muay Thai industry evolved into a more competitive business segment, further research is needed to improve our understanding of the Muay Thai consumers. An investigation of what motivates this martial art consumption would be the first step for future development of the Muay Thai industry in the country.

Motivation is regarded as the result of a need that drives an individual to take an action in a specific way to achieve the satisfaction of desire. According to Ko et al. [5], motivation is defined as 'a conscious experience or subconscious condition, which serves as a factor in determining an individual's behavior or social conduct in a given situation.' It is imperative for practitioners to identify the fundamental needs of consumers because motivation is a significant determinant of sports participation [6]. To date, numerous studies have examined motivational factors regarding why people participate in sports activities. However, only a few studies have been conducted on motivation of martial arts participation. In general, previous studies of motivation supported that fun, skill development, challenge, and fitness were the most important motivational factors in sports participation. For example, Twemlow and Lerma [7] found that self-defense and physical fitness are the two most important motivation factors for martial arts participation. On the other hand, Stefanek's [8] study revealed that young Taekwando participants were motivated by fun, physical exercise, skill development, and friendship. In addition, Jones et al. [9] found that martial arts participants have strong motives of affiliation and friendship, followed by fitness, reward, competition, situational, and skill development.

In further understanding of sports participation motivation, two major motivation theories that have been widely employed were Maslow's Need Hierarchy Theory [10] and Alderfer's Existence-Relatedness-Growth (ERG) Theory [11]. Maslow's hierarchy of needs theory states that people have a pyramid hierarchy of needs that they will satisfy from bottom to top. Starting from the bottom is the physiological needs, followed by safety needs, social needs/belongingness, self-esteem, and self-actualization. However, ERG theory condenses Maslow's five human needs into three categories: existence, relatedness, and growth.

1. Existence need—includes all basic material and physiological desires (e.g., food, water, air, clothing, safety, shelter), which relates to Maslow's first two levels of need.
2. Relatedness need—Encompasses social facilitation and affiliation; relationships with significant others such as family, friends, co-workers, and employers. This also means to be recognized and feel secure as part of a group or family. This is related to Maslow's third level of need.
3. Growth need—Internal esteem and self-actualization; these impel a person to make creative or productive effects on himself and the environment (e.g., to progress toward one's ideal self). This includes desires to be creative and productive, and to complete meaningful tasks. This is related to Maslow's fourth and fifth level of need.

In the study of martial art participation, Ko et al. [5] have suggested that ERG theory was found to be more valid than Maslow's hierarchy of needs because it closely reflects our knowledge of how the importance of various factors can simultaneously act to motivate an individual. According to Ko et al. [5], existence need is related to fun, physical fitness, self-defense, skill mastery, and stress release. Relatedness need is focusing on maintaining interpersonal relationship. Growth need is concerning achievement, self-esteem, value development, and cultural awareness.

Most previous studies in sports participation motivation among gender were more focused in exercise and sports games participation. Studies of participation motivation in martial arts and combat sports examined that participation motivation between genders is rather limited. Elijah and Eric's [12] study on gender motivational differences in sports and exercise participation noted that both genders were motivated by the affiliation factor and friendship factor. Another study of motivational orientations among collegiate athletes in Kenya noted that four most important motivations for both male and female were affiliation, fitness, skill development, and friendship, as opposed to three least influential motivators which were reward/status, situational, and competition [13]. Previous study also showed that there is significant difference of motivation factors between male and female athletes.

In order to further understand the psychological needs of the sports consumers, it is important for sports marketers to identify the motivation factors that lead to sports consumers' participation in sports [6]. In the past decades, numerous studies have been conducted by scholars to investigate the psychological motivational factors of dominant sports participants. However, there is limited information regarding the motivation of martial arts participants and their consumption behavior [14]. Recently, studies regarding different contexts of martial arts have been conducted. For example, an analysis of spectator motivation for an individual combat sports was conducted by Seungmo et al. [15]. Several researchers had also probed into the motivation of martial arts participation [5, 16]. There were studies focus on specific type of martial arts such as Taekwando [17] and Karate [18]. Nonetheless, research on Muay Thai participants as martial arts consumers has not been a main focus of investigation among sports management and marketing studies. Hence, there is a paucity of information in the literature regarding the characteristics of Muay Thai participants and their motivation of participation, especially in the Malaysian context. The main purpose of this study was to examine the motivational factors of people who become involved or participate in Muay Thai. Hopefully, the present study will advance the knowledge base of consumer motivation research in the field of sports marketing and provide implications for sports marketers within the emerging martial arts industry, especially Muay Thai sports. Consequently, the objectives of this study were as follows:

(a) To identify the socio-demographic profiles of the Muay Thai participants,
(b) To examine the motivational factors of Muay Thai participants, and
(c) To compare the motivational factors of Muay Thai participation between male and female participants.

2 Methodology

2.1 *Design of the Study*

This is a survey research with questionnaire constructed based on the literature reviews regarding motivation of martial arts participants as sports consumers. Since the target population is the Muay Thai participants, a purposive sampling technique was adopted. Self-administered questionnaires were distributed utilizing convenience sampling and collected from participants' on-site, at four randomly selected Muay Thai training centers in Klang Valley. Respondents were met on-site and were kindly asked to participate in the survey voluntarily. The researcher was present throughout the session to answer any question from the respondents with regard to the questionnaires. No time limit was placed on the respondents to complete the inventory. A total of 120 questionnaires were collected for further analysis.

2.2 *Instrumentation*

The research instrument was adapted from the measurement of martial arts participant motivation scale developed by Ko et al. [5]. In addition to the three ERG's motivation dimension, sports characteristic was included as the fourth motivation dimension in this study. The questionnaire for this study was designed in two sections. The first section emphasizes the demographic data of respondents which contains several demographic questions regarding respondent's age, gender, marital status, ethnicity, education level, occupation, and year of participation. The second section consists of 43 items measuring four dimensions of Muay Thai participation motivational factors, which are growth (12 items); relatedness (6 items); existence (15 items); sports characteristic (10 items). The scale for this 43-item instrument was rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). A pilot study was conducted to test the reliability of the questionnaire. The Cronbach's alpha reliability score for each of the dimension was growth ($\alpha = 0.869$), relatedness ($\alpha = 0.793$), existence ($\alpha = 0.894$), and sports characteristics ($\alpha = 0.767$). The overall reliability of the motivational scale was $\alpha = 0.930$.

2.3 *Data Analysis*

Data analysis was conducted utilizing the Statistical Package for Social Sciences (SPSS Ver.20). For categorical and demographic variables of respondents, descriptive statistics consist of percentage, frequencies, and mean, and ranking was utilized to explain and describe the findings. The items in demographics variables such as age, gender, marital status, ethnicity, education level, occupation, and years of participation were summarized using the descriptive statistics. Independent sample *t* test was utilized to analyze and compare the Muay Thai participation motivation between male and female participants.

3 Research Findings

3.1 Demographic Profile of Respondents

The results of the demographic background of respondents are summarized in Table 1. In terms of gender, 49.2 % of the respondents were male, while 50.8 % of the respondents were female.

In regard to age group, most of the respondents were young adults with 33.3 % aged from 21 to 25 years and 39.2 % of them were aged from 26 to 30 years. There were 14.2 % of the respondents aged from 18 to 20 years. 11.7 % of respondents were aged between 31 to 35 years and only 1.7 % (2) of the respondents were aged above 36 years. This result indicated that young adults are the more likely participants in Muay Thai sports. Correspond to marital status, most of the respondents were single (65 %) and the others (35 %) were married.

In terms of ethnic group, Malay was the largest group (54.2 %) of respondent involved in the Muay Thai sports. Chinese represented 29.2 % of the respondents, followed by Indian (12.5 %). The respondents of this study come from various education backgrounds. Majority of the respondents (88.3 %) have tertiary education. The highest percentage of respondents are those with degree education level (55 %), followed by 33.3 % who were diploma level, and 11.7 % has secondary educational level. The result indicated that students (33.3 %) and company employee (32.5 %) were the largest groups of Muay Thai participants in this study. 15 % of the respondents were self-employed and 9.2 % were civil servants. The lowest percentage of the respondents were professionals (5 %) and housewives (5 %).

In relation to the duration of involvement in Muay Thai, most of the respondents (37.5 %) had involved in Muay Thai less than 6 months, whereas 34.2 % had involvement of 6–12 months. The result showed that 19.2 % of the respondents had participated for 2–3 years and 9.2 % had participated for 4–5 years in Muay Thai.

3.2 Participation Motivation of Respondents

Table 2 represents the mean score for all four motivation dimensions of respondent's participation in Muay Thai. Among the motivation dimensions, existence dimension (m = 6.063) has the highest mean value. In this dimension, physical

Table 1 Demographic profile of respondents

Demographic characteristics	Frequency (N = 120)	Percentage (%)
Gender		
Male	59	49.2
Female	61	50.8
Age		
18–20 years	17	14.2
21–25 years	40	33.3
26–30 years	47	39.2
31–35 years	14	11.7
36 and above	2	1.7
Marital status		
Single	78	65
Married	42	35
Ethnicity		
Malay	65	54.2
Chinese	35	29.2
Indian	15	12.5
Others	5	4.2
Education level		
Primary	0	0
Secondary	14	11.7
Diploma	40	33.3
Degree	66	55
Occupation		
Company employee	39	32.5
Self-employed	18	15
Civil servant	11	9.2
Professional	6	5.0
Housewife	6	5.0
Students	40	33.3
Years of involvement		
Less than 6 months	45	37.5
6–12 months	41	34.2
2–3 years	23	19.2
4–5 years	11	9.2
6 years or more	0	0

fitness factor has the highest mean value (m = 6.650). Respondents agree that 'participating in Muay Thai develops physical fitness, keeps me healthy, and stay physically fit.' The other factors are 'self-defense,' 'fun,' and 'stress reduction.' Factor with the lowest mean in this dimension was skill mastery (m = 4.797).

Table 2 Mean score for participation motivations of respondents

Dimension	Mean score	Rank
Existence	6.063	1
Relatedness	5.447	2
Growth	5.384	3
Sports characteristics	4.968	4

Relatedness dimension has the second highest mean score of 5.447. This relatedness dimension consists of two factors which is social facilitation and the second-ranked affiliation. Respondents revealed that participation in Muay Thai gives them chance 'to improve social relationship,' 'to spend time with friends,' and 'leads to improved social relationship.' The third rank was growth dimension, with mean value of 5.384. The factors in the growth dimension were self-esteem, value development, achievement, and cultural awareness. Respondents feel that Muay Thai participation 'makes me feel confident about my abilities,' 'feel like a special and successful person,' and 'gives me a feeling of self-assurance.' The other motivation factor, sports-characteristics dimension, has the lowest mean value (m = 4.968). This dimension includes factors such as 'esthetic,' 'aggression,' 'competition,' and 'risk taking.'

3.3 Participation Motivation of Male and Female Participants

Table 3 illustrated the participation motivation among respondents with different gender. Both male and female participants are motivated to participate in Muay Thai sports, as the mean scores for all dimensions are above average. However, the result indicated that mean score of motivation dimensions for males were generally higher than females, reflecting that males are more motivated than females in the participation of Muay Thai.

The highest mean score for participation motivation for both male and female participants is existence dimension, with mean score of 6.158 (male) and 5.975 (female), respectively. Motivational dimension with lowest mean score for both groups was sports characteristic. However, the second rank motivational dimension

Table 3 Participation motivation mean between male and female participants

Dimension	Male		Female	
	Mean	Rank	Mean	Rank
Existence	6.158	1	5.975	1
Relatedness	5.477	3	5.418	2
Growth	5.643	2	5.134	3
Sports characteristics	5.283	4	4.663	4
Overall mean	5.640		5.298	

for males is growth dimension, with mean score of 5.643. Then, it is followed by relatedness dimension (*m* = 5.477). However, the second rank motivational dimension for female participants is relatedness (*m* = 5.418) and followed by growth dimension (*m* = 5.143). It showed that male participants are more motivated to involve in Muay Thai for the reason of self-esteem, value development, and achievement, rather than social facilitation as preferred by female participations.

3.4 Comparison of Participation Motivation Between Genders

The result in Table 4 shows that the mean score for male (*m* = 5.640) is slightly higher than female participants (*m* = 5.298), in terms of overall motivation factor. Independent sample *t* test revealed that significant differences exist between gender, with *t*-value = 3.215 and $p = 0.002$ which was less than 0.01.

3.5 Participation Motivation Differences Between Different Genders

From the results shown in Table 5, there were statistically significant differences in two participation motivation dimensions, namely growth and sports characteristics between Muay Thai participants of different genders. Compared to female participants, the male participants are more motivated to participate in Muay paintball for the reason of growth-related factors such as self-esteem, value development, achievement, and cultural awareness. Male participants are tend to be more motivated to participate in Muay Thai in appreciation of its sports characteristics such as 'esthetic' form, 'aggression' nature, 'competition,' and 'risk-taking' aspects.

Table 4 Comparison of participation motivation between genders

Gender	*N*	Mean	*t*	*df*	Sig. (2-tailed)
Male	59	5.640	3.215	118	0.002**
Female	61	5.298			

$^{**}p < 0.01$

Table 5 Results of *t* test for motivation dimension between participants of different gender

Motivation dimensions	*t*	Sig. (2-tailed)
Existence	1.726	0.087
Relatedness	0.423	0.673
Growth	3.896	0.000**
Sports characteristics	3.865	0.000**

$N = 120$; $df = 118$, $^{**}p < 0.01$

4 Conclusion

The findings of this study indicated that Muay Thai sports is equally accepted and participated by both genders. The result indicated that Muay Thai participants are likely to be single, young Malaysian adult aged from 21 to 30 years, with tertiary education. Majority of the participants were Malays, followed by Chinese and Indians, which is consistence with the composition of ethnic groups in the country. Most participants are likely to be students, company employees, and self-employed individuals. Muay Thai can be considered a 'growing' sports gaining popularity in the country, as majority of its participants have experience of only one year or less, involving in the sports. However, it is interesting to note that the sports has managed to attract many female participants. According to Elijah and Eric [19], it was apparent that males mostly took part in ball games and weight training, while the female students preferred aerobics, walking, jogging, and swimming that involves both aerobic and anaerobic energy system. As Muay Thai is a physically demanding activity/sports that recruits both the energy systems, possibly this could explain for the female's interest in the sports.

The purpose of this study was to develop a better understanding of motivation factors associated with Muay Thai participation. The finding of this study disclosed that the most prominent participation motivation dimension is existence which includes factors such as physical fitness, self-defense, fun, stress release, and skill mastery. The result is consistent with the findings of previous research on sports participation motivations [20, 21], suggesting that young athletes are highly motivated by fun, skill development, challenge, and fitness. The result is also consistent with previous research that found fun and physical fitness to be the two most important reasons why people participate in martial arts [5]. However, attention should be given to 'self-defense' factor which poses to be an important motivation factor in existence dimension. Self-defense is an application of the defensive skills developed to combat life-threatening situations. According to Maslow [10], safety need (needs for protection, stability, and order) is one of the fundamental human needs to be satisfied. The hostile social environment in everyday living may have inevitably position 'self-defense' as a unique specific motivation for Muay Thai participation.

Participation motivation differences were found between Muay Thai participants of different genders in growth dimension and sports characteristic dimension. The result suggests that both genders are attracted to participate in Muay Thai because of the personal growth opportunities offered in Muay Thai training. This finding supports prior study which found that growth-related motivations are very important for today's martial arts practitioners [5]. Comparatively, the male participants graded the growth dimension as more important than the females. This may imply that male participants perceived that personal improvement is one of the important benefits of Muay Thai training. Their participation motives may be influence by factors such as enlightenment and self-improvement.

Both genders agreed that sports-characteristics dimension is the least motivated factors for them. This result was in line with the previous study suggesting that other than esthetics, sports-specific characteristics (i.e., risk taking, competition, and aggression) were the least important motivation factors for martial arts participants [5]. Nevertheless, the males rated this dimension higher than female participants. For male participants, other than the esthetic art forms embodied in Muay Thai, the aggression and risk-taking nature of the sports also attracted their participation.

With information about demographic profile of Muay Thai participants, the service providers and marketers can easily identify the potential target market and design suitable packages and program suitable for the target group. Since the Muay Thai participants are more likely to be single, young adults aged from 21 to 30 years, with tertiary, promotional messages about Muay Thai, should emphasizes on the aspect of fun, physical fitness, healthy lifestyles, and stress-releasing benefits to attract the 'young' market. The benefits of 'self-defense' skills learned in Muay Thai should be emphasized in the promotional materials and Web sites.

In order to develop effective marketing strategies, understanding the various consumers' participative motivation is very important. The profile of the participants in this study revealed that Muay Thai participation motivation differs between genders. In the case of male participants, promotional advertisement ought to stress on the benefits of value development and personal improvement in the training of Muay Thai. For the female participants, marketing strategies offering special package or discount rates for group enrollment could be promoted, and social facilitation opportunities should be highlighted as the main attraction for Muay Thai participation.

As a conclusion, the results of this study contributed to a better understanding of Muay Thai participants that can be used to develop consumer profiles. The findings suggested that Muay Thai consumers have a diverse need to be met depending on gender differences. Ultimately, service providers may employ the results of this study to predict the consumption behavior of Muay Thai participants and to develop effective marketing strategies to satisfy the needs and wants of Muay Thai participants.

For future research, it is recommended that similar study should be conducted at other states, with broader samples to provide a better understanding and generalization of the Muay Thai consumers market. It is also suggested that other psychographic variables such as attitudes and perceptions toward the Muay Thai sports could be explored to further enhance the comprehension of Muay Thai sports.

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Fan Curiosity, Attachment and Allegiance Towards Harimau Malaya Fans

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Abstract The aim of this paper was to analyse the causal relationships among fan curiosity impact towards attachment and allegiance within the model of psychological continuum model (PCM). The theoretical causal model is integrated by the scale known as sport fan exploratory curiosity scale (SFECS). Then, exploratory curiosity will lead to attachment and allegiance against football fans. Some hypotheses are put forward and tested in a causal-comparative study of 382 football fans who attending matches at National Stadium Bukit Jalil. The data were tested by structural equation modelling (SEM). The results reveal that the attachment was mediator variables to the exploratory curiosity and allegiance. The findings further offer important insights for the future research and sport practices especially focused on football development industry.

Keywords Exploratory curiosity · Attachment · Allegiance · Football fans

1 Introduction

Since Harimau Malaya (nicknamed for Malaysian National football team) won the SEA Game 2009 at Laos, AFF Suzuki Cup 2010 and SEA Game 2011 at Indonesia, the fans' attendance at the stadium is increasingly high. Furthermore, for the first leg of the AFF Suzuki Cup 2010 final, the 25,000 tickets from 70,000 tickets for Malaysian fans have been sold on the first day of ticket sales [1]. Hence, this tournament was rated a huge success with big crowds and massive television viewership for the year of 2010. The issues that influence the crowds are likely to vary depending on the performance of the Harimau Malaya time to time. If the

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issues can be identified, fan can be consider to be more attach and loyal towards the Harimau Malaya team.

Recent research has provided more insight to examine the fans' attachment in attending sport event. For example, such as motivation factors, game attractiveness, economic factors, competitive factors, stadium factors, value of sport community, sport involvement and fan identification [2]. A few studies done by Park et al. [3, 8–10] had investigated that curiosity can initially attracted non-sport fans or casual sport fans to attend at sporting events. Furthermore, some individuals have been curios and after they feel enjoy and fun, it will be more curios for them to discover more in future as a loyal fans. However, while many sport fan behaviour studies have focused on highly identified sport fans, little research has investigated the curiosity behavioural of fan that leads to attachment and allegiance [3]. This study builds on existing knowledge of the psychological continuum model (PCM) approach investigating the importance of exploratory curiosity, attachment and allegiance [4]. In the realm of PCM approach, the sport consumption activities occur through a sequence of inputs, processes and outputs. The PCM model composed of four stages along a continuum: of awareness, attraction, attachment and allegiance [5]. Furthermore, PCM is intended to provide researchers with a platform for the systematic study of sport spectators and sport fans [6]. This study focused on a continuum of attachment and allegiance because the Harimau Malaya football fans are aware and attracted to football environment. From this perspective, the goals of this study are to analyse the fan curiosity dimensions and the impact towards attachment and allegiance within the model of PCM.

2 Conceptual Framework and Research Hypotheses

2.1 Fan Curiosity

The early main author who works on curiosity was Berlyne [19]. The literature review shows that curiosity is an appetitive state involving the recognition, pursuit and intense desire to investigate novel information and experiences that demand one's attention [7]. Therefore, curiosity has been regarded as a key intrinsic motivational drive for facilitating human exploratory behaviours in many domains, such as psychology, education and sport [8]. Furthermore, curiosity has been found to be one of the crucial motivators that initially influence human exploratory behaviours in many domains [9].

Basically, fan curiosity components are based on two scales, identified as sport fan exploratory curiosity scale (SFECS) and sport fan-specific curiosity scale (SFSCS). These scales was developed by Park et al. [10] for sport fan curiosity in order to better examine the curiosity construct in a sport setting. This study focused only on SFECS components that relates to the sensational and novel stimulation of sports, players or sport teams that leads people to engage in sport fan exploratory [10]. Park et al. outlined three items, which are excitement, new sport events and sport facility. Study done by Park et al. [8] that only focusing on SFECS in this study and can be concluded that curiosity in sport context is different compare to curiosity in other setting. Therefore, relationship between curiosity and fan behaviours (crowds) had been suggested that there are different personalities who can lead individuals towards various aspects of fan behaviour. Following the above, it guides the researchers to the following hypothesis:

H_1: Exploratory curiosity has direct influence on attachment towards attending the matches at the stadium.
H_2: Exploratory curiosity has direct influence on allegiance towards attending the matches at the stadium.

2.2 Attachment

According to Funk [4], attachment may be creation of an important and meaningful individual relationship among favourite object and enhances the liking of the objects as it assumes a deeper consequence. In other literature, review stated that attachment can be characterised as the emotional, functional and symbolic meaning to an individual places on a sport object such as sense of belonging, important, values and team victories [5]. Another literature review concluded that attachment is the emotional involvement felt with a group, the degree to which the individual feels at one with the group. Furthermore, attachment can reflect the affective involvement to an individual experiences with a social group. Study by Kwon et al. [11] stated that attachment can bring an encouraging to the spectators and fans attendance behaviour at sporting event. Thus, this study will utilise the function of attachment in order to increase the loyalty of sport fans to continuing support to the sport team. Following the above, researchers state the following hypothesis:

H_3: Attachment has a direct influence on allegiance towards attending at the stadium.

2.3 Allegiance

Allegiance may be explained as loyalty or devotion to some object, group or cause [6]. Allegiance within the sport consumer behaviour literature is usually known as loyalty, which includes the core elements of commitment and continuance [4]. It corresponds to the strongest psychological connection and creates the most improved level of psychological engagement and complex behaviour engagement such as remains unchanged over a period of time, consistency between feelings and beliefs, attendance at sporting event and purchasing merchandise. In this study, allegiance is defined as the loyalty sport fans against Harimau Malaya football

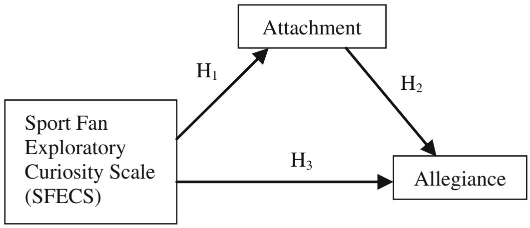

Fig. 1 Theoretical causal model

team. For conclusion, the exploratory curiosity will lead to the attachment and allegiance towards the increasing number of Harimau Malaya football fans attendance at the Stadium National Bukit Jalil.

The causal model is summarised in Fig. 1.

2.3.1 Methodology

To carry out this study, 382 fans were surveyed during the AFF Suzuki Cup between Malaysia (Harimau Malaya) and Singapore. Data collection took place at National Stadium Bukit Jalil and randomly selected during the match by the means of structured questionnaire.

First, the dimensions, reliability and validity of the scale of measurement of the exploratory curiosity, attachment and allegiance were analysed. Next, the relationship between exploratory curiosity, attachment and allegiance was established by equation modelling.

2.3.2 Measurement of Variables

First, the demographic questionnaire gathered some background demographic variables and spot-fan information in order to describe the respondents in this study. These variables included gender, age, level of education, number of respondents attending at the stadium and number of respondents watching live matches on TV. There are 10 items from SFECS, and this scale was adopted and developed by Park et al. [10].

Next, the 7 items of attachment were adopted from point of attachment (PAI) and developed by Heere and James [12]. Thirdly, the 7 items of allegiance were adopted from attitudinal loyalty to team scale (ALTS) by Heere and Dickson [13]. The total of questions in this questionnaire was 29 items. The questionnaires used a Likert scale, which is a seven-item scale from strongly disagree to strongly agree.

3 Results

Before analysing the dimensionality, reliability and validity of the scales, the demography of the sample is described: 72 % are men, and 28 % are women. As regards age, 54.5 % are aged between 21 and 30 years. Their level of education is degree qualification, with 30.9 %. For the respondents who attend at the stadium, 32.5 % are over than 10 times attending and 54.7 % for over than 10 times watching on TV.

Table 1 presents factor loading, Cronbach's alpha, CR and AVE score for this study. Overall score of Cronbach's alpha for SFECS is $\alpha = 0.802$, whereas for factor loading overall score for three subscales is ranging from 0.54 to 0.90. In addition, attachment and allegiance factor also indicated strong reliability scores which are $\alpha = 0.928$ and $\alpha = 0.890$. Convergent validity exists as all the factor loadings are greater than 0.5. The scale is also reliable because the values of the statistics that determine dimension reliability are above 0.60.

After all the items were valid and reliable, next step is to evaluate the structural model to the schematic diagram. The selected goodness-of-fit that related to the hypothesised model is shown in Table 2. The results indicated that all the required level was achieved. The result showed good model fit, χ^2 (24) = 88.320, $p < 0.001$,

Table 1 Factor loading, Cronbach's alpha, CR and AVE score

Construct	Items	Factor loading	Cronbach's alpha	CR	AVE
SFECS	ext1	0.54	0.802	0.83	0.53
	ext2	0.78			
	ext3	0.82			
	ext4	0.74			
	nse1	0.84			
	nse2	0.75			
	nse3	0.63			
	sf1	0.89			
	sf2	0.90			
	sf3	0.89			
Attachment	att1	0.85	0.928	0.94	0.58
	att2	0.88			
	att3	0.88			
	att4	0.65			
	att5	0.68			
	att6	0.70			
	att7	0.63			
Allegiance	all1	0.81	0.890	0.95	0.60
	all2	0.86			
	all3	0.92			
	all4	0.56			
	all5	0.74			
	all6	0.75			
	all7	0.71			

Table 2 The fitness indexes for structural model

Name of category	Name of index	Index value	Comments
Absolute fit	RMSEA	0.085	The required level is achieved
Incremental fit	CFI	0.975	The required level is achieved
Parsimonious fit	χ^2/df	3.680	The required level is achieved

Table 3 Path analysis of hypotheses model

	Structural paths	Beta estimation	Critical ratio	*p*-value	Result
H_1	Exploratory curiosity → attachment	0.102	0.797	0.425	Not supported
H_2	Exploratory curiosity → allegiance	0.372	3.088	0.002	Supported
H_3	Attachment → allegiance	0.500	8.459	0.001	Supported

RMSEA = 0.085 and CFI = 0.975. Furthermore, the value of χ^2/df showed the good result with 3.680.

Based on the result from Table 3, the two hypotheses in this study were positively supported; meanwhile, the first hypothesis was not supported. From the result, it shows that the attachment in this study was the mediating variable that involved in this structural model. This happened due to the score of exploratory curiosity has a direct effect on allegiance compared with indirect effect of attachment. This type of mediation here is called a partial mediation since the direct effect of exploratory curiosity on allegiance is still significant after the attachment entered in the model. In this case, the exploratory curiosity has a significant and direct effect on allegiance through the mediator variable of attachment.

Furthermore, the exploratory curiosity was indirectly effect the attachment for this study. According to the Park et al. [3], exploratory curiosity was related to the sensational and novel stimulation of sports, players or sport teams that will lead the sport fan to get involved in sport fan behaviours. There are three factors that involved in exploratory curiosity, which are excitement, new sport events and sport facility. Meanwhile, the variable of attachment in this study was referred to the Harimau Malaya football team. One of variable loadings to the question from the questionnaire stated that "I consider myself first and foremost as a Harimau Malaya football team fan" indicates the level of to the team.

The hypothesis was not significant may be due to the lack of commitment towards the team. After reviewing the study of Wann and Pierce [14], it is found that commitment plays an important role for football fans to be more attached to the team. Moreover, their study also revealed that sport fans with strong team identification and commitment to their favourite team were developed attitudes that were resistant to change. Meanwhile, Dutton et al. [15] discovered that the greater level of attachment with a team, the more likely that a fan will define himself/herself as a member of a team. This result was related with H_3, whereby attachment is called partial mediated with exploratory curiosity and allegiance. Thus, the attachment does mediate the relationship between exploratory curiosity and allegiance. In conjunction with this result, future study should attempt to test the dimension of commitment.

4 Theoretical and Practices Implications

The testing of hypotheses proposed on the basis of the literature review gives rise to a series of conclusions and practical implications. In respect of the allegiance sport fans, the identification of exploratory curiosity dimension has been found out in this study. Even though the dimensions of curiosity already done by Park et al. [10], the new variables are added in this study which are attachment and allegiance. Based on Dhurup [16], others variables need to discovered more on loyalty of sport fans because of the demand itself. This study bring the important results for sport marketers in order to maintain the sports fans behaviour (crowds) towards consuming in attending matches at the stadium. First implication that sport marketers can look is the sport facility at the stadium. From the result in this study, the sport facilities also play as a factor that bring towards curiosity of sport fans and were supported from other researcher who did on sportscape and sport facility [17, 18].

Other important conclusions of the study arise from the relationship among the variables. As mentioned earlier, the theoretical causal model has built from an existing knowledge of PCM and result of this study can be a new knowledge for the sport fan context. The use of curiosity and PCM in this study has been supported by the literature from Berlyne [19] and stated that the exploratory behaviours influence individual to seek and acquire specific knowledge and information. Since possessing curiosity in search of specific information, it would influence the process in PCM especially to become the allegiance sport fans.

A major criticism of the study concerns a few limitations. First, the respondents that involve in this study only 382 football fans which the sample is not very large, causing problems with sample error. The second weakness concerns on cross-sectional research design that is used. It is required to do longitudinal research on future to fully capture the dynamic nature of sport fans loyalty through behaviour. Furthermore, this study only focuses on one sport, which is football. It could be necessary to do future research on different sports context.

It may be fruitful for future research to look on differentiate between gender behaviour. Because this was the first attempt to measure on curiosity context and loyalty factor, a future study could be done with more diversified sample in order to improve the scale. It is also important that future study could be undertaken to extend the present model by integrating sport fan behaviour and commitment.

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The Relationship Between Socioeconomic Status and Fine Motor Skills Among Six-Year-Old Preschool Children

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Abstract Fine motor skills are important for preschool children because they spend most of their time doing activities such as writing, cutting and colouring. Children from low socioeconomic status (SES) have high prevalence of growth restriction due to inequalities in lifestyle and may associate with delay in motor development. The purpose of this study was to determine the relationship between fine motor skills and SES among six-year-old preschool children. A total of 168 children (male = 84, female = 84) aged six years old participated in this study. They were divided into three groups based on parent's income (low, moderate and high incomes). McCarron Neuromuscular Development (MAND) was used to measure fine motor skills. The results showed that there were significant differences in fine motor skills between groups ($p < 0.05$). No significant difference was found between fine motor skills and gender ($p > 0.05$). A significant correlation exists between fine motor skills and SES ($p < 0.05$). Children from low SES have low fine motor skill performance compared to higher SES. Overall, the result of current study showed that gap in SES has influenced fine motor skill development.

Keywords Socioeconomic status · Fine motor skills · Preschool children

1 Introduction

Skilled movement is a fundamental for human life as it is a necessity in order for them to meet their needs in communication and learning [1]. Fundamental motor skills are the foundation and prerequisite for children to be able to participate in

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physical activities and advance in sport skills later in life which include locomotor, object control and most importantly stability [2–6]. When children participate in recreational activities, it is often associated with a higher proficiency in motor skills [7, 8].

The interaction of individuals, tasks and environments influences children's motor skill development [9–12]. Children who do not receive adequate motor skill instruction and practice may demonstrate development delay in gross motor skills [13]. If the children are unable to master their gross motor skills, it will lead to a delay in their development of fine motor skills as these two have a correlation [14].

Fine motor skills are important as gross motor skills since it is necessary for the development of basic self-help skills in daily living activity [15]. Fine motor skills include reaching, grasping, carrying, releasing, eye–hand coordination and bilateral hand use, which are all essential skills for interaction with the environment [16, 17].

One of the key predictors of development in school-age children is socioeconomic status (SES) [1, 18–21]. Few studies have proven that the development of gross motor skills and fine motor skills was influenced by ethnicity, parent's income and parent's education [9, 22]. Low SES had negative effect on children outcomes indirectly affect fine motor skill development since brain was growing insufficiently [9, 23]. A variety of factors can stunt the normal development in fine motor skills such as neurological and psychiatric conditions in childhood [24].

Children with better SES performed better in fine motor skills compared to children with low SES because children with better SES went to school starting from two years of age [25]. Preschool children developed throughout their school years and by the time of reaching school age, most children possess a sufficient repertoire of skills with the basic demand of both home and school environments [20].

Previous studies have found that fine motor skill development appears approximately from the age of four and completed at six years old [26, 27]. Unfortunately, there are few studies found that fine motor skills are not matured at six years. Results showed that six-year-old children do not show any evidence on matured end-state comfort movements while performing fine motor skills' activities [28, 29]. Therefore, the purpose of the present study was to determine the relationships between fine motor skills and SES among six-year-old preschool children.

2 Methodology

2.1 Participants

The study involved 168 preschool children aged six years old. Each group consists of 56 participants that include both genders. The children must be free from chronic diseases, learning disabilities and physical impairment. The study was approved by the Ethic Committee of Universiti Teknologi MARA, Malaysia, and Ministry of Education Malaysia.

2.2 Socioeconomic Status (SES)

The parent's income was used to rank students in SES groups [1, 30, 31]. The parent's income was divided into three categories: low, moderate and high incomes [1, 32]. The SES groups were based on the Midterm Review Ninth Malaysia Plan.

2.3 Fine Motor Skills

Fine motor skills were measured using McCarron Assessment of Neuromuscular Development (MAND). The test consists of five subtests: integration of fine and visual motor skills (beads in the box), hand–eye coordination and visual motor coordination (beads on the rod), complex coordination and strength of grasping (nut and bolt), persistent control and motor inhibition (rod sliding) and dissymmetry and dystonic (finger tapping) tests. The fine motor score is calculated by summing the five fine motor scaled scores.

2.4 Statistical Analysis

A descriptive statistic was used to analyse the characteristics of the participants. One-way analysis of variance (ANOVA) was conducted to compare fine motor skills between SES. Independent *T* test was used to compare fine motor skills between genders. The Spearman's rho was used to determine the correlation between SES, gender and fine motor skills. The statistical significance was set at an alpha level $p < 0.05$. Data were presented as mean and standard deviation (SD). All the data were analysed using the Statistical Package for Social Science version 17.0.

3 Results

The characteristics of the participants are presented in Table 1. Table 2 presents the result of fine motor skills' subtest and total score. Results showed that all subtest and total score of fine motor skills were significantly different for all three groups except for nut and bolt.

Table 1 Participant characteristics

Characteristics	Mean ± SD
Age (years)	6.32 ± 0.21
Height (cm)	113.80 ± 5.05
Weight (kg)	16.27 ± 2.21
BMI (kg m^{-2})	12.58 ± 1.83

Table 2 Comparison of fine motor skills attainment between SES groups

Subtest	SES		
	Low	Moderate	High
Beads in the box	39.93 ± 3.32[a,b]	46.91 ± 3.60[a,c]	49.61 ± 3.957[b,c]
Beads on the rod	7.63 ± 2.409[a,b]	13.00 ± 2.435[a,c]	14.59 ± 2.592[b,c]
Nut and bolt	113.30 ± 5.69[a,b]	126.59 ± 7.42[a]	128.18 ± 7.57[b]
Rod sliding	27.39 ± 4.42[a,b]	37.75 ± 4.32[a,c]	41.43 ± 4.60[b,c]
Finger tapping	35.34 ± 2.58[a,b]	42.70 ± 2.78[a,c]	44.23 ± 2.84[b,c]
Total score	223.59 ± 13.30[a,b]	266.95 ± 15.54[a,c]	277.96 ± 17.04[b,c]

[a]Significant difference between low SES and moderate SES
[b]Significant difference between low SES and high SES
[c]Significant difference between moderate SES and high SES

Table 3 Comparison of fine motor skills attainment between gender

Subtest	Gender	
	Male	Female
Beads in the box	44.69 ± 5.56	42.27 ± 5.27
Beads on the rod	11.60 ± 3.97	11.88 ± 3.79
Nut and bolt	121.75 ± 10.20	123.63 ± 8.95
Rod sliding	34.99 ± 7.47	36.06 ± 7.34
Finger tapping	41.15 ± 4.73	41.15 ± 4.73
Total score	258.95 ± 26.91	258.95 ± 26.91

Table 4 Relationship between SES, gender and fine motor skills

Characteristics	Fine motor skills (*r*)
SES	0.79*
Gender	0.10

*Correlation is significant at $p < 0.05$ (2-tailed)

The comparison between fine motor skills and genders is presented in Table 3. There is no significant difference between male and female for all fine motor skills' subtest and total score.

Table 4 shows the correlation between SES, gender and fine motor skills. Significant high correlation was found between SES and fine motor skills ($r = 0.79$, $p < 0.05$). No correlations were found between gender and fine motor skills.

4 Discussion

The results showed that the children have matured in fine motor skills. Majority of the children were at normal subscale in each task. However, there were significant differences in fine motor skills between SES groups. This study also proved that fine motor skills are associated with SES. Previous study has shown that more advantaged children had better fine motor skills than the less advantaged peers [31]. SES has been found to be the predictor to fine motor skill performance at school-age children especially in preschool children [1, 18, 19].

Family resources were associated with fine motor skills, as involvement with more activities, greater parental educational expectations and more books in the household were linked to better performance on the fine motor skills [31]. Parents with high SES acknowledge the importance of their children development and afford to provide materials, tools, books and other external materials which can enhance their children development especially in motor skill development and education [33, 34]. Even though parents from low SES spent more time with the children, they are unable to provide appropriate health care, cognitive stimulating materials at home and early exposure to their children [22, 30]. Children from low SES have less exposure to activity that involved fine motor skills and do not have the opportunity in education since the parents cannot afford to support their early education compared to children from better SES [4, 21]. Perception of financial resource availability is related to maternal depression and parents-to-child interaction which can affect children cognitive and motor competence development [35].

Childhood is the critical period for brain development. Undernutrition in children during early childhood may affect the brain growth [36]. Low SES is known as undernutrition, and it is associated with permanent impairment of brain size, neurons numbers, synapse and myelination together with neurological and behavioural deficits [30]. Low SES leads to low motor development because it involves the children brain development [37]. Previous study has shown that undernourished boys and girls have scored lower in motor performance compared to well-nourished children [30].

Parent's education correlated with the fine motor skill performances of their children [21]. Furthermore, educated parents are associated with better SES. A study revealed that children with low SES and low parental education performed badly during balance cluster task [9]. High-income parents have high expectation, and they believe through playing can increase their children development in either cognitive or motor skills [34, 38]. Parents with high education expose their children to play with the gadgets such as video games or computer since fine motor skills involve the eye–hand coordination [39, 40]. Motor development has connection with cognition because when doing an activity of motor skills, it will activate same brain path for fine motor skills [31].

This finding can be explained from the activities followed by these children in school. Activities conducted in schools at this age group are mostly drawing and writing regardless of gender. Result of current study may be due to motor competence assessment used in this study which is neutral in gender in all tasks [6, 41]. Besides that, there was a possible low correlation between fine motor skills and gender since there is no norm available for different gender. Furthermore, fine motor skills are simple tasks and only involved sitting without requiring controlling the balance of body parts [10, 42]. This could account for similar result between males and females for motor competence.

5 Conclusion

The fine motor skills were difference between three SES groups, but the children were still in normal scale. The children from high SES were found to achieve higher fine motor skill. No significant difference was found in fine motor skills attainment between genders. This study revealed that there was a relationship between fine motor skills and SES but no association was noted between fine motor skills attainment and gender. The current finding has contributed to a better understanding of the importance of SES in fine motor development in preschool children.

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Effective Drug Policy on Athletes

Vincent A. Parnabas, Julinamary Parnabas, Antoinette Mary Parnabas and Nagoor Meera Abdullah

Abstract The rationale for an antidrug policy in sports concern on legal consideration, ethical issues related with cheating and creating an unfair performance, and medical problems. The aim of this research was to evaluate the best policy to curb drug usage among athletes. The sample consisted of 127 athletes, with national ($N = 54$), state ($N = 35$), district ($N = 21$), and university ranking athletes ($N = 17$). The sample was chosen from Universiti Teknologi MARA, Malaysia. A 20-item questionnaire called drug policy for athletes was used. The factors which derived from the questionnaire were punishable by fines, punishable by imprisonment, banned for one to three years, and banned for life and rehabilitation. The results showed that the most effective drug policy to prevent drug usage among athletes was banned for life (mean = 4.51), followed by punishable by imprisonment (mean = 4.16), banned for one to three years (mean = 3.95), and punishable by fines (mean = 3.10). Athletes indicated rehabilitation as the least effective policy on combat drugs. Apparently, significant differences emerged for the athletes having different skills at sports except for rehabilitation. In order to implement drug policy through sanction process, drug testing should carry on at the major sport events such as Majlis Sukan Universiti Malaysia (MASUM), Sukan Malaysia (SUKMA), and Majlis Sukan Sekolah Malaysia (MSSM). Drug testing can be a particularly powerful behavioral controller when the threat of dismissal or some other serious penalty accompanies a positive drug test.

Keywords Drug policy · Punishable by fines · Punishable by imprisonment · Banned for life

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1 Introduction

The word ‘drug’ can be applied to almost any substance that can modify one or more of the functions of a living organism [1]. Drug can be defined as any chemical compound that is used in the prevention, diagnosis, treatment, cure of disease, and to relief pain, control, and improve any physiological or pathological disorder in humans and animals [2].

The most common physical cause for ingesting drug is attempting to enhance performance. For example, anabolic steroids can increase athletes’ size, strength, blood volume, endurance, power, and alertness [3, 4]. Besides that, it also decreases reaction time, anxiety, fatigue, and muscle tremor [4]. Stimulant drugs activate the central nervous system, enhance wakefulness, and increase physical activity on athletes [1]. Athletes use depressants and analgesic drugs to relive stress and pain [1], which can facilitate performance.

Research done by [5] at Majlis Sukan Universiti Malaysia (MASUM) or Sports among Universities, with 111 athletes showed that the usage of drugs increased sports performance. Besides that, research of [6, 7, 8] showed that taking drugs can increase sports performance.

The widespread usage of drugs in sports event in Malaysia requires the Malaysian government, Majlis Sukan Negara, Majlis Sukan Negeri, and other sports organization, to develop a drug policy in order to teach a lesson of the consequences of taking drugs among athletes. Malaysian athletes should know the limits or boundaries, between acceptable and unacceptable behavior in sports. The rationale for an antidrug policy in sports concerns legal consideration, ethical issues related with cheating and creating an unfair performance advantage, and medical problems [4].

In legal consideration, taking certain drugs is against the federal law. For example, drugs in the hallucinogenic category can cause distort visual perception, which can affect the athletes’ personal safety and can cause criminal activities or violence.

Condemnation of doping on ethical grounds appeared during the 1920s as sports became a genuine mass-cultural phenomenon [9]. Drugs are considered as cheating, unfair, harm (to users, clean athletes, society), perversion of sports (against its nature), unnaturalness, and dehumanization [10]. Furthermore, according to [11], drugs harm the society (socially debilitating effects of doping), coercion (taking risks with their health as a consequences of being remain competitive), and contract violation (failing to respect other competitors). Drugs are unnatural and unethical, since winning in sports is valued as natural performance. The main reason for drugs that should be banned by sports organization is because it may facilitate athletic performance [12]. The use of drugs can resulted in performance enhancement.

Table 1 illustrates the arguments against drug use in sports of [10] and [11]. Schneider and Butcher [10] categorize drugs as harm, conceptualization arguments

Table 1 A harms-based conceptualization of arguments against doping and drug use in sports

Schneider and butcher (2000)	Present categorization of harm
Categorization of harm	Cheating and unfairness
Harm: √to athletes √to (clean) athletes √to the sporting community √cause by the bans	Harm to others: √athletes (users) unfair advantage, health √athletes (non-users) unfair advantage, contract violation, coercion √members of the sporting community
Perversion of sport's nature	Expectations of disappointment and role models
Unnaturalness and dehumanization	Harm to society Harm to the nature of sports: √unfair advantage/deskilling √rule breaking √compromise of internal goods √unnaturalness

against drugs. In contrast, the present categorization of harm reflects these 'other' arguments as also indicative of some form of harm [10].

Perhaps the most important problem with drug use in sports is the potential lethal effect on health and well-being [4]. Taking anabolic steroid, depressants, and stimulants at the long term can cause serious health problems on athletes' related with increase heart risk of heart disease, damage of organs, and cancers; shrinking testes, hair loss, enlarged breast, and possible sterility for men; and shrinking breast, enlarged clitoris, irregular menstruation, and increased facial and body hair for women [3]. Sport organizations in Malaysia have a duty of care for athletes to prevent reasonably foreseeable health risks. In order to curb the negative impact of drugs on health and for a health-promoting environment of sports, it is necessary to develop and implement a drug policy and plan of actions.

2 Aim of the Study

This research explores some rationales of regulating drug policy among athletes in order to prevent cheating in sports. The aim of this research was to evaluate the best policy to curb drug usage among athletes.

3 Methodology

The sample consisted of 127 athletes, with national ($N = 54$), state ($N = 35$), district ($N = 21$), and university level athletes ($N = 17$). The sample was chosen from the Universiti Teknologi MARA, Malaysia. A 20-item questionnaire called drug policy for athletes was used. Athletes will indicate their responses to a Likert-type scale ranging from strongly agree (5) and strongly disagree (1). Five factors were derived from the questionnaire. They are punishable by fines (item number 1–4), punishable by imprisonment (item number 5–8), banned for one to three years (item number 9–12), banned for life (item number 13–16), and rehabilitation (item number 17–20).

4 Result

4.1 Cronbach Reliability Coefficients

In this study, Cronbach alpha coefficients were found relatively high, ranging from 0.77 to 0.89 (Table 2).

4.2 Profile of the Respondents

The profile of the respondents described the gender, sports, marital status, level of achievement, ethnic, and age. Table 3 shows the overall results of the respondents' profile of 73 males and 54 females.

The mean age for overall respondents was 22.03 years old. The age of male varied from 18 to 25 years, where the mean age was 23.31 years old. The age of females ranged from the minimum of 18 to the maximum of 24 years old. The mean age for female respondents was 22.03 years old.

The variable 'skills in sports' is gathered through the studies. This variable is categorized into four levels. They are university, district, state, and country levels. The result showed that 58 respondents had participated at national level, while 30 respondents participate at state level, 25 had participated at district level, and 14 respondents participated at university level. The sports category showed that majority of the respondents, 19.69 %, were football players, followed by basketball

Table 2 Cronbach reliability coefficients

Drug policy	Cronbach's alpha (n = 127)
Punishable by fines	0.7841
Punishable by imprisonment	0.8357
Banned for one to three years	0.8907
Banned for life	0.7789
Rehabilitation	0.8191

Table 3 The profile of respondents (n = 127)

Variables	Frequency	Percentage	Mean	SD
Gender				
Male	73	57.48		
Female	54	42.52		
Sports				
Football	25	19.69		
Basketball	22	17.32		
Futsal	18	14.17		
Badminton	15	11.81		
Track and field	12	9.45		
Hockey	9	7.09		
Takraw	8	6.30		
Ping-Pong	7	5.51		
Silat	6	4.72		
Taekwondo	5	3.94		
Athletes skill				
National	58	45.67		
State	30	23.62		
District	25	19.69		
University	14	11.02		
Ethnic				
Malay	93	73.23		
Sabahan	19	14.96		
Sarawakian	15	11.81		
Age				
Male			23.31	2.17
Female			22.17	2.11
Overall			22.03	1.98

(17.32 %), futsal (14.17 %), badminton (11.81 %), track and field (9.45 %), hockey (7.09 %), takraw (6.30 %), Ping-Pong (5.51 %), silat (4.72 %), and taekwondo (3.94 %).

4.3 Effective Drug Policy

The results showed that the most effective drug policy to prevent drug usage among athletes was banned for life (mean = 4.51), followed by punishable by imprisonment (mean = 4.16), banned for one to three years (mean = 3.95), and punishable by

Table 4 Effective drug policy in sports (n = 127)

Drug policy	Mean	SD
Banned for life	4.51	0.41
Punishable by imprisonment	4.16	0.55
Banned for one to three years	3.95	0.57
Punishable by fines	3.10	0.67
Rehabilitation	2.97	0.71

Table 5 Comparison of drug policy on athletes based on skills (n = 127)

Drug policy	Athletes skill	Mean	F value
Punishable by fines	National	12.2145	10.001*
	State	14.3317	
	District	13.4167	
	University	15.7181	
Punishable by imprisonment	National	10.2131	12.824*
	State	14.3613	
	District	16.2271	
	University	18.1253	
Banned for one to three years	National	12.2256	11.417*
	State	13.3178	
	District	14.2714	
	University	15.2751	
Banned for life	National	10.2157	10.191*
	State	11.3166	
	District	12.9129	
	University	12.3871	
Rehabilitation	National	12.2315	17.883
	State	12.2561	
	District	11.981	
	University	12.3921	

*$p < 0.05$

fines (mean = 3.10). Athletes indicated rehabilitation as the least effective policy on combat drugs (Table 4).

4.4 *Effective Drug Policy Based on Athletes Skill*

Apparently, significant differences emerged for the athletes having different skills at sport except on rehabilitation (Table 5).

5 Discussion

5.1 *Effective Drug Policy*

The result of the present research showed that the most effective policy to curb drugs among athletes was banned for life. Drug abuse is considered as a serious problem in sports, especially the use of steroids, depressants, and stimulants, to enhance strength and performance. Drug abuse by athletes is condemned by all sports governing bodies. Therefore, it is necessary to implement severe punishment, like banned for life from taking part in any sports competitions. For example, in an arguable the most famous case ever of drug abuse in sport, during the 1998 Olympic Games in Seoul, South Korea, the Canadian sprinter, Ben Johnson, was stripped of gold medal he won and banned for two years because he was tested positive for anabolic steroids. After serving his ban, Ben Johnson tested positive again for stanozolol, a banned anabolic steroids, and has now being banned for life [13, 14]. This destroyed his career and reputation. This case study shows that, banned for one to three years, punishable by fines or rehabilitation is not an effective policy to prevent the usage of drugs in sports. Severe or strict punishment like banned for life will be the most effective policy to stop athletes from taking drugs. Hence, respondents indicated that banned for life in sports, as the best policy to make sports free from drugs misuse.

The International Olympic Committee (IOC) and International Amateur Athletic Federation (IAAF) adapted strict rules governing drug abuse by competitors in events organized by them. Any competitors who found to have taken drugs are disqualified and suspended [14]. Besides athletes, action must be taken against coaches and managers who helped their athletes to take drugs as they also benefit financially from an improved performance. For example, Charlie Francis, the coach of Ben Johnson, was banned for life in 1991, by Canadian athletics governing body, for helping him to be on drugs [13, 14]. Furthermore, Dr. Jamie Astaphan, the doctor who prescribed drugs for Ben Johnson, was found guilty of professional misconduct and suspended [14, 15].

Rehabilitation, in this present study, was the least effective policy to prevent drugs in sports. Even though drug rehabilitation centers are considered as the solutions for drug problems through therapy procedures but not everyone will success with that method. Most of the drug rehabilitation sessions were found ineffective to curb drug habits [16]. It is important to note that changing drug addicts' behavior is difficult and not easy. In most cases, the drug addicts return to old behavior of taking drug, after stoping for a short period of time. A few studies indicated that 85 percent of drug addicts returned to drug use again [17]. There are varieties of cognitive distortions that impact initiation, maintenance, and recovery trajectories of people who are addicted [18]. These may involve the belief that one cannot cope with a particular situation, without resorting to the addiction, that is, the person lack a belief in his or her own self-efficacy or power to effect change [19].

5.2 Effective Drug Policy Based on Athletes Skill

If take a careful look at the table on drug policy on athletes' skill, one of the most phenomenon evident, which is very clear that the mean of national athletes are the lowest compared with other skill categories of athletes. In other words, the mean score obtained for the national rank athletes was lower than those in other categories. This means that the national athletes were not in favor of the implement of the drug policy. This is because quite a number of researches showed that among all categories of athletes, national ranking athletes or elite athletes are the ones who consume drugs the most to enhance their performance. Research of [20, 21] and [4] showed that elite or national athletes are the famous categories of athletes using drugs. The main reason for elite athletes to consume drugs due to high expectation place on them by their university, coach and fans [4, 5, 22]. Since elite athletes' profession is as full-time athletes, it is common for elite athletes to consume drugs [23]. Therefore, 60 % of the national skilled athletes response as disagree (2) and doubt (3), in most of the items. In item number 5–8 (Punishable by imprison) and 13–16 (Banned for life), 65 % of the national athletes answer as disagree (2) and doubt (3). Most of the national athletes respond as agree (4) and strongly agree (5) on punishable by fines (item number 1–4) and rehabilitation (item number 17–20). This showed that national athletes are trying to avoid severe punishment since they choose punishable by fines and rehabilitation.

In order to implement drug policy through sanction process, drug testing should be carried out on the major sport events. Sports organization should focus their drug testing at popular sports events such as MASUM, Sukan Malaysia (SUKMA), and Majlis Sukan Sekolah Malaysia (MSSM). Drug testing can be a particularly powerful behavioral controller when the threat of dismissal or some other serious penalty accompanies a positive drug test [4]. According to [4], three principles contribute to an effective drug-testing program. They are as follows:

1. Announce the policy in advance. All athletes should aware of their teams or league's rules and guidelines from the first day of their participation, so that participants can effectively be held accountable for their actions. However, the actual testing procedure should not be announced in advance. To reduce cost, random testing can be applied for drug testing. In random testing, only a percentage of the team's athletes required to be tested rather than all the players. However, since most of the research indicated that national or elite athletes consume drugs compared to other categories, more percentage can be taken from this category to be tested.
2. Be consistent in implementing the policy. The least effective approach to enacting a drug policy is responding to one athlete differently than to others. For example, testing only national ranking athletes, while ignoring state, district, school, or university level athletes. If the coach or league officials are serious about drug abuse prevention and control, they must react vigorously and consistently to all the athletes. Otherwise, any credibility the policy has will be destroyed.

3. Link test results to sanctions. The coach or sport organization responses to positive drug tests can be very restrictive (punishable by imprisonment, banned for one to three years, and banned for life) or flexible (sent for rehabilitation). However, the least appropriate response is to have a policy that includes sanctions that are not implemented or used inconsistently. Athletes, unlike others in subordinate position, need to realize that their behaviors that might be illegal, unethical, and medically unsafe cannot be tolerated. Sanctions should be fare without favoritism of any kind of athletes.

6 Conclusion

The results of this present research showed that the most effective drug policy to prevent drug usage among athletes was banned for life, followed by punishable by imprisonment, banned for one to three years, and punishable by fines. Athletes indicated rehabilitation as the least effective policy on combat drugs. Apparently, significant differences emerged for the athletes having different skills at sports except on rehabilitation. The result also showed that the mean score obtained for the national level athletes in all the policy was lower, except on rehabilitation.

The policy had addressed the new and established challenges associated with drug use among athletes. The result of this present study can be used as a platform to consider the implement of drug policy on athletes. Drug testing should be carried out in all the sports events to prevent athletes from taking drugs to enhance performance. Administering drug policy on sport venue can reduce cheating and unfair, harm (to users, clean athletes, society), perversion of sports (against its nature), unnaturalness, unethicality, and dehumanization. By implementing drug policy, Malaysian sports organization can stand out as a model for other nations committed to treating drug use and addiction in a health-based and fiscally responsible manner.

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Differences in Game Statistics Between Winning and Losing Teams in 2011 Rugby World Cup

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Abstract The current study was designed to investigate the statistical differences between winning and losing teams that competed in the Rugby World Cup 2011. Data were collected from eight (8) recorded matches starting from the quarterfinal until the final match (Wales vs. Ireland, England vs. France, South Africa vs. Australia, New Zealand vs. Argentina, New Zealand vs. Australia, France vs. Wales, Australia vs. Wales, and New Zealand vs. Argentina). A total of 21 performance indicators were selected as the variables in this study. Descriptive and inferential statistics were used to analyze the data. The results showed the winning teams were significantly higher in points scored, successful in penalty goals, and turnovers won compared to the losing teams. Meanwhile, losing teams had significantly higher averages for the variables such as scrums lost, lineouts won, and errors made. It was disclosed that (i) on points collection, winning teams had performed better with higher average through the penalty goals than losing teams; (ii) the losing teams tended to have more errors during the matches including scrums, lineouts, rucking, ball handling, and tackle; and (iii) on defense, winning teams had more ball turnovers and completed more tackles than losing teams. There was a significant difference (success penalty goals, p = 0.021; lineouts won, p = 0.002; turnovers, p = 0.034; and errors made, p = 0.001) in performance indicators for winning and losing teams. The result presented in this study can be useful as a reference for coaches in designing a training program for higher level rugby competitions.

Keywords Performance analysis · Performance indicators · Video analysis

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1 Introduction

Research in rugby usually focuses on several factors such as pattern of the game, working rates of players, and performance indicators [1]. Vaz et al. [2] stated that the game of rugby is extreme, complex, and chaotic with insecure situations varying with every game. The changes might happen due to changing of conditions including the weather, the strategies, and the tactical approaches used. Performance analysts are able to analyze the strategies and the tactical approaches of their own team or opponents in turn to win the competition. Previous research states that the analysis of strategies or tactical approaches is either based on individual skills or collective team effort, during training or matches [1, 3]. The analysis is important and very useful to gain greater feedback on strengths and weaknesses of their own team or the opponent. This feedback is very useful for a coach in order to implement suitable strategies during a match. Another reason why coaches and researchers depend on such information is that it is useful for identifying the most valuable players, assess the impact of rule changes, investigate the home advantages, evaluate the contribution of the starting, reserve players in the game, and determine players' involvement toward team performance [4].

The match analysis is able to distinguish the difference between the winning and losing teams in any competition. To attain this target, the study should be well designed with specific objectives. In rugby, previous research shown that the winning teams always had better statistics than the losing teams. According to Ortega et al. [1], the winning teams had an effective forward during the lineout, where they have a variation of moves to get possession, and they were better at pushing in the scrum.

Initially, the analyst has to set the performance indicators that need to be focused on. According to James et al. [5], the analyst must highlight the needs on the development of performance indicators related with the match analysis. Furthermore, it must be useful to build up a profile of ideal performance that characterizes athletic action in order to achieve a particular performance, and most importantly, it must be useful in helping the team achieve success [1, 3]. In addition, Vaz et al. [2] stated the performance indicators actually do not relate directly to the results of the match, but were more related to the various game strategies and structures. This was supported by Lago et al. [6] who claimed that any team could lose even having a very good performance or be on the track of success after having a poor performance.

O'Shaughnessy [7] stated that to be successful in any competition, the important thing is to be in possession in order to control the game and not be controlled by the opponent. The team with greater possession usually will stand a chance to win. As stated by Lago et al. [6], possession of the ball was the most popular performance indicator in match analysis. Generally, it is a common thing for the successful team to display better performance in scoring points each time they penetrate the opponents' field area with success in the lineout, in continuing play, in 16 balls keeping during phase to phase play, and being very efficient in foot game [1].

The performance of both winning and losing teams is based on the efficiency and efficacy in applying their pattern of play in matches, with well-developed strategy and tactical approaches [4]. Such information collected during the match or training would allow for more specific strategic and tactical team preparation, from player recruitment to practice planning, execution, and control. Vas et al. [2] in their study had also emphasized that the differences between winning and losing teams can be detected even in close scoring match. Thus, the present study was designed to analyze the statistical differences between winning and losing teams in the 2011 Rugby World Cup that was held in New Zealand.

2 Method

2.1 Sample

Eight (8) recorded videos beginning from the quarterfinals until the final match including the 3rd placing match during the 2011 Rugby World Cup were analyzed with using the notational analysis (frequency tables). A total of 21 performance indicators were used in this study. Reliability of the analysis and analyst percentage of total error was calculated before the collection of data was initiated.

2.2 Instrumentation

To get valid results, the type of instrument to be used should be relevant to what will be analyzed. Instrumentation describes the measuring instrument or equipment used in the study. This study used the Gamebreaker software (Sportstech) for video analysis. All the videos were converted to suit the software.

3 Data Collection

Performance indicators selected in this study were based on performance indicators stated in previous research [1, 2]. The 21 performance indicators used are illustrated in Table 1.

Reliability of the analyst was recorded before the data collection by implementing analysis and re-analysis of one match to find the correlation value and percentage of total error. Based on the results, the analyst who conducted the data collection showed high value of reliability ($r = 0.89$) and small percentage of total error (3.8 %). Hence, the analyst was qualified to perform the data collection. Data collection was based on eight (8) recorded matches.

Table 1 Variables studied in the 2011 Rugby World Cup

No.	Variables
1	Tried scored
2	Conversions
3	Penalty goal errors
4	Successful penalty goal
5	Drop error
6	Successful drop
7	Scrums won
8	Scrums lost
9	Lineouts won
10	Lineouts lost
11	Penalty conceded
12	Free kicks
13	Ruck and drive
14	Ruck and pass
15	Mauls won
16	Mauls lost
17	Turnovers won
18	Passes completed
19	Tackles made
20	Tackles missed
21	Errors made

4 Data Analysis

The Statistical Package for Social Science (SPSS) Version 17 was used to analyze the results of the notational data. The descriptive statistics (means, medians, and standard deviations) and inferential statistical analysis (the Mann-Whitney U test) were used to answer the research hypothesis. This study was classified as non-parametric as the sample was not normally distributed. The significance level was set at $p \leq 0.05$.

5 Results

5.1 Demographic Data

The demographic data (%) of all the performance indicators for the winning and losing teams are presented in Tables 2 and 3, respectively.

The overall descriptive analysis showed that the winning teams had higher percentage value for the positive indicators compared to the losing teams. The detailed analysis of means, medians, and standard deviations is illustrated in Table 4.

Table 2 Demographic data of winning teams

Variables	QF1	QF2	QF3	QF4	SF1	SF2	¾	F
Tried scored	75	50	100	66.7	100	0	50	50
Conversions	66.7	0	0	50	0	0	50	0
Penalty goal errors	100	100	0	0	100	0	50	50
Successful penalty goal	50	100	50	87.5	80	75	50	100
Drop error	0	50	0	0	100	50	100	0
Successful drop	0	100	0	0	50	0	0	0
Scrums won	40	72.2	65	44.4	80	45.4	44.4	42.9
Scrums lost	0	0	0	0	0	0	0	0
Lineouts won	11.8	36.8	35	43.5	41.7	45.8	60.9	50
Lineouts lost	100	33.3	100	0	50	14.3	0	50
Penalty conceded	50	35.3	40	60	61.1	53.8	44.4	58.8
Free kicks	50	0	50	0	0	100	100	100
Ruck and drive	40	81.5	30	56.3	58.3	34.8	93.5	68.2
Ruck and pass	42.9	40.9	22.4	81.1	51.9	24.2	65.6	47.4
Mauls won	42.9	50	50	57.1	50	87.5	100	37.5
Mauls lost	0	0	0	0	0	0	0	0
Turnovers won	64.7	81.8	47.4	66.7	66.7	55.6	57.1	68.8
Passes completed	36.3	34.9	26.2	84	55.2	29.4	55.8	35.6
Tackles made	60.3	52.5	72.6	28.3	52.2	47.8	33.5	53.8
Tackles missed	47.4	64.3	56.3	20	41.4	58.6	80	55.6
Errors made	36	47.7	33.3	40	38.1	61.9	48.6	29.4

5.2 Inferential Statistics

The Mann-Whitney U test was performed to investigate the differences between the winning and losing teams (Table 5).

The result showed that the winning teams had averages that were significantly higher for the variables such as point scored ($Z = -2.105$, $p = 0.035$, $p < 0.05$), successful penalty goals ($Z = -2.302$, $p = 0.021$, $p < 0.05$), and turnovers won ($Z = -2.118$, $p = 0.034$, $p < 0.05$).

Additionally, winning teams had higher averages for the variables such as tried scores ($Z = -1.118$, $p = 0.264$, $p > 0.05$), penalty goal errors ($Z = -0.499$, $p = 0.618$, $p > 0.05$), scrums won ($Z = -0.745$, $p = 0.457$, $p > 0.05$), and lineouts lost ($Z = -0.970$, $p = 0.332$, $p > 0.05$). Other than that, no significant differences were found in penalty conceded ($Z = -0.753$, $p = 0.451$, $p > 0.05$), free kicks ($Z = -0.114$, $p = 0.910$, $p = 0.05$), mauls won ($Z = -0.321$, $p = 0.748$, $p > 0.05$), and tackles made ($Z = -0.947$, $p = 0.343$, $p > 0.05$) although they had higher averages for these variables.

Losing teams had significantly higher averages for the variables such as scrums lost ($Z = -2.219$, $p = 0.027$, $p < 0.05$), lineouts won ($Z = -3.098$, $p = 0.002$,

Table 3 Demographic data of losing teams

Variables	QF1	QF2	QF3	QF4	SF1	SF2	¾	F
Tried scored	25	50	0	33.3	0	100	50	50
Conversions	33.3	100	0	50	0	0	50	100
Penalty goal errors	0	0	100	100	0	100	50	50
Successful penalty goal	50	0	50	12.5	20	25	50	0
Drop error	0	50	100	0	0	50	100	100
Successful drop	0	0	100	0	50	0	0	0
Scrums won	60	27.8	35	55.6	20	54.6	44.4	57.1
Scrums lost	0	100	0	0	100	100	0	0
Lineouts won	88.2	63.2	65	56.5	58.3	54.2	60.9	50
Lineouts lost	0	66.7	0	0	50	85.7	0	50
Penalty conceded	50	64.7	60	40	38.9	46.2	44.4	41.2
Free kicks	50	100	50	0	0	0	100	0
Ruck and drive	60	18.5	70	43.7	41.7	65.2	93.5	31.8
Ruck and pass	57.1	59.1	77.6	18.9	48.1	75.8	65.6	52.6
Mauls won	57.1	50	50	42.9	50	12.5	100	62.5
Mauls lost	0	0	0	0	0	0	0	0
Turnovers won	35.3	18.2	52.6	33.3	33.3	44.4	57.1	31.2
Passes completed	63.7	65.1	73.8	16	44.8	70.6	55.8	64.4
Tackles made	39.7	47.5	27.4	71.7	47.8	52.2	33.5	46.2
Tackles missed	52.6	35.7	43.7	80	58.6	41.4	80	44.4
Errors made	64	52.3	66.7	60	61.9	38.1	48.6	70.6

$p < 0.05$), and errors made ($Z = -3.366$, $p = 0.001$, $p < 0.05$). They also had higher averages, although insignificantly so, for the variables such as conversions ($Z = -0.648$, $p = 0.517$, $p > 0.05$), drop goals error ($Z = -0.810$, $p = 0.418$, $p > 0.05$), ruck and drive ($Z = -0.105$, $p = 0.916$, $p < 0.05$), ruck and pass ($Z = -1.682$, $p = 0.093$, $p < 0.05$), passes completed ($Z = -0.945$, $p = 0.345$, $p > 0.05$), and tackles missed ($Z = -0.318$, $p = 0.751$, $p > 0.05$).

6 Discussion

In the first match of the quarterfinals, the result showed that the winning team had possessed it through tries scored and conversions. The losing team had played the ball more often rather than the winning team. It seems that the losing team had played lots of ruck and drives with ruck and pass. This team had controlled the ball as they had a higher number of passes completed.

In the defense playing system, the winning team had higher tackle completion and turnovers won with less missed tackle. In scrums and lineouts, the winning team had controlled both variables. The losing team had made more mistakes or

Table 4 Demographic data of winning and losing teams

Variables	Winning team			Losing team		
	Mean	Median	SD	Mean	Median	SD
Point scored	17.88	19.50	8.323	10.00	9.50	3.74
Tried scored	1.50	1.50	.926	1.00	1.00	0.76
Conversions	0.50	0.00	0.756	0.63	1.00	0.52
Penalty goal errors	1.50	2.00	1.414	1.13	1.00	1.13
Success penalty goal	2.75	2.00	1.982	1.00	1.00	0.76
Drop goals error	0.50	0.00	0.756	0.75	1.00	0.71
Successful drop	0.38	0.00	0.518	0.38	0.00	0.74
Scrums won	6.63	5.00	4.307	4.50	4.50	1.6
Scrums lost	0.00	0.00	0.000	.63	0.50	0.74
Lineouts won	8.63	9.50	3.335	13.38	13.00	0.92
Lineouts lost	2.25	1.50	2.121	1.63	0.50	2.26
Penalty conceded	8.00	8.00	2.390	7.25	7.00	1.67
Free kicks	0.88	0.50	1.126	0.75	0.50	0.89
Ruck and drive	12.13	11.50	7.918	13.00	13.00	7.58
Ruck and pass	49.88	46.50	17.924	69.75	77.00	28.34
Mauls won	2.75	2.50	2.121	2.38	2.00	1.51
Mauls lost	0.00	0.00	0.000	0.00	0.00	0.00
Turnovers won	9.13	9.50	2.748	5.50	5.50	3.02
Passes completed	67.13	49.50	43.370	80.38	83.50	29.14
Tackles made	134.25	139.00	51.964	115.63	92.00	57.98
Tackles missed	8.38	9.00	4.868	9.88	8.50	6.08
Errors made	9.63	9.50	3.021	20.13	20.0	4.52

errors, which gave an advantage to the winning team. Result of the first quarter-finals did not demonstrate any differences in certain performance indicator such as the points both teams obtained through penalty goals and drop goals, the advantages from penalty conceded and free kicks, and errors such as scrums lost, mauls lost, and unsuccessful drop goals. Although both teams had shared the same try scoring in the second semifinals, the winning team won the game by points from penalty goals and drop goals. The winning team had also won in numbers of scrums and ruck and drive, and they also played a defensive system where they had higher tackles completion and turnovers won. In this match, the losing team had more advantage play when they got more penalty and free kicks, but they made more mistakes in scrums and lineouts.

The third quarterfinals and fourth quarterfinals showed match statistics and had a very small margin in points scored. Losing teams had control over the ball and had higher number of ruck and pass and also pass completion; however, the winning teams had control over the variables for points scored to win those match. Winning teams did not have a try, but they still won the match by converting the penalty goals. On the other hand, the losing teams wasted the penalty goals and drop goals.

Table 5 Correlations

Variables	Z value	p value
Tried scored	−1.118	0.264
Conversions	−0.648	0.517
Penalty goal errors	−0.499	0.618
Success penalty goal	−2.302	0.021*
Drop goals error	−0.810	0.418
Successful drop	−0.323	0.747
Scrums won	−0.745	0.457
Scrums lost	−2.219	0.027*
Lineouts won	−3.098	0.002*
Lineouts lost	−0.970	0.332
Penalty conceded	−0.753	0.451
Free kicks	−0.114	0.910
Ruck and drive	−0.105	0.916
Ruck and pass	−1.682	0.093
Mauls won	−0.321	0.748
Mauls lost	0.000	1.000
Turnovers won	−2.118	0.034*
Passes completed	−0.945	0.345
Tackles made	−0.947	0.343
Tackles missed	−0.318	0.751
Errors made	−3.366	0.001*

* $p < 0.05$

The same problem occurred with three other losing teams. The competition for these four matches seemed quite tough, as the losing team had a chance to win the match if they did not commit a quite number of mistakes. Differences also existed with the other variables, but with a small margin between winning and losing teams.

The margin for points scored was greater than other matches in the 2011 Rugby World Cup when comparing winning and losing teams. The winning teams had more try and penalty goals and won the match. They also made fewer errors and tackles missed, but they won more on ball turnover and used the advantages from the penalty conceded to gain points. The thing that made the difference is that the winning teams played the ball more often than losing teams. The winning teams did more pass completion and performed higher driving and passing after rucking.

The results of the overall matches signifies that winning teams scored almost twice the amount of points than the losing teams, and this finding is in agreement with previous research findings [1, 2]. Winning teams scored more points from tries and penalty goals compared to losing teams, while there were no differences in conversions and drop goals.

The errors occurred when both teams tried to get more points. It seems that no differences were found when both winning and losing teams did quite the same in term of numbers of unsuccessful drops and penalty goals. Based on these results, it can be conclude that winning teams are stronger than losing teams in offensive play.

Similar results were reported in a previous study [3]. For defensive variables, the results showed that the winning teams had higher tackle completion and turnovers won during the match. However, no differences were found in missed tackles. It indicates that winning teams demonstrated more in defense and this is in agreement with previous research [8], which reported that winning teams were better in offense and defense compared to losing teams.

This study also found that the winning teams had higher percentage of scrums won. However, the losing teams were better during the lineout execution. Losing teams had higher percentage of passing after rucks, but no differences were found on the driving after rucks. These results differ from those reported earlier [1], in which winning teams are more effective during the lineout, in continuing play, and in keeping the ball in dynamic phases of play.

As for the advantages given by the referees such as penalty and free kicks, no differences were found on these variables. The values show that when the level of competition is very high, every team prepares their best to win the world cup. There were no errors while defending or attacking to avoid the advantages given to the opponent such as scoring points from penalty kicks or gain on distance. This study has shown that losing teams have a higher percentage of errors made compared to the winning teams. This indicates that the losing teams committed more mistakes that gave an advantage to the winning teams to capitalize their chances to control the game. Based on inferential analysis, there were significant differences on performance indicators among winning and losing teams. The significant performance indicators are points scored, successful penalty goals, scrums lost, lineouts won, errors made, and turnovers won. There were also no significant differences existed for certain variables such as ruck and pass, tackles made, and passes completed.

The feedback on the significant differences in performance indicators between winning and losing teams is important, as it can help to guide the process of training for improving and correcting the weaknesses in the performance indicators of the team. In addition, the findings from this study can be used by the coaches in developing suitable training programs for their players [9].

7 Conclusion

Winning teams achieved success percentages of 73 % in penalty goals, 50 % in drop goals, and 44 % in conversions. These percentages can be used as references by coaches to develop a proper training program based on kicking and for monitoring kicking efficacy and efficiency during difficult situations in competition.

This paper provides an important indicator values that may serve as a reference to design and evaluate training for rugby peak performance of teams in competition tournaments. Coaches can use these results to establish the suitable objectives for their players and teams by maintaining the strengths and improving on the weaknesses.

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The Problem with S.League Club Structure: A Case for Incorporating Singapore Football Clubs as Companies

Ganga Sudhan and Shankar Selvam

Abstract In Singapore, football clubs are registered under the Registry of Societies Act which means that the management board is engaged under a voluntary arrangement with no salaries paid. This casual leadership arrangement has resulted in poorly managed local football clubs, operating on many considerations that do not involve the core business of football, with decisions regularly made at the expense of football performance. If local football clubs were able to operate as companies instead, management and administration would vastly improve and, consequently, the quality of football, fan retention and youth development would all trend upwards. As ownership will become a key feature and be taken seriously under such circumstances, regardless of whether the club is succeeding or failing, there is everything to gain and nothing to lose for Singapore football clubs to be incorporated as companies.

Keywords Singapore · Football · Soccer · S.League

1 Football in Singapore

The S.League was created in 1996 by the Football Association of Singapore (FAS) after participation in the Malaysian Semi-Pro League was no longer viable [1]. The purpose was to incorporate a professional National Football League (NFL) to develop local football and "to bring back the thrill and excitement of competitive soccer previously provided by the Semi-Pro and Premier Leagues and the Malaysian Cup competition" [2]. This was done by replacing the existing

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Premier League with the S.League competition and inviting football clubs to submit an application to participate.

With ten million dollars in funding from the Singapore Sports Council (SSC)—now known as Sport Singapore—the FAS allocated each participating S.League club $1 million to run operations and pay player salaries for the first run of the S. League [2]. The clubs which participated in that inaugural competition in 1996 were existing local football clubs who had been around since the 1970s. By fulfilling criteria prescribed by the FAS and the competition committee—such as financial and management capability [1], they became eligible to officially include a team into the S.League.

In addition, the Prime League was created to include youth teams of S.League clubs to act as a platform for their feeder squads. There is no relegation component to either the S.League or Prime League, with just a subsidy deduction of $30,000–$50,000 awaiting the bottom two clubs if they do not achieve at least 20 % of the possible points for that season [3, p. B5].

In the meanwhile, the existing amateur league called the NFL continues to operate as an open competition for all other football clubs registered with the FAS, including an open island-wide league, followed by a three-tiered division of ten teams each that incorporate promotion and relegation for the top two and bottom two teams in each division [4].

2 Football Clubs as Registered Societies

In terms of global history, football clubs largely originated as social clubs for members of the distinguished class such as religious associations and educational institutions to engage one another over a common interest—football [5, p. 7]. But in the world of modern football, only amateur grassroots soccer clubs operate in this fashion—today, most professional football clubs are independent business and legal entities which are run like companies rather than non-profit organisations [6]—with annual reports and financial audit. Many football clubs around the world are even listed on various stock exchanges to further empower themselves financially [7]. This trend has already reached the regional level, with the Football Association of Malaysia (FAM) actively seeking opportunities to privatise the Malaysian Super League soon [8].

In Singapore, however, all football clubs are registered under the Registry of Societies Act [9], which require membership and annual general meetings according to their respective constitutions [10]. This means that they can create paid memberships and offer facilities such as game rooms for rental and jackpot machines to play and generate revenue through a clubhouse. While this model enables clubs to earn income through member activities, this also means that the management board is engaged on a voluntary arrangement with no salary [9].

This casual leadership arrangement has resulted in poorly managed local football clubs that are operated on many considerations that do not involve the core business of football [11]. Decisions are often made on pragmatic and practical grounds that revolve around operating the clubhouse, at the expense of football performance and worse, leaving players who depend on playing football for their livelihood in the lurch at times [12]. Over the past 19 years, the S.League has seen 15 clubs come and go, with at least three of those through mergers. In the case of Tanjong Pagar United, which has dropped out twice, the reason cited is largely linked to finances [11].

In terms of youth development, the FAS typically launches the initiatives and the clubs then take their cues from there to implement the processes. For example, in 2014, a new Centre of Excellence format was revealed by the FAS and three football clubs (i.e. Home United FC, Warriors FC and Balestier Khalsa FC) collaborated with the governing body to implement junior age group teams at their respective clubs [13].

It is an extremely easy process to dissolve a society [10]; thus, a football club in Singapore can legally exist and cease to exist in a matter of minutes. But the impact of this decision is far-reaching because players go out of contract, operational staff is retrenched, and the fans are left confused [14]. In fact, most S.League football clubs do not have any system to manage an official supporters club where fans are rewarded with a package price for the club's tickets and merchandise (G. Gan, personal communication, January 14, 2015).

Essentially, the S.League seems to micromanage the clubs as part of a single entity, leaving no room for unique club personalities to be cultivated (G. Gan, personal communication, January 14, 2015). This results in a football climate of disarray, and comical arrangements such as Tampines Rovers FC (that is based in the eastern part of Singapore) being relocated to Clementi stadium located in the western area for three years [15] and then moved still further to Jurong West stadium for the current season—making the club physically located some 35 km away from its geographic base. With all S.League coordination falling under the direct purview of FAS, who must itself abide by the larger authority of Sport Singapore, decisions end up being at the national level rather than involve any local constituency consideration.

3 Football Clubs as Companies

However, if local football clubs were able to operate in an entirely independent fashion, it is quite probable that the management and administration of the clubs would vastly improve and, with that, naturally bring the quality of football up, increase investment in youth development and enhance the management of fan relationship. To that end, Singapore certainly has the expertise and business climate to facilitate football clubs being run as companies instead of societies [16]. There is also no shortage of business leaders who would consider owning a football club—evidenced by Singaporean businessman Peter Lim's investment in top Spanish club Valencia for over half a billion dollars [17].

By allowing local football clubs to be registered as companies, they would become legal entities that can be owned, take corporate loans, enter into partnerships, buy stakes in property (such as a stadium) and develop business in other complementary areas that can support their core focus on football. Management staff can be hired on a competitive pay scale and coaching talent can match the financial muscle of the club—which in turn can draw better quality players.

Recognising club supporters can also become an integral part of the club infrastructure with merchandise sales allowing for clubs to generate revenue while offering value for money to the fans, instead of creating debacles such as S.League club jerseys being inexplicably marked down from around $55 to $10 at one match in June 2014, seemingly on the decision of someone at the S.League or FAS [18].

Similarly, youth development will become a cost-effective investment to tap on raw talent and nurture that into quality players—again, leading to potential success. Even if success on the pitch eludes a club, it would still be suitably positioned to explore the option of generating revenue by developing quality talent and selling up-and-coming players to clubs with better financial backing—not unlike what some clubs practice in the English Premier League [19].

Ultimately, with the financial bottom line being a key performance indicator, there will be more impetus for football clubs to be run in a way that fosters financial success as well as positive branding—which has been shown to be regularly achieved through success on the pitch [20]. This means that player salaries would be pegged to performance and can be termed for a longer period than the current "minimal six (6) months basis" [3, p. E7], paving the way for player unions that can offer better protection against loss of income and secure collective bargaining agreements [21].

Ownership will become a key feature of football clubs and will—more importantly—be taken seriously. Even at the negative end of the spectrum, for clubs that find themselves struggling to survive, everyone vested in the institution would be fighting for its survival. Many football clubs based in Spain [22] and even the English Premier League [6] have been operating at a dangerous financial deficit for years, but the focus has still been to improve the football success and increase the branding—not give up and close shop. With the direct investment of his money, the owner no doubt will be fighting for the club's survival and success on all fronts. And at the end of the day, if at all the decision has to be made to end the club's existence, the process of termination would also be a robust and transparent sequence of events [23].

There appears no plausible reason to remain in the current model of clubs existing as registered societies. It is in fact crucial that Singapore adopts the best practices of world football into the local scene. It is therefore the position of this paper that there is everything to gain and nothing to lose for football clubs here to be incorporated as companies instead of being registered as societies.

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Relationship Between Physical Activity Level and Low Back Pain Disability Among Pregnant Women: An Online Survey

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Abstract Pregnancy caused numerous complications which may interfere pregnant women's lives. Most of the pregnant women complained on low back pain throughout the gestational period. Hence, the objective of this study was to investigate the association between physical activity level (PAL) and low back pain disability among pregnant women. A total of 126 pregnant women at the gestational age more than 21 weeks filled the self-administered online form which consists of socio-demographic status, International Physical Activity Questionnaire (IPAQ), and Oswestry Low Back Disability Questionnaire. Chi-square statistical test was used to analyse the data. A number of 36.5 % of the sample analysed were categorised of having minimal low back pain disability, 46.0 % having moderate low back pain disability, and 17.5 % suffered from severe low back pain disability. While according to PAL, 34.1 % scored the lowest level of physical activity and the rest scored moderate level of physical activity. There is no association between PALs with the low back pain intensity during the course of pregnancy. Therefore, pregnant women may still keep active during gestational period.

Keywords Pregnancy · Low back pain · Physical activity · Malaysia

1 Introduction

Pain is defined as an unpleasant and emotional experience associated with actual or potential tissue damage. Lumbo-pelvic pain is a common condition faced by the pregnant women, with prevalence reported to vary between 24 and 90 % [1]. On the other hand, back pain during pregnancy was also found as a common complication that reported on almost 50 % from the overall pregnancy and it also may become

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severe and tend to disturb their ability to work [2]. A study was conducted in Sweden revealed that 72 % of 891 pregnant women experienced low back pain. Most of the previous studies support the statement that at least 50 % of pregnant women prone to have low back pain during their pregnancy [3, 4].

People are still debating either physical activity may reduce the risk of getting low back pain or oppositely may increase the risk of getting low back pain during the course of pregnancy. People with lighter physically demanding task were found to face similar back pain just like those who involved in a greater physically demanding jobs [5]. However, other study had found that sedentary occupations, which usually involved sitting and standing for a long period of time, had been related to lower back pain [6].

For pregnant women, the physiological changes during the course of pregnancy such as the enlargement of their abdomen size, which may contribute to the difficulty with reaching action, caused them to change their body posture to perform their task. All of these probably may associate with the incidence of low back pain during the course of pregnancy. On the other hand, moderate intensity and duration ($\sim$30 min) of daily physical activity were advisable for pregnant women [7].

Several studies had been conducted to determine the prevalence of work-related low back pain [8, 9]. Nevertheless, the study which related to low back pain and physical activity level (PAL) among pregnant women was poorly understood. Hence, this study was conducted to determine the PAL and low back pain disability index among pregnant women in Malaysia and the association between PALs with low back pain disability during pregnancy.

2 Methods

2.1 Participants

The participant included 126 Malaysian pregnant women at the gestation age of 21 weeks and above. At 21 weeks, the enlargement of the abdomen area already visible, this condition will cause back pain since the adjustment of the centre of gravity (COG) of the body takes place. All of the participants in this study responded through online questionnaire in which the advertisements were made in social networking medium such as Facebook and blog. The inclusion criteria and the objectives of the study were clearly stated in the advertisement to avoid any misunderstanding by the participants.

2.2 Survey

This study was conducted using survey methods which consist of three components: (i) socio-demographic, (ii) PAL, and (iii) Oswestry Low Back Disability Questionnaire. The socio-demographic items were established to gather the demographic data of the participants. It includes the data on ages, working status, gestational age, number of pregnancies, and weight and height of the participant.

PAL was estimated using the International Physical Activity Questionnaire (IPAQ) which includes five domains: job-related physical activity; transportation physical activity; housework, house maintenance, and caring for family; recreation; and sports and leisure-time physical activity. These five domains are then being classified into walking activity, moderate activity, and vigorous activity. Total physical activity (PAL) performed per week was calculated using an average metabolic equivalent (MET) score, while total MET minutes/week = Walking (3.3 METs × minutes × days) + Moderate (4.0 METs × minutes × days) + Vigorous (8.0 METs × minutes × days) [7]. The scores of the questionnaire were being categorised into three categories which were low (0–599 METs), moderate (600–2999 METs), and high (>3000 METs).

Meanwhile, Oswestry Disability Index (ODI) was calculated to access limitation of various activities of daily living which related to low back pain. This questionnaire comprised ten sections which were pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and travelling. Each section was scored on six-point scale (0–5), with 0 representing no limitation and 5 representing maximal limitation. The score for each section was added up and divided by the total possible score for all sections which was 50. The score was interpreted as a percentage of patient perceived disability. All women were requested to report their physical activity status, pain intensity, and functional disability that they experienced during past seven days [7, 12].

2.3 Statistical Analysis

The data collected were recoded from the question responses into meaningful variables. The coded data then were transferred into the Statistical Package for Social Sciences (SPSS) version 22.0. The chi-square test was utilised to determine the relationship between PAL and ODI with the level of significant set at $P < 0.05$.

3 Results

A total 126 questionnaire were distributed via online among pregnant women in Malaysia, and the entire 126 questionnaires were completed, making the response rate of 100 % as reported in Table 1. The participant ages range from 20 to 40 years with mean age of 29.6 ± 4.4 years old. The number of pregnancies recorded includes the first pregnancy to the fifth pregnancies. The ages of gestation are also one of the parameters being measured in this study; however, only the pregnant women with gestation age ≥21 weeks and above were included in this study. The gestational ages range from 21 weeks to 40 weeks with mean gestational age of 27.5 ± 5.6 weeks.

3.1 *Prevalence of Low Back Pain Among Pregnant Women*

The low back pain disability was categorised into three categories which were minimal disability, moderate disability, and severe disability. However, only moderate and severe disabilities were considered as having low back pain. This study demonstrated the prevalence of 63.5 % of low back pain among pregnant with 46 % of the cases reported to have moderate disability and the other 17.5 % was reported as severe disability.

Table 1 Socio-demographic Characteristics (N = 126)

Variables	Frequency (%)
Age	
20–25	23(18.2)
26–30	49(38.9)
31–35	39(31.0)
36–40	15(11.9)
Number of pregnancies	
1	51(40.5)
2	44(34.9)
3	22(17.5)
4	7(5.5)
5	2(1.6)
Gestational age	
21–25	58(46.0)
26–30	36(28.6)
31–35	18(14.3)
36–40	14(11.1)
Working status	
Working	92(73.0)
Not working	34(27.0)

Table 2 Correlation between age and gestational age with ODI and PAL

	ODI	PAL
Age	$P < 0.05$, $r = 0.213$	$P > 0.05$, $r = -0.050$
Gestational age	$P < 0.01$, $r = 0.730$	$P > 0.05$, $r = 0.050$
BMI	$P < 0.01$, $r = 0.513$	$P > 0.05$, $r = 0.032$

3.2 Socio-demographic Relationship

A few statistical analyses were further conducted to explore any relationship between demographic characteristic and low back pain level during pregnancy. Among the demographic data which being analysed were age, gestational age, body mass index (BMI), number of pregnancy, and working status.

Pearson correlation was conducted to reveal the relationship of age, gestational age, and BMI with ODI and PAL as shown in Table 2. Positive significant correlation was observed between age and gestational age with ODI, while no significant correlation was observed between age and gestational age with PAL.

There was no significant mean difference ($P > 0.05$) observed between number of pregnancy with ODI and PAL with one-way ANOVA. Working pregnant women seem to have higher PAL as compared to those non-working. Meanwhile, there was no significant mean difference ($P > 0.05$) observed between working status with ODI.

3.3 Physical Activity Level and Oswestry Disability Index Relationship

Chi-square test was conducted to explore the relationship between PAL and ODI during pregnancy. The analysis reported that there was no significant association between PAL and ODI during pregnancy, X^2 (2, N = 126) = 1.21, $P > 0.05$.

4 Discussion

The aim of the current study was to identify whether there was any relationship between low back pain during pregnancy and PAL among pregnant women in Malaysia. Other than that, this study was also conducted to explore whether there was any relationship exist between the low back pain during pregnancy with the demographic characteristic of the pregnant women and the physical activity participation among the pregnant women. This study revealed a good response of 100 % (N = 126) from the participant. This implies that pregnant women in

Malaysia have positive response and interest towards pregnancy-related low back pain and its preventive measure. The respondents with minimal disability considered having no low back disability, while the respondents with moderate and severe disability were considered as having back pain.

This study found that the prevalence of low back pain among pregnant women in Malaysia was at 63.5 %. This finding was supported by a previous study that stated that at least 50 % of pregnant women will experience low back disability to some extend during pregnancy [10]. This finding was similar to the study carried out in Nigeria on prevalence and pattern of back pain among pregnant women. Another study in Nigeria found the prevalence of low back pain 52.5 % of the 1919 subjects and mean age of the subjects with and without back pain are 26.8 ± 5.3 and 27.1 ± 5.4 years, respectively [3]. Other than that, a study was conducted on prevalence of low back pain among Norwegian pregnant women and found that nearly 50 % of the women experienced moderate to severe back pain during the course of pregnancy [11]. On the other hand, a clinical study on Iranian pregnant women reported a lower prevalence, which was 40.2 % of low back pain occurrence on the onset of the pregnancy [12].

This study found that there was no association between PAL and low back pain during pregnancy as reported in previous study [1] where there was no difference of low back pain level between active and inactive pregnant woman. Further analysis need to conduct to explore factors that contribute to this result.

Previous studies concluded that multiparity was one of the contributing factors for low back pain in pregnant women [1, 13]. Another study had found that women with first pregnancy tend to have low back pain than multiparous women [14]. Conversely, this study found that there was no mean difference between the number of pregnancy and the low back pain as reported in [15]. This may due to low number of participant who participates in the study.

This study also found that older pregnant women and more gestational age tend to develop high low back pain disability index. These findings contradicted with previous study which had found that younger pregnant women were prone to develop low back pain regardless of their gestational age [16]. This study also found that higher BMI in pregnant women increases ODI score in agreement with previous study which found that the increase in BMI may be a risk factor for low back pain in pregnant women [17].

5 Conclusion

There is no significant relationship between physical activity and low back pain during pregnancy. Therefore, pregnant women may still keep active during their pregnancy to maintain a healthy lifestyle. Other factor such as age, gestational age, and BMI may become the contributing factors for low back pain during pregnancy.

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Sport Fan Curiosity Dimension: Empirical Studies of Malaysian Football Fans

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Abstract The aim of this paper was to test the reliability and validity of the sport fan exploratory curiosity scale (SFECS) and sport fan specific curiosity scale (SFSCS) in order to examine the curiosity dimensions among Malaysian football settings. The variables that involved in these two scales are excitement, new sport events, sport facility, specific information, general information and sport facility information. A total of 382 football fans were surveyed during the match between Malaysia and Singapore at the Bukit Jalil National stadium. The overall evaluation fit was completed using a separate goodness of fit index. All these factors showed good reliability and validity. In order to confirm the construct of sport fan curiosity, a series of confirmatory factor analyses were performed. The final results showed that the SFECS with 10 items and the SFSCS with 11 items were overall reliable and valid structures. The findings further offer important insights for future research and sport practices.

Keywords Sport fan curiosity · Football fans · Confirmatory factor analysis

1 Introduction

Curiosity is an important tool to measure motivation in order to improve turnout in a sporting event [1]. Furthermore, the roles and concepts of curiosity have been broadly discussed by quite a number of researchers. However, in a sport context, only a few researchers have managed to conduct their studies [1–4]. Recent research has provided more insights into examining the fans' curiosity in attending sport events. A few studies done by Park [1–4] investigated that curiosity can initially attract non-sport fans or casual sport fans to attend sporting events.

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Furthermore, some individuals who are curious will enjoy and have some fun watching a sport event and will eventually make sport events more exciting for them to discover more as a loyal fan in the future.

According to the theory of curiosity, curiosity can broadly defined as a reaction and desire that motivates human exploratory behaviours in order to seek and acquire new knowledge and novel stimuli [5, 6]. Berlyne [5] also described that curiosity is an important and potential motivator that facilitated human exploratory behaviours and played an important role in motivating learning. Moreover, Berlyne believed that curiosity itself can bring a strong motivational drive for humans' behaviours and lead them to explore their environment for better understanding. Adopted from Berlyne's theory, Park [1] has developed the two scales on curiosity of sport fans. The scales were sport fan exploratory curiosity scale (SFECS) and sport fan specific curiosity scale (SFSCS).

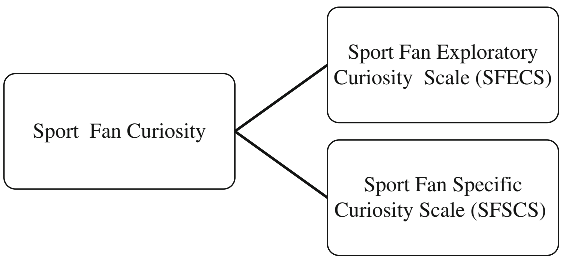
The primary purpose of this study was to test the reliability and validity of the SFECS and SFCSC in order to better examine the curiosity dimensions among Malaysian football environments. To fulfil this purpose, these two scales had been used in this study to examine the reliability and validity of measurement in the Malaysian football attendance. The literature review revealed strong reasons to explore curiosity and its possible influence on fan behaviours. Understanding these sport fans' curiosity and measuring the dimensions would enrich the sport fan behaviour research.

2 Measurement of Sport Fan Curiosity

According to Park [1], there are two components of sport fan curiosity scales: SFECS and SFSCS. These scales were developed by Park [1] for sport fan curiosity in order to better examine the curiosity constructed in a sport setting. The SFECS relates to the sensational and novel stimulation of sports, players or sport teams that leads people to engage in sport fan exploratory curiosity [1]. Park outlined three items which are excitement, new sport events and sport facility (Fig. 1).

Meanwhile, Park [1] added more variables that are included in the SFSCS which is to specify other curiosity that seeks specific and cognitive information about sports, players, sport teams or facilities that lead individual to become engaged in

Fig. 1 Conceptual framework



various sport fan behaviours [1]. Park outlined three items in this scale which are specific information, general information and sport facility information. Study done Park, only focuses on SFECS in this study and can be concluded that curiosity in sport context is different compared to curiosity in other setting. Therefore, the relationship between curiosity and fan behaviours (crowds) had been suggested that there are personality differences that can lead individuals towards various aspects of fan behaviour.

3 Methodology

Prior to distributing questionnaires, the approval from the Football Association of Malaysia (FAM) was obtained. Subjects for this study were football fans of Malaysian that attending the Asian Football Federation (AFF) Suzuki Cup 2012. As a result, a total of 382 of Malaysian football fans were surveyed. Data collection took place at the Bukit Jalil National Stadium and randomly selected during the match between Malaysia and Singapore by means of structure questionnaire. Then, the dimensions, reliability and validity of the scale of measurement of sport fan curiosity were analysed.

4 Measurement of Variables

First, the demographic questionnaire gathered some background demographic variables and sport fan information in order to describe the respondents in this study. These variables include gender, age, levels of education, number of spectators at the stadium and number of viewers watching the live match on television since 2008. Sport fan curiosity consists of two scales: to measure the dimension, the 10 items from SFECS and 11 items from SFSCS. This scale is adopted from SFECS and SFSCS and developed by Park [1]. The original scale in Park [1] study had Cronbach's alpha ranging from 0.76 to 0.89 and average variance extracted (AVE) values ranging from 0.52 to 0.72. The items were anchored by a 7-point Likert-type scale ranging from (1) strongly disagree to (7) strongly agree. Frequency statistics and confirmatory factor analysis (CFA) were conducted on the random sample. A new study with CFA is needed in order to test the multidimensional construct of curiosity further [7]. Furthermore, Reio [8, 9] also highlighted the importance of a CFA in the study of curiosity concepts. For the purpose of CFA, multiple fit indices were used (i.e. x^2; x^2/df; RMSEA; SRMR; CFI). Construct validity was assessed by means of convergent validity and discriminant validity [10]. In order to achieve an acceptable ratio of observations to estimate parameters, it is essential to run two separate measurement models; the fit indices suggest that these models fit the data well.

5 Result

Before analysing the dimensionality, reliability and validity of the scales, the demographic information of the sample is described as shown in Table 1. The result showed that the number of male is more (72.0 %) than female (28.0 %). In terms of age, the majority of the respondents were 21–30 years old (54.5 %). The highest level of education was graduated from degree qualification with 30.9 %. Interestingly, for the respondents who went to the stadium since 2008, 32.5 % was over than 10 times of attending at the stadium and 54.7 % for over than 10 times watching on television since 2008.

The first CFA included 10 items from SFECS questionnaires and was conducted with 382 respondents. This information from the respondents was analysed through the maximum likelihood method using AMOS 20.0. The 10 SFECS items were loaded on three factors. The results of the first CFA of the SFECS were shown in

Table 1 Frequency table

		Frequency	Valid per cent
Gender	Male	275	72.0
	Female	107	28.0
Total		382	100.0
Age (years old)	<20	120	31.4
	21–30	208	54.5
	31–40	40	10.5
	>40	14	3.7
Total		382	100.0
Education	High school	114	29.8
	Diploma	105	27.5
	Degree	118	30.9
	Master	23	6.0
	PhD	3	0.8
	Others	19	5.0
Total		382	100.0
Attend stadium since 2008	Once	88	23.0
	2–5 times	109	28.5
	6–9 times	61	16.0
	>10 times	124	32.5
Total		382	100.0
Watching TV since 2008	Once	25	6.5
	2–5 times	79	20.7
	6–9 times	69	18.1
	>10 times	209	54.7
Total		382	100.0

Table 2 Reliability measures: dimensions of sport fan exploratory curiosity scale

Construct	Item	Factor loading	Cronbach's alpha	Construct reliability	AVE
Excitement	ext1	0.54	0.802	0.83	0.53
	ext2	0.78			
	ext3	0.82			
	ext4	0.74			
New sport events	nse1	0.84	0.778	0.81	0.55
	nse2	0.75			
	nse3	0.63			
Sport facility	sf1	0.89	0.922	0.92	0.79
	sf2	0.90			
	sf3	0.89			

Table 2. The data did not strongly fit the proposed three-factor model with excitement, new sport events and sport facility. Although statistically the one variable was the candidate for deletion for possible model fit improvement, the researchers were cautious to delete the variable based on mere statistical interpretation [11].

In addition, if the measurement model showed a good model fit, the item could be retain in the model. As a result, no item was eliminated due to the adequate fit of comparative fit index (CFI). The results of the first measurement model are given as follows: the fit statistics were χ^2 = 118.617, df = 32, p < 0.01, GFI = 0.944, CFI = 0.967 and RMSEA = 0.079. All indicators loaded heavily on the construct, and all standardized coefficient are greater than 0.50. Thus, all fit indices seemed adequate.

The second measurement model is comprised of SFSCS, and then, the first CFA included 11 items questionnaires and was conducted with 410 respondents. The 11 SFSCS items were loaded on three factors. One of the items (sfi1) indicate low factor loading, but due to the results of measurement model showed a good model fit, the item could be retain in this model. The fit statistics were χ^2 = 177.768, df = 39, p < 0.01, GFI = 0.878, CFI = 0.940 and RMSEA = 0.077. All indicators loaded heavily on the construct, and all standardized coefficient are greater than 0.50. Thus, all fit indices seemed adequate.

The next phase, construct reliability (CR) and AVE were examined using the information that was obtained through the CFA procedures. CR was also assessed by estimating AVE, which reflects the overall amount of variance captured by the latent construct and CR. CR reflects the internal consistency of the construct indicators, while AVE reflects the amount of variance captured by the construct indicators. Based on Table 2, the results showed that the SFECS factors had a good internal consistency (α = 0.807 for excitement, α = 0.796 for new sport events and α = 0.924 for sport facility). The AVE values for each factor were calculated based on the equation and the result shown in Table 2.

Table 3 Reliability measures: dimensions of sport fan specific curiosity scale

Construct	Item	Factor loading	Cronbach's alpha	Construct reliability	AVE
Specific information	si1	0.70	0.884	0.91	0.61
	si2	0.74			
	si3	0.80			
	si4	0.78			
	si5	0.87			
General information	gi1	0.92	0.902	0.92	0.75
	gi2	0.84			
	gi3	0.83			
Sport facility information	sfi1	0.59	0.775	0.71	0.57
	sfi2	0.80			
	sfi3	0.85			

Meanwhile, for SFSCS, CR and validity (AVE estimate) were examined using the information that was obtained through CFA procedures. Based on Table 3, the results showed that the SFECS factors had a good internal consistency ($\alpha = 0.913$ for specific information, $\alpha = 0.921$ for general information and $\alpha = 0.785$ for sport facility information). The AVE values for each factor were calculated based on the equation and the result shown in Table 3.

All CR scores for SFECS ranging from 0.81 to 0.92 and for SFSCS ranging from 0.71 to 0.92 were much higher than the recommended cut-off point of 0.7 [12]. Thus, each of the factors reliably measured its respective constructs. Meanwhile, for the AVE, all scores for SFECS ranged from 0.53 to 0.79 and for SFSCS ranged from 0.57 to 0.75, exceeding the recommended cut-off point of 0.5 [12]. Therefore, the overall CR was adequate by the fact that the all AVE values exceeded 0.50. The results provided that both the SFECS and SFSCS and all the constructs were considered reliable.

6 Discussion

Understanding the fan's psychological characteristics in a sport context is significant because one's personality traits could be an important factor in determining and explaining sport fan behaviours and the fan's ascent from not being a fan of a team or just being a casual fan to becoming loyal fan [2]. The literature on sport fan behaviour has been mainly focused on motivational factors which stimulate spectators to become loyal fans [13–16]. In an increasingly competitive sport marketplace, the sport marketers must strive in order to attract and sustain the interest of sport fans. Prior research suggested that sport marketers can increase their chances of achieving success by appealing to the motivation of sport fans. However, while many sport fan behaviour studies concentrated on highly identified sport fans, little research has investigated what factors that initially attract one to consume in sport and what initially motivates individuals to watch sports and teams still remain under examined.

The literature has shown that the curiosity can motivate the individuals to behave in several ways in order to satisfy their curiosity [5, 7, 8, 17]. Thus, it is believed that curiosity could play the important roles in motivating sport fans. The new scale for sport fan curiosity was needed in order to better examine the curiosity structure for further research. To fulfil the needs, the primary purpose of this study was to test the reliability and validity of the SFECS and SFCSC in order to better examine the curiosity dimensions among Malaysian football setting. The findings based on CFAs of Tables 2 and 3 indicated that for both SFECS and SFSCS, all the three factors of each scale showed a good reliability and validity. Overall, the SFECS and SFSCS seemed to explain and predict various sport fan behaviours.

The findings of the study accentuate that the AFF Suzuki Cup 2012 management can stand to gain the model that allows sport marketers to fully understand what aspects should be new and unique in order to comprehend the fans' behaviours towards the Malaysian football team. Thus, the sport marketers can build the innovative reflection of experience consumption by focusing on the excitement, sport facilities, new sport events, new information and players' performance. The limitations of the present research provide opportunities for further research direction. It may be fruitful for future research to replicate and validate all or parts of the present research model, in order to determine the robustness of the findings in other sporting event settings.

Further research should consider on the roles of sports marketers with curiosity in order to maintain the existing of the fans. It is also deemed particularly important that future study be undertaken to extend the present model by integrating loyalty sport fans. It seems reasonable to speculate that fans that had memorable and enjoyable experience will increase propensity of their loyalty towards football tournament as their most preferred sporting event. It is also noteworthy that future study should devote the focus on extending the present model by integrating other pertinent constructs in sporting events such as commitment, attachment and loyalty. A remarkable future research is to investigate the effect of curiosity on fans attachment and loyalty behaviours by employing longitudinal research design. Perhaps, this prospective research endeavour could impact more interesting and deeper insights to both academic and practitioners.

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Preliminary Analysis Between FIFA World Cup 2014 Winning and Losing Teams' Goal Scoring Characteristics

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Abstract This study was conducted in order to determine the differences in terms of scoring characteristics between winning and losing teams in FIFA World Cup 2014. 51 matches were selected to be observed. The indicators chosen for this analysis were the pitch area where goal was scored, goal scoring time, and the position of player who scored the goal. Wilcoxon test used to prove the differences between winning and losing teams. Winning team scored most of the goals in the second half (68 goals) of the match compared to the first half (48 goals). In the first half of the match, there were significant differences in scoring time between winning and losing teams in 0–15 min ($Z = -3.00$, $p < 0.05$) and 31–45 min ($Z = -2.982$, $p < 0.05$). In the second half of the match, the scoring patterns increased with time for the winning team; 15, 24, 30, and six goals during 45–60, 61–75, 76–90 min, and extra time, respectively. Significant differences in the scoring time between the teams were observed in the second half of the match, 61–75 min ($Z = -3.386$, $p < 0.05$), and 76–90 min ($Z = -3.403$, $p < 0.05$). In addition, there were significant differences between winning and losing teams in all pitch areas; inside goal box ($Z = -3.154$, $p < 0.05$), outside penalty box ($Z = -2.357$, $p < 0.05$), and penalty zone noted the highest tally for the winning teams ($Z = -5.230$, $p < 0.05$). Finally, striker scored the most goal for both winning (69 goals) and losing (20 goals) team ($Z = -4.862$, $p < 0.05$) as well as the midfielder ($Z = -3.139$, $p < 0.05$). As for the winning team, the defender also managed to scored goals (16 goals) ($Z = -3.557$, $p < 0.05$) compared to no goal for

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losing teams. The analyses showed that the winning teams have significant higher performance indicators in goal scoring compared to losing teams.

Keywords Football · Goal · Scoring · Winning · Losing · Team · Analysis

1 Introduction

The study of players and team is very important for the management team to increase their own team performance. Nowadays, the advancement of modern technology enables the coaches and team management to understand and evaluate their athlete's performance. Thus, the study on performance analysis helps to increase the opportunity to understand their team better. In order to get the correct data from the tournament, performance indicators play major role to help coaches and management team to further enhance the strategy of their team. These indicators can help to predict the past, present, and future performance levels of the athletes. Besides, the indicators also serve as a mirror of the athletes shortcomings in sports. Performance indicators can be defined as the selection and combination of variables that defined the variables of performance and simultaneously help athletes and coaches to achieve their goals [1]. In order to form a good football/soccer team, it is best for a coach to gain some resources and external information [2]. Feedback from the performance analysis is an important component of the coaching process and become information source for both players and coaches [3]. Crucial analysis toward the shots delivered is increasing the winning rate of a team. Furthermore, having good players with the ability to control the ball and scored goal is valuable to their teams [4]. The team is at advantage when goals are scored against its opponent. Even, the spectators evaluate the teams as a good team when that team is able to score many goals. The goals in football can be explained as the main factor or the achievement of the teams [5]. Nowadays, the findings that have been found by the researcher on the performance analysis help the coach and the team management to create a good training program [6]. Hughes and Franks stated that, the difference between successful and unsuccessful teams is the ability of the teams that can lead the possession of shots on goals [7, 8]. The higher the number of shots made, the higher the rate of opportunity to get the goals.

2 Method

2.1 Sample

This study analyzed 51 matches from the FIFA World Cup 2014 using recorded video. The data were collected from the matches that end up with the result of winning and losing. All matches ended with draw was excluded from this analysis.

Table 1 Variables studied

Variables	Performance indicators
Variables	Pitch area where the goal was scored
	Time the goal was scored
	Position of the scorer

Among the match that were also included were matches which ended with extra times, but ended as draw in knockout phase.

This tournament was selected because it was major benchmark tournament for soccer teams' performance and the biggest tournament in the world where all top-notch country who qualified participated in the match. Making it the most high-performance game compared to others. All participating teams also had a world ranking approved by FIFA (Table 1).

2.2 Procedures

All the matches were analyzed by viewing the highlights of all the 51 matches that end up with the result of winning and losing. The remaining 13 were excluded as the scores were draw. The 51 matches were separated into two categories which were winning teams and losing teams. The winning teams were the teams that end up the match with the result of winning and the losing teams were the teams that end up with the result of losing.

Data were obtained using hand notational analysis by the help of Dartfish Easy Tag software for android phone (Dartfish Ltd., version 1.0.8) during the period of viewing the video. To ensure enough processing power, this software was operated using ASUS device (ZenFone 6, Android 4.3, Intel Atom Z2580 2.0 GHz, ASUSTek Computer Inc., Taiwan). The software was set according to the preferred indicators before starting analysis. All the variables intended for the study were coded in this software. Upon viewing the video, researcher clicks on the appropriate button during the occurrences of the action. All related information such as the numbers of action occurred during the recording was given by the software.

2.3 Reliability Testing

Inter- and intra-tester reliability testings were carried out in order to determine the reliability of the produced data. A gap of five-day period was considered between each data collection in order to prevent any memory retention from previous data collection to prevent biasness which can disrupt the process. Inter-tester test was performed by two different testers, and their results were compared to calculate the reliability of the testers. Allowable error limit was considered limiting within 5 % [7, 8].

2.4 Data Analysis

Descriptive statistics was used in order to analyze the performance indicators. For the inferential statistics, nonparametric statistical test Wilcoxon signed-rank test was used to investigate the significant differences of the performance indicators. Within-group analysis for the winning team was carried out using Friedman test, and post hoc test was carried out using Wilcoxon signed-rank test to seek the differences within the group. All statistical data were analyzed by using the Statistical Package for the Social Sciences version 22 (SPSS ver. 22.0). Significant value was set as $p < 0.05$.

3 Result

A total of 123 goals were scored by the winning teams and 32 goals by the losing teams.

Figure 1 shows that there was significant difference between winning team and losing team regarding time of scoring in the first half ($Z = -4.017$, $p < 0.05$). Two segments of total time of 0–15 min ($Z = -3.00$, $p < 0.05$) and 31–45 min ($Z = -2.982$, $p < 0.05$) were obtained for the significant difference between winning and losing. The time segment 16–30 min was discarded as it did not reach statistical significant level ($Z = -1.661$, $p > 0.05$). On the other hand, there was significant difference between winning and losing teams during the second halves ($Z = -5.047$, $p < 0.05$). Only three segments of the total time showed significant differences for the second halves of the matches, which were 61–75 min ($Z = -3.386$, $p < 0.05$), 76–90 min ($Z = -3.403$, $p < 0.05$), and extra time ($Z = -2.000$, $p < 0.05$). The time segment if 45–60 min did not reach statistical significant state ($Z = -2.357$, $p > 0.05$). Goal scoring patterns are shown in Fig. 2.

Within-group analysis was carried out for the winning teams as presented in Fig. 3 shows that all three segments for the first halves did not show any significant

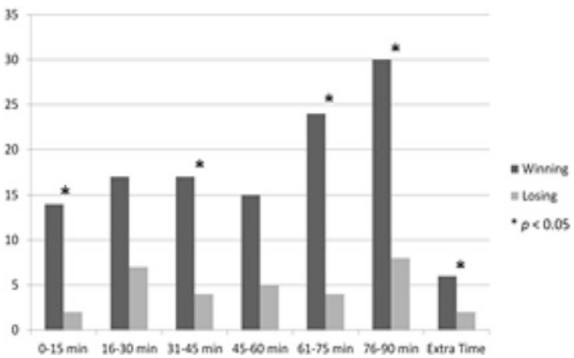

Fig. 1 Segment of time goal being scored by winning and losing teams

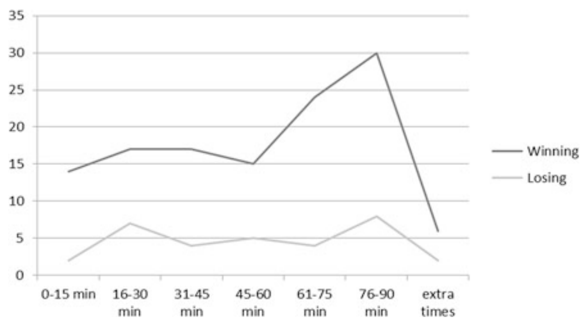

Fig. 2 Goal scoring pattern by winning and losing teams

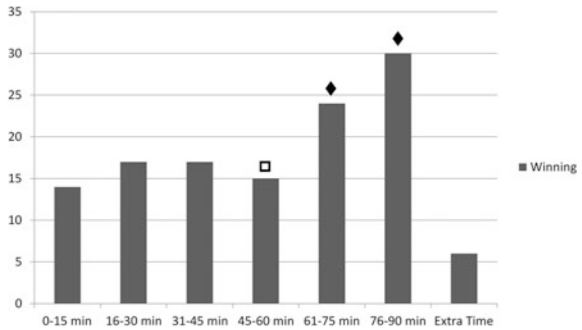

Fig. 3 Time segment of goal scored by winning teams. *Open square* denotes significant difference with 76- to 90-min segment ($p < 0.05$); *filled diamond* denotes significant difference with extra time segment ($p < 0.05$)

differences. For the second halves of the match, there was a significant difference in the segment of goal scored ($N = 51$, chi-square = 19.177, $p < 0.05$). Post hoc test showed that there was a significant difference in time segment the goal was scored between 45 to 60 min and 76 to 90 min ($Z = -2.473$, $p < 0.05$), 61 to 75 min and extra time ($Z = -2.509$, $p < 0.05$), and between 76 to 90 min and extra time ($Z = -3.350$, $p < 0.05$). Based on the descriptive statistics (Mean ± standard deviation) the highest number of score was scored during 76- to 90-min segment (0.59 ± 0.431).

Significant differences are observed for the second variable which is pitch area between winning and losing teams. The observed differences are goal box ($Z = -3.154$, $p < 0.05$), penalty box ($Z = -5.230$, $p < 0.05$), and outside of penalty box ($Z = -2.357$, $p < 0.05$) (Fig. 4).

Within-group analysis was carried among the winning team as presented in Fig. 5 showed that there was significant difference between pitch areas ($N = 51$, chi-square = 33.776, $p < 0.05$). Post hoc test revealed significant differences

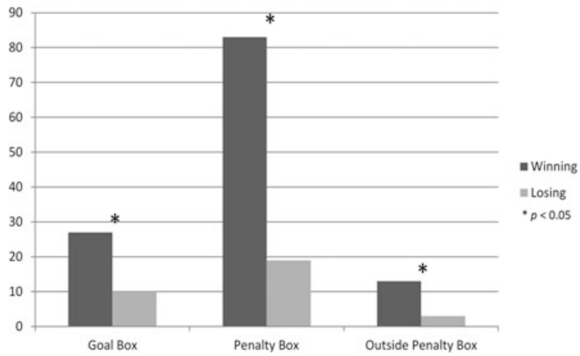

Fig. 4 Area of goal scored for winning and losing teams

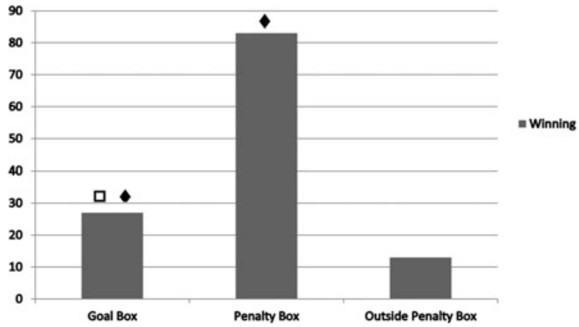

Fig. 5 Area of goal scored for winning teams. *Open square* denotes significant difference with penalty box ($p < 0.05$); *filled diamond* denotes significant difference with outside penalty box ($p < 0.05$)

between goal box and penalty box ($Z = -4.330$, $p < 0.05$), goal box and outside the penalty box ($Z = -2.306$, $p < 0.05$), and also penalty box and outside of penalty box ($Z = -5.021$, $p < 0.05$). It was found from descriptive statistics (Mean ± standard deviation) the highest number of goals was scored from the penalty box (1.63 ± 1.326).

The last variable analyzed was the player position that scored the goal. Figure 6 further illustrates the differences in goals scored according to the position. There were significant differences of player positions between winning and losing teams. The positions were striker ($Z = -4.862$, $p < 0.05$), midfielder ($Z = -3.139$, $p < 0.05$), and defender ($Z = -3.557$, $p < 0.05$). However, scores obtained by own goals not reach statistical significant level ($Z = -1.000$, $p > 0.05$).

Within-group analysis for the winning teams presented in Fig. 7 showed significant differences between the position of scorers ($N = 51$, chi-square = 28.612, $p < 0.05$). Post hoc test acknowledged that there were significant differences

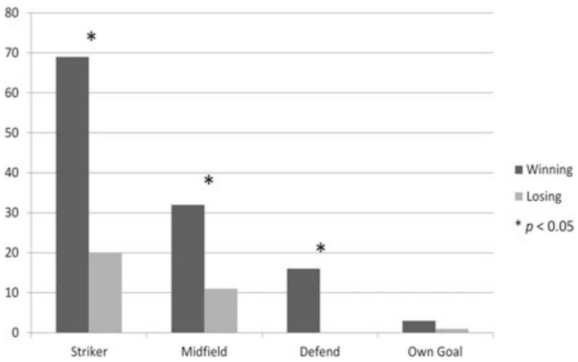

Fig. 6 Goals scored according to players position

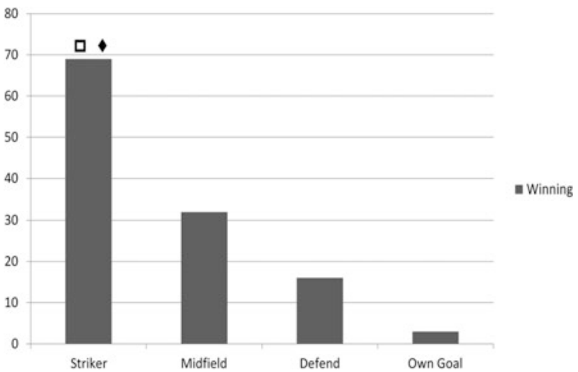

Fig. 7 Goals scored according to players positions for winning teams. *Open square* denotes significant difference with midfielder ($p < 0.05$); *filled diamond* denotes significant difference with defender ($p < 0.05$)

between striker and midfielder ($Z = -3.902$, $p < 0.05$) and striker and defender ($Z = -4.702$, $p < 0.05$). However, there was no significant difference between midfielder and defender ($Z = -1.923$, $p > 0.05$). From descriptive statistics (Mean ± standard deviation), the highest number of goals was scored by the strikers (1.35 ± 1.055).

4 Discussion

In this study, the first variable that we examined was on the pitch area where the goal was scored. Previously, there were three common areas where the players can score the goals: the goal area, penalty area, and outside of penalty area. For this study, we found that most goals were scored from penalty box (Mean ± SD, 1.63 ± 1.326). This showed that the penalty box was the main area where the shots were made by players. This is supported by the result from past research which showed that most of the goals came from the area of penalty box [9]. In this range, the player is more confident compared to goal box which is near to the goalkeeper and outside of penalty box that was too far from the goal post. Study [7, 8] stated that when the player was not in the goalkeeper area, the player can make shots with added comfort. Penalty area was the best area that has higher opportunity to score the goal compared to the goal area and outside of penalty area. Finding found that 86 % of balls passed into the area then into the penalty have higher opportunity to score the goals [10]. A study done at European Championship 2004 showed that 44 % goals scored from the penalty area, 35.2 % goals scored at the goal area and 20.4 % scored outside of penalty area [11].

The second variable we observed was on the segment of time the goal was delivered. By looking at the winning team, it can be concluded that there was a significant difference between the first half and the second half of matches. In this research, the result showed that there were more goals scored during the second half compared to the first half of the matches. This is because, there was an increase to attempt to score as many goals as they can before the final whistle is blown. Past study also stated that most goals scored at the first 15 min in the second half that were between 45 and 60 min [12]. However, in our analysis, we only investigate that the time goal was scored but not differentiating between the winning and losing teams. Study by [7, 8] found that most of the winning teams score at the last 15 min between 76 and 90 min and the losing teams scored at the 45–60 min during the first 15 min after the second half started. The current data prove that the winning teams were able to score more goals at the last 15 min and this is supported by the previous research [13]. This happened due to the psychology and physical condition which cause bad performance and early exhaustion before the end of the match [7, 8, 11]. The best solution to overcome this shortcoming is to increase the fitness level of the teams. According to [14], most of the goals scored at the end of the match were influenced by the mental and physical fatigue. Reilly reported that in Scottish League 1991–1992, average scoring rate was at the final of 10 min of play [2]. Armatas stated that statistically, more goals scored in the second half of the matches and the last 15 min in the three latest World Cup matches [9].

Final variable examined was on the position of the player that scored the goal. The most number of goals was scored by the striker. However, we discovered that the defenders from the losing team slightly assisted in the aspect of scoring goal compared to the winning teams. Based on the previous study, most goals were scored by the striker and midfield for both winning and losing teams [7, 8]. However, there were no significant difference of own goals because this was not the main attention, and both winning and losing teams contributed to others goal tally. The attackers from both winning and losing teams had scored more goals compared from other position. This is because the players of this position were agile so they were able to respond quickly to the situation. [7, 8]. The decision making is also important and this has been shown from the previous study that stated awareness can support the position of midfield in how they select the correct action in situation of attacking and defending [15]. A study [16] stated that striker had the most opportunity in shooting toward goal and performed some skill to overcome the defender, the midfielder had the most in dribbling and defenders had the most in tackling. This can be said why the striker from this research is the top in scoring the goals compared to midfielder and defend position [17].

5 Conclusion

We showed that most of the goals scored by both winning and losing teams were at the penalty area which was not too near to the goalkeeper position and also not too far from the goal post. We also provided the evidence on time the goal was scored. The winning teams and losing teams scored most at the goal during the last 15 min, which was during the 76- to 90-min segment. Finally, we showed the position of the goal scorer. Most of the goals were scored by the strikers of the winning and losing teams. Therefore, with evidence provided, it is advisable for coaches and team's management to:

(a) Develop a training program that focuses more on the last 15 min of the match due to the fact that it was the time where more goal attempts being made.
(b) Incorporate psychology and physical conditioning in future training program to ensure their team is able to concentrate to the game until the end of the match.
(c) Train more on penalty box distance, due to the fact that most of the goals tried and scored were from this distance.
(d) Focus more shooting drills to the striker. Nevertheless, other positions also need to train on shooting to increase the chances of goals.

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Part III
Performance and Behaviour

The Differences in Physical Fitness Levels Between Hearing and Visually Impaired Students

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Abstract The purpose of the study is to identify the differences of fitness profile between students with hearing impairment and students with visual impairment at secondary schools. A number of 62 subjects from two types of disabilities with 30 students who have hearing impairment (male = 21; female = 9) and 32 students with visual impairment (male = 18; female = 14) voluntarily participated in the study. A fitness profile was determined to identify the fitness level between two types of disabilities. Seven fitness tests were conducted on both groups such as 1600-m run test, 10-m agility run test, standing broad jump test, vertical jump test, handgrip strength test, sit and reach test, and sit-up test. The findings showed that students who are visually impaired performed better in sit-up test (36.50 ± 11.02), 1600-m run test (11.53 ± 2.26), and sit and reach test (31.09 ± 5.04) and students with hearing impairment performed better in handgrip strength test (right hand 29.27 ± 10.57) (left hand 27.48 ± 9.55), standing broad jump test (176.03 ± 43.26), and vertical jump test (40.00 ± 12.81) but with both groups showed similar strength in agility test. There was a significant difference in the sit-up test between two groups (0.0000, $p > 0.05$), whereas other tests did not show much difference.

Keywords Physical fitness · Fitness tests · Visually impaired · Hearing impaired · Disabilities

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1 Introduction

Children with disabilities are less likely to engage in physical activity and may be limited in terms of motor abilities as well as fitness levels. This statement was supported by [1] saying that the percentage of children and youth with disabilities who typically have lower level of fitness and this is something that would prevent them to participate in any activity with their peers, and also could lead them in high risk of health diseases and problem. Unhealthy lifestyles can cause obesity and other psychological effects such as depression, anxiety, and stress. Previous researchers have studied the effects of deaf or hearing impairment children on their motor development which results indicated that hearing impairment children has lagged in motor skills because of their vestibular disorder as compared to the healthy peers [2].

Health-related fitness and skill-related fitness are the two components in physical fitness. Health-related fitness is composed of cardio respiratory endurance, abdominal muscular strength and endurance, flexibility of lower back/upper thigh (sit and reach test), and body composition specifically fatness/leanness [3–7]. Skill-related fitness is referred to as athletic performance-related physical fitness which involves agility or running speed (shuttle run), balance (Flamingo balance), explosive strength or power (vertical jump), static strength (arm pull), and coordination [3–7]. Relatively little is known about the physical fitness of children with hearing impairment from other countries, particularly Asia, and there have been few efforts to conduct large-scale fitness test batteries including all components such as body composition, muscular strength/endurance, cardiorespiratory endurance, and flexibility in this population. The levels of fitness depend on age, gender, body type, and constraints of doing physical activity. Therefore, everyone needs a minimal amount of fitness to be healthy and competent of achieving minimal fitness levels.

Hearing impairment or deaf is a broad term used to describe hard of hearing or deaf from one or both ears. People with mild hearing loss and be able to communicate well throughout their community is usually refers as hard of hearing [8]. WHO [22] describes hearing impairment as a complete or partial loss of the ability to hear in one or both ears. Hearing loss can be categorized as conductive HL, sensorineural HL, and mixed HL [9]. Hearing loss has been categorized by The American Sign Language Hearing Association as mild (20–40 dB), moderate (40–60 dB), severe (60–80 dB), and profound (over 80 dB) [8].

Physical fitness illustrates a physiologic state of well-being that allows individual to meet the demands in one or both physical fitness which is health-related fitness and skill-related fitness. However, skill-related physical fitness refers to components that are more closely related to sports and athletic performance such as balance, agility, coordination, and power; whereas health-related physical fitness involves components of everyday functional fitness including cardiorespiratory fitness, muscular strength or endurance, body composition, and flexibility [10]. Levels of fitness reflect the outcomes of regular physical activity and health and functional abilities. Previous researches that investigated factors influencing physical fitness revealed that those with physical disabilities have lower physical fitness when they are associated with participation in physical activity. However, this does not seem to apply to children with hearing loss since their physical fitness is comparable with those children who do not have loss of hearing.

However, it is still unclear why deaf children generally scored lower on physical fitness tests than visually impaired children. Thus, a valid and reliable modified version of the popular fitness test battery was used to assess physical fitness. Test items included percent body fat (skinfolds and weight and height scale), cardio-respiratory endurance, abdominal strength/endurance (curl-ups), and flexibility (sit and reach). According to [1], the school-age children with disabilities typically have decreased fitness which normally prevents them from participating in any activity with their peers. This can result in psychological aspects such as low self-esteem and metabolic syndrome (diabetes). On the other hand, blindness can cause low physical work capacity, posture problems, orientation difficulties, depression, and problems with balance [11–13].

Participation in physical activity during childhood can help in the development of motor abilities and put the foundation for a good health [14]. Individuals who participate in sports will actively gain additional bone mineral content and mineral density during while their growth and maturation process. However, visually impaired people need more support in their psychosocial and physical development. Sport gives the visually impaired children the chance to be a part of the group. Craft suggested that physical education can promote the acquisition of daily living skills, orientation, and mobility skills needed by visually impaired students by helping them to develop their physical fitness and psychomotor abilities [12].

Children with visual impairment (those who are blind and have low vision) are at risk for poor motor skill performance [15]. They have a behavior that appears clumsy, especially in a new situation. They hold head in an awkward position to look at something or hold a book or other objects in a peculiar position to look at them. Constantly, they ask a neighbor to tell him/her what is going on. They also show signs of fatigue or inattentiveness. They exhibit poor self-concept and ego development. Therefore, the objective of the study is to differentiate the fitness level between the students with hearing impairment and those with visual impairment.

2 Methodology

2.1 Sample

A total of 62 subjects from two types of disabilities, who are 30 students with hearing impairment (male = 21; female = 9) and 32 students with visual impairment (male = 18; female = 14), voluntarily participated in the study. The selection of the subjects is according to the random sampling method. The subjects' age ranged between 13 and 21 years old, and they are studying at special schools for the

Table 1 Demographic data between male and the female students with hearing impairment and students with visual impairment

Demographic	Hearing impairment (n = 30)		Visual impairment (n = 32)	
	Male (n = 21)	Female (n = 9)	Male (n = 18)	Female (n = 14)
Age in years	16.90 (1.51)	16.11 (1.76)	15.28 (1.93)	15.50 (1.35)
Height (cm)	161.00 (7.94)	148.33 (8.50)	162.88 (8.83)	150.06 (6.67)
Weight (kg)	53.33 (10.06)	39.89 (8.00)	51.39 (11.22)	45.35 (7.92)
BMI	20.38 (2.78)	18.00 (3.04)	19.31 (3.71)	19.99 (2.08)

visually impaired and hearing impaired. All subjects were informed of the study procedures, and purpose of research and letters of consent were obtained from their teachers, parents, or guardians (refer Table 1).

2.2 Instrumentation

This study employed seven (7) tests, which are 10-m shuttle run test, handgrip strength test, vertical jump test, standing board jump test, sit and reach test, sit-up test, and also 1600-m run test to determine the subjects' fitness level. Before the test was embarked, permission was granted from the team manager and the coaches. Subjects need to fill in the personal detail form, the consent form, and also briefed about the tests. A demonstration session has also been conducted by the test administrators. The entire tests were then conducted for a day. The subjects were given two (2) trials to complete the tests.

Standing height was recorded to the nearest half cm with the subject barefoot and with the back against a vertical wall. Body weight was measured to the nearest 0.5 kg with shoes and sweaters (SECA model 841). Body mass index (BMI) was defined as body mass (kg, measured using an electronic weighing scale to the nearest 0.1 kg) divided by height (m, measured to the nearest 0.1 cm) squared (kg/m^2).

Coaches often use the vertical jump to measure athlete's lower body muscular power [3]. The vertical jump (countermovement jump with 90° knee flexion before the extension). The jump was performed on a hard and flat surface using the Vertec equipment adjusted to each of the participants. The subjects were asked to do a countermovement jump in which they began in a standing position, dropped into the semi-squat position, and immediately jumped as high as possible. The jump height was given automatically by the Vertec. Two tests were performed with 5 min of rest between them. The best jump was used for analysis.

Grip strength is an important prerequisite for good performance of the upper limb. In the study, handgrip strength was measured using a standard adjustable handgrip strength test (Takei model TKK5401). Maximum handgrip forces for dominant hand were recorded in kilograms as the highest of two trials. Before testing the subjects individually, the researcher gave a brief explanation and demonstration to the entire group. The dynamometer was adjusted to the size of the hand of participants. The arm, the hand, and the body position were standardized according to the suggestion of The American Society of Hand Therapists. Subjects were requested to sit with their shoulder and neutrally rotated, elbow flexed at 90° resting on the table surface, and the forearm in neutral and wrist in 0°–30° extension. The test was performed by squeezing calibrated hand dynamometer as forcefully as possible with the dominant hand. Static strength was assessed.

Sit and reach test was used to measure the flexibility of the hamstrings, buttocks, and lower back [14]. The subjects were instructed to reach as far as possible from a sitting position (Acuflex model 1).

Sit-up test was used to measure muscular endurance of the abdomen. The subjects need to lie down on the exercise mat, with both their legs bend at 90°. Upon receiving the signal Go, the subjects need to perform sit-up with their chest touching their leg as many as they can within 1 min. The score will be recorded.

Standing broad jump test is used to measure leg power. Subjects need to stand behind a starting line and try to jump as far as they could horizontally. The measurement will be taken from the nearest part of the feet to the starting line.

A 10-m agility shuttle run test is used to measure agility. Mark two lines 10 m apart using marking tape or cones. The two blocks were placed on the line opposite to the line they are going to start at. On the signal "ready," the subjects placed their front foot behind the starting line. On the signal "go," the subjects sprint to the opposite line, picked up a block of wood, ran back, and placed it on or beyond the starting line. Then turning without a rest, they ran back to retrieve the second block and carried it back across the finishing line. Two trials were performed. For students with visual impairment, they were provided with a guide runner to assist them in running and turning quickly. For students with hearing impairment, the signal GO was replaced with a tap at his/her back to start the test.

A 1600-m endurance run test is used to measure cardiovascular endurance. Subjects need to run a distance of 1600 m in a 400-m synthetic track. Students with visual impairment will be provided with a guide runner and a tether (rope).

2.3 Test Administration and Data Collection

In this study, 10-m shuttle run test, handgrip strength test, vertical jump test, standing board jump test, sit and reach test, sit-up test, and also 1600-m run test were employed. The entire test was conducted at 10.00 a.m. to 4.00 p.m. at Kampung Pandan Sports Complex, Kuala Lumpur. Before conducting the test, a briefing on how it will be conducted was given by the test administrators. Besides that, the subjects' weight and height were taken and the test administrators conducted warming up and stretching for 15–20 min to prepare the body from injury.

Then, the subjects performed the test and followed the procedure with the highest scores recorded in the score sheet. Students with visual impairment were provided with guides to assist them in doing the tests.

2.4 Analysis of Data

The results are presented in means and standard deviations. The SPSS package was used for the statistical analysis. Independent sample t-test is used to compare the physical fitness level between two groups.

3 Results

Table 2 shows the level of physical fitness among the male students with hearing impairment and the male students with visual impairment. Male students with hearing impairment show better results in 10 m agility test (11.07 ± 0.92) compared to male students with visual impairment (10.97 ± 1.09). Male students with hearing impairment showed better results in handgrip strength test for both hands (Right—33.29 ± 10.14; left—31.27 ± 8.75) compared with male students with visual impairment (Right—29.67 ± 7.30; Left—28.57 ± 6.66), standing broad jump test (196.43 ± 33.48), vertical jump test (45.33 ± 11.17), and sit and reach test (32.38 ± 8.57), but male students with visual impairment did better in 1600-m run test (10.76 ± 2.37) and sit-up test (41.28 ± 10.84).

Table 3 shows the level of physical fitness among the female students with hearing impairment and the female students with visual impairment. Female students with visual impairment showed better result in most of the test compared with the female students who have hearing impairment. The female students with visual

Table 2 Fitness status between male students with hearing impairment and male students with visual impairment

Test	Hearing impairment (Male)		Visual impairment (Male)	
	Mean	Sd	Mean	Sd
10-m agility run test	11.07	0.92	10.97	1.09
1600-m run test	9.61	2.18	10.76	2.37
HGS test (right)	33.29	10.14	29.67	7.30
HGS test (left)	31.27	8.75	28.57	6.66
Stand broad jump test	196.43	33.48	177.89	34.63
Vertical jump test	45.33	11.17	42.47	11.55
Sit and reach test	32.38	8.57	31.94	5.53
Sit-up test	29.62	6.84	41.28	10.84

HGS handgrip strength test

Table 3 Fitness status among the female students with hearing impairment and students with visual impairment

Test	Hearing impairment (Female)		Visual impairment (Female)	
	Mean	Sd	Mean	Sd
10-m agility run test	13.00	1.10	12.25	0.87
1600-m run test	13.52	1.71	12.51	1.73
HGS test (right)	19.91	2.74	20.69	3.94
HGS test (left)	18.64	3.67	19.81	4.87
Stand broad jump test	128.44	18.44	130.50	19.69
Vertical jump test	27.56	5.81	31.79	4.53
Sit and reach test	25.00	9.08	30.00	4.28
Sit-up test	19.56	3.88	30.36	7.98

HGS handgrip strength test

impairment are better at handgrip strength test (Right—20.69 ± 3.94; Left—19.81 ± 4.87), standing broad jump test (130.50 ± 19.69), vertical jump test (31.79 ± 4.53), sit and reach test (30.00 ± 4.28), and sit-up test (30.36 ± 7.98). However, female students with hearing impairment showed better result in 10-m agility run test (13.00 ± 1.10) and 1600-m run test (13.52 ± 1.71).

Tables 4 and 5 show the results of the independent t-test between the male and the female groups of students with hearing and visual impairment. Results showed that there is no significant difference in 10-m agility run test between two groups, male and female of hearing and visual impairment ($p > 0.05$). This shows that both groups of impairments have the same ability in agility and coordination, even though the students with visual impairment have to perform the test with the assistance of guide runner. In 1600-m run test, there was also no significant difference between two groups ($t = 1.73$; 1.92; $p > 0.05$). Both groups seemed to have similar good cardiovascular fitness. Both groups were also found out to have the same ability in handgrip strength test whether on their right hand or on their left

Table 4 The differences of fitness tests between the male students with hearing impairment and the male students with visual impairment

Fitness profile	Hearing impairment	Visual impairment	t	d*f*	p value
	Mean (SD)	Mean (SD)			
10-m agility run test (s)	11.00 (0.89)	10.97 (1.09)	0.09	37	0.932
1600-m run test (min)	9.48 (2.27)	10.76 (2.37)	−1.73	37	0.093
Right handgrip strength (kg)	33.24 (10.08)	29.67 (7.30)	1.25	37	0.220
Left handgrip strength (kg)	31.24 (8.80)	28.57 (6.66)	1.05	37	0.300
Standing broad jump test (cm)	196.33 (33.54)	177.33 (33.97)	1.75	37	0.088
Vertical jump test (cm)	45.33 (11.17)	43.58 (10.92)	0.49	37	0.625
Sit and reach test (cm)	32.38 (8.57)	31.94 (5.53)	0.19	37	0.854
Sit-up test	29.62 (6.85)	41.28 (10.84)	−4.08	37	<0.001

$p > 0.05$

Table 5 The differences of fitness tests between the female students with hearing impairment and female students with visual impairment

Fitness profile	Hearing impairment	Visual impairment	t	df	p value
	Mean (SD)	Mean (SD)			
10-m agility run test (s)	13.00 (1.00)	12.25 (0.87)	1.92	21	0.069
1600-m run test (min)	13.44 (1.81)	12.51 (1.73)	1.24	21	0.228
Right handgrip strength (kg)	19.78 (2.64)	20.83 (4.24)	−0.66	21	0.515
Left handgrip strength (kg)	18.56 (3.58)	19.81 (4.87)	−0.662	21	0.515
Standing broad jump test (cm)	128.44 (18.44)	130.50 (19.69)	−0.25	21	0.805
Vertical jump test (cm)	27.56 (5.81)	31.79 (4.53)	−1.96	21	0.064
Sit and reach test (cm)	25.00 (9.08)	30.00 (1.28)	−1.79	21	0.088
Sit-up test	19.56 (3.88)	30.36 (7.98)	−3.76	21	0.001

$p > 0.05$

hand. Both impairments seemed to use right hand as their dominant hand. In standing broad jump test, results showed no significant difference in both groups, male hearing and visual impairments ($t = 1.75$; $p > 0.05$) and female hearing and visual impairments ($t = -0.25$; $p > 0.05$). It means that both groups have similar leg power. There is also no significant difference in vertical jump test between both groups, male hearing and visual impairments ($t = 0.49$; $p > 0.05$) and female groups of both disabilities ($t = -1.96$; $p > 0.05$). For sit and reach test, t-test results showed that there is no significant difference between the two groups, male or female ($p > 0.05$) It means both groups have similar ability in leg power and also flexibility. However, there was a significant difference in sit-up test between both groups, male hearing and visual impairment ($t = 0.000$; $p < 0.05$) and female hearing and visual impairments ($t = -3.76$; $p < 0.05$). Results showed that male and the female students with visual impairment performed better in most tests which indicated better abdominal muscular endurance compared to the male and the female students with hearing impairment.

4 Discussions

The study examined the differences between students with hearing impairment and the students with visual impairment on their physical fitness. According to [16], students with visual impairment have lower fitness level compared to their sighted peers. Overall, the present findings have shown the students with hearing impairment have higher BMI, but female students with visual impairment had higher BMI readings than the female students with hearing impairment. A high BMI reading contributed to the reduced level of physical activity and an increased incidence of hypokinetic disease [16]. A low BMI indicates a low percentage of body fat or lower weight as a result of lower lean body weight.

There was only one study reported using handgrip strength test to compare the grip strength among the students with hearing impairment and the students with visual impairment. Lieberman et al. [16] exposed that students with visual impairment demonstrated significantly lower results compared to their sighted peers. Grip strength has been previously reported to correlate with gender and age and also hand dominance. A study been conducted by [17] to show the grip strength of the hand increased with age peak in subjects, and decreased progressively. In many tests, the right hand has larger value than the left side, which can be explained that the right hand is the dominant hand for them. The decrease of the peak strength of the forearm muscles may be frequently found in daily functional activities such as lifting heavy load. Grip strength at both gender begins to decline at pubertal period. The handgrip strength among school-age children in this study showed that handgrip strength is greater among male students. Previous studies found out in the same way that female students with hearing impairment show the lowest result compared to blind girls and also to the male in the same-age groups [18]. The reason why female scored lower result than male in most tests in the studies was because sustained isometric handgrip can be certified to limit blood flow by intramuscular pressure in stronger men contracting at a greater absolute force but similar relative contraction intensity as weaker women [19].

In 10-m agility run test, present findings showed that no significant difference between students with hearing impairment and the students with visual impairment. However, the male students with hearing impairment performed better than the male students with visual impairment. We can justify that visual acuity does affect the movements especially when it involves agility and speed, and changing direction. Physical fitness is related with the ability to perform fundamental motor skills, such as jumping, throwing, or kicking, which have been positively associated with physical activity participation among children, and is considered as an important prerequisite to sport participation [20].

In other tests such as standing broad jump test and vertical jump test, the findings showed that students with hearing impairment especially the male performed better than the visually impaired male students. However, the female students with visual impairment score better compared to the female students with hearing impairment. No other study conducted on these two types of tests. Jumping is an integral part of movement that is used everyday in physical activity. Other studies found body weight or body size can clarify vertical jump performance because it directly measures the muscle power and also the energy storing capacity of the musculo-tendinous apparatus [21]. The sit and reach test shows that the male students with visually impaired had lower score compared to the male students with hearing impairment. This may be contributed to the lack of lower back and hamstring flexibility since they involved less in physical activity [21]. Most probably, it is because muscles are elongated during preadolescence in response to increased bone length and a decrease in flexibility during period of rapid development.

Finally, the result for sit-up test showed significant differences between the students with hearing impairment and the students with visual impairment where both gender from the visual impairment group performed better. This indicated that the core abdominal muscle is important for health and so, the students with hearing impairment should concentrate on improving their core abdominal muscle, and the visual acuity does not affect the score in sit-up test generally.

5 Conclusion

Through the entire study, students with hearing and visual impairment have less involvement in physical activity. Their lack of participation in physical education class can be strongly related as their are not sustaining their physical healthy lifestyle. The present study had shown that this situation can be improved with proper instructions and equipment with appropriate training programmers. These both groups have the same potential ability as their sighted peers. However, lack of opportunity, lack of equipment at schools, and trained and qualified physical education teachers hampered them to be active. The contributions of physical activity toward empowering them to achieve maximum independence in activities of daily living (ADL) include sporting and recreational activities.

It is not a surprise that there was a relation between lack of opportunity and lower potential for success among students with sensory impairments. Regardless of their ability, individuals with impairment need to have the chance to engage in attempts to be excellent in physical activity. However, lower potential for students with sensory impairment may directly translate into significant adults providing less opportunity for mastery attempt. Therefore, the physical education teachers and parents need to be well educated about the possibilities for adapting activities for students or children with hearing or visual impairment. In addition, the lack of opportunities and the lack of peer involvement limit participation in activities otherwise in or out of school, which may lead to reduce self-determination. Thus, future study needs to be conducted to improve physical fitness, at the same time gaining an understanding of the opportunities that students with sensory impairment can develop their ability and be talented in sport performance and involvement in organized sport programs.

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Motives of Outdoor Recreational Activities

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Abstract Outdoor recreation involves voluntary participation in free-time activity, occurs in outdoors and embraces the interaction of people with the natural environment. A few researches have indicated that taking part in outdoor recreational activities can enhance a person's quality of life in psychological well-being. The purpose of this study was to evaluate the quality of psychological well-being obtained by athletes by taking part in outdoor recreational activities. Besides that, the present study also will identify types of outdoor recreational activities participated by the athletes. Psychological Well-being of Outdoor Questionnaire (PWOQ), which contains 20 items, was used to collect the data. Five psychological well-being factors were derived from the questionnaire. They are personal satisfaction and enjoyment, socialization, positive attitude, aesthetics and sensation seeking. 98 athletes from Universiti Teknologi MARA were randomly chosen to take part in this study. Overall, the athletes are pursuing their degree courses and aged between 19 and 22 years. Based on gender, the male ($N = 53$) and female ($N = 45$) respondents took part voluntarily in this study. The highest psychological well-being obtained by the participants in outdoor activities was socialization ($M = 3.73$), followed by personal satisfaction and enjoyment ($M = 3.65$), positive attitude ($M = 3.38$), aesthetics ($M = 3.17$) and sensation seeking ($M = 3.10$). Male respondents were higher than the female respondents in personal satisfaction and enjoyment ($t = 2.51$, $p < 0.05$), aesthetics ($t = 2.50$, $p < 0.05$) and sensation seeking ($t = 3.17$, $p < 0.05$). Meanwhile, there were no significant differences of psychological well-being for socialization ($t = 1.01$, $p > 0.05$) and positive attitude ($t = 1.33$, $p > 0.05$). The results revealed that the outdoor activity designers should emphasize on the outdoor activities for socialization environment.

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1 Introduction

The term outdoor recreation has been part of the leisure studies for over 50 years [1]. It is a very broad term commonly used to describe activities that participants choose to take part during leisure time.

Outdoor recreation has been defined as voluntary participation in free-time activity that occurs in the outdoors and embraces the interaction of people with the natural environment [1]. This definition emphasis on three important elements of outdoor recreation involves voluntary participation in free-time activity, occurs in outdoors and embraces the interaction of people with the natural environment. Leitner and Leitner [2] defined outdoor recreation as an interaction between an activity and an outdoor natural environment that recreates an individual physically, psychologically, emotionally and socially. Furthermore, according to [3], outdoor recreation is not only the activities that occur in the parks or open areas, but also the activities that took place from the playground to playfield, and to wilderness trips and camping. From the above definition, we can conclude that the characteristics of outdoor recreation are non-competitive physical activities individuals participate with their own risk and self-rewarding (pleasure).

A few researches have indicated that taking part in outdoor recreational activities can enhance a person's quality of life in many aspects. Smith [4] and Ham [5] had identified many benefits a person can derive through participating in outdoor activities. Those benefits, which can enhance a person's quality of psychological well-being are better self-concept, awareness and respect of natural environment, adventure in learning, fun, entertainment, self-enrichment, self-improvement, a better life, passing time (nothing better to do), improvement in communication, creativity and development of the inner man (spiritual). Besides that, by taking take part in outdoor recreation, participants will fell relax, enhance the quality of health, have fun and socialize [6]. According to [7], Camp Riley is an outdoor recreational activity, which is fun, since it is capable of carrying out activities, which cannot be done at home. Children's positive attitude, such as self–confidence, will be enhanced by taking part in Camp Riley [7]. Outdoor recreational activities have the tendency to relief from stress, maintain psychological well-being, relax, improve self-esteem and confidence, improve social interaction skills, occupy free time and provide alternatives to substance abuse [8–10]. Research of [11] showed that wilderness hikers in the White Mountains and Adirondacks were motivated by aesthetic and positive emotional feelings.

Jensen [12] had identified the following five benefits of engaging in outdoor recreational activities:

(i) Appreciation of nature: outdoor recreation builds knowledge, enhances understanding of ecological processes and develops an awareness of sensitivity of natural environments to human impacts.
(ii) Personal satisfaction and enjoyment: outdoor recreation provides a vehicle by which people may positively experience nature and derive personal pleasure.
(iii) Physiological fitness: outdoor recreation frequently provides opportunities for active physical engagement.
(iv) Positive behaviour patterns: outdoor recreations instil an attitude of respect, consideration and sincerity towards fellow participants and resource managers.
(v) Stewardship: outdoor recreation provides opportunity for the exercise of moral and ethical values towards the environment, stewardship as a chief and spirits fostered by outdoor recreations.

Attitudes also have been found affected by participation in outdoor activities. In a study done on university students, it was found that those enrolled in a recreation and park management courses held more positive attitudes towards the environment than students registered in other disciplines [13].

Outdoor recreational activities enhanced a person's quality of life. Manning [14] found that there are quite a number of benefits a person can acquire through outdoor activities such as personal benefits (enhance self-esteem and personal health), social benefits (lower crime rate and family solidarity), economic benefits (lower healthcare costs and increased work productivity) and environment benefits (increased commitment to conservation and higher-quality environment).

The understanding of the quality of psychological well-being obtained from the outdoor recreational activities led path to create or modify environment, according to a person's interest and needs.

2 Aim of the Study

The purpose of the study was to evaluate the quality of psychological well-being obtained by athletes by taking part in outdoor recreational activities. Besides that, the present study also tends to identify types of outdoor recreational activities participated by the athletes.

3 Method

Psychological Well-being of Outdoor Questionnaire (PWOQ), which contains 20 items, was used to collect the data. Five psychological well-being factors were derived from the questionnaire. They are personal satisfaction and enjoyment, socialization, positive attitude, aesthetics and sensation seeking. 98 athletes from Universiti Teknologi MARA were randomly chosen to take part in this study.

Overall, the athletes are doing their degree courses and aged between 19 and 23 years. The male ($N = 53$) and female ($N = 45$) participants took part voluntarily in this study.

4 Result

4.1 Respondents' Profile

Respondents' profile based on frequency, percentage and standard deviation is presented in Table 1. This profile described respondents' ethnics, gender and age.

Based on the ethnic, the majority of athletes belong to Malays (54.08 %), followed by Sabahan (17.35 %) and Sarawakian (15.30 %). The mean age for overall respondents was 21.65 years. The age of male respondents varied from 19 to 23 years, where the mean age was 22.07 years. The age of females ranged from the minimum of 19 to the maximum of 22 years. The mean age for female respondents was 21.35 years.

4.2 Cronbach's Reliability Coefficients

In this study, Cronbach's alpha was found ranging from 0.75 to 0.88. Coefficients of 0.70 and above were considered reliable, therefore included in the interpretation of the data (Table 2).

Table 1 Respondents' profile

Variables	Frequency	Percentage	Mean	SD
Ethnics				
Malay	66	67.35		
Sabahan	17	17.35		
Sarawakian	15	15.30		
Gender				
Male	53	54.08		
Female	45	45.92		
Age				
Male			22.07	2.01
Female			21.35	1.89
Overall			21.65	1.93

Table 2 Cronbach's reliability coefficients

Psychological well-being of outdoor	Cronbach's alpha (n = 98)
Personal satisfaction and enjoyment	0.8807
Socialization	0.8171
Positive attitude	0.7758
Aesthetics	0.8909
Sensation seeking	0.7531

4.3 Level of Involvement in Outdoor Activities

Table 3 shows Universiti Teknologi MARA athletes' level of involvement in 11 outdoor activities. The results show that the highest involvement of outdoor activities was camping ($\bar{x} = 3.75$), followed by treasure hunting ($\bar{x} = 3.71$), mountaineering ($\bar{x} = 3.13$), adventure park ($\bar{x} = 3.07$), running or jogging ($\bar{x} = 3.03$), canoeing or kayaking ($\bar{x} = 2.79$), hunting ($\bar{x} = 2.71$), fishing ($\bar{x} = 2.53$), bicycling ($\bar{x} = 2.49$), bird watching ($\bar{x} = 2.15$) and sailing ($\bar{x} = 2.03$).

4.4 Psychological Well-Being of Outdoor Activities

Table 4 shows the psychological well-being benefits of Universiti Teknologi MARA athletes. The highest benefits were socialization (M = 3.73), followed by personal satisfaction and enjoyment (M = 3.65), positive attitude (M = 3.38), aesthetics (M = 3.17) and sensation seeking (M = 3.10).

Table 3 Level of involvement of outdoor activities

Outdoor recreational activities	Mean
Camping	3.75
Treasure hunting	3.71
Mountaineering	3.13
Adventure park	3.07
Running/Jogging	3.03
Canoeing/Kayaking	2.79
Hunting	2.71
Fishing	2.53
Bicycling	2.49
Bird watching	2.15
Sailing	2.03

Table 4 Level of psychological well-being of athletes

Psychological well-being	Mean
Socialization	3.73
Personal satisfaction and enjoyment	3.65
Positive attitude	3.38
Aesthetics	3.17
Sensation seeking	3.10

4.5 Gender Differences on Levels of Psychological Well-Being in Outdoor Activities

The t-test shows that there was significantly difference of psychological well-being in outdoor activities between genders. Male respondents were higher than the female respondents in this psychological well-being. The psychological well-being was personal satisfaction and enjoyment ($t = 2.51$, $p < 0.05$), aesthetics ($t = 2.50$, $p < 0.05$) and sensation seeking ($t = 3.17$, $p < 0.05$). Meanwhile, there were no significant differences of psychological well-being for socialization ($t = 1.01$, $p > 0.05$) and positive attitude ($t = 1.33$, $p > 0.05$). Table 5 shows the overall test results of psychological well-being in outdoor activities according to gender.

5 Discussion

5.1 Psychological Well-Being in Outdoor Activities

The result showed that the highest psychological well-being obtained by the participants in outdoor recreation was socialization. Outdoor recreation provides an important social environment because many people can meet from diverse

Table 5 Psychological well-being in outdoor activities according to gender ($n = 98$)

Psychological well-being	Gender	Mean	SD	T-value
Personal satisfaction and enjoyment	Male	4.38	0.17	2.51*
	Female	4.13	0.31	
Socialization	Male	4.29	0.42	1.01
	Female	4.23	0.58	
Positive attitude	Male	4.09	0.43	1.33
	Female	4.13	0.39	
Aesthetics	Male	4.65	0.55	2.50*
	Female	4.50	0.76	
Sensation seeking	Male	4.51	0.34	3.17*
	Female	3.75	0.77	

*$p < 0.05$

population. Furthermore, outdoor recreational activities provide opportunities for the respondents to be with friends and family members. Friendship and companionship are building through taking part in outdoor recreation [15]. Outdoor recreational activities, which were designed for socialization, should focus on the following elements [16]:

(i) Respect each person's dignity.
(ii) Maintain open lines of communication.
(iii) Establish patterns for integrated decision-making.
(iv) Focus on group challenges and activities.
(v) Develop symbiotic relationship among participants.

5.2 *Gender Differences on Psychological Well-Being of Outdoor Activities*

The result shows that there was significant difference of psychological well-being in outdoor activities between genders on personal satisfaction and enjoyment, aesthetics and sensation seeking.

Males' engagement in the recreational activity is because it brings fun and enjoyment. Male respondents' participation in outdoor recreational activities had derived enjoyment and developed personal skills through their experiences [15]. The result showed males are more oriented for fun and enjoyment in taking part in outdoor recreational activities.

Furthermore, the result shows that male athletes involved in outdoor recreational activities for aesthetics. Aesthetics involves the manner in which the individual appreciates the environment [1]. Outdoor activities give opportunities for a great connectedness to nature [17]. Research shows that quality of an environment for outdoor recreation is directly related to perceived naturalness and wilderness [18]. See, smell and touch the nature through outdoor recreational activities give the opportunity to experience the great adventure for man compared to women. By taking part in outdoor activities, participants aware that all of us are a part of a much larger world and can better appreciate the greatest cycle of life in natural surroundings and the beauty of nature.

Males are higher in sensation seeking than females. Zuckerman's definition on sensation seeking included a willingness to take risk with respect to the novel and intense sensation and experience that one wants [19]. Sensation seeking participants ensure that engagement in the recreational activities matches with their challenge. According to Cara Evans in [7], outdoor recreational activities such as Camp Riley is challenging because it requires a high level of physical effort. 'Thrill and adventure seeking' contains physical thrills such as parachute jumping, mountaineering or skiing. Those athletes with high sensation seeking like to involve in high risk sports [19]. Humans evolved in a challenging, variable and often risky environment and developed a need for challenges, a seeking of strong sensations and a willingness to take risks [20].

Meanwhile, there were no significant differences of psychological well-being for socialization and positive attitude. Social skills such as cooperation and gaining knowledge are not only for males who participated in the outdoor activities but also for females. Therefore, the result failed to derive any difference in socialization between genders. Besides that, male and female obtain positive attitudes by engaging in outdoor activities. The positive attitudes through engaging in outdoor recreational activities are managed to release emotional stress, gain prestige and glamour [15].

6 Conclusion

The result of the present study showed that the highest psychological well-being obtained by participants taking part in outdoor activities was socialization, followed by personal satisfaction and enjoyment, positive attitude, aesthetics and sensation seeking. Male respondents were higher than the female respondents in personal satisfaction and enjoyment, aesthetics and sensation seeking. Based on the results, outdoor designers should emphasize outdoor activities for socialization environment. Outdoor developers should focus on socialization environment to attract more people. Parks and green space environment, where people easily can move around, sightseeing and chatting corner, may attract people to engage in outdoor activities. Future research should focus on the barriers of people taking part in outdoor activities. By knowing the barriers that people facing from taking part in outdoor activities, recreational service providers can find ways to remove those barriers in order for more people to get involved in outdoor activities.

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Factors Influencing Coaching Efficacy Among Youth Team Sport Coaches

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Abstract Coaches play a vital role in the determining success and the overall improvement of an athlete, and in order to do that, coaches must possess both the coaching process knowledge and sport-specific knowledge. However, not much is known about the efficacy of coaches involved in youth team sports and what factors that may influence them. Hence, the purpose of this study was to identify factors that can affect the coaching efficacy among youth team sport coaches. A total of 77 youth team sport coaches who coached during the SUKMA 2012 (a sports event that involved young athletes below 21 years of age) were selected through purposive sampling to participate in this study. Coaching Efficacy Scale (CES) questionnaire was used to measure the coaches' coaching efficacy. Overall, Malaysian coaches who coached team sports showed that their level of coaching efficacy was on the higher end of the scale with the mean total scores of 7.68 (SD = 0.51). Among the four subscales, technique efficacy (M = 7.61, SD = 0.65) showed the lowest mean total scores compared to other subscales, namely character building (M = 7.78, SD = 0.57), motivation (M = 7.69, SD = 0.51), and game strategy (M = 7.66, SD = 0.57). Furthermore, regression results showed that coaching courses attended ($p < 0.001$), coaching experience ($p < 0.05$), and education level ($p < 0.01$) of coaches were the most related factors that affected coaches' coaching efficacy. In conclusion, coaches who showed better efficacy to guide youth athletes are those who have attended intermediate coaching course, have coaching experience more than five years, and possess degree level of education. The information from this study may possibly help the relevant authorities to spot and recruit suitable coaches that are effective in guiding, motivating, correcting, and instilling good sports performance in their athletes.

Keywords Coaching efficacy · SUKMA · Team sports

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1 Introduction

The roles of coaches have become more complex as sport has revolutionized and become increasingly professionalized. Coaches must possess both the coaching process knowledge and sport-specific knowledge in order to ensure success and the overall improvement of an athlete. Coaches are normally been viewed as a motivator, but in reality, coaches hold many other responsibilities and roles to fulfill their ultimate goal of ensuring quality performance of their athletes in competition. Coaching roles have grown to become more technical, more pedagogical, and more demanding of multitasking competencies [1, 2]. Previous studies have stated that coaches were appointed to be as counselors, organizers, leaders, teachers, and motivators besides many other roles in their profession [3, 4]. Even though coaches serve many roles in sports area, their roles in improving athletes' athletic skills and mastery of basic skills specifically in technical, tactical, psychological, and physical preparation for sporting events are more important aspects for them to become a successful coach [5].

Coaching required the use of various methods and strategies to accomplish various expectations. Therefore, they have to be multitasking (to acquire good knowledge and skills and to be highly motivated in delivering responsibilities to develop quality athletes). As a matter of fact, a competent coach is able to motivate their athletes to perform confidently in their games [6].

According to Lim et al. [5], although Malaysia has some great achievement in several sports such as diving, badminton, squash, and cycling, other Malaysian athletes are finding it very difficult to at par or maintain such reliable position. One of the reasons put forward is the incompetency of the local coaches in handling Malaysia athletes. The quality or level of competency of coaching in Malaysia is said to be less encouraging because coaches were not up to date in their coaching techniques in the coaching systems due to the lag in the support of scientific knowledge in sports and this has also been highlighted by the secretary of Olympic Council of Malaysia, Sieh Kok Chi, that Malaysian coaches were incompetence and have led to shortcomings of Malaysian sports [5].

Sukan Malaysia or better known as SUKMA is a national-level sporting event for youth athletes. It is the platform for each respective state in Malaysia to display their talented athletes. Due to this, every state in Malaysia has engaged sports coaches for various sports to prepare their states' youth athletes for the SUKMA tournaments. However, such developmental programs involving significant amount of money need high and continuous commitment. Hence, the question that is a concern to many stakeholders is whether do these states' youth team coaches possess good coaching efficacy and are able to develop the potential athletes?

Fung [7] defines coaching efficacy as "the extent to which coaches believe that they have the ability to enact behaviors and fulfill tasks expected of coaches" (p. 13). Coaches need to be confident and have the capability to plan game strategies such as matching up the team's strategy with the strengths and weaknesses of their opponents [3]. If a coach has low level of self-efficacy, it may have a detrimental effect on athletes' performance. Conversely, if the coach has high self-efficacy, it may help in influencing his or her own performance, as well as the athletes' performance during training and competition. Past study has identified four dimensions of coaching efficacy which are motivation, technique, strategy, and character building [7, 8].

There are many factors that can influence the level of coaches' efficacy in coaching such as coach education, coach development, and the use of psychological strategies. An interesting finding that is worth noting is that Gilbert and colleagues noted that most coaches felt the most important knowledge sources that helped them develop their coaching styles were their "day-to-day coaching experience" [9].

Raja and Kee [2] in their study on youth sports coaches found that overall coaching efficacy scores for Malaysian youth coaches were high and showed similar capabilities in coaching and have the same potential as others to be successful coaches in the type of sports they coached. However, in their study, they found that coaches who coached team sports have lower coaching efficacy level compared to coaches who coached individual sports.

Although there are numerous researches [2, 5] that study on coaching efficacy among Malaysian youth sports coaches, few actually studied on the factors that can affect the coaching efficacy. Therefore, this purpose of study is to identify the factors that may affect the coaching efficacy level, especially in youth team sports coaches.

2 Methodology

2.1 Participants

A total of 77 youth team sports coaches from 14 states who coached in Sukan Malaysia (SUKMA) 2012 volunteered to serve as participants in the study. These participants were selected through a purposive sampling comprising of various team sports (badminton, gymnastic, hockey, lawn ball, archery, tenpin bowling, sepak takraw, and volleyball).

2.2 Outcome Measure

The Coaching Efficacy Scale or CES [8] questionnaire that has been translated to Malay language [2] was used to measure the coaches' coaching efficacy. The reliability of the CES questionnaire in this study is 0.94.

3 Statistical Analysis

The data collected for this study were analyzed using the Statistical Package for the Social Sciences version 17. Descriptive analysis such as frequencies was calculated to illustrate the characteristics of coaches. Hierarchical multiple regression was conducted to assess the ability of four control measures (level of coaching courses attended, coaching experience, level of playing experience, and education level) to predict levels of coaching efficacy (CES).

In addition, preliminary analyses were conducted to ensure the assumption of normality, linearity, multicollinearity, and homoscedasticity was met.

Since the data were categorical in nature, additional steps are needed to ensure that the results are interpretable. This step includes recoding the categorical variable into a number of separate, dichotomous variables, also known as "dummy variables". Dummy coding uses only ones and zeros to convey all of the necessary information on group membership. One of the categories then serves as the "reference" category for comparison with other categories. This current study measures on four different variables which are coaching education, coaching experience, playing experience, and level of education. For coaching education, there are four levels (Never attended, Beginner, Intermediate, Advance) and the Never attended act as "reference" category, and three dichotomous variables were constructed (Beginner vs Never attended, Intermediate vs Never attended, Advance vs Never attended). The reference category (Never attended) was then compared with the three dummy variables created (Never Attended vs Beginner, Never attended vs Intermediate, Never Attended vs Advance). For coaching experience, it can be converted into one dummy variable which is coaches who have experience of more than 5 years versus coaches who have experience of below 5 years. For playing experience, there are three levels (School, State, National) and playing experience at school level act as "reference" category with two dichotomous variables constructed (State vs School, National vs School). For education level, there are four levels (SPM, Diploma, Degree, Postgraduate) with Postgraduate act as "reference" category and three dichotomous variables being constructed (SPM vs Postgraduate, Diploma vs Postgraduate, Degree vs Postgraduate).

4 Results

Table 1 shows that majority of respondents are male coaches (males = 56, females = 21). Furthermore, the majority of coaches were above 36 years of age (75.3 %). In terms of education level, the majority of coaches (88.3 %) have some form of tertiary education (diploma holder or higher).

Table 2 shows the coaches' attributes in relation to their academic qualification, their playing experience, and their coaching experience.

Table 1 Gender, age, and education level among team sports SUKMA coaches

Characteristics	Frequency
Gender	
Male	56
Female	21
Age (years)	
<30	13
31–35	6
36–40	20
41–45	22
>45	16
Education level	
SPM (Certificate)	25
Diploma	32
Degree	20
Postgraduate	12

Table 2 Level of playing experience, coaching courses attended, and coaching experience among team sports SUKMA coaches

Characteristics	Frequency
Level of playing experience	
School	12
State	39
National	26
Level of coaching courses attended	
Never attended	12
Beginner	22
Intermediate	26
Advance	17
Level of coaching experience	
Less than 5 years	25
More than 5 years	52

In terms of playing experience, majority of the coaches had experience playing at the state level (n = 39, 50.6 %), while another 26 coaches had experience playing at the national level (n = 26, 33.8 %).

Furthermore, most of the respondents (n = 65, 84.4 %) have reported that they have attended before the coaching courses organized by the Malaysian Sports Council, while 18.2 % (n = 28) of them have revealed that they have not attended any coaching courses organized by the Malaysian Sport Council before. Overall, in terms of level of coaching courses attended, there was fairly even spread among the participating coaches. However, coaches who had attained the intermediate level of coaching were slightly more (n = 26, 33.8 %) than other levels (Table 2).

Table 3 Coaching efficacy among team sports SUKMA 2012 coaches

Characteristics	Frequency	
	M	SD
Motivation	7.69	0.51
Game strategy	7.66	0.57
Technique	7.61	0.65
Character building	7.78	0.57
Overall CES	7.68	0.51

In terms of the level of coaching experience, more than two-thirds (n = 52, 67.5 %) of the coaches have more than 5 years of involvement in coaching. This indicates that majority of the coaches are not new to coaching at least at SUKMA level.

The means and standard deviations of each subscale of the CES, which includes motivation, technique, game strategy, and character building efficacy, are presented in Table 3.

Overall, Malaysian SUKMA coaches who coached team sports showed high mean scores of total coaching efficacy (M = 7.68, SD = 0.17). In terms of subscales, the top three of highest mean scores by the coaches are in character building subscale (M = 7.78, SD = 0.57) motivation subscale (M = 7.69, SD = 0.51), and game strategy (M = 7.66, SD = 0.57). On the contrary, these coaches scored lowest in technique subscale (M = 7.61, SD = 0.65).

Table 4 shows the result for multiple regression. In the final model (Step 4), there were five variables that have statistically significant contribution ($p < 0.05$) with the intermediate level of coaching course recording a higher beta value ($\beta = 0.71$, $p < 0.001$) than other variables.

5 Discussion

Becoming a coach for a youth sports team is an important and challenging role. A coach is responsible for teaching and guiding a number of young people. Other than developing the numerous techniques and skills associated with a sport, coaches play an important role in building character of young athletes. The CES measurement developed by Feltz has been widely used in past studies to measure the confident or efficacy level among school and collegiate coaches [8]. It measures the coaches' efficacy in carrying out duties based on the four subscales of coaching tasks, which are motivation, technique, game strategy, and character building. Coaches who have a high degree of coaching efficacy do give a more positive feedback [10].

Findings from this study indicated that the level of coaching courses attended by the coaches was a good predictor for the coaches' level of coaching efficacy. Previous research [6] has shown that factors that influence changes of coaching behaviours and coaching efficacy are the attendance of formal coaching courses.

Table 4 Summary of hierarchical regression analysis for variables predicting level of coaching efficacy

Variable	*B*	SE *B*	*ß*
Step 1			
Beginner[a]	0.76	0.15	0.67**
Intermediate[a]	0.94	0.15	0.86**
Advance[a]	0.81	0.15	0.67**
Step 2			
Beginner[a]	0.68	0.15	0.60**
Intermediate[a]	0.78	0.17	0.72**
Advance[a]	0.62	0.18	0.51**
Coaching experience above 5 years	0.24	0.13	0.22
Step 3			
Beginner[a]	0.68	0.15	0.60**
Intermediate[a]	0.78	0.17	0.72**
Advance[a]	0.63	0.19	0.52**
Coaching experience above 5 years	0.24	0.13	0.22
State level[b]	0.13	0.14	0.13
International level[b]	0.02	0.15	0.12
Step 4			
Beginner[a]	0.65	0.15	0.58**
Intermediate[a]	0.78	0.16	0.71**
Advance[a]	0.71	0.18	0.59**
Coaching experience above 5 years	0.29	0.12	0.27*
State level[b]	0.18	0.14	0.17
International level[b]	0.10	0.15	0.09
SPM[c]	0.18	0.15	0.17
Diploma[c]	0.21	0.16	0.20
Degree[c]	0.54	0.21	0.30*

Note $R^2 = 0.35$ for Step 1; $R^2 = 0.38$ for Step 2; $R^2 = 0.37$ for Step 3; $R^2 = 0.40$ for Step 4 ($p < 0.05$)
B unstandardized coefficient B; *SE B* standard error; *ß* beta
**$p < 0.001$; *$p < 0.05$
[a]Compared to coaches who have not attended any coaching course
[b]Compared to coaches who have playing experience at school level
[c]Compared to coaches who have postgraduate degree

Study by Fung [7] stated that attending coaching education programs that help in providing mentor teaching for less experienced coaches would help improve their commitment in coaching. Coaching education or coaching courses were found to have a significant relationship with coaching efficacy, and it has been proven by past studies [11, 12] that coaching course-attended coaches have affected the outcomes of coaching efficacy in both youth (aged 12–16 years) and adult coaches. Trudel [13] reviewed that coaches' efficacy knowledge, beliefs, and behaviours are positively affected by coaching course program (Canada's National Coaching Certification Program). More specific to the current study, past studies [14–17] reported that youth sport coaches viewed that coaching education program is an important component of their growth and development. The current result supported major past studies that the impact of coaching course/education/program is significant for youth sport coaches. Previous study, furthermore, supported that coaching education programs were the most effective method in increasing the coaches' coaching efficacy and also their competency [18, 19]. Thus, coaching courses attended by the Malaysian SUKMA coaches may have boosted their confidence level in coaching their athletes.

On the contrary, several studies [14] investigated on how elite or expert coaches develop their knowledge have found that there are disparity in the perceived importance of formal coach education program toward coaches knowledge development. However, there is a common agreement that the learning process that the coaches got from discussion with other coaches, mentoring, and own playing experience does play a significant role in their coaching efficacy. These studies conclude that coach education should not be strictly delivered through formal courses and that other factors that can influence coaching efficacy such as coaching experience and the observation of other coaches should also be considered [9, 18].

Results in this study also showed that Malaysian SUKMA coaches who had more years of coaching experience show higher mean score in all four subscales of coaching efficacy compared to coaches who had fewer years of coaching experience. This finding was similar to several past studies which also stated that coaching experience affects coaching efficacy [20, 21]. Many of the studies cited so far also showed that day-to-day learning experiences in the field were more valued by coaches compared to their attendance of formalized learning venues [22, 23]. This is because the number of hours a coach spent in the sporting venue, coaching, and interacting with athletes was longer compared to the time he or she might spend in a formalized learning environment [9]. Longer past coaching experiences and time spent on the field usually gave the coaches opportunities to demonstrate and correct their athletes' skills and techniques.

In past studies, coaching experience had been correlated not only with higher levels of technique efficacy subscale, but also with game strategy efficacy subscale [19, 23, 24], motivation efficacy subscale [22, 24], and character building efficacy subscale [23]. Possible reason for this finding is as mentioned by Feltz and colleagues that coaching experiences allow the coaches to be able to motivate the athletes, demonstrate skills effectively, recognize talent and diagnose skill errors, and affect the mood and psychological states of the athletes [20]. Therefore, it can be concluded that the years Malaysian SUKMA coaches spent in coaching make them become more confident in dealing with their athletes in terms of motivating, developing game strategies, correcting techniques, and instilling good characteristics.

Other than coaching education and coaching experience, academic qualification also serves as the predictor factor that can influence coaches' coaching efficacy.

Results showed that coaches who have higher academic qualification significantly influence their coaching efficacy. Despite general coaching experience, knowledge also served as a "unique source of efficacy information that deals mainly with the knowledge to prepare teams" [25]. Because it is strongly linked to the positive outcomes that humans value, academic qualification is one of the most important factors that should be taken seriously by coaches. Coaches with high levels of education and who are academically successful have stable employment, are more likely to be employed, have more employment opportunities than those with less education, and earn higher salaries. Furthermore, coaches with successful academic have lower levels of depression and anxiety, have higher self-esteem, are socially inclined, and are less likely to abuse alcohol and engage in substance abuse. Sports coaches have to be able to manage stress effectively and the capacity to focus and block out distractions by employing positive self-esteem and self-confidence.

Coaching efficacy is usually measured through four dimensions or subscales which are motivation, game strategy, technique, and character building efficacy. However, among these four subscales, current finding revealed that the team sport coaches have lowest level of technique efficacy. One possible reason that Malaysian SUKMA coaches who coached team sports had lowest mean scores of technique efficacy might be due to limited contact time between coaches and athletes. As indicated by Delano, communication is very important for the coaches to deliver correctly and precisely to the target athletes [26]. Therefore the lack of contact time between coaches and athletes may have hindered the efficacy of the coaches to deliver well on technical elements. In addition, most of the youth athletes involved in team sports came from schools where most of the time they were being supervised by their school coaches. The Malaysian SUKMA coaches were only able to be with their athletes during centralized training just before the event. Due to the short duration of centralized training, there is a limited contact between coaches and their athletes which resulted in limited time for coaches to improvise athlete's skills and technique. Furthermore, the SUKMA event is organized only once every two years, which gives little opportunity of exposure for coaches to guide their athletes in real game situations [22, 24]. Therefore, coaches have to look for other methods to improve their technique efficacy. For example, coaches may have to organize more competitions or friendly matches in increasing their team performance so that they can practice using different methods in correcting and demonstrating the perfect skills and techniques. Using different approaches may be challenging for the coaches yet it is attainable and help to increase the efficacy in coaching [27]. Further research is paramount to expanding the understanding of coaching efficacy in this environment. However, this study has provided additional knowledge of coaching efficacy related to Malaysian youth team sport coaches.

Past studies had already noted that coaches who had high coaching efficacy used more positive coaching styles, had more players who were satisfied with their playing experiences, had higher winning percentages, and had higher efficacy levels among athletes and teams [5, 9]. Therefore, it would be interesting to examine these variables on Malaysian coaches to determine whether the outcomes were similar.

6 Conclusion

In conclusion, several sources or factors that can influence coaches' coaching efficacy have been identified in this study. Coaches are able to refer to these findings in helping increasing future coaching efficacy. For example, by attending coaching seminars, reading coaching materials, and watching instructional videos, coaches can continue to develop and progress. In turn, organizer of coaching seminars can use this information to provide reputable coaches to share experiences and information for beginner coaches to enhance their coaching efficacy.

This study has successfully demonstrated that Malaysian SUKMA coaches have a high level of coaching efficacy to coach youth athletes. Their level of coaching efficacy was primarily determined by their playing experiences and coaching courses attended. Measuring coaching efficacy is important because it does not only provide a direct impact on coaching behavior, but also include both constructive and destructive influences that impact on the development as well as performance of individuals and teams. This study has provided a foundation to building a body of knowledge on coaching efficacy that is related specifically to the Malaysian environment.

Coaches are important individuals linking the relationship between the athlete and their sports performance. Hence, it is paramount to understand the factors that influence coaches' efficacy. When carrying out research or setting up interventions, the capability of coaches to enhance learning and performance of his or her athletes must be taken into account [25]. Under the guidance of efficacious coaches, young athletes can acquire the technical and tactical skills of a sport and confidence in their physical abilities, develop leadership qualities, and work toward achieving their goal.

In addition, it is recommended that future research should continue to identify the sources and other factors that influence coaching efficacy particularly in the aspect of coaches' self-development since there is inconsistency in findings reported.

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Effect of SENAMSERI™ Dance Therapy Intervention on Psychological Well-Being Among Sedentary Adults

Mastura Johar, Rosita Abdul Latif, Haizan Mohd Taha and Mardian Shah Omar

Abstract The purpose of this investigation was to evaluate the effect of a 12-week SENAMSERI™ group dance therapy intervention in the treatment of total stress score among sedentary adults in higher education organization. Forty subjects were postgraduate and undergraduate students from Universiti Tenaga Nasional. Subjects were between the ages of 19 and 30 years, had a diagnosis of total stress score (TSS) above the mean, were not enrolled in any exercise program over the period of one-year (sedentary) overweight (body mass index above 25) and had a cardiovascular endurance score below the mean. Subjects were randomly assigned to a 12-week low-intensity dance therapy intervention of either SENAMSERI™ or a conventional aerobics dance exercise as the control group. A pretest–posttest control research design was utilized. Both groups met for 50 min, three times a week (36 sessions). The Transactional Approach Multidimensional examined the emotional response sub-scale of TSS. Statistical analysis includes (group × time) repeated-measures ANOVA to determine between- and within-group mean differences. The hypotheses of the study received significant support. There were statistically significant differences between*group effect (between treatment and control groups) on the combined dependent variables: $F(4, 35) = 20.79$, $p < 0.01$, eta square = 0.790. An inspection of the mean scores indicated that treatment group reported an improvement for TSS (M = 39.0, SD = 1.15), hostility sub-scale (M = 47.70, SD = 3.34), anxiety sub-scale (M = 35.65, SD = 3.64), and for depression sub-scale (M = 35.65, SD = 2.58). It was concluded that low-intensity

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dance therapy exercise intervention of “SENAMSERI™” had contributed greatly to the positive findings concerning both the emotional responses of TSS among sedentary adults in higher education.

Keywords SENAMSERI™ dance therapy · Psychological well-being · Total stress score

1 Introduction

The connection between physical and psychological well-being has been pursued for more than 2000 years [1]. Wellness is a holistic concept and includes mental and physical components [2]. Hermon and Hazler [3] and Omizo and Omizo [4] identified well-being as the attention to both mental and physical health. However, to date, the role of physical exercise has expanded to one of great importance in the promotion of physiological and psychological well-being [5–7]. The physical fitness “boom” which began in the 1970s resulted in considerable increase in focus on the importance of engaging in physical activity, and this trend appears to continue as we move forward through 2014s. Along with the belief that participation at five times a week, performing vigorous exercises of more than 150 min at moderate intensity per week will improve both the physical and psychological well-being [8]. Further to this, dance has been used as a healing ritual for thousands of years and has its historical roots among indigenous people [9]. Thus, dance itself has been ascribed to have a curative power, whereby dance (movement) therapy has been developed in the last decades and follows a specific approach of treatment. Dance movement therapy’s impact on stress management and stress reduction has not been addressed specifically by research. Dance movement therapy (DMT) is defined as a form of creative body-oriented psychotherapy that uses movement, dance, and verbal intervention to further the emotional, cognitive, physical, and social integration of the individual. It is believed to have a positive impact on the well-being of people with social, physical, or psychological impairments.

SENAMSERI™ is a stress therapy that combines dance movement and local music which combines the movement of both upper and lower body with simple dance movement which improvise sitting and standing position. The goals of SENAMSERI™ dance movement therapy are to help individuals grow and to interrelate psychological and physiological process through movement or dance. SENAMSERI™ helps individuals to understand their own feelings, images, and memories, as well as those of others, by expressing themselves through movement or dance thus able to control self when at stress. SENAMSERI™ can help individuals improve and lower the levels of the stress hormone called cortisol and thus increase the physiological and psychological well-being. The dance movement improvises sitting (on the chair) and standing position which helps the releasing opiate beta-endorphins into the system, which induce feelings of calm, satisfaction, and euphoria. There are 3 newly composed music, and the dance movement routine was specially choreographed for the above purposes. The music composed were created with light lyrics, dance rhythmic music of 130–140 beat per minute. This is to raise the body temperature, increasing blood flow to the brain, relaxing the nervous and muscular systems, and altering electrical patterns in the brain. Anyone at any fitness level will be able to follow the routine. A slower music of 80 beat per minute is used to calm and cooldown after the vigorous movement. Focusing the mind and dance body movement offers distraction from external and internal stressors. People with anxiety or depression are often more likely to ruminate on negative thoughts, so this type of distraction is excellent, providing an environment in which trusting and open relationships may be built. SENAMSERI™ routine was created not only to reduce stress but also to improve cardiovascular endurance due to vigorous time frame (aerobically).

This study is used to observe any beneficial effect of dance exercise therapy on total stress level of young adults suffering from high-level stress and low self-esteem. This study allows the effects of exercise to be clearly understood in terms of existing psychobiological knowledge, and it can thereby provide the theoretical base that is needed to guide future research in this area. Therefore, to achieve some insight regarding the influence and effect of low-intensity aerobics group dance exercise on the physiological well-being that is health-related fitness and psychological well-being in terms of total stress score (TSS) and self-esteem among working women, the following objectives are formulated: firstly, to identify the difference between the experimental (low-impact dance exercise improvised local Malaysian music) and control group (conventional aerobic dance) in terms of the difference between pretest, posttest one, and posttest two scores on psychological well-being in terms of total stress scores (Derogatis Stress Profile) and its sub-scale, namely hostility, anxiety, and depression; and secondly, to make recommendation based on this study on the effectiveness of group dance therapy activity toward improving the future preventive medicine and better psychological health and lifestyle of young adults suffering from high-level stress and low self-esteem to perform and increase productivity in their daily life.

2 Methodology

The research design used in this study using quasi-experimental designs has a pretest, posttest one, and posttest two time period. Quasi-experimental design provides as much control as possible [10]. A pretest was administered to all participants of study to measure the level psychological well-being variables (total stress level and its sub-scale, namely hostility, anxiety, and depression) before treatment condition was introduced. Subjects were measured again at week eight and week 12 after the treatment is given [11]. The intervention condition for this research is dance therapy exercise program conducted by the researcher. Subjects are required to participate in 36 sessions, 50 min each, 3 times per week for a

12-week period. Their psychological well-being variables were measured at posttest one (week eight) during the 24 session and again after the 36 session at week 12 to determine the effect of the intervention program on the dependent variables. Figure 1 shows treatment assignment and the pretest–posttest design used in this research study. Both groups experienced treatment between the pretest, posttest one, and posttest two. Subjects went through 36 sessions, 50 min each, three times per week for a 12-week period of treatment working at 60–70 % of maximum training heart rate as their treatment. It is gauged by comparing the differences between pretest and posttest scores of the intervention group with that of the control group.

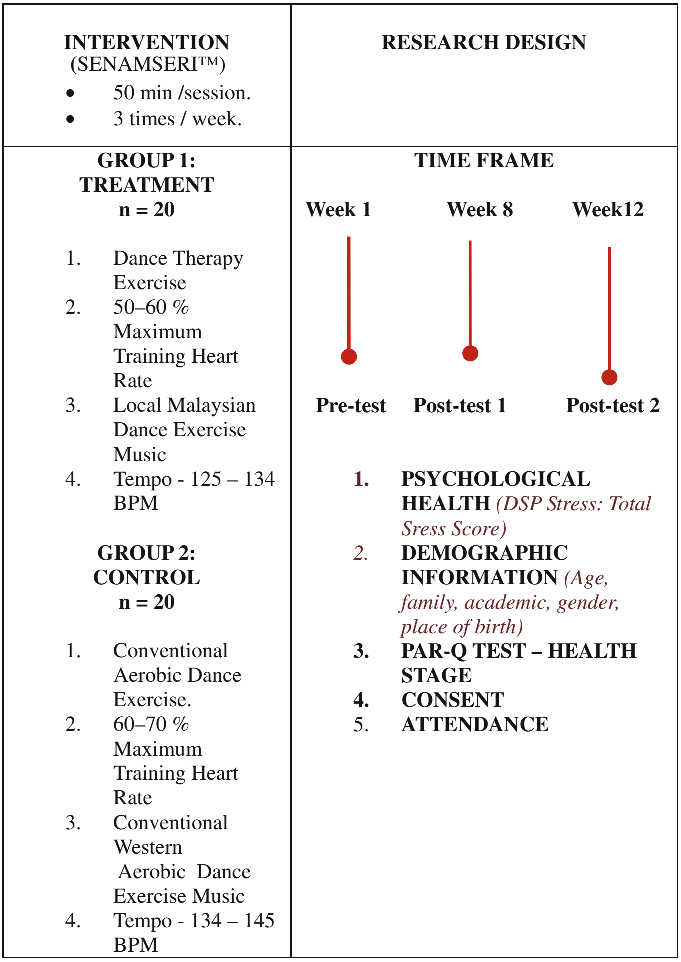


Fig. 1 Treatment assignment and pretest, posttest design

Table 1 Respondent profile on frequency of age, race, and program

Variables	Frequency	Percentage
Age (years)		
19–22	12	30
23–26	17	42.5
27–30	11	27.5
Race		
Malay	14	35
Chinese	14	35
Indian	12	30
Program		
Masters	11	27.5
Bachelor	8	20
Diploma	10	25
Foundation	11	27.5

2.1 Respondents/Subjects

A total of forty subjects were postgraduate and undergraduate students from Universiti Tenaga Nasional. Subjects were between the ages of 19 and 30 years, had a diagnosis of TSS above the mean, were not enrolled in any exercise program over the period of one-year (sedentary) overweight (body mass index above 25) and had a cardiovascular endurance score below the mean. Subjects were randomly assigned to a 12-week low-intensity dance therapy intervention either SENAMSERI™ or a conventional aerobics dance exercise as the control group. Twenty subjects were assigned in the treatment group and 20 were in the control group. Before the statistical analysis was done, the respondent profile data were examined. As depicted in Table 1, 35 % subjects were Malay, 35 % were Chinese, and 30 % were Indian (M = 2.050, SD = 0.815). Age group was categorized according to three ranges where results indicate that age range 19–22, 30 %, age range 23–26, 42.5 %, and majority subjects were in the age range of 29–30, 27.5 % (M = 1.975, SD = 0.767). From the total number of subjects involved in this research, 27.5 % subjects were in master's degree program, 20 % were in bachelor's degree program, and 25 % were taking diploma, and 27.5 % foundation program (M = 2.525, SD = 1.176).

3 Findings/Results

3.1 Total Stress Score

To examine the research objective on psychological well-being, repeated-measures MANOVA was performed to investigate groups' differences in TSS and its sub-scale, namely hostility, anxiety, and depression. The dependent variables were analyzed, namely total stress score, hostility sub-scale, anxiety sub-scale, and depression sub-scale. Preliminary assumption testing was conducted to check for normality, linearity, univariate, and multivariate outliers, homogeneity of variance–covariance matrices, and multicollinearity, with no serious violations noted. The results of this study show all the four variables of stress shows statistically significant difference on "SENAMSERI™" the treatment group compared to the convention aerobics dance. There was a statistically significant difference between*group effect (between treatment and control groups) on the combined dependent variables: $F(4, 35) = 20.79$, $p < 0.01$, eta square = 0.790. When the results for the dependent variables were considered separately, all the variables of stress reach statistically significance, using a Bonferroni-adjusted alpha level (TSS) $F(1, 38) = 4.69$, $p < 0.05$, eta square = 0.11; hostility sub-scale $F(1, 38) = 7.16$, $p < 0.05$, eta square = 0.16; anxiety sub-scale, $F(1, 38) = 84.67$, $p < 0.05$, eta square = 0.69; and depression sub-scale $F(1, 38) = 0.241$, $p < 0.05$, eta square = 0.70. An inspection of the mean scores indicated that treatment group reported an improvement for TSS (M = 39.0, SD = 1.15), hostility sub-scale (M = 47.70, SD = 3.34), anxiety sub-scale (M = 35.65, SD = 3.64), and for depression sub-scale (M = 35.65, SD = 2.58). As compared to the control group reported TSS (M = 40.75, SD = 1.94), hostility sub-scale (M = 56.2, SD = 1.43), anxiety sub-scale (M = 46.05, SD = 5.99), and depression sub-scale (M = 45.15, SD = 5.54). Figure 2 provides the graph for estimated mean of TSS, while Figs. 3, 4, and 5 provide the graph for all the stress sub-scales, hostility, anxiety, and depression, respectively.

The pairwise comparisons as depicted in Table 2 present all the three time trials (with Bonferroni adjustment) of TSS and its sub-scale. The results reported a

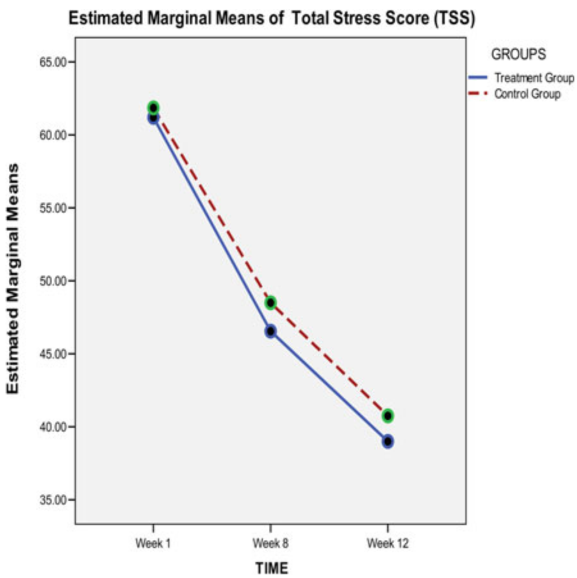


Fig. 2 Estimated marginal means of total stress score between treatment and control groups

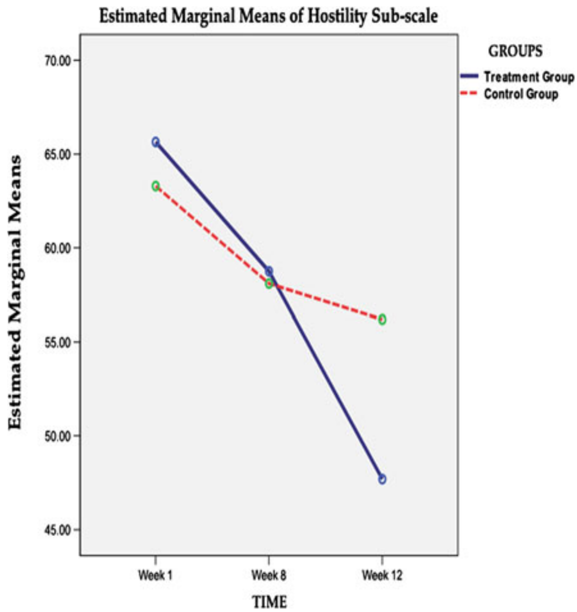


Fig. 3 Estimated marginal means of hostility sub-scale between treatment and control groups

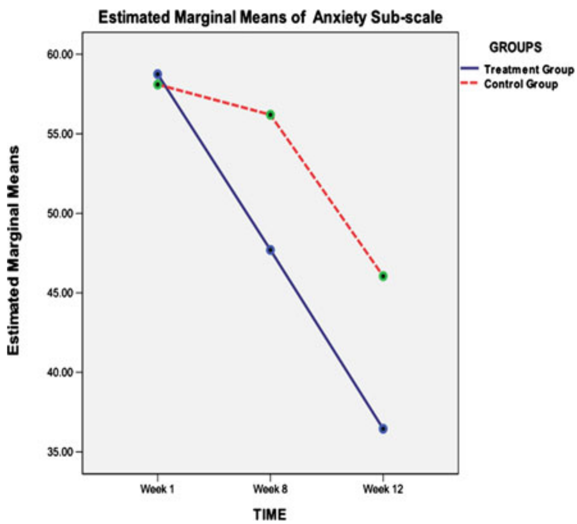
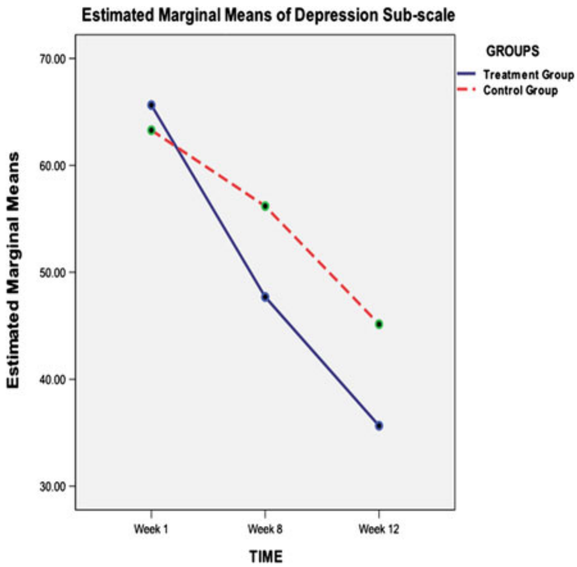


Fig. 4 Estimated marginal means of anxiety sub-scale between treatment and control groups

significant difference ($p < 0.05$) across the three time trials. The first pairwise comparison of pretest–posttest one indicated a big improvement with the mean difference of ($M = 14.0$) and improved constantly at the second paired posttest one–posttest two with the mean difference of ($M = 7.65$), and with overall improvement from pretest to posttest two, the total mean difference of ($M = 21.6$).

Fig. 5 Estimated marginal means of depression sub-scale between treatment and control groups



Further to that, pairwise comparison for hostility, anxiety, and depression sub-scales, results reported a significant difference ($p < 0.05$) across the three time trials. The first pairwise comparison of pretest–posttest one indicates an improvement with the mean difference of hostility sub-scale ($M = 6.05$), anxiety sub-scale ($M = 6.47$), and depression sub-scale ($M = 12.$). It improved constantly at the second paired posttest one–posttest two with the mean difference of hostility sub-scale ($M = 6.47$), anxiety sub-scale ($M = 10.7$), and depression sub-scale ($M = 11.5$) and with overall improvement from pretest to posttest, two total mean difference of hostility sub-scale ($M = 12.5$), anxiety sub-scale ($M = 11.5$), and depression sub-scale ($M = 24$). Using guidelines proposed by Cohen (1988) (0.01 = small effect, 0.06 = moderate effect, and 0.14 = large effect), this result suggests a large effect size. Result shows that 11 % TSS, while the sub-scale is 16 % hostility. 69 % anxiety and 69 % depression of the variability were associated with the treatment after the variability caused by individual differences was removed. To conclude, research objective one posited a statistically significant difference between the treatment of "SENAMSERI™" and control groups of conventional aerobics dance on stress the dependent variables. Table 2 provides the results on the repeated multivariate analysis of variance (MANOVA).

Table 2 Results of mixed repeated multivariate analysis of variance (MANOVA) for total stress score between treatment and control groups

Effect	Trial	*F*	Sig.	Eta	Mean differ		
					Pre to post	Post 1 to post 2	Pre to post 2
Within-subject							
Time* subject		20.64	**0.00***	0.98			
Between-subject effect		23.79	**0.00***	0.79			
	Total stress score (TSS)	4.69	**0.03***	0.110	14	7.65	21.6
	Sub-scale hostility	7.16	**0.01***	0.159	6.05	6.47	12.5
	Sub-scale anxiety	84.67	**0.00***	0.690	6.47	10.7	17.2
	Sub-scale depression	0.241	**0.00***	0.695	12.5	11.5	24.0

* The mean difference is significant at the .05 level

4 Conclusion

SENAMSERI™ is a stress therapy that combines dance movement and local music. The movement improvises sitting and standing positions via simple dance movements involving both the upper and lower parts of our body. The goals of SENAMSERI™ dance movement therapy are to help individuals develop and interrelate psychological and physiological processes through movement or dance. SENAMSERI™ helps individuals to understand their own feelings, images, and memories, as well as those of others, by expressing themselves through movement or dance. This enhances self-control when under stress. SENAMSERI™ can help individuals to reduce the release of stress hormone called cortisol. The findings of the study revealed that subjects (sedentary, stressed, and overweight adults) in the intervention group (treatment group) benefited statistically significant improvements on the psychological well-being in terms of total stress score compared to the control group. In addition to the above findings, this interaction effect indicates that the difference between the experiment and control groups on the linear combination of all dependent variables was different at pretest (week one) than it is at posttest one (week eight) and posttest two (week 12). Examination of the means suggests that this is because groups do not differ on either dependent variable at the time of the pretest, but they do differ, particularly on all the dependent variables at the time of the posttest one (week eight) and posttest two (week 12) significantly. However, interestingly repeated-measures ANOVA reported that treatment group (intervention group) improved significantly $p < 0.05$ during week 12 compared to week eight, where there were statistically no significant differences between the two groups. In addition, examination of the means suggested that there was a change in the posttest one (week eight) and posttest two (week 12) outcomes held for both the treatment and control groups for all the dependent variables.

In summary, this research will serve as a base for future studies and developments. The research efforts work toward improving the future of preventative medicine and better the well-being and lifestyle of sedentary adults suffering from high-level stress to perform and increase productivity in their lifestyle. An application of SENAMSERI™ dance movement therapy can help individuals who are suffering from severe psychological stress. Secondly, SENAMSERI™ therapy has a positive impact on physical and mental health when individuals are physically experiencing worries and stress. SENAMSERI™ combined exercise movement accompanied with created light upbeat rhythm music with positive lyrics to boost the endorphin hormone. Lastly, SENAMSERI™ allows clients to experience both emotional and physiological feelings simultaneously, which can lead to a better understanding of self. In short, low-impact exercise routine is indeed simple and cost-effective. It is a fun and safe way to exercise for people from all walks of life. Ultimately, low-impact exercise routine improves the population's psychological well-being as it promotes one's quality of life.

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The Relationship Between Self-Efficacy and 6 Feet Golf Putting Distance

Mazlan Ismail and Wan Ramlee

Abstract The previous literature has so far never investigated the relationship between hardest putting distance and psychological state of the golfers. This study aims to determine to what extent efficacy was associated with the hardest distance (6 feet). The putting tests were conducted on 127 golfers, and golfers were assigned to rate their self-efficacy prior to putting test. The two Pearson product-moment correlation coefficient results indicated that there was a significant positive relationship between putting scores and self-efficacy. The results provide evidence that highlights the strong connection between psychological state, e.g., self-efficacy of golfers and putting performance from the 6 feet distance.

Keywords Self-efficacy · Hardest distance · Golf putting

1 Introduction

There is something about golf as to why this sport has become popular to the researchers and attracts people of all ages and skill levels [1–3]. Previous researchers found that pressure also influenced the performance of the golfers during the game [1]. The data were focuses on muscular, kinematics, and psychological factors while performing under pressure. The findings revealed that perceived pressure and anxiety increased during the game psychologically. Furthermore, the reasons of poor performances were from increasing of heart rate and the movement of muscle while playing golf [1]. According to [4], putting skill

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is not an easy task to perform. Likewise, previous researchers found [5] the emotional controls during the game found problem in putting were not from the streakiness but from the green.

Previous literature also demonstrates that golfers experience difficultly when putting from a 6 feet distance [6]. Additionally, the golfers also perceived that their self-belief and anxiety were the biggest problem in putting [6]. Also, the grips and body positions are other reasons that make putting so difficult in certain distances. The results are in line with the objective to identify the distance considered the most difficult to hole in, other than to justify the golfers' perceptions toward the putting problem.

The association between self-efficacy and performance has become one of the priority mechanisms in sport psychology [7]. As [8] clarified that in social cognitive theory, belief influences emotional reactions and thoughts of athletes such as worries, behaviors, and attributions such as choices, effort, and persistence. Similarly, the cognitive goal setting refers to when golfers make judgments about their abilities [9]. However, the relationship between the self-efficacy of golfers and putting performance from a 6 feet distance required additional research. Therefore, the objective of this study was to determine to what extent efficacy was associated with a 6 feet putting distance performance.

2 Methodology

2.1 *Participants*

Hundred and twenty-seven golfers (females 85, males 42) with playing experiences (M = 2.59, SD = 1.39) participated in this study.

2.2 *Instrumentation*

2.2.1 Self-Efficacy

For the purpose of this study, researcher developed the self-efficacy scale particularly to be performed from the 6 feet distance. A set of guidelines [8] is used for constructing efficacy scales in this study. The scale was hierarchically arranged to represent increasing levels of complexity, also task specific and concordant with putting performance [9–11]. The homogeneity of items for this scale is unnecessary [7], and the Cronbach alpha coefficient was 0.86. The measure started with the phrase "Rate your confidence on what you believe you can get out of 10 strokes" the individual items were (I believe I can get 1 putt in the hole out of 10 strokes, I believe I can get 2 putts in the hole out of 10 strokes and etc. The scale asks participants to record the strength of their belief in their putting performance from the specific distance. Finally, the participants record the strength on a 100-point scale, from 0 (cannot do at all), 50 (moderately can do), and 100 (highly certain can do).

2.2.2 Putting Scoring

The participants' putting scores were rated based on scoring systems [12], e.g., for any hole putts, any putts that stop at the edge of the hole, putts that fell over the high side of the hole, and for putts that pull up short. Each participant was awarded a total score of a maximum of 50 points (see Fig. 1).

2.3 Procedure

For the purpose of data collection, one golf club was selected in this study. Researcher explained the objective of the study to club manager and golfers during the initial meeting. Additionally, one professional golfer was assigned as a reference particularly as a technical aspect to avoid any biasness during the test.

Fig. 1 The shape and position of the scoring system

The golfers were asked to use their own putter to make it consistent with their own skill of putting [12]. Additionally, they were also provided five standard golf balls by the researchers. The present study used 10 putting task which is consistent with the previous study [13] or less than 15 putting tasks [12]. All golfers were asked to putt the 10 putting strokes from a 6 feet distance at the artificial indoor putting mat and 10 m from the actual putting green [12, 14, 15]. Lastly, the two Pearson product-moment correlation coefficient results were used to analyze the relationship between self-efficacy and 6 feet distance putting performance.

3 Results

The relationship between self-efficacy and 6 feet distance putting performance on male (*M*: 30.4, SD: 6.46) and female (*M*: 52.12, SD: 8.04) golfers was analyzed using Pearson product-moment correlation coefficient. No violation of linearity, normality, and homoscedasticity during the preliminary analyses. Table 1 shows that there was a strong positive correlation between two variables in male and female golfers and 6 feet distance putting performance $r = 0.87$, $n = 85$, and $p = 0.01$ for female golfers and $r = 0.91$, $n = 42$, and $p = 0.01$ for male golfers. These results suggested that there were strong, positive correlations between self-efficacy on male and female golfers and 6 feet distance putting performance. The results supported the perspectives of golfers where 6 feet distance was considered the most difficult to perform psychologically.

4 Discussion

Nevertheless, despite these issues of complexity, the findings drawn from this study show that self-efficacy and putting performance from a 6 feet distance was significantly related between two variables. Previous researchers also clarified that athletes are more drawn to participate in activities that they feel good in. In fact, athletes who are particularly good in a task will be recruited and continue to perform the task and vice versa [16]. However, athletes who are not good in those activities will stay away from it [17].

Although there were no previous researchers who have examined whether self-efficacy affects putting performance from the 6 feet distance, this study

Table 1 Pearson correlation between self-efficacy and 6 feet putting performance in male and female golfers

N		
Male	0.91**	42
Female	0.86**	85

**Correlation is significant at the 0.01 level (2-tailed) subsequently brings up the idea for future golf putting studies. Results are consistent that feelings and belief particularly affect golfers while playing as supported by the previous study [18]. As [19] clarify that in golf, belief and confidence level are different in each of the competition. Therefore, psychological strategies are needed when practicing any skill, and this improves confidence or self-belief of the athletes [3, 12, 15].

The aim of the study is to identify the correlation between golfers' psychological states and the 6 feet distance putting performance. In doing so, future researchers will emphasize more on solutions to improve golf putting performance based on the distance that the golfers feel most difficult to perform. On top of that, the 6 feet distance has to be investigated in a real putting green and to identify the efficacy of the golfers on the green itself. Furthermore, psychological skills' training is important to improve putting performance based on this distance.

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Comparison of Coaching Behaviour Between Super and Premier League Soccer Coaches

Muhammad Zulqarnain Mohd Nasir, Lianyee Kok and Aishah Nadirah

Abstract In the sports context, both researchers and practitioners generally accept the idea that personalities and leadership affect and influence the performance of their teams and athletes (Terry in Can J Appl Sport Sci 9:201–208, 1984). In Malaysia, there is limited information concerning coaching behaviours practiced by coaches especially in sports such as soccer. Therefore, this study was conducted to compare coaching behaviours between Malaysian Super and Premier League coaches. The Coaching Behavior Scale (CBS-S) utilized feedback from players participating in both leagues. A sample of 313 players was selected from a total of 720 players. Data from the sample were analysed using independent *t*-tests, and the results indicate that there are differences between Super and Premier League in terms of technical training ($p = 0.01$), mental preparation ($p = 0.00$) and the athletes' satisfaction ($p = 0.00$). However, no differences were found for physical training, goal setting, preparation of competition strategy, the role of the head coach and the assistant coaches. It can be concluded that there is significant difference in physical conditioning, technical skill, mental preparation, head coach and athletes' satisfaction between Super and Premier League soccer coaches

Keywords Coaching · Behaviour · Leadership · Personality introduction

1 Introduction

Coaching can be defined as a part of learning where the coach learns by providing their athlete several sources of knowledge [1]. A coach plays an important role in guiding their athlete towards success or failure [2, 3] irrespective of whether

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individual or team sports are concerned. The influence from coaches involves aspects such as physical, technical and tactical training, and psychosocial management. Coaches develop athletes during training through their presence, actions and speeches. No matter how good athletes may be, his/her coach would probably have a profound impact on his/her life [4]. A number of researchers have attempted to develop instruments to measure behaviour exhibited by coaches. The most frequently used is the Leadership in Sports Scale, LSS [5]. The LSS model examined training and instructional behaviour, democratic behaviour, autocratic behaviour, social support behaviour, and rewarding behaviour. However, LSS was shown to have some psychometric problems [6, 7]. The context of the LSS seemed to focus only on behaviours within the training environment. Also, the LSS explores the dimensions of decision-making by coach through autocratic and democratic behaviour, with several studies reporting that this instrument has a low-level internal consistency [8]. It has also been indicated that the extensive use of this instrument has become a problem and provided a limited view on coaching as a whole [8]. The LSS was suggested to be unable to give correct and accurate details about what coaches did, and was ineffective in helping coaches improve their coaching behaviour.

The inconsistency in the quality of play during soccer competitions has generated much scepticism, particularly in terms of the quality of soccer players in Malaysia. Many questions have also been asked regarding the quality of coaches working within the two highest competitive leagues in the country. It would seem logical that the best players are competing in the Super League, while players who do not make the cut for the highest league would be in the Premier League. Thus, it would be interesting to examine whether there are differences in coaching behaviour between coaches coaching in these two leagues. Coaches emphasize different aspects of coaching on their own teams. It is uncertain which coaching behaviours can produce better quality performance during competition. Many coaches mould their team according to the style they think is best. However, their thoughts and opinions may not be similar to what their athletes think of them. It is important for coaches to understand the needs and desires of their players in order to improve their satisfaction. However, most coaches seem to have failed to take into account the needs and desires of their players [9]. Good coaching behaviours favoured by the athletes can lead to higher levels of satisfaction and increase athletic performance. Coaches who understand what is required by their athletes may be more effective in motivating their athletes [10].

With soccer being one of the most popular sports in Malaysia, it is not surprising that the ability of coaches come under greater scrutiny. However, there are few published details regarding coaching behaviour of Malaysian soccer coaches. Few studies that examined coaching behaviour utilized the LSS which has been criticized as having has many flaws as it does not seem able to give a comprehensive clarification for coaching behaviour. Additionally, data regarding coaching behaviour were obtained from the coaches. To rectify this, the CBS-S instrument was designed in 1999 [1] and used to assess behaviour from the perspective of athletes. Also, the use of the CBS-S instrument is important because it measures the dimensions of coaching not accounted for by the LSS and other instruments such as the Coaching Behaviour Assessment System (CBAS). These dimensions include mental preparation, goal setting and personal relationships. Furthermore, the CBS-S has been found to be suitable for trainees of different age groups. This differed from the LSS which was administered to adults, while the CBAS was designed to evaluate the behaviour of coaches who train youths. Putting all the previous circumstances together helped frame the objective of this study which was to compare coaching behaviours between Malaysian Super and Premier League coaches.

2 Method

2.1 Participants

A sample of 313 players was selected from a population of 720 male players involved in both leagues. From this sample, 163 participants (52.1 %) were from the Super League and 150 (47.9 %) from the Premier League. The mean age of the participants was 23.35 years. The participants involved players aged between 17 and 35 years who had trained for at least 2 months under the supervision of the coaches being investigated.

2.2 Procedures

After all the athletes gathered, the same researcher administered the CBS-S questionnaires to all participants at different training sites. The CBS-S instrument was translated from English to Malay and back to English by language teachers who have degrees in the teaching of English and Malay and had taught in schools for twenty years. The double translation that was performed to ensure translation did not jeopardize the validity of the instrument. All completed questionnaires were then coded and analysed. The first part of the questionnaire consisted of items to obtain background and profile information of players. The other parts of the instrument were answered by players to evaluate their coaches on eight dimensions:

1. *Physical training and planning* (PTP; nine items on coaches' participation in physical training and competition planning)
2. *Technical skills* (TS; nine items on feedback, demonstration and signals from coaches)
3. *Setting goals* (GS; nine items assessing coaches on the identification, development and monitoring of goals set by players)
4. *Mental preparation* (MP; seven items focusing on how coaches help players to stay focused and confident when under pressure)

5. *Competition strategy* (CS; ten items focusing on the interaction between coaches and athletes during competition)
6. *Interaction with the head coach* (HC; fourteen items evaluating the approach used and understanding the coach towards players)
7. *Assistant coach* (AC; eleven items assessing the role of assistant coaches to help players)
8. *Athlete satisfaction* (ST; ten items assessing the level of satisfaction of players towards all aspects of coaching).

2.3 Procedures

Questionnaires from each participant were scored for every dimension. Mean scores for each dimension from participants of both leagues were compared using independent t-tests. Statistical significance was set at $P < 0.05$.

3 Findings

The independent t-tests performed on each dimension of coaching behaviour found that there are few differences about the coaching behaviour between Super and Premier League. In the meantime, the Super League scored their coaches significantly higher than players from the Premier League for performing coaching tasks related to technical skill training ($p = 0.01$), the mental preparation of the athlete ($p = 0.00$) and satisfaction of the athlete ($p = 0.000$). There were no differences between players from both leagues in terms of what they thought of their coaches for behaviours related to physical training and planning ($p = 0.244$), the goal setting ($p = 0.95$), preparation of competition strategies ($p = 0.93$), interaction with the head coach ($p = 0.78$) and the performance of the assistant coaches ($p = 0.24$). As the assumption of equal variances was met for all the dimensions analysed, the t values for equal variances were utilized for the analyses (Table 1).

4 Discussion

Based on the findings, there are three factors that were difference between the Super and Premier League coaches which is the technical skills, mental preparations and also the athletes' satisfaction. However, looked at the means different the Super League coaches perform coaching behaviours related the mentioned factors were slightly higher than Premier League coaches. Possible reasons for this could be that Super League teams have more funding and are able to hire coaches who are better

Table 1 Coaching behaviour factors

Variable	League	Mean	SD	Sig. (2-tailed)
Physical training	Super League	5.02	0.58	0.24
	Premiere League	4.92	0.83	
Technical skills	Super League	5.53	0.47	0.01
	Premier League	5.32	0.86	
Setting goal	Super League	4.93	0.52	0.95
	Premier League	4.99	1.01	
Mental preparation	Super League	5.26	0.60	0.00
	Premier League	4.88	0.96	
Competition strategy	Super League	4.97	0.68	0.93
	Premier League	4.96	0.94	
Head coach	Super League	4.11	1.14	0.78
	Premier League	4.01	0.77	
Assistant coach	Super League	4.77	0.55	0.24
	Premier League	4.88	0.99	
Athlete satisfaction	Super League	6.14	0.56	0.00
	Premier League	5.60	0.94	

trained, have higher coaching certification levels, and have trained players at higher competition levels, including national teams. These advantages have made Super League coaches more knowledgeable, experienced and skilful when conducting technical training and mental preparation and always took really a good care about what the athletes concern regarding not just training regime but also in all other aspects as well. Previous research has indicated that teams that are physically and technically strong also become psychologically tough [11–13]. Unlike the Super League, teams in the Premier League primarily use the services of former players who have retired from competition. According to the players, these coaches are less proficient when conducting physical conditioning, technical training, and mental preparation. Therefore, the cycle of coaches with better coaching behaviours producing better players can be observed through these two leagues. For coaching behaviours involving physical training, the goal setting, interaction with the head coach, and the use of assistant coaches, no differences were observed between Super and Premier League coaches. It would seem that coaches from both leagues were not different in these coaching behaviours. As such, their players could evaluate the dimensions that their coaches emphasized and those that were given less prominence. Coaches from the Premier League had similar scores for all coaching behaviours probably because their coaching ability and knowledge kept their coaching skill at a lower level when compared to the Super League coaches.

The final dimension that examined players' satisfaction with their coaches' overall behaviours found that players from the Super League were more satisfied with their coaches compared with players from the Premier League. It is likely that coaches from the Super League were more organized in terms of management before, during, and after competition. Coaches who are better organized, more knowledgeable and skilful tend to be more respected by their players. This suggests that coaches from the Premier League need to improve in all coaching dimensions in order that their players perform better.

5 Conclusion

Overall, the results of this study found that there were significant differences in coaching behaviours between Malaysian Super and Premier League coaches in coaching behaviours related to the technical skills, mental preparation and athletes' satisfaction. There were no significant differences in coaching behaviours related to physical training, goal setting, competition strategy, interactions with the head coach and the use of assistant coaches. The differences between the technical skills, mental preparation and athletes' satisfaction highlight differences in performance displayed by players of the two leagues with the Super League players coming out superior. Therefore, it is recommended that future studies be conducted in other sports such as hockey, rugby, volleyball and other team sports with the aim to identify whether the same dimensions of coaching behaviour occur in the same manner. Such studies are important for improving both the quality of the coaches and also the athlete's performance. Additionally, the validity of the sub-scale items should also be considered because too many items may cause respondents to lose their concentration when answering the questionnaire.

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Improvement of the Saccadic Eye Movements with the Sport Training Activity

Ahmad Mursyid Ahmad Rudin and Maryam Nazihah Sharipan

Abstract Saccadic eye movement is a short rapid and abrupt movement of the eye occurring in fixating from one point to another. The demand of eye movement in sport vision is crucial to locate visual targets and stabilize images on the retina. Athletes were reported to have better visual abilities than non-athletes. In this study, athletes who actively played badminton (n = 20) and non-badminton players (n = 20) aged between 12 and 18 years old were recruited. Electro-oculography (EOG) was employed for analysis of saccadic eye movements. The clinical EOG made indirect measurement to record the eye movement with EOG angle of 30º. Subjects were instructed to follow the alternated light fixation without turning head during the saccadic task. The system automatically measured the average result of Arden ratio, latency, and amplitude potentials in dark phase and light phase of saccadic eye movement with both dark and light stages plotted and curve fitted. No significant differences (p = 0.20) were found between badminton player and non-badminton player in the mean latency of saccadic eye movements with 19.25 ± 0.83 and 18.79 ± 1.35 ms, respectively. Meanwhile, the badminton player showed statistically significant difference in amplitude of saccadic eye movements than non-badminton player (p < 0.001). The mean amplitude of saccadic eye movements in badminton player and non-badminton player was 28.34 ± 8.04 and 19.51 ± 5.61 µV, respectively. The saccadic eye movement showed how fast the visual system can fixate on an object. Improvement in the component in saccadic eye movements indicated that training activities might be contributed to the superiority of vision skills in badminton player.

Keywords Electro-oculography (EOG) · Saccadic eye movements · Sport training · Latency · Amplitude

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1 Introduction

The role of visual performance in sports had received considerable attention over the years. In an article by Babu et al. [1], it was stated that the eye movement was an important function of visual system to locate visual targets and stabilize images on the retina. Saccadic eye movement is a short, rapid, and abrupt movement of the eye occurring in fixating from one point to another to change fixation rapidly [2]. This was the oculomotor response involved in rapidly shifting the direction of fixation between two points in space. More precisely, it was a basic response of the versional eye movement system where the eyes moving in the same direction [3].

As such, many sports rely heavily on the accuracy of saccadic eye movements. Saccades were a requisite in those sporting activities in which rapid changes of fixation were required. In the real world, saccade remains accurate throughout our life; it is constantly recalibrated through a process of saccadic adaptation for individual without any pathological or experimental perturbation [4]. It was a motor learning mechanism driven in response to the detection of saccade error made in between the planned movement and the movement made. Further, the saccadic adaptation caused the reduction of error made over time by increasing the accuracy upon performing saccadic eye movement toward fast moving target. A research showed the correlation between the saccadic adaptation and the midline cerebellar in the brain structure where the adaptation skills were developed through continuous stimulation in the cerebellum [4].

According to Di Russo et al. [5], sport was a specific condition where athletes had superiority in complex motor and visual performance compared to those non-athletes. However, their superiority in elementary motor and visual tasks was not clearly explained from the previous research findings. Abrams et al. [6] proposed in their research that one of the popular approaches of studying underlies the mechanism of saccadic eye movements was to measure the dynamic features of saccades trajectories, including of the duration of movements, amplitude, and peak velocity. It was supported by Carpenter, whereas he described in his study that saccadic eye movement was rapid, ballistic, yoked movements of the eyes which bring the gaze to a new location in visual space [7]. So, the components of latency and amplitude of the saccadic eye movement were being investigated in this study to answer this relationship.

The latency of saccadic eye movements was one of the important aspects which most athletes required during eye movements in various directions. Many visual functions including the latency of saccadic eye movements showed some significant differences in athlete's person by comparing with non-athletes person [1, 5, 8]. Those differences were believed due to the physical exercise affected on their sport activities or training.

The amplitude of saccadic eye movements referred to the angular distance that the eye needs to travel during the eye movements. As mentioned by Joyce et al. [9], the amplitude of saccadic eye movements was also called the size of saccades. The amplitude measured the accuracy of the saccadic task by make up a minimal set of independent dimensions which the values determine the identities of all possible movements in the task.

If the accuracy in saccadic eye movement is found to be better in badminton player compared to non-badminton player, it suggests that a strategic component or environmental influences, such as practice, may play a role in saccadic adaptation for badminton player in order to improve the visual skills in their performance. Thus, data from this study will be useful for other practitioner to develop a sport vision specialty to lead performance among athletes.

2 Methodology

2.1 Subjects

The subjects of the study were the badminton athletes ($n = 20$) and non-badminton player ($n = 20$). Subjects, aged ranging between 12 and 18 years old. Refractive error range for ammetrope was spherical power less than ±5.00D and/or refractive error range for astigmatism was ≤−0.50DC. Visual acuity for distance was 6/6 or better and for near was N5 at 40 cm or better with habitual correction. The exclusion criteria included of any ocular diseases, any ocular deviation, or binocular vision anomaly and anisometropia exceeds ±1.00DS. Athletes who are participated in this research group were actively playing badminton and had played sports for a minimum 5 years with current participation >6 h per week, while non-athletes in this control group were not participated in badminton and other racquet sports continuously.

2.2 Instrumentation

The Espion E^2 Electrophysiology System was used in this study. Based on Kohmura et al. [10] studies, the electro-oculography (EOG) was a representative method for the analysis of eye movement. EOG detects any electric changes through the electrodes applied to the skin surrounding the eyes. The system was operated by taking advantage of the fact that the cornea has positive electric potential to the retina and the fact that voltage change associated with eye movement has a near proportional relation to eye rotation angle. On the other hand, EOG did not require any apparatuses that block vision, such as the video camera that needs to be placed on the subjects when employing the corneal reflex method that commonly used in other method of the eye movement measurement. Therefore, EOG is less burdensome for the subject than other methods, even though the electrodes applied to the skin do have the potential to cause slight discomfort. The usage of EOG also made it possible to examine a relatively large number of study subjects and to detect a wide range of eye movement. Where applicable, tests were designed to meet the standards prescribed by the International Society for Clinical Electrophysiology of Vision (ISCEV).

2.3 Procedures

Subjects were seated in a chair in front of the stimulator with a comfortable forehead and chin rest. They were instructed to fixate on a fixation light which was the red LED light at the center of stimulator. The fixation light alternately changed in simple rhythmic manner for every 10 s. The duration of the test was 15 min in dark phase and 15 min in light phase. Subjects have to move eyes in single sweep to next one when the light changed from left to right and right to left. During the light changes, subjects were not allowed to turn their head and anticipated the changes.

In a dark phase, total room darkness was needed and subjects should not be exposed to any large changes in lighting. The fixation light will be changed alternately for 10 s for every 1 min and the EOG system recorded the saccadic potentials. The subject should remain looking into the stimulator at all time and should be warned of the start of each measurement sequence to ensure attention. The test was continuously remaining for 15 min and had 30-s interval time for every alternated fixation light.

In a light phase, the background light in the stimulator should be 100 photopic cd/m^2 [11]. As in the dark phase, the fixation light will be changed alternately for 10 s every 1 min and the EOG system will be recorded the saccadic potentials in light phase. The subjects were instructed to keep looking in the stimulator bowl for the whole time and with eyes open. The test was continuously remaining for 15 min and had 30-s interval time for every alternated fixation light.

2.4 Data Analysis

The Espion E^2 Electrophysiology System measured the change in EOG potential and latency of saccades resulting for each saccade and calculated automatically by the system. Thus, the mean latency and amplitude of saccadic eye movement data obtained from the research was analyzed using a Statistical Package for the Social Sciences (SPSS) program version 15.0. The comparison of the mean difference in latency and amplitude of saccadic eye movement between badminton player and non-badminton player was measured by independent sample t test (parametric test system) to assess the significance of any differences.

3 Result

The latency of saccadic eye movement data showed no statistically significant differences ($p > 0.05$) between badminton player and non-badminton player (see Table 1). The descriptive statistics data showed badminton players have high mean

Table 1 Comparison of latency of saccadic eye movements between youth badminton player and non-badminton player

	Mean differences	95 % confidence interval		*P*-value
		Lower	Upper	
Latency (ms)	0.46	−0.26	1.18	0.20

latency of saccadic eye movements compared to non-badminton players, 19.25 ± 0.83 and 18.79 ± 1.35, respectively (see Table 2).

The amplitude of saccadic eye movement data showed statistically significant differences ($p < 0.001$) between badminton player and non-badminton player (see Table 3). The descriptive statistics data showed that badminton players have high mean amplitude of saccadic eye movements compared to non-badminton players, 28.34 ± 8.04 and 19.51 ± 5.61, respectively (see Table 4).

Table 2 Descriptive statistics for latency of saccadic eye movements of youth badminton player and non-badminton player

	Latency (ms)	
	Badminton player (n = 20)	Non-badminton player (n = 20)
Mean	19.25	18.79
Standard deviation	0.83	1.35
Median	18.8	18.68
Minimum	17.97	16.25
Maximum	20.47	22.02

Table 3 Comparison of amplitude of saccadic eye movements between youth badminton player and non-badminton player

	Mean differences	95 % confidence interval		*P*-value
		Lower	Upper	
Amplitude (μV)	8.84	4.38	13.29	0.00

Table 4 Descriptive statistics for amplitude of saccadic eye movements of youth badminton player and non-badminton player

	Amplitude (μV)	
	Badminton player (n = 20)	Non-badminton player (n = 20)
Mean	28.34	19.51
Standard deviation	8.04	5.61
Median	27.82	19.25
Minimum	16.27	8.20
Maximum	39.97	31.52

4 Discussion

The component of eye movements contained in saccades were depend on visual information from the retina to tell the brain that there was something in the visual field to be recognized. Saccadic eye movements contained in oculomotor function was the perceptual mechanism in information processing and it can be evaluated the steadiness of fixation [12]. In the dynamic type of sport tasks, the ability to initiate accurate saccadic eye movements to shift fixation from one location to another was an essential aspect. If the components of the saccade were taking into consideration, the results in this research indicated that there was no significant difference in the latency of saccadic eye movements between the athletes and non-athletes of youth badminton sports, whereas there was a significant difference of amplitude of saccadic eye movement between both groups.

A few researchers found that there was positive correlation between latency, amplitude, and velocity of saccadic eye movements [13]. Velocity of saccadic eye movement was increased as the amplitude increased. Latency was found constant irrespective of saccade amplitude showed the linear relationship between both elements.

The latency of saccadic eye movements involved a complex combination of procedures in brain for visual information processing [10]. The other findings also found that after a step change in target position of saccadic task, an adult human central nervous system responds with a saccade after latency approximately 200–250 ms [14]. Several processes were believed to take place during the latency period, such as shift of visual attention to the new target, disengagement of oculomotor fixation and computation of the metrics of the movement. Each of these processes involved activation of cortical area in the brain. Therefore, latency of eye movements is a cognitive–physiological parameter. A research finding by Yang et al. [14] can be summarized that all latencies and their variability of the eye movements in 3D space were longer in children than in adults, and there was a decrease progression with age. Moreover, latencies approached or reached the normal values approximately at age 10–12 years. As the subjects recruited for this study ranged from 12 to 18 years old, the latency of saccade may reach the normal value and the dynamic sport task found not to contribute significantly on the further development of this element.

The amplitude of the saccadic movement results supported the initial hypothesis where the badminton player had superior visual function relatively to non-badminton player. Brecht et al. [15] reported that amplitude and direction of saccadic eye movements depend on the synchronicity of collicular population activity. It has been observed in numerous brain structures, but opinions diverged regarding its significance in neuronal processing. This may agreeable with the findings of a study of fixation stability in high-level clay target shooter and control group found that athletes were not affected by the absence and presence of distracters compared to the control group [5]. Thus, this proved that athlete had developed a high level of focusing ability and changes in the elementary visuomotor function through training [5]. The result of increased amplitude of saccadic eye movement element also was inline with another research that compared saccadic eye movement between volleyball athlete and non-athlete. The outcome of the study also showed that athletes were able to identify and locate target of interest in their visual in addition with the ability to process the information of the target of interest in a shorter time than the non-athlete [8].

In conclusion, there were evidences of component in saccades that might contribute to the superiority of saccadic eye movement due to effect of sport training activity. The extensive practice in sport training of athletes may contribute to the modification of elementary visuomotor functions, and athletes may represent a special population for investigating this effect. This result could be served as a baseline understanding in the strategy for selecting talented players and improving them by special training. Future studies are needed to determine whether a strategic component or environmental influences, such as practice, may play a role in saccadic eye movements for athletes to improve the visual skills in their sports performance.

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Effect of Imagery Intervention on Flow State and Performance in Tennis

Dayang Zulaikha Nadira Abang Sardon, Mardiana Mazaulan and Muhamad Noor Mohamed

Abstract The aim of this study was to determine the effect of imagery intervention on-court and off-court on flow state and on-court assessment in tennis. Purposive sampling used in this study involved eight UiTM's tennis athletes. The respondents were required to answer SIAM and FSS-2 questionnaires. They were tested on their groundstroke accuracy, groundstroke depth and serve accuracy based on the International Tennis Number Manual. Analysis of paired *t*-test data showed a significant difference for flow state between pre-intervention and post-intervention phase for on-court group ($t = -12.23$, $p < 0.05$) and off-court group ($t = -7.78$, $p < 0.05$). The on-court imagery intervention group showed higher mean difference ($M = 55.25$) than off-court imagery intervention group ($M = 31.50$). Off-court imagery intervention showed a significant difference for groundstroke accuracy ($t = -3.69$, $p < 0.05$) and groundstroke depth ($t = -3.61$, $p < 0.05$). There was no significant difference in serve accuracy for both the imagery intervention groups. It can be concluded that on-court imagery intervention should be implemented during training session to improve flow state while off-court imagery intervention is effective for improving performance and should be included as off-court training program.

Keywords Component · Imagery intervention · Flow state · Performance · Tennis

1 Introduction

Both experience and performance in sports were closely intertwined and optimal experience was often related to superior performance [1, 2]. Flow was an optimal state of psychology often associated with high-level performance and positive

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experience [3]. In order to reflect flow experiences in sports, nine dimensions were proposed, namely challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration on task at hand, sense of control, loss of self-consciousness, time formation, and autotelic experience.

Psychological variables could be controlled apart from improving sports skills by applying imagery techniques [4]. Previous study found that factors affecting flow involved mental and physical preparation, positive mood, arousal control, focus, and positive feedback [5]. Imagery of green space reduced the level of anxiety which leads to better performance [6]. A study to determine whether imagery could enhance flow state involving 64 professional dancers within 8 weeks showed that flow and relaxation imagery were effective for enhancing optimal positive experience and performance in dancers [4].

A study on the efficacy of imagery training on swimming performance conducted where performance measure was collected once a week each on the same day for 15 weeks showed that after being introduced to the imagery intervention, three out of four participants significantly improved their times on the 1000-yard practice set [7]. Previous researcher conducted a study on motor imagery and its effect on tennis serve performance, in which it carried out over 16 weeks and the results showed that motor imagery practice in combination with physical practice enhanced performance and significant improvement in first serves in real tennis match situation [8]. Imagery intervention to increase flow state and performance on four participants for 12 weeks revealed that three participants showed increase in flow experience and all four participants improved both their serve performance ground stroke and ranking-list position [9].

This study was done to determine the effect of imagery intervention on-court and off-court on flow state and on-court assessment. There is a dearth of studies that investigate the effect and its relationship between imagery and flow state [9]. Previous study recommended imagery education as part of coaching education [10]. In Malaysia, [6] used imagery of green space for better performance with lowered anxiety among athletes. More research of this kind needs to be carried out. It was hypothesized that there was a significant difference in flow state in imagery intervention. It was also hypothesized that there was a significant difference in on-court assessment in imagery intervention in terms of groundstroke accuracy, groundstroke depth, and serve accuracy.

2 Methodology

2.1 Participants

Five male and three female tennis players within the age between 18 and 22 years participated when the study began. All participants had at least nine years of tennis and six years of competition experience. The participants entered at least five tournaments per year.

2.2 Design

A pre-experimental design was implemented in this study. Since there was no random sampling, the design had poor control [11]. It might had also caused the study to have many definite weaknesses and had little control over validity. Two groups were tested in this study. Each group was required to be tested before the experimental treatment was administered as well as after treatment. The first group was required to do on-court imagery intervention and another did off-court imagery intervention after pretest was administered. After 12 weeks, the post-test was administered, where the same test was used for the pretest. The experimental treatment was found to be effective for the group which showed improved results. However, the changes might have not been due to the treatment as there were other factors that could affect the results such as maturation, history, and physical training.

3 Instrumentations

3.1 Sport Imagery Ability Measure (SIAM)

The Sport Imagery Ability Measure (SIAM) was used to assess athletes' ability to do imagery in sports [12]. Athletes were asked to imagine four generic sport scenes, each within 60s. Each generic scene consisted of 12 imagery abilities, such as control, vividness, ease of generation, speed of generation, duration, kinesthetic, tactile, visual, auditory, olfactory, gustatory, and emotional.

A 100-mm analog scale was used in SIAM. If a participant had a quite clear image, placing a cross at the 80-mm spot would be scored as 80 points on the scale ranging between 0 and 100. The SIAM revealed alpha values between 0.66 and 0.87 reliability through the validation process.

3.2 Flow State Scale-2 (FSS-2)

The Flow State Scale-2 (FSS-2) assessed the flow state's intensity in one specific activity [3]. Likert scale was used, anchored by 1 which represented 'strongly disagree' and 5, represented 'strongly agree' with 3 as neither 'agree' nor 'disagree.' This 36-item scale yielded an overall flow state factor score as well as nine subscales with four items.

3.3 International Tennis Number (ITN) Manual on-Court Assessment

The ITF International Number (ITN) created by the International Tennis Federation was initially used as an objective method to determine and rate the level of tennis players [13]. It was also a motivational tool for players at all levels to measure their improvement in relation to accuracy and power on their key strokes.

Assessment involved the measurement of serve accuracy, groundstroke depth, groundstroke accuracy, volley depth, and mobility of the subjects. For this study, the assessments involved were serve accuracy, groundstroke depth, and groundstroke accuracy.

3.4 Imagery Intervention

Tennis serves and groundstroke performances were the two common performances integrated into the imagery script [9]. Each imagery session consisted of three parts which involved relaxation techniques, imagery of serves, and imagery of ground strokes. Participants were asked to make themselves comfortable depending on their venue assigned, whether in the court or outside the court. The script consisted of three sequences of important parts of the tennis serve and groundstroke performance. There were pre-shot routines, vital aspects during performance, and performance outcomes.

4 Procedure

Prior to conducting the study, permission as well as ethical approval was obtained from the relevant authorities. Consent letters were obtained from all subjects.

Two weeks prior to the experiment, subjects were notified about the study. The study consisted of pre-intervention and post-intervention phases. Each phase consisted of testing the groundstroke depth and accuracy as well as serve accuracy before competition and measuring the flow state after competition. First, the subjects were given the SIAM questionnaires to measure and identify their ability in imagery. Half of the subjects used on-court imagery intervention. They underwent their imagery intervention on the court as if it was the actual situation or condition when playing tennis. Another half of the subjects used off-court imagery intervention. Instead of being on-court carrying out the imagery intervention, they carried out the intervention in an indoor environment.

The imagery script consisted of three parts which are relaxation, imagery of first and second serves, and imagery of forehand and backhand strokes. In order to enhance all nine flows of dimensions, images of successful and winning performance, together with image of being confidence and in control, were included into the script. There are three important parts of service and groundstroke performance, namely pre-shot routine, vital aspects during performance, and performance outcomes. Imagery was practiced thrice a week over a 12-week period. A systematic literature review on imagery training showed that on average imagery intervention was applied thrice a week over a 34-day period [14]. Subjects were asked to practice thrice a week for a period of 10–15 min. Participants only involved in a tournament during the measurement of flow state. Both flow state and performance measure were collected after 12 weeks during the post-intervention phase.

5 Data Analysis

The purpose of this study was to determine the effect of imagery intervention on-court and off-court on flow state and performance in tennis. Paired *t*-tests were implemented to calculate the statistical differences between the pre-intervention and post-intervention phase. The statistical significance was set at an alpha level $p < 0.05$. All statistical analysis was done using SPSS version 20.0.

6 Results

6.1 Imagery Ability

SIAM scores were typically above 200 points involving control ($M = 382.50$), vividness ($M = 391.25$), ease of generation ($M = 394.38$), speed of generation ($M = 393.75$), visual ($M = 395.00$), auditory ($M = 350.75$), kinesthetic ($M = 396.00$), tactile ($M = 386.88$), emotion ($M = 411.88$) except for olfactory ($M = 198.75$), and gustatory ($M = 190.62$) subscales. These subscales play a minor role in tennis which appears to be less important. Thus, these findings show that the participants' imagery ability was moderately high which allowed them to imagine effectively.

6.2 Flow State in Competition

Table 1 shows the difference in flow state between pre-intervention and post-intervention phase among on-court group. The post-intervention phase ($M = 147.75$, SD = 12.53) reported had significantly higher flow state score than

Table 1 Difference in flow state between pre-intervention and post-intervention phase among on-court group

Flow state	Mean (standard deviation)	Statistical significance (*t*)	Degree of freedom (df)	*P*-value
Pre-intervention	92.50 (15.02)	−12.23	3	0.001
Post-intervention	147.75 (12.53)			

$^*p < 0.05$

Table 2 Difference in flow state between pre-intervention and post-intervention phase among off-court group

Flow state	Mean (standard deviation)	Statistical significance (*t*)	Degree of freedom (df)	*P*-value
Pre-intervention	99.00 (3.65)	−7.78	3	0.004
Post-intervention	139.50 (6.95)			

$^*p < 0.05$

pre-intervention phase (M = 92.50, SD = 15.02), $t(3) = -12.23$, $p < 0.05$. Thus, it showed a significant difference in flow state for on-court imagery intervention.

On the other hand, the post-intervention phase (M = 139.50, SD = 6.95) for the off-court group reported had significantly higher flow state score than pre-intervention phase (M = 99.00, SD = 3.65), $t(3) = -7.78$, $p < 0.05$. There is a significant difference in flow state for off-court imagery intervention as well (Table 2).

6.3 Groundstroke Accuracy Performance

The analysis in Table 3 showed the difference in groundstroke accuracy between pre-intervention and post-intervention phase among on-court group. The post-intervention phase (M = 42.75, SD = 11.44) reported had significantly higher groundstroke accuracy score than pre-intervention phase (M = 35.25, SD = 15.39), $t(3) = -1.52$, $p > 0.05$. Thus, there is no significant difference in groundstroke accuracy for on-court imagery intervention.

As for the off-court group, the post-intervention phase (M = 45.00, SD = 1.63) reported had significantly higher groundstroke accuracy score than pre-intervention

Table 3 Difference in groundstroke accuracy between pre-intervention and post-intervention phase among on-court group

Groundstroke accuracy	Mean (standard deviation)	Statistical significance (*t*)	Degree of freedom (df)	*P*-value
Pre-intervention	35.25 (15.39)	−1.52	3	0.23
Post-intervention	42.75 (11.44)			

$^*p < 0.05$

Table 4 Difference in groundstroke accuracy between pre-intervention and post-intervention phase among off-court group

Groundstroke accuracy	Mean (standard deviation)	Statistical significance (*t*)	Degree of freedom (df)	*P*-value
Pre-intervention	35.00 (5.89)	−3.69	3	0.03
Post-intervention	45.00 (1.63)			

$^*p < 0.05$

phase (M = 35.00, SD = 5.89), $t(3) = -3.69$, $p < 0.05$. This indicates that there is a significant difference in groundstroke accuracy for on-court imagery intervention. It can be concluded that at 5 % level of significance, there is a significant difference in groundstroke accuracy in outside the court imagery intervention (Table 4).

6.4 Groundstroke Depth Performance

The analysis in Table 5 showed the difference in groundstroke depth between pre-intervention and post-intervention phase among on-court group. The post-intervention phase (M = 43.00, SD = 9.38) reported had significantly higher groundstroke depth score than pre-intervention phase (M = 35.25, SD = 15.39), $t(3) = -1.64$, $p > 0.05$. There is no significant difference in groundstroke accuracy for on-court imagery intervention.

As for the off-court group, the post-intervention phase (M = 44.25, SD = 5.38) reported had significantly higher groundstroke depth score than pre-intervention phase (M = 35.00, SD = 5.89), $t(3) = -3.61$, $p < 0.05$. There is a significant difference in groundstroke depth for off-court imagery intervention (Table 6).

Table 5 Difference in groundstroke depth between pre-intervention and post-intervention phase among on-court group

Groundstroke depth	Mean (standard deviation)	Statistical significance (*t*)	Degree of freedom (df)	*P*-value
Pre-intervention	35.25 (15.39)	−1.64	3	0.20
Post-intervention	43.00 (9.38)			

$^*p < 0.05$

Table 6 Difference in groundstroke depth between pre-intervention and post-intervention phase among off-court group

Groundstroke depth	Mean (standard deviation)	Statistical significance (*t*)	Degree of freedom (df)	*P*-value
Pre-intervention	35.00 (5.89)	−3.61	3	0.036
Post-intervention	44.25 (5.38)			

$^*p < 0.05$

Table 7 Difference in serve accuracy between pre-intervention and post-intervention phase among on-court group

Serve accuracy	Mean (standard deviation)	Statistical significance (t)	Degree of freedom (df)	P-value
Pre-intervention	28.25 (15.39)	−1.60	3	0.21
Post-intervention	40.25 (9.38)			

*$p < 0.05$

Table 8 Difference in serve accuracy between pre-intervention and post-intervention phase among off-court group

Serve accuracy	Mean (standard deviation)	Statistical significance (t)	Degree of freedom (df)	P-value
Pre-intervention	30.50 (13.08)	−2.07	3	0.13
Post-intervention	39.50 (11.09)			

*$p < 0.05$

6.5 Serve Accuracy

Table 7 shows the difference in serve accuracy between pre-intervention and post-intervention phase among on-court group. There is no significant difference in serve accuracy in on-court imagery intervention as $p > 0.05$. However, the post-intervention (M = 40.25, SD = 17.61) has the higher mean of the serve accuracy than the pre-intervention phase (M = 28.25, SD = 4.19).

As for the off-court group, there is also no significant difference in groundstroke accuracy for off-court imagery intervention. Post-intervention phase (M = 39.50, SD = 11.09) reported had higher serve accuracy score than pre-intervention phase (M = 30.50, SD = 13.08), $t(3) = -2.07$, $p > 0.05$. Therefore, there is no significant difference in serve accuracy between on-court and off-court imagery intervention (Table 8).

6.6 Mean Difference

Figure 1 shows the mean difference for each variable. For flow state, on-court imagery has a higher mean difference between pre-intervention and post-intervention compared to off-court imagery intervention. Therefore, on-court imagery intervention is more effective than off-court imagery intervention in increasing flow state. However, for groundstroke accuracy and depth, the off-court imagery intervention showed an improvement whereby the on-court imagery intervention increases the mean for the serve accuracy.

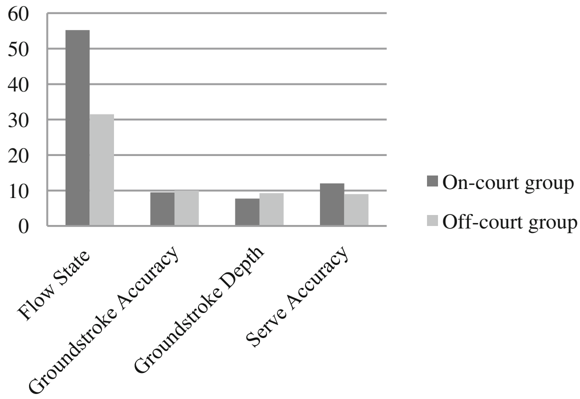

Fig. 1 Mean difference in variables

7 Discussion

This study investigated the effectiveness of an imagery intervention on-court and off-court on flow state and performance in tennis. Performances were measured as an on-court assessment before competition started. The assessment consisted of groundstroke accuracy, groundstroke depth, and serve accuracy. Therefore, performance-wise, for each assessment, differences between pre-intervention and post-intervention phase were identified. By testing the participants' imagery ability, it was discovered that they had sufficient control over their images to use the imagery script effectively.

7.1 *Flow State*

Earlier result showed a significant difference in flow state for both on-court ($t = -7.78$, $p < 0.05$) and off-court imagery interventions. ($t = -0.82$, $p > 0.05$). This finding is similar to the finding of the previous study which proved that cognitive and effectiveness of imagery intervention was able to enhance flow in sports [9]. The increased flow state may suggest that the participants' confidence and preparation is also at optimum level. Reference [4] stated that psychological variables can be controlled as well as improved by applying imagery. Previous studies assessed that preparation and self-confidence as well as readiness to perform had a strong influence on both college and elite athletes' flow state [15, 16]. It is also found that reduced level of anxiety contributed toward improvement, confidence, self-efficacy, and other factors that facilitate flow state [6, 17]. Situational factors could affect the flow state of athletes. In this study, on-court imagery intervention group had a higher mean difference between two phases due to the situational factors that they were facing such as weather and venue [15, 16].

7.2 Performance

Both groups showed significant differences between the intervention phases. For the groundstroke accuracy and the groundstroke depth, there was a significant difference in groundstroke accuracy and groundstroke depth for off-court imagery intervention group. Reference [9] suggested that athletes were able to use imagery effectively as part of their off-court training program. However, there was no significant difference in the on-court imagery intervention group. The results for on-court imagery intervention suggested that the intervention had little effect on the participants' performance. A similar result occurred in a study which found that one of the participants showed a non-significant improvement in completing a 1000-yard practice set after the intervention [7]. A possible explanation for both findings was that maybe the participants had less room for improvement, and thus, no significant difference was observed. Previous research suggested that imagery might be beneficial more in performance for athletes with skills and have a greater room for improvement [18]. The mean of on-court imagery intervention for post-intervention in groundstroke accuracy did increase by 9.75 whereby the off-court increases by 10.00.

As for the serve accuracy, both the intervention groups showed that there was no significant difference. However, there was a mean difference for both groups between the pre-intervention and post-intervention phases. This result can be related to the previous study conducted examined the effect of the motor imagery toward tennis serve performance by comparing the mean and percentage score between pre-training and post-training of the serve [8]. The result showed an improvement in serve accuracy and velocity as well as successful first serve and points won during a match. Reference [9] showed that rather than training, competition could have triggered the relaxation process which could produce stronger differences in flow state as well as performance. Another possible reason why that there was no significant difference in serve accuracy between the pre-intervention and post-intervention phase can be seen through the finding of a study showed that state-oriented participants had higher scores than action-oriented participants in both ground stroke and serve tasks [9]. On the other hand, a similar study found that only action-oriented athletes increased their performance [19]. This indicates that action and state orientation among the participants can influence the differences of outcome of a performance.

8 Conclusion

There are number of conclusions that can be derived from this study. First, it can be concluded that imagery intervention facilitates an increase in flow state and performance. In terms of flow state, the on-court imagery intervention was more effective than off-court imagery intervention. Although both groundstroke accuracy and depth showed a significant difference between the two intervention phases, there is a non-significant difference in serve accuracy.

However, the off-court imagery intervention showed a higher mean difference between pre-intervention and post-intervention phase than the on-court imagery intervention in all the three on-court assessments. In short, on-court imagery intervention is more effective in increasing flow state while the off-court imagery intervention facilitates an increase in performance. Due to the findings, it is advisable to:

1. Include the on-court imagery intervention as part of the training whether before or after field training
2. Include the off-court imagery intervention should be as part of the off-court training program.

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Students' Perceptions Toward Information, Navigation, and Interface Design of Volleyball Learning Courseware

Boon Kiat Lee and Noor Dayana Abd Halim

Abstract The purpose of this study was to investigate students' perception of the information, navigation, and interface design of the volleyball learning courseware. The courseware explains the basic rules of volleyball and three volleyball skills, namely dig, spike, and serve. Elsewhere, the courseware integrates several multimedia elements such as text, graphics, audio, and video to deliver the information to the students. Ninety-two Form 3 students were involved in this research. Overall, the results showed that students agreed and satisfied with the design of the information, navigation, and interface of the courseware able to enhance the teaching and learning quality.

Keywords Courseware · Volleyball · Navigation · Information · Interface design

1 Introduction

Educational technology and multimedia play an important role in delivering information and materials to students in the classroom [1]. Cutting [2] pointed out that interactive multimedia such as interactive courseware can be a very powerful learning tool when used in the right way. The integration of educational technology and multimedia in the process of teaching and learning in schools is attractive and effective in terms of the transfer of information or knowledge to students. This statement was supported by Teoh and Neo [3] that students can be engaged in learning when teachers integrated interactive courseware in teaching and learning process. Some researchers also believe that educational technology and multimedia can help the teacher to achieve the objective of the lesson because these technol-

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ogies afford teachers the ability to convey concepts in new ways that would otherwise not be possible, efficient, or effective with other instructional methods [4].

Educational technology includes all the equipment and materials that are used for the purpose of presenting and supporting learning during the teaching process [5]. Moreover, Malik and Agarwal [6] defined educational technology as an assortment of tools that might prove helpful in student-centered learning, problem-based learning, or case-based learning. These definitions indicate that educational technology allows the process of teaching and learning to become more effective and efficient. This process is also referred to as computer-assisted learning.

Today, computer-assisted learning is not an uncommon phenomenon in the education arena in Malaysia [7]. During class, teachers use interactive courseware to teach in subjects such as mathematics, science, history, English, Malay, and Chinese. However, the use of interactive courseware to teach the physical education syllabus in Malaysia (Integrated Curriculum for Secondary Schools) is still limited [1, 7]. Yet, interactive courseware can be very helpful in the teaching and learning process during physical education classes because the interactive courseware is able to provide proper guidance and instruction to avoid unnecessary injury.

2 Background of Problem

A lot of previous research has shown that the integration of technology in education is able to have a positive effect on teaching and learning [8]. During the teaching and learning process in Malaysia, teachers are supposed use the materials provided by the government, including application software for subjects such as science, mathematics, English, and Malay. However, teachers still use the traditional chalk-and-talk method to teach their students [1, 3, 9]. Mork [10] stated that integrated technology in the classroom has the potential to make the school syllabus become more relevant, interesting, and motivating for students. Unfortunately, there are few physical education courseware materials available in the market and teachers are not easily find or develop courseware by themselves which is related to this field and apply it to teach in class.

Physical education is an important area of study because it has a lifelong impact on students by guiding them to adopt positive behaviors such as the undertaking of physical activities to build a healthy body [7, 11]. Physical education also integrates the development of physical, social, intellectual, and spiritual aspects of each student [7]. Despite these benefits, schools tend to be less focused on physical education than on other subjects. Physical education may be seen as a minor subject because the teachers are not masters in all the sports that are covered in the syllabus and tend to teach the subject based on their personal experiences or through their teacher training program [12]. In Malaysia's physical education syllabus, a teacher is required to teach a few types of sport such as basketball, football, or volleyball during the class, but the teachers often do not have the knowledge or skill to teach their students how to dribble the ball in basketball, how to dig in volleyball, or how to make a header in football. Consequently, both teacher and student will be less interested to teach or be involved in sport.

To prevent this situation from getting worse, some teaching methods and approaches need to change so that teachers can improve the teaching efficiency and increase the knowledge of healthy physical and psychological development among students [11]. Yuzhong [11] argued that, compared with the traditional teaching method in physical education, the use of multimedia courseware in teaching improves the teaching effect and delivers a lot of information to students. A good courseware product with the right combination of multimedia elements such as text, graphics, video, audio, and animation can influence the way students learn, increase their interest, improve their performance, and affect the learning environment [7].

Although the Malaysian Government provides courseware to schools for teaching and learning purposes, there is a lack of courseware in several subjects including physical education. The students are only able to learn the theory of sport skills through the textbooks which are provided by the government. Some topics need to be practiced in the field, such as volleyball. Teachers need to demonstrate the volleyball skills to the students, but there is a lack of courseware that can assist teachers to demonstrate the correct actions and movements that should be followed in volleyball. In addition, the individual teacher may be an expert in another sport and may not have any knowledge about the sport of volleyball, so those teachers can use the courseware to teach the students before doing the practical part.

3 Methodology

This research consisted of two phases in the methodology process, which is the design and development phase and implementation and evaluation phase. The instructional design model and learning theory were chosen to be implemented in the proposed multimedia courseware. The instructional design model allowed the progress of developing the courseware to be monitored to ensure the courseware would be able to solve the problems that occur during physical education classes. Once developed, the courseware was utilized by teachers and evaluated following a physical education class.

3.1 Design and Development Phase

According to Morrison [13], the goal of instructional design is to make learning more effective, less difficult, and more efficient. In this research, the ADDIE model was used as an instructional design model to develop the courseware. This model consists of five phases: analysis, design, development, implementation, and evaluation. The ADDIE model phases were followed to develop the courseware because a systematic design procedure can make the instruction more effective and efficient [13]. Besides, the multimedia elements such as audio, graphics, text, and video were integrated into courseware so that students as the users would be able to obtain the information in the most effective way.

3.2 Implementation and Evaluation Phase

The developed courseware was implemented to 92 of Form 3 students. Before the teacher used the courseware in the classroom, the researcher demonstrated how to use it. The content was explained to the teachers to make sure they understood the content and would be able to deliver the correct information to the students. The students were asked to complete a questionnaire when the lesson finished. The questionnaire consisted of a number of statements presented in three sections which is information, navigation, and interface design. The Likert scale was used to represent the perceptions of the students by asking them to rate their agreement with the statements, with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

In the evaluation phase, all the data collected from the questionnaire was analyzed using the Statistical Package for the Social Sciences (SPSS) version 16 software. The ratings given by the students were analyzed to become descriptive data based on the means.

4 Finding and Discussion

The first part of the questionnaire was related to the sample's demographic details. There are 35 male and 57 female students involved in this research. The majority of students in the sample (71 out of 92) had no experience in playing volleyball. 12 male students and 9 female students had experience in playing volleyball. Among the students who had no experience in playing volleyball, there were 23 male students and 48 female students.

There were 30 questions in the second part of the questionnaire which include 10 questions for each design. The data were analyzed using the descriptive analysis method which is based on the mean of the responses to the items. Subtopics below discussed the findings for the three types of design.

4.1 Students' Perception of Information Design

Table 1 shows the average mean of students' responses on information design in courseware. The findings from the questionnaire showed that most of the students agreed that the content was presented through a variety of methods including

Table 1 Average mean of students' responses on information design in courseware

No.	Item	Mean	Std. deviation
1	The content meets the goals and objectives	3.96	0.71
2	The content is structured in a clear and understandable manner	3.99	0.83
3	The content is easy for users to understand	4.14	0.72
4	The content is enough to inform users about volleyball skills	4.01	0.79
5	The vocabulary is relevant to learners' ability	3.89	0.90
6	The content is presented through a variety of methods (graphics, text, and video)	4.32	0.89
7	The content is able to maintain users' attention throughout the courseware	3.66	0.86
8	The video is able to enhance the level of understanding of volleyball skills	4.15	0.86
9	The video demonstrates relevant content/skills to users	4.13	0.74
10	The content is able to increase the users' knowledge of volleyball	4.23	0.79
	Total mean	4.05	0.81

graphics, text, and video. Cairncross and Mannon [14] claimed that the learning process can be enhanced through integrating multimedia as it provides users control over the delivery of information and supports interactivity.

However, the students were neutral regarding the construct that investigated whether or not the content was able to maintain users' attention throughout the courseware. Based on the comments made by the students in the questionnaire, the students believed that the facilities in their schools needed to be improved in order to facilitate better presentations. This statement supported by [15] that learning assistance tools can increase engagement in the learning process. This is because

Fig. 1 Skill page of the volleyball courseware

the better technological facilities such as projectors and sound systems are able to present better quality courseware. Some projectors may decrease the quality of the color and video when the courseware is projected on the screen. In addition, the sound of the courseware cannot be heard properly when the sound system is not functioning well. In conclusion, the students agreed that the information in the courseware was useful for learning volleyball rules and skills. Figure 1 shows main menu for this courseware which covered three volleyball skills, namely dig, spike, and serve.

4.2 Students' Perception of Navigation Design

Navigation is important to engage the students in learning and encourage them to keep exploring the courseware. Based on Table 2, the results of the study showed that the students agreed that the help page in the courseware was useful to explain the function of each button.

The help page consists of an explanation of the function of each button, so the students will not get lost while using the courseware. Su and Klein [16] pointed out that navigation tools increase navigation efficiency, reduce the feeling of being lost, improve learning performance, and encourage better learner navigation patterns. Moreover, navigation tools such as indexes, content lists, and concept maps are usually presented to the user in order to show them an overview of the structure [16]. Figure 2 depicts the help page in the courseware.

Table 2 Average mean of students' responses on navigation design in courseware

No.	Item	Mean	Std. deviation
1	The buttons are easy to understand	4.04	0.84
2	There is a content map key to make it easy to see the list of options available	3.99	0.85
3	The courseware has consistent tools for navigation	3.75	0.81
4	It is easy to find the button for moving forward and backward in a lesson	4.11	0.94
5	The courseware can be exited at any time	3.73	1.04
6	The instructions in this courseware are clear	4.01	0.88
7	The help button is useful to explain the function of each button	4.08	0.87
8	The user is able to access the menu page at any time	3.98	0.88
9	The courseware is easy to navigate with buttons	4.01	0.82
10	The buttons (links) are free of errors	3.97	0.92
	Total mean	3.97	0.89

Fig. 2 Help page of the volleyball courseware

4.3 *Students' Perception of Interface Design*

Table 3 illustrate average mean of students' responses on interface design in courseware. The results showed that the students agreed that the video in the courseware was suitable for the information provided.

The video was placed at the end of each subtopic on skills. The purpose of viewing the video at the end of each subtopic was to recap the skills learned from the previous notes. This is because Ilin et al. [17] pointed out that video can facilitate learning by appealing to different senses via sound, image color, and shape at the same time. Video is also able to attract the students' focus on specific details based on the prepared material [18]. Figure 3 shows one of the examples of video integrated in this courseware.

Among the items investigated in the questionnaire, the students did not unilaterally agree that the sound in the courseware was good quality. The students suggested that the sound quality should be improved. As mentioned before, audio is

Table 3 Average mean of students' responses on interface design in courseware

No.	Item	Mean	Std. deviation
1	Screen is well laid-out with a combination of text and graphics	4.01	0.88
2	Effective use of colors and design elements	4.09	0.90
3	The design uses proper fonts (style and size)	4.17	0.78
4	The presentation of information can attract the attention of users	3.91	0.95
5	The quality of the image is clear	3.72	1.16
6	The use of graphics supports the meaning of the text	4.14	0.83
7	The video enhances the presentation of information	4.21	0.88
8	Video is suitable for the information provided	4.24	0.76
9	Sound is good in quality	3.34	1.28
10	The integration of multimedia features (graphic, text, video, and audio) is well coordinated	4.20	0.94
	Average	4.25	0.94

Fig. 3 Video page of the volleyball courseware

a multimedia element that affects the learning quality. The efficient integration of audio in teaching is able to create a better learning environment and also can attract the users' attention to the information being presented [5].

In conclusion, it is clear that video and audio are important components in the teaching and learning process that integrates multimedia. Video and audio are used in the classroom to encourage the learning process and make the process easier and interesting. Furthermore, video and audio provide the learners with realistic experience, while capturing their attention and helping the understanding of the historical phenomena [19].

5 Conclusion

This research attempted to develop a multimedia courseware related to volleyball skills (dig, spike, and serve) and to investigate the perceptions of students regarding the information, navigation, and interface design of the courseware. The findings of this research support the conclusion that the students were satisfied with three designs in the courseware. The results indicated that the students showed a positive perception toward the multimedia courseware and they agreed that teachers should consider applying this teaching method in class to enhance the students' performance and the teaching quality in physical education subject. The use of multimedia interactive courseware for teaching and learning is able to enhance students' motivation, learning style, quality of teaching and overcome the time constraint factor. In addition, multimedia interactive courseware can help teachers conduct effective, interesting, and fun lessons that increase students' motivation. Therefore, the integration of learning courseware especially in learning physical education is beneficial to teachers and students.

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Body Image Perception and Physical Activity Among Female Adolescents

Amirah Zaker and Azila Azreen Md Radzi

Abstract Body image is the dynamic perception of one's body, which can be either positive or negative. It was believed that perception of physical appearance predicts physical activity level. Dissatisfaction of body image has the potential to influence physical activity participation rates in a positive way. Thus, a study was conducted to determine the relationship between body image perception and physical activity among female adolescents. A total of 100 female adolescents, aged 14 and 15 years, were recruited for this study. Body image perception and level of physical activity were measured by using Contour Drawing Rating Scale and Physical Activity Questionnaire for Adolescents (PAQ-A), respectively. A significant difference was shown between the group of participants and the level of physical activity (χ^2 = 36.67, p = 0.00) with normal-weight participants who were physically active compared to the overweight group. Similarly, there was also a significant difference between group of participants and body image perception (χ^2 = 7.92, p = 0.01). It was reported that the normal-weight participants had a higher degree of body image dissatisfaction compared to overweight participants. Moreover, a linear positive correlation with lower relationship was found between body image perception and physical activity (r = 0.26, p = 0.01). Participants who dissatisfied with their current body image were more likely higher in physical activity level due to the desire to lose their body weight. Therefore, body image intervention programmes among children and adolescents should be implemented to prevent overweight and obesity problems.

Keywords Body image perception · Physical activity · Female adolescents

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1 Introduction

Nowadays, overweight and obesity have been considered as one of the major health problems faced by people from all around the world and have reached an alarming stage with 2.8 million of people who suffered from overweight or obese were died [1, 2]. In previous years, overweight and obesity usually occurred in developed countries, but now, it was already spread to the developing countries [3, 4]. A study conducted by Journal of British Medicine reported that Malaysia was in the first rank among Asian countries and ahead of South Korea, Pakistan and China with 45.3 % of the population who were getting overweight and obesity problems [5]. Currently, the overweight and obesity problems were affected not only adults, but also children and adolescents. In the United States in 2012, the statistics of obesity among children aged between 6 and 11 years increased from 7 to 28 % and it was also found that for adolescents aged 12 to 19 years the statistics increased to 21 % [6]. Obesity is referring to those people who are having a greater and abnormal accumulation of fat, and they have higher possibilities to suffer chronic diseases such as heart diseases, stroke, hypertension and some kinds of cancer [4].

Apart from the several factors that lead to the overweight and obesity problems, which are unhealthy eating behaviour, genetics and lack of weight management knowledge, previous studies have proved that sedentary lifestyle and misperception towards body image were also contributed to this issue [3, 7]. Decline in physical activity involvement had been seen, especially among children and adolescents [8, 9]. According to previous studies, decline in physical activity among female adolescents was reduced by 7.4 % per year [3]. Besides that, relationship between involvements in physical activity with body weight status had been shown by several researches. Children and adolescents who experienced overweight had low physical activity level compared to normal-weight group [10]. Adolescents who were highly active physically were influenced by several motivation factors, including health benefits, enjoyments, stress reduction and perception towards body image [11]. It was supported that adolescents who frequently involved in physical activity were more likely dissatisfied with their body image and desire to change their body shape to get the ideal of body image [12, 13]. According to a previous study, young girls were more motivated to participate in physical activity because of the desire to achieve and maintain the slim body shape [14].

Perception of body image plays an important part and motivation in the body weight management especially among adolescents [3]. This is due to the understanding of adolescents regarding their current body weight to either reduce the excess weight or maintain their normal weight. Adolescents especially female were more concerned with their body weight during puberty since their physical body parts were changing and how the perception of other people towards their body weight and shape [15]. Body image can be defined as the way a person evaluates their current body weight or shape as underweight, normal weight or overweight from their actual body mass index (BMI) [2]. It might influence self-esteem and self-confidence of the individuals. The misunderstanding about body image can lead to negative consequences such as eating disorders, depression, social anxiety and poor self-esteem [16, 17]. A previous study also revealed that the most contribution of being overweight and obesity is body image dissatisfaction [18]. The study that conducted among adolescents aged between 11 and 13 years found that adolescents who were overweight and obese had a misperception on their current body image and felt that they were in the normal range of body weight but actually they were not [19].

Besides that, healthy or overweight adolescents who judge themselves as overweight are more tend to physically act as desire to lose their weight rather than overweight adolescents who are not judged by themselves as overweight and might not engage in weight reduction activities [2]. Adolescents who dissatisfied with their body weight tend to involve in physical activity regularly to reduce their body weight compared to those who were satisfied with their body weight [14]. A study that was conducted among female students in Kaunas also showed that 45.2 % of them were engaged in physical activity due to the image improvement factor [20]. Thus, by engaging in physical activity, they are not only improve body health condition, but also able to burn the excessive fats for energy production which might reduce their body weight [21]. However, adolescents who already satisfied with their current body image and did not have any intention to lose or gain weight were found to have less physical activity [14]. It was also reported by [3] that adolescents who satisfied with their current body image were always feel that they had a healthy body weight category even though they were not. As a consequence, they were withdrawn from physical activity due to undesire to lose the body weight. Thus, as a body image perception plays an important role in body weight management and prevents from the negative effects towards health conditions, the purpose of this study was to determine the perception towards body image and levels of physical activity involvement among female adolescents.

2 Method

2.1 Participants

A total of 100 female adolescents aged 14–15 years (M = 14.48, SD = 0.51) participated in this study. Participants recruited were regarded on the permission from the parents or guardian to participate in this study. The study obtained the approval from the Research Ethics Committee of Universiti Teknologi MARA (UiTM) Malaysia, Ministry of Education and State Education Department of Kedah. However, participants were permitted to withdraw at any point in proceeding.

2.2 Body Image Perception

The body image perception was determined using the Contour Drawing Rating Scale [22] with the reliability $r = 0.78$ [23]. This Contour Drawing Rating Scale consists of nine silhouette drawings of female figures that range from underweight, normal weight, overweight to obese. Each silhouette was given a score of 1 which is categorized as the thinnest until 9, which is the biggest body size. In order to determine their body image perception, participants need to choose two silhouettes that represent their current body shape and their desired body image, respectively, in the same Contour Drawing Rating Scale. Body image discrepancies score was calculated by subtracting ideal body image score from current body image score. The degree of body image perception was shown by this score. The participants who had a zero total discrepancy score were categorized as satisfied with their body image while positive or negative total discrepancy score showed they were dissatisfied with their body image.

2.3 Physical Activity

The Physical Activity Questionnaire for Adolescents (PAQ-A) [24] was used to determine the level of physical activity among female adolescents. It was reported to have higher reliability, $r = 0.70$ [25]. The PAQ-A consisted of nine items which measured their physical activity that had been done in the past seven days. It consisted of five-point scale in which lower score, which is 1, indicates low physical activity and higher score, 5, refers to high level of physical activity. The level of physical activity was categorized into low, moderate and high based on their overall mean score of the eight items. Additionally, they were given 15 min to answer the questions and were not allowed to discuss with other participants. The participants were considered as finished with this test when all the questions were answered.

2.4 Data Analysis

Data were analysed using the Statistical Package for Social Sciences for Windows version 20.0. Descriptive statistics were used to describe the mean and standard deviation for body height, weight, age, BMI, physical activity score and body image perception score. Chi-square test of independence was conducted to compare group differences, and Pearson's correlation test was done to determine the relationship between the variables. Statistical significance was set at $p < 0.05$.

3 Results

3.1 Demographic Characteristics

Normal-weight participants were aged 14 and 15 years with a mean age of (M = 14.48, SD = 0.51) years and (M = 14.62, SD = 0.49) for overweight participants. The mean body height for normal weight was (M = 1.54, SD = 0.06) while that for overweight was (M = 1.55, SD = 0.05). In terms of body weight, mean for normal weight was (M = 48.28, SD = 4.48) and that for overweight participants was (M = 59.94, SD = 6.31). Moreover, the mean for BMI showed that, normal weight with (M = 20.29, SD = 1.28) and (M = 24.94, SD = 1.64) was overweight (refer Table 1).

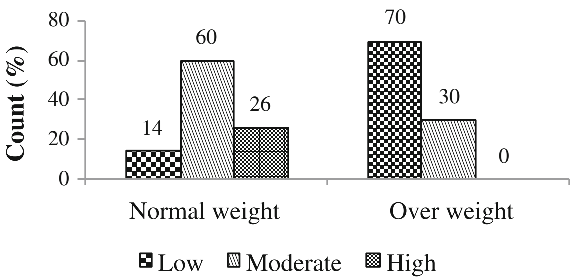
3.2 Physical Activity

The mean physical activity score showed that all the participants were in moderate levels of physical activity (M = 1.71, SD = 0.69). Normal-weight participants were significantly more active in physical activity than overweight participants (χ^2 = 36.67, p = 0.00), and normal-weight participants (60 %) were classified in moderate levels of physical activity compared to the overweight participants (30 %). Majority of the overweight participants (70 %) were in low level of physical activity while only 14 % of the normal-weight participants were in low level of physical activity. Moreover, normal-weight participants (26 %) were classified in high level of physical activity while none of the overweight participants were categorized in this level (Fig. 1).

Table 1 Demographic data

Variables	Normal weight Mean (SD)	Overweight Mean (SD)
Age	14.48 (0.51)	14.62 (0.49)
Height	1.54 (0.06)	1.55 (0.05)
Weight	48.28 (4.48)	59.94 (6.31)
Body mass index (BMI)	20.29 (1.28)	24.94 (1.64)
Physical activity score	2.12 (0.63)	1.30 (0.46)
Body image perception score	1.70 (0.46)	1.40 (0.50)

Fig. 1 Comparison of physical activity between groups



3.3 *Body Image Perception*

There was a significant difference in body image perception between normal-weight and overweight participants ($\chi^2 = 7.92$, $p = 0.01$) with more normal-weight participants (70 %) than overweight (40 %) were dissatisfied with their current body image. However, only 30 % of normal-weight participants were satisfied with their current body image compared to overweight participants (60 %). Thus, with the mean ($M = 1.55$, SD = 0.50), overall participants showed that 55 % of them desired to gain or lose the body weight while 45 % desired to maintain their current body size (Fig. 2).

3.4 *Relationship Between Body Image Perception and Physical Activity*

There was a significant linear correlation between body image perception and physical activity ($r = 0.26$, $p = 0.01$) (refer Table 2). Therefore, adolescents who were not satisfied with their current body image tend to be more active in physical activity compared to those who satisfied with their current body size.

Fig. 2 Comparison of body image perception between groups

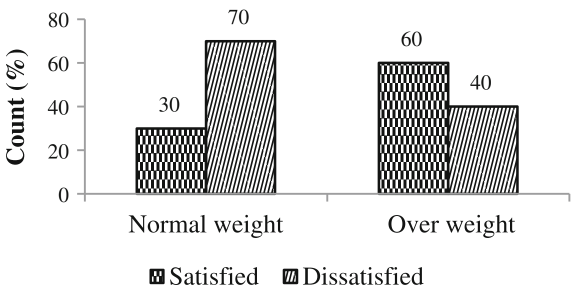


Table 2 Relationship between body image perception and physical activity

	r-value, *p*-value	
Variables	Physical activity	Body image perception
Physical activity	–	0.26, 0.01
Body image perception	0.26, 0.01	–

4 Discussion

The purposes of this study were to determine the body image perception and physical activity and the relationship between both variables among female adolescents. The finding of this study is that there was a significant difference between normal-weight and overweight groups on body image perception. Results showed that normal-weight participants had a higher degree in discrepancy score of body image perception compared to overweight participants. This means that adolescents who were classified as normal-weight category were dissatisfied with their current body image compared to the overweight group and believed that they were in overweight category although they were not. Researches on female adolescents also revealed that majority of them had higher body image dissatisfaction and desired to look thinner even though they were already categorized as underweight or normal weight [23, 26, 27]. Similarly, a previous study stated that 16.7 % of overweight or obese adolescents were not to lose or gain their weight while 48.8 % of normal-weight participants selected the thinner silhouette and wanted to reduce their body weight [28].

Moreover, there was a significant difference in physical activity among normal-weight and overweight participants where the normal-weight participants were more physically active and classified in high and moderate levels. Meanwhile, only 30.0 % of overweight participants were considered as moderate level in physical activity, and none of them were in high level. Majority of the overweight participants were found to be in sedentary lifestyle. This study was in line with a previous study where the adolescents who have high BMI status were less in physical activity participation compared to those who had normal BMI status [29]. Furthermore, in the study that conducted among Italian adolescents, more overweight students were less in physical activity compared to normal-weight students and most of their leisure time was spent for watching the television and in front of the computer without engaged in any physical activity [30].

Body image perception and physical activity of female adolescents were also found to be significantly correlated. However, the correlation had shown that there was a low relationship between both variables. It might due to the disability of the participants to evaluate their correct current body size and lack of knowledge on the importance of physical activity. This revealed that dissatisfied adolescents tend to be more physically active than satisfied adolescents due to some intention and desire to lose their body weight and improve their body image. It was also supported by a previous study that there was a strong significant correlation between body image and physical activity. It showed that those adolescents who had a higher body image score were also higher in physical activity score [20].

Adolescents were more motivated to involve in physical activity because of the factors of weight management and to get a better appearance, health and mental condition [31]. Basically, based on Motivation Theory, adolescents will perform the certain task or behaviour if they had the intention or desire that might lead to the increase in their self-satisfaction. Previous and recent studies had found that young girls were more motivated to participate in physical activity because of the desire to achieve and maintain the slim body shape [14]. It was supported by [12] and [13] that adolescents who frequently involved in physical activity were more likely dissatisfied with their body image and desire to change their body shape and to improve the appearance. In a study of Mauritians teenagers, 3.8 % of the participants who tried to lose weight were involved in physical activity for 1 h daily [2]. Moreover, another study found that adolescents who had higher levels of physical activity were those who had higher body image dissatisfaction due to their desire to get the ideal body shape and maintain the normal range of body weight category [32].

In the satisfied group, they were not physically active because most of them believed that they were already having a healthy body weight and did not realize regarding the later bad risks towards their health condition. Thus, they felt that no need for them to involve in physical activity which might bring many benefits to them [14]. Besides that, adolescents who satisfied with their current body image have reported in low level of body weight management knowledge compared to dissatisfied group [3]. Thus, it might bring the incorrect knowledge regarding body weight loss practice to them, and they always feel that they are in a healthy body weight category even though they were not. Additionally, study among Taiwanese adolescents also showed that adolescents who were always satisfied with their current body image had lack of knowledge regarding body image perception and importance of physical activity involvement where most of them believe that by spending a lot of time in front of the computer, it can burn their calories and fats without need to engage in physical activity movement [9].

Other than that, adolescents who had a higher feeling of dissatisfaction and overly concern about their current body image might increase their self-esteem and self-confidence level when involved in physical activity. This is due to the benefits of physical activity which can improve the mental and physical health by reducing the anxiety, stress and depression level. Thus, it can lower the feeling of high concern about the body image and at the same time might correct the misperception towards their current body image [21]. Hence, it can be concluded that body image perception plays an important role as a motivator to influence female adolescents to be active in physical activity and maintain a healthy lifestyle in their daily life.

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Comparison of Body Fat Percentages and Power Among Male Boxers Based on Winner and Non-winner

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Abstract Boxing is a contact sport where the boxers use both hands to gain point by punching to a target area. There are variety of fitness components embedded in the training of defining good boxers such as body composition, speed, strength, coordination, and power. The purpose of the study was to identify the profiling of male boxers and comparing the body fat percentages and power among winner and non-winner male boxers. Thirty-five male boxers who represented their state in the National Youth Boxing Tournament possessed the following body composition, $n = 35$; mean height 168.00 (±6.03) cm; weight 59.49 kg (±10.12); and BMI 21.01 (±2.93). Several tests were conducted in the following sequence (i) weight and height measurement; (ii) skinfold test; and (iii) Vertec power test. Results showed no significant difference ($p > 0.05$) among the winners and non-winner boxers, and for power, there was a significant difference of ($p < 0.05$) among winners and non-winner boxers. It is concluded that the body fat percentage did not show any significant difference among the winners and non-winner boxers in terms of power, whereas there was a significant difference among the winners and non-winner boxers. To be a sound boxer, it requires good fitness attributes as demanded by the nature of boxing. This study will be a contribution to the physiological profile of Malaysian boxers.

Keywords Boxing · Body composition · Power · Winner · Non-winner

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1 Introduction

Boxing is a combat sport which requires courage, speed, strength, power, accuracy, and passion. These fitness components are the essentials needed in creating champion boxers. Physical stamina is another attribute which is required in producing the continuous physical energy demand over many rounds of a boxing tournament. Hence, body composition, physical fitness, and skills are to be optimized and used together in contributing the development of a great boxer. That is why body composition and physical fitness are important to be developed and increase the performance of the fighter. By measuring the physiological and anthropometric criteria combined with the proper training through the discovery of talent, strength, and weakness, these may avoid the wastes of assets or resources [1]. The connection between characteristic and performance of the athletes was crucial in order to find the strength and weakness which affect the performance of the athletes [1]. Data obtained from specific tests in this study which were suited with the nature of boxing could lead to the appropriate development in boxing where the potential for boxing sport to be successful is high.

Body fat percentage becomes the significant contributor especially in evaluating the fitness of the player [2]. It shows that boxers who have less body fat percentage might have higher fitness level compared with boxers with a higher fat percentage. The successfulness in most sports is significant with the low relative body fat compared to the high relative body fat where it would not improve the efficiency in force and energy production that could subsequently lead to decrease in relative strength [3]. There is a belief in the ancient times where success in sport is highly related with a good physical attribute [2]. Boxing is a sport where the fighters compete according to the category distinguished by the body weight. Proper body weight gives advantage toward the boxer where they are able to deliver an optimal performance. In order to build a good boxer, body composition needs to be well combined with other fitness components such as speed, strength, and power [4]. Lack of power might cause the boxers to be inefficient in performing certain moves such as to plunge for a punch at the opponent, to be in a stable fighting stance, and to move around the ring. Besides that, power also assists in delivering a great punch since power is a combination between speed and strength. According to [5], it was found that leg power stabilizes a boxer's fighting stance.

Study conducted by [6] illustrated that there are various techniques or methods in order to improve the speed, strength, and power, and training the boxers should incorporate enough intensity and effort to aid in increasing a boxer's performance in a match. Martial art athlete tends to develop the motor abilities in terms of flexibility and vertical jump after being provided with intervention or training program [5]. Therefore, the researcher was enthralled to acquire and study the profiling of Malaysian boxers which could be significant in recognizing the potential of boxers to be a champion. Besides that, the researcher was also interested to seek on the differences of fitness components of the winner and non-winner boxers of the Malaysia National Youth Boxing Tournament. With these findings, it would help the Boxing Association to recognize the ideal fitness components of a winner for the international and the world-class level.

2 Methodology

2.1 Research Design

An ex-post facto was employed to discover whether the data contain any differences in terms of physical attributes which may affect the groups' results later. The subjects underwent skinfold test purposely to measure body fat percentages and vertical jump test to measure lower limb power of the boxers. These were the quantitative parts of the study and permitted the researcher to boost the collection of data regarding the body composition and power among winner and non-winner boxers.

2.2 Study Population

A purposive sampling method was employed for this research. Boxers who participate in competitions were recruited by the Malaysia Amateur Boxer Association, Persatuan Tinju Amatur Malaysia (PTAM), to represent Malaysia and compete at the international level. The population for this study is taken from these boxers. Eighteen ($N = 18$) gold and silver medalists, considered as winners, and seventeen ($N = 17$) bronze medalists, considered as non-winners, were selected to contribute in this study. The boxers have competed in the Malaysia Youth Boxing Tournament and had undergone the training program with their chosen state coaches.

2.3 Data Collection Procedures

The researcher gave an enlightenment of the purpose of the study, and a short explanation of the tests that would be conducted, and the state boxing organization and the researcher came into consensus on the terms and conditions which were applied to both parties. To begin the collection of data, the researcher again gave a brief explanation to the subjects on the purpose of the study and the tests that he would conduct before the consent form and the physical activity readiness questionnaire (PAR-Q) Malay version [7] were distributed to the subjects. The participation of the subjects in this study was on a voluntary basis, and a subject had the right to withdraw at any time he wished, by informing the researcher and the coach of his intention to withdraw.

The subjects were divided into two groups, 17 non-winner boxers and the 18 winner boxers. All the boxers who successfully reached the semifinals were tested. The subjects underwent the entire test required accordingly and started the tests of weight, height, skinfold test, and vertical jump. The weighing session for the boxers determined the category in which the boxers competed in the tournament. The tests were held in a hall that was deemed to be an applicable area for the tests to be executed.

The anthropometric measurements consisting of the weight and height of the boxers were measured using a SECA electronic scale 7802321134, made in Germany, and a SECA 206 wall mounted measure, made in Germany. The body fat percentages were measured using Harpenden skinfold caliper. Skinfold caliper was used to measure the four sites of skinfold selected on the right side of the subjects which were the biceps, triceps, subscapular, and suprailiac. Besides that, lower body muscular power was measured using vertical jump device (Vertec).

2.4 Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (version 19.0 for Windows, SPSS Inc., Chicago, IL, US). *T* test was used to assess comparisons between winner and non-winner boxers. Nonparametric test (Mann–Whitney *U*-test) was used to determine whether the distribution of the tests was not normal. The significance level was set at $p < 0.05$.

2.5 Ethical Approval

The collection of data started once the endorsement for them had been given by MARA University of Technology (UiTM) ethics board. Upon the reception of the approval from the ethics committee, the researcher embarked on his study by approaching each state boxing organization with an official letter to seek permission to work and to collaborate with the boxing organization. A letter of approval from the faculty of Sports Science and Recreation was attained before the researcher approached the boxing organizations.

Table 1 Descriptive statistics for age, weight, height, and BMI of winner and non-winner boxers

Variables	Winner n = 18	Non-winner n = 17
Age (year)	19.22	19.06
Weight (kg)	60.62	59.08
Height (cm)	168.67	168.23
BMI (kg/m^2)	21.18	20.83

3 Results

3.1 Physical Characteristics

The mean age of the winners was 19.22 years, higher than the mean age for the non-winners, of 19.06 years. The mean weight of the winners was 60.62 kg, and the mean weight of the non-winners was slightly lower, at 59.08 kg. The mean height of the winners was 168.67 cm, which was higher than the mean height of 168.23 cm for the non-winners. The mean body mass index (BMI) of the winners was 21.18 kg/m^2, which is higher than the mean BMI for the non-winners of 20.83 kg/m^2. Table 1 shows the descriptive statistics for age, weight, height, and BMI of winner and non-winner boxers.

3.2 Body Fat Percentages Between Winner and Non-winner

As shown in Table 2, the mean score of the winner (M = 14.22) is slightly lower than non-winner (M = 14.70) in terms of the body fat percentages. The results of t test yielded a t value of 0.359 which was not statistically significant at $p > 0.05$. The result indicated that statistically there was no significant difference in body fat percentages between winner and non-winner boxers.

Table 2 Independent sample t test of body fat percentages based on winner and non-winner boxers

Group	N	Mean	SD	t value	P	Df
Winner	18	14.22	4.69	−0.359*	0.722	33
Non-winner	17	14.70	2.97			

*refers to p value in t test analysis. $p < 0.05$

Table 3 Independent sample *t* test of power based on winner and non-winner boxers

Group	*N*	Mean	SD	*t* value	*P*	Df
Winner	18	41.22	4.10	4.054*	0.000	33
Non-winner	17	35.59	4.12			

*refers to p value in t test analysis

3.3 Power Between Winner and Non-winner Boxers

As shown in Table 3, the mean score for the power of the winner ($M = 41.22$) is higher than non-winner ($M = 35.59$). The results of t test yielded a t value of 4.054 which was statistically significant at $p < 0.05$. The result directed that statistically there was significant difference in power between the winner and non-winner boxers.

4 Discussion

Based from the findings, the mean body fat percentages of non-winner are slightly higher compared to the winners. However, the first hypothesis regarding the body fat percentages does not indicate any significant difference. The findings specified that most of the boxers are conscious about their body weight since the body fat percentages showed no significant difference among winner and non-winner boxers who participated in the National Youth Boxing Tournament. This finding showed no significant difference perhaps due to the most of the boxers who are aware about their the body weight since boxing is a sport where the fighters have to compete permitting the specific body weight range. The boxers have to reduce weight in many ways in order get the ideal body weight that suits with the height to become a good boxer. The first hypothesis on the body fat percentages of the winner and non-winner contradicted with the previous study where body fat percentages showed the significant difference between boxers [8]. The finding's difference might be due to the greater number of body fat percentages of the fighters. Immense changes in body fat percentages could happen because of the training period since the first day the boxers joined the training.

Previous study by [2] found that there was no significant different in body fat percentages among senior and junior boxers and this had indicated the connection to the study done by the researcher. It also showed some similarities to the study done by the researcher. This might be due to the maintenance of the body weight in order for the boxers to compete according to their suitable respective body weight. Boxers prefer to lose weight by doing the long duration exercise such as running, swimming, cycling, and skipping where the duration basically takes longer than 30 min. Moreover, the boxers are very conscious about the meal they consume in order to avoid the buildup of fat under the adipose tissue. Furthermore, combining the proper training program and proper meal allowed the boxers to have the lean muscle mass compared to the body fat mass.

Power is the ability to achieve great movement velocities required to skillfully force a movement in a shortest possible time since it is a combination between speed and strength. Basically, there are two mechanisms purposively used to improve the power of the movements which are muscular hypertrophy and neural adaptation. Strength training is combined with the neural adaptation in order to improve the muscular power. Previous study indicated that elite and non-elite judo athletes had similar power [9]. This finding was contradicted with the study done by the researcher where winner boxer was superior in terms of strength. The elite or winner martial art athlete might be good in terms of strength because they have good resistance training and enough rest for muscle recovery after the training. Moreover, nutrition also plays an important role for muscle strength. Power among female Filipino martial art athletes showed significant difference than other international counterparts [10]. This finding was in agreement with the study done by the researcher. This situation might occur due to the cultural and environmental difference of the international counterpart. Besides that, the methods that their coach had executed to them might be different based on the experience and expertise even though their coach trained the same sport.

This study analyzed the power of boxers using the (Vertec) vertical jump test. The study reported significant level of power among winner and non-winner boxers who have participated in the National Youth Boxing Tournament. It is concluded that there is significant difference in power between winner and non-winner boxers. This study was different with the study done by [11] where they reported that there is no significant difference of leg power among martial arts groups. This scenario might happen because between the martial art groups, they have the same training method since both have the same origin such as taekwondo and judo [11]. Among winner and non-winner boxers, power showed significant difference where winner boxers are superior compared to non-winners. This situation might occur due to the boxers' muscle ability where it could be possibly affected by their training. Moreover, boxing movement also requires the boxers to jump or be dynamic in their movements. While jumping, it is easier for boxers to attack the opponent since they are in a ready position.

5 Conclusion

In conclusion, it can be concluded that the winner and non-winner boxers' body fat percentages showed a little significant difference. Both groups of boxers were particular about their body weight since boxing is competed based on body weight. Furthermore, this study reported that power was significantly different between winner and non-winner boxers. Studying another fitness component which is highly related to boxing could assist the development in boxing especially in screening and development process.

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