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Original article

Participation in physical activity and exercise in Greece: a systematic literature review

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Summary

Objective: To review the evidence from research relevant to participation in physical activity and exercise in Greece.
Method: Systematic search of peer-reviewed literature.
Results: No such previous review was found for Greece. Thus, its originality should provide valuable information. Selected publications included 36 papers, published between 1993 and 2006, concerning 15 studies. Most studies investigated exercise, sports and leisure-time physical activity but total and occupational physical activity was also studied.
Conclusion: Prevalence of physical activity and exercise in Greece was found to be low in the 1990s and 2000s, both in absolute and comparable terms. However, recent data reveal the development of a more active profile. The main reasons for participation were health, weight control, fitness and stress management, while lack of time was the main perceived barrier. Influencing factors were age, gender, income, type of work, marital status, residence and educational background. Recommendations include specific policies, strategies and campaigns to be addressed to the general public aiming at increasing participation rates. Future researchers should focus more on longitudinal and intervention studies.

Key words: European Union – Prevalence – Leisure-time – Health-enhancing – Occupational – Sports – Sedentary.

The health benefits of a physically active lifestyle have been extensively documented (USDHS 1996; Pols et al. 1998; Bauman et al. 2000; Pitsavos et al. 2003a). However, many countries appear to have a high proportion of people who are not sufficiently active to avail of these benefits (USDHS 1996; Martinez-Gonzalez et al. 2001).

The most widely accepted definition of physical activity is "any bodily movement produced by the skeletal muscles that results in caloric expenditure" (Caspersen et al. 1985). Exercise is a subcategory of physical activity defined as "planned, structured, repetitive, and results in the improvement of one or more facets of physical fitness" (Caspersen et al. 1985). It is generally agreed that there is no internationally accepted definition or measure of physical inactivity (Varo et al. 2003; Van der Wilk & Jansen 2005). The most common definitions include participation in sedentary activities (e. g. sitting, watching TV), or non/low participation in physical activities (Varo et al. 2003).
The aim of this paper is to present information about Greece, both in absolute terms and in comparison with other countries, regarding the following issues:
– From recent studies, the proportion of the population that is physically active and physically inactive;
– Characteristics of physical activity participation such as type, frequency, duration and intensity;
– Reasons for and barriers to participation in physical activity;
– The influence of socio-demographic factors on physical activity.

Methods

A search of the literature was conducted using several electronic databases, including ISI Web of Knowledge, MEDLINE, PsycINFO, Pub Med, ERIC, PYSCHLIT, SOCIAL SCIENCE INDEX, and SPORTS DISCUS. Key words used for the electronic searches were physical activity, physical inactivity and exercise in combination with Greece, Greek, European Union and review. The only time limit regarding publication date for the reviewed papers was the last update of the search which was performed in April 2007. Only publications in English

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and Greek or translations to these languages were considered. An additional inclusion criterion was the age of the participants that had to be 15 years or older. Studies were included if one of their variables was physical activity or exercise and their conclusions were relevant to the aims of this review.
Studies using variables such as fitness or physical conditioning were excluded, as were qualitative reports and case studies. Manual searches were also performed using the reference lists from recovered articles. Finally, studies were judged according to the soundness of their methodology regarding sampling, operational definitions, data collection and statistical analyses.

Results

A search of the literature did not reveal any previously published review of participation in physical activity and exercise in Greece. Consequently, this should be the first review article tackling this issue in a systematic way for Greece.
Thirty-six papers published from 1993 to 2006 were identified and included in this review (see Tab. 1). They reported on 15 studies. Seven papers were published in the 1990s and 29 papers in the 2000s. It is worth noting the much larger number of papers in the 2000s which highlights a growing research interest in these issues for Greece. Nine international studies were identified, of which six used a nationally representative sample, while the other three had relatively large samples. Two national studies were identified and three other studies with large samples were included. Lastly, only one small-scale study was found. The majority of studies focused on exercise and sports (seven), leisure-time physical activity (six) and occupational physical activity (four). Only three studies provided data for household physical activity and two studies for total physical activity.
No intervention studies were found. Also, no longitudinal data on participation in physical activity and exercise in Greece have yet been published, despite the fact that two of the studies had longitudinal designs. Only data from the first measurement of these two studies have been published to date. The rest employed a cross-sectional design with the inherent methodological problem of not being able to separate cause from effects in associations. All studies relied on self-report levels of physical activity. Notably, all associations were two-tailed and set at a 95 % confidence interval. Consequently confidence intervals will not be reported separately for each study.

Eurobarometers
The Eurobarometers are international surveys across all European Union (EU) member states examining public opinion in a variety of issues since 1972. Recently, exercise and sports data in the 25 EU member states were collected by Eurobarometer 52.1 in 1999 (EORG 2000), 60.0 in 2003 (EORG 2003) and 62.0 in 2004 (EORG 2004). Physical activity data in the 15 EU member states were collected by the Eurobarometer 58.2 in 2002 (EORG 2003) and in the 25 EU member states by Eurobarometer 64.3 in 2005 (EORG 2006).
In every member state, a multi-stage, random sample design was applied. In Greece around 1000 participants aged 15 years and older were interviewed. According to Abel (2004) Eurobarometer 58.2 was the first international study to investigate health-enhancing physical activity. The use of the International Physical Activity Questionnaire (IPAQ) enabled estimation of the frequency, duration, and level of intensity of total or health-enhancing physical activity in the previous seven days (Craig et al., 2003) and in multiple-domains such as leisure-time physical activity, physical activity at work, at home, or for the purpose of transportation (Pate et al. 1995; Sjöström et al. 2006).
The IPAQ has been tested for reliability and validity with convenience samples in a cross-national study and it was concluded that it possesses acceptable measurement properties (Craig et al. 2003). Nevertheless, rather low test–retest reliability and comparability with extant national EU physical activity items were found when it was used for the EUPASS project (Rütten et al. 2003), indicating possible weaknesses of the IPAQ.

Eurobarometers 58.2 and 64.3 regarding Physical Activity
The majority of Greeks seemed to engage in little or no physical activity at work (51 % in 2002 and 67 % in 2005) and little or no recreational, sport and leisure-time activities (50 % in 2002 and 82 % in 2005). On the contrary, they seemed to participate in a lot or some physical activity in their household (76 % in 2002 and 56 % in 2005). The above trends were also evident in the total EU sample.
Greeks claimed, on average, to perform vigorous physical activities on two days per week both in 2002 (the highest in EU) and 2005 (4th highest in EU), spending almost two hours per day. A steep decline in the percentage of Greeks who never performed vigorous physical activities was seen between 2002 and 2005 (61 % vs. 28 %). This decline was evident among the 15 EU member states, as well, but was not as steep (68 % vs. 46 %).
On average, Greeks engaged in moderate physical activities on three days per week in 2002 (3rd highest in EU) and 3.3 days per week in 2005 (6th highest in EU), spending just over two hours per day. A large decline in the percentage of Greeks who never performed moderate physical activities was seen between 2002 and 2005 (50 % vs. 5 %). A much more moder-

Table 1 Characteristics of selected studies

Study	Greek sample			Type	Scale	variable
paper	n	Men	Age (yrs)			
Eurobarometers						
Eurobarometer 58.2 (2003)	1000	49%	15+	EU 15	NR	TPA
Rütten & Abu-Omar (2004)	1000	49%	15+	EU 15	NR	TPA
Sjöström et al. (2006)	1000	49%	15+	EU 15	NR	TPA
Eurobarometer 64.3 (2006)	1000	49%	15+	EU 25	NR	TPA
Eurobarometer 52.1 (2000)	1000	49%	15+	EU 15	NR	Exercise
Eurobarometer 60.0 (2003)	1000	49%	15+	EU 15	NR	E & S
Eurobarometer 62.0 (2004)	1000	49%	15+	EU 25	NR	E & S
Pan-EU						
Kearney et al. (1999a)	1011	44 %	15–65+	EU 15	NR	LTPA
Margetts et al. (1999)	1011	44 %	15–65+	EU 15	NR	LTPA
De Almeida et al. (1999)	1011	44 %	15–65+	EU 15	NR	LTPA
Zunft et al. (1999)	1011	44 %	15–65+	EU 15	NR	LTPA
Varo et al. (2003)	1011	44 %	15–65+	EU 15	NR	Sedent.
EHBS						
Steptoe et al. (1997)	639	46 %	18–30	International	Large scale	Exercise
IHBS						
Steptoe et al. (2002)	1468	46 %	17–30	International	Large scale	Exercise
ATTICA						
Pitsavos et al. (2005b)	3042	50 %	18–89	Regional	Large scale	LTPA
Pitsavos et al. (2003b)	3042	50 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2005b)	3042	50 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2006)	3042	50 %	18–89	Regional	Large scale	LTPA
Pitsavos et al. (2005a)	3042	50 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2005a)	3042	50 %	18–89	Regional	Large scale	LTPA
Manios et al. (2005)	3042	50 %	18–89	Regional	Large scale	LTPA
Skoumas et al. (2003)	2772	50 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2003)	2772	50 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2004a)	2282	49 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2004c)	2266	48 %	18–89	Regional	Large scale	LTPA
Pitsavos et al. (2003a)	1856	48 %	18–89	Regional	Large scale	LTPA
Skoumas et al. (2002b)	1480	44 %	18–89	Regional	Large scale	LTPA
Skoumas et al. (2002a)	1480	44 %	18–89	Regional	Large scale	LTPA
Pitsavos et al. (2006)	853	53 %	18–89	Regional	Large scale	LTPA
Panagiotakos et al. (2004b)	853	53 %	18–89	Regional	Large scale	LTPA
EPIC						
Haftenberger et al. (2002)	9669	38 %	50–64	International	Large scale	LTPA+O
Other important studies						
Milias et al. (2006)	5003	49 %	18–74	National	NR	LTPA+W
Athyros et al. (2005)	4153	49 %	18+	National	NR	LTPA+W
Pitsavos et al. (1998)	2009	100 %	18–24	Worksite	Large scale	Exercise
Adamopoulos et al. (1993)	1205			Regional	Large scale	LTPA+O
Trigonis et al. (2002)	171	54 %	18–65	Worksite	small scale	Exercise

Abbreviations: NR = nationally representative, TPA = Total physical activity, LTPA = leisure time physical activity, O = occupational physical activity, E & S = Exercise and Sports, Sedent. = Sedentariness, W = work type, EU 15 or 25 = 15 or 25 European Union member states.

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ate fall was evident among the 15 EU member states, dropping from 47 % to 36 %.

Greeks claimed, on average, to walk at least 10 minutes at a time on 4.2 days per week both in 2002 (6th highest in EU) and 2005 (18th highest in EU), spending 43.8 minutes per day. A large decline in the percentage of Greeks who never walked for at least 10 minutes at a time was seen between 2002 and 2005 (24 % vs. 3 %). This decline was evident among the 15 EU member states, as well, but was smaller (21 % vs. 13 %). On average they spent six hours and 10 minutes sitting on a usual day while the EU average was five hours and 12 minutes. Finally, 57 % of Greeks agreed that lack of time prevented them from taking advantage of sport and physical activity opportunities compared to the 53 % EU average.

Using data from the Eurobarometers, Sjöström et al. (2006) stated that in 2002 the prevalence of health-enhancing physical activity, sedentariness, walking and sitting in Greece was 37 %, 32 %, 35 % and 37 %, respectively. Additionally, Rütten & Abu-Omar (2004) stated that Greece had the 5th highest position regarding energy expended in total physical activity with 38.57 MET-hours/week.

In 2002 men seemed to be significantly more active than women (43 % vs. 31 %), while women were significantly more sedentary (37 % vs. 28 %) (Sjöström et al. 2006). No significant differences were seen between men and women in walking or sitting (39 % vs. 31 % and 38 % vs. 35 %, respectively). Additionally, according to Rütten & Abu-Omar (2004) men exhibited a higher frequency than women in vigorous physical activity but not in moderate physical activity or walking. Furthermore, regarding energy expended in total physical activity Greek men had a higher expenditure than women.

Eurobarometers 52.1, 60.0 and 62.0 regarding Sport & Exercise

In 1999, the Eurobarometer 52.1 included only one question relevant to exercise which asked people if they "exercised at least twice a week". The lowest prevalence was found in Greece (19 %) while the EU average was 40 %. The proportion of Greeks who claimed to exercise or play sports at least once per week increased from 19 % in 2003 to 26 % in 2004 (EU average 35 % and 38 %, respectively). Those who never exercised or played a sport decreased from 75 % in 2003 (highest in EU) to 57 % in 2004 (4th highest in EU).

Similar trends were found in 1999, 2003 and 2004 regarding socio-demographic variables and participation in exercise and sports in the EU. Men exercised and played sports more often than women. Participation in exercise and sports was negatively associated with increasing age, but positively associated with education level and with student, executive and employee status. In 2004, 44 % of Greeks claimed lack of time as the main reason for non-participation in sports and exercise (5th highest in EU), slightly higher than the European Union average of 34 %.

Pan-EU Survey

The Pan-EU survey was conducted in 1997 among the 15 member states in the EU at the time (Kearney et al. 1999b). Its main aim was to identify attitudes towards, and beliefs about, physical activity, body weight and health. However, part of the methodology also included the gathering of data about physical activity levels. The surveyed samples were nationally representative. Approximately 1000 participants from each member state aged 16 years or older were interviewed in a two-week period between February and April 1997 (Martinez-Gonzalez et al. 2001). Seasonality was not taken into account since only spring participation was examined. The instruments used to evaluate participation in leisure-time physical activity were the Compendium of Physical Activities and a questionnaire designed by Paffenbarger (Martinez-Gonzalez et al. 2001), both collecting data through self-reporting of participation. Furthermore, according to Varo et al. (2003) the term sedentary classified those who expended less than 10 % of their leisure-time energy expenditure in activities requiring more than 4 MET (e. g. walking) or those who combined non-participation in physical activities and sitting down for a long time.

According to Kearney et al. (1999a), Greece together with Portugal shared the highest inactive population who were not willing to change this behaviour in the following six months (46 % compared to 29 % EU average). Only 14 % of the Greek sample reported being currently quite physically active and had been so for longer than 6 months (Zunft et al., 1999). The above was the lowest of all member states and less than half the EU average (30 %). Varo et al. (2003) estimated the prevalence of sedentary people in Greece to be 70 %, which placed it in the second highest group of countries after Portugal.

According to De Almeida et al. (1999), Greece had the lowest proportion who reported participation in some kind of physical activity during the previous week (61 % compared to 69 % EU average). The most common activities for Greece were walking (24 %), keep fit (15 %) and gardening (10 %). Concerning leisure time dedicated to physical activity, 40 % of the Greek sample devoted no time to such pursuits. At the other extreme, 54 % reported more than 3.5 hours per week of their leisure time engaged in physical activities, with only 7 % of the sample in-between (0 <t >3.5 hrs/week) (De Almeida et al. 1999).

Zunft et al. (1999) listed the top four reasons for participation in physical activity/exercise for Greeks as: "to maintain good health" (49 %), "to control weight" (25 %) "to get fit" (24 %)

and "to release tension" (23 %). The main perceived barriers to increasing levels of physical activity/exercise for Greeks were reasons concerning "work or study" (44 %) and being "not the sporty type" (17 %). A third reason was stated to be "looking after children/elderly" (15 %) which, together with those indicating work or study as a barrier (44 %), form a cumulative 59 % who seemed to have a lack of leisure time.

Women and the less educated cohorts showed higher levels of non-participation among all EU countries (De Almeida et al. 1999) and this trend was patently evident in the Greek sample. Margetts et al. (1999) reported that 48 % of Greek non-participants in any recreational activities were females compared to 33 % males. However, women did not seem to be more sedentary than men in the EU as a whole (Varo et al. 2003). In all EU countries a clear pattern of high non-participation among the less educated was highlighted by Zunft et al. (1999). In the Greek sample 30 % of respondents who had only experienced primary education reported non-participation (14 % EU average), compared to only 12 % of secondary (10 % EU average) and 10 % of tertiary educated respondents (7 % EU average).

According to Margetts et al. (1999), there was moderate consistency across countries between higher rates of participation in physical work and lower rates of participation in recreational activities. Nearly twice as many respondents who reported spending more than six hours a day in physical work were likely to have no physical recreations as those spending less than two hours a day in physical work. The highest proportion (approximately 60 %) of participants spending more than six hours a day in physical work rather than sitting or standing was found in Greece (Margetts et al. 1999).

The European Prospective Investigation into Cancer and Nutrition Study (EPIC)

EPIC is a prospective cohort study investigating the role of nutrition and other lifestyle and environmental factors on the aetiology of cancer and other chronic diseases (Trichopoulou et al. 2001). Participants will be followed up for the rest of their lives (Riboli and Kaaks 1997), although no longitudinal data regarding physical activity have been published yet. Occupational and leisure time activities were assessed for an overall evaluation of physical activity level. Type, intensity, and duration of a broad range of physical activities were examined in a typical week during the previous year. The physical activity questionnaire was validated only for a Dutch sample (Pols et al. 1997). The validation study showed that these questions were not appropriate for estimating energy expenditure on an absolute level, but the reproducibility and relative validity of ranking the participants were within acceptable ranges (Pols et al. 1997).

Haftenberger et al. (2002) conducted a cross-sectional analysis of baseline data from the EPIC study within the 50–64 years age group. Physical activity data were available for 3676 men and 5993 women from the Greek cohort. Walking was the most common physical recreation in all EPIC centres, including Greece, where 96 % of the cohort took part. In Greece gardening was the second most popular activity (62 %), while sport/exercise ranked third (25 %). Almost all Greek women (99 %) engaged in household activities compared to only about half of the Greek men (55 %). However, men engaged more in home repairs compared to women (21 % and 5 %, respectively). Total time devoted to recreational activities was 11.2 hours/week for Greek men (SD = 8.9) and 10.9 hours/week for Greek women (SD = 6.9). In all European centres, total time dedicated to recreational activity in the summer was higher than in the winter. During the summer Greek men spent 1.1 and women 1.7 more hours per week in recreational activities compared to the winter season.

The European Health and Behaviour Survey (EHBS)

Conducted between 1989 and 1992 (Steptoe et al., 1997), the EHBS was a questionnaire survey of university students from 21 European countries studying non-health-related courses. The Greek sample consisted of 639 students (54 % female) aged between 18 and 30 years. However, it should be mentioned that the samples of university students were not representative of the student population in each country. For example, the Greek sample was taken from only two of the 19 Universities, one in Iraklion and one in loannina. Among other variables, the researchers asked about type and frequency but not mode of exercise over the previous two weeks. Participants were considered active if they had taken part in any exercise in the previous two weeks. In subsequent analyses, participants were divided into rare (one to four times) and frequent (five or more times) exercisers in the previous two weeks.

Data were collected over several months in each country to account for seasonal effects. Information about non-respondents (20 % of the original sample) was not collected. As admitted by Steptoe et al. (1997), "it is possible that non-respondents had less interest in health issues … (so) the data might be biased toward more favourable attitudes to exercise". In a pilot study of 46 UK students test-retest stability over 17 days for exercise proved mediocre, since 22 % of the respondents changed categories (Wardle and Steptoe 1991).

According to Steptoe et al. (1997), the highest prevalence of physical inactivity adjusted for age was observed in the Greek sample (54 % compared to a 30 % European average). Additionally, Greece had the highest inactivity both in men (45 % compared to the European average of 37 %) and women (71 %

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compared to the European average of 32 %). Women's lower participation levels compared to men proved statistically significant in the Greek sample, which was not the case in the majority of other countries. Greek men were more likely than women to engage in frequent physical exercise which was defined as five or more occasions in the previous two weeks. This difference was also significant in the whole European sample (p <0.0001).

The International Health and Behaviour Survey (IHBS)

The IHBS followed up the EHBS in 13 of the original 21 participating countries after 10 years (Steptoe et al. 2002). However, it did not follow up the same participants and thus the data were not longitudinal. Its aim was to identify trends and associated beliefs in major health behaviours. The Greek sample was 1468 students (54 % women) aged 17–30 years old, studying non-health-related courses. In most countries the same Universities were utilised in both surveys, but not in Greece, where the Universities of Athens and loannina were surveyed. Health behaviours were assessed with identical questions in both studies. As with the EHBS, a limitation of the survey was that students were not systematically sampled from universities across each country, so they were not representative of the student population.

The Greek sample had the second largest rise in exercise participation across countries among men (14.6 %, p <0.001) and the highest increase among women (19.5 %, p <0.001). Although this was a positive trend, Greece was still second from lowest among the 13 European countries regarding prevalence of physical exercise (59 % compared to the European average of 70 %).

The ATTICA Study

The ATTICA study was a health and nutrition survey carried out during 2001 and 2002 in Athens and its environs (Pitsavos et al. 2003b). It was further described as a prospective, population-based cohort study. In most reports relating to the study, analyses were carried out for a multistage (city, sex, age) random sample of 3042 participants, 50 % men, aged 18–89 years, without any evidence of cardiovascular or other chronic diseases (see Tab. 1). In other reports the sample was filtered and several sub-samples were used (see Tab. 1).

Participants were interviewed with a Greek version of a questionnaire assessing energy expenditure through frequency (times per week), duration (in minutes) and intensity (light, moderate, vigorous) of sports related physical activity during a usual week (Pitsavos et al. 2003b). The original English questionnaire was validated for a North American population (Pate et al. 1995) but the translated version was not validated for the Greek population. Participants were considered physically active if they reported non-occupational physical activity at least once per week during the previous year.

Sedentary proportions ranged from 50 % to 62 % in various reports (see Tab. 2). One explanation for the range of proportions could be the different samples used by each report. However, in six reports of the same sample size (n = 3042) the sedentary proportion still ranged from 50 % to 59 % (see Tab. 2). Thus, a possible methodological inaccuracy might exist.

Regarding physical activity levels, 11 %–12 % had low levels, 15 %–21 % medium and 5 %–22 % high (Pitsavos et al. 2003b; Skoumas et al. 2003; Pitsavos et al. 2003a; Panagiotakos et al. 2004a). In two earlier papers by Skoumas et al. (2002b; 2002a) 15 % reported occasional exercise (engaging in non-occupational physical activity one or two times per week) and 21 % reported regular exercise (three or more times per week). Women seemed to be more sedentary than men. This difference was statistically significant in three and non-significant in five out of eleven reports (see Tab. 2). Pitsavos et al. (2005b) found that women were more sedentary than men across all age groups (p = 0.001). Also, men were more frequently active (p = 0.03) and exercised with more intensity than women (p = 0.02).

According to Pitsavos et al. (2005b), as participants moved into older decades of their lives they tended to participate in physical activities less frequently, devote less time and have less intention to participate. Furthermore, it was revealed that physically active participants were significantly younger than sedentary participants (Skoumas et al. 2003; Panagiotakos et al. 2005b). However, this conclusion is in contrast with the an earlier study by Pitsavos et al. (2003a) where it was found that physical activity levels were not associated with age (p = 0.086).

People living in urban areas were more likely to be sedentary compared to people living in rural areas (54 % vs. 45 %, p = 0.02) (Skoumas et al. 2003; Pitsavos et al. 2005b). Married or divorced/widowed were more likely to be sedentary compared to singles (56 % vs. 43 %, p <0.001), irrespective of age and sex (Pitsavos et al. 2005b). In a number of reports physical activity levels were not significantly associated with education levels or annual income for both genders (Pitsavos et al. 2003a; Panagiotakos et al. 2004c; Manios et al. 2005; Panagiotakos et al. 2005b; Pitsavos et al. 2005b). However, Pitsavos et al. (2005b) discovered that skilled professionals were more active compared to unskilled among both men (p = 0.02) and women (p = 0.01).

Other important research projects

While conducting a cross-sectional medical study (MetS-Greece Study) Athyros et al. (2005) interviewed a nationally representative sample of 4153 participants (age >18 years;

51 % women). It was carried out in 2003 and its aim was to estimate the prevalence of the metabolic syndrome in Greece. Representation was established in relation to age, gender and type of residence. Data about work type and leisure time physical activity were obtained by using a structured interview. A sedentary lifestyle was reported by 81 % of the population. Military personnel (n = 300) had the lowest proportion in the sedentary category (27 %).

Milias et al. (2006) carried out a telephone survey of a nationwide, random, multistage sample of the Greek population in the autumn of 2004. The main aim of this study was to evaluate the prevalence of self-reported hypercholesterolaemia and its relation to nutritional habits. The sample consisted of 5003 adults (51 % women) aged 18–74 years. Physically active participants were defined as those who reported that they participated in a leisure exercise programme at least once a week, or that their occupation presupposed a certain level of physical fatigue. The vast majority of the population (75 %) were considered sedentary. Fewer men were sedentary than women (68 % compared to 82 %, p <0.001).

Low levels of physical activity, expressed as walking in kilometres per week during leisure time and at work, were also shown by Adamopoulos et al. (1993) in a random sample of the Athens adult population (n = 1205). Men and women placed in the category of those that walked less than seven km/week were 53 % and 73 %, respectively.

A high proportion of active participants (76 %) was reported in a study of 2009 male Greek army recruits [mean age (SD) = 22.37 (3.03) years] (Pitsavos et al. 1998). Active was defined as exercising at least three times per week for more than 45 min each time. This sector of the population showed different activity patterns compared to the general population probably because of their occupational requirements and the lower mean age. Thus, this cohort ought not to be considered as representative of the wider population.

Trigonis et al. (2002) investigated a sample of 171 employees (54 % men, 18–65 years-old, mean age 42.5 years) in a major work site in Greece. Participants completed a questionnaire measuring several variables including leisure-time exercise and reasons for involvement or non-involvement in a physical activity programme. Participants of health and fitness programmes indicated that important reasons for participation were health, fitness, enjoyment, social benefits, and stress relief. The primary reasons for not participating in health and fitness programmes were time constraints, family commitments, boredom, involvement in other exercise programmes, crowding and lack of parking. With respect to types of exercise, aerobic dance was the most popular (35 %), while jogging, walking, swimming, tennis, basketball, and cycling were the next most popular.

Discussion

This systematic review of literature provided sufficient data regarding participation in physical activity and exercise in Greece. Since it is the first review of its kind for Greece it should assist future investigators interested in physical activity and exercise. However, care needs to be taken in interpreting the results due to the limitations mentioned below.

None of the studies used an objective method of measuring physical activity. Thus, most of the results are self-reported estimates of physical activity. This limitation is a common finding in the field, especially in large-scale studies (Pols et al. 1998; Trost et al. 2002). Also, different self-report measures of physical activity were utilised, which makes comparisons difficult. Furthermore, none of the instruments were validated in Greece and therefore there is concern as to whether they possessed satisfactory levels of validity and reliability for the Greek population.

Many different aspects of physical activity were investigated, namely; total or health-enhancing physical activity, leisure-time physical activity, occupational physical activity, household physical activity, activity for transportation, exercise and sports. Mostly earlier studies seemed to confuse the terms physical activity and exercise or use them interchangeably. The same problem was recognised by Caspersen et al. (1985) and the USDHS (1996). The majority of studies focused on exercise and sports, leisure-time physical activity and occupational physical activity. Few studies provided data for household physical activity and total physical activity. However, when investigating physical activity for health purposes total lifestyle needs to be estimated since according to USDHHS (1996) and Margetts et al. (1999) all forms of physical activity contribute to total energy expenditure. It is noticeable that there is a recent trend of focusing more on total or health enhancing physical activity.

The criterion for participants to be considered physically active was usually participation in some kind of physical activity once per week or per two weeks, which is less demanding than the internationally established guidelines which have set the criteria of at least 30 minutes of moderate intensity physical activity, three to five times per week (USDHHS 1996). In most cases the less demanding criteria would have led to overestimation of the active proportion of the sample. However, these criteria led to a more valid categorisation of sedentary participants. Consequently, sedentary rather than active behaviour was reported where meaningful.

Another issue that should be addressed is the seasonality effect, since seasonal variation exists in physical activity participation (USDHHS 1996). Data collection in most studies was usually completed in one to two months and thus, they

Table 2 Results of selected studies investigating participation in physical activity and exercise in Greece

Study/paper	variable	sedentary	men	women	p (sex)
Eurobarometers					
Eurobarometer 58.2 (2003)	TPA	51 %/50 %/24 %[a] 61 %/50 %/24 %[b]			
Rütten & Abu-Omar (2004)	TPA	1.98/3.06/ 4.18/38.57 [c]	2.37/2.91/ 4.27/42.12[c]	1.56/3.22/ 4.07/35.12[c]	SS/SNS/ SNS/SS[c]
Sjöström et al. (2006)	TPA	32 %/37 %/ 37 %/35 % [d]	28 %/38 %/ 43 %/39 % [d]	37 %/35 %/ 31 %/31 % [d]	SS/SNS/ SS/SNS[d]
Eurobarometer 64.3 (2006)	TPA	67 %/82 %/44 %[a] 28 %/5 %/3 %[b]			
Eurobarometer 52.1 (2000)	Exercise	81 %			
Eurobarometer 60.0 (2003)	E & S	75 %			
Eurobarometer 62.0 (2004)	E & S	57 %			
Pan-EU					
De Almeida et al. (1999)	LTPA	39 %	33 %	48 %	SS
Varo et al. (2003)	LTPA	70 %			
EHBS					
Steptoe et al. (1997)	Exercise	54 %	45 %	71 %	SS
IHBS					
Steptoe et al. (2002)	Exercise	41 %			
ATTICA					
Pitsavos et al. (2005b)	LTPA	50 %	47 %	52 %	< 0.05
Pitsavos et al. (2003b)	LTPA	58 %	57 %	59 %	SNS
Panagiotakos et al. (2005b)	LTPA	58 %	57 %	59 %	SNS
Panagiotakos et al. (2006)	LTPA	58 %	57 %	59 %	< 0.01
Pitsavos et al. (2005a)	LTPA	57 %	56 %	58 %	
Panagiotakos et al. (2005a)	LTPA	59 %	58 %	61 %	
Skoumas et al. (2003)	LTPA	59 %	58 %	60 %	0.06
Panagiotakos et al. (2003)	LTPA	59 %	58 %	60 %	
Panagiotakos et al. (2004a)	LTPA	61 %	59 %	63 %	< 0.01
Pitsavos et al. (2003a)	LTPA	62 %	64 %	60 %	
Skoumas et al. (2002b)	LTPA	57 %			
Skoumas et al. (2002a)	LTPA	57 %			
Pitsavos et al. (2006)	LTPA	55 %	50 %	60 %	0.58
Panagiotakos et al. (2004b)	LTPA	55 %	50 %	60 %	0.58
Other important studies					
Milias et al. (2006)	LTPA+W	75 %	68 %	82 %	< 0.01
Athyros et al. (2005)	LTPA+W	81 %			
Adamopoulos et al. (1993)	Walking	63 %[e]	53 % [e]	73 % [e]	SS
Pitsavos et al. (1998)	Exercise	24 %			

Abbreviations: TPA = Total physical activity, LTPA = leisure time physical activity, O = occupational physical activity, E & S = Exercise and Sports, Sedent. = Sedentariness, W = work type, SS = Statistically significant at 95 % Confidence Interval, SNS = statistically non-significant at 95 % Confidence Interval.

[a] little or no physical activity at work/little or no recreation, sport and leisure-time activities/little or no household physical activity

[b] vigorous physical activity/moderate physical activity/walking at least 10 minutes at a time

[c] mean energy expended in TPA (MET h/week)/frequency of (days per week): vigorous physical activity/moderate physical activity/walking at least 10 minutes at a time

[d] sedentariness/sitting/sufficient total physical activity/walking at least 5×30 min/week

[e] walked less than 7 km/week

estimated seasonal participation, which might be different from that of the whole year. Most studies collected data during autumn or spring. This is done to avoid the extreme differences that have been observed between winter and summer participation (USDHHS 1996). Nevertheless, this issue adds another complicating factor in the assessment of physical activity and in the comparison between studies.

Taking the above limitations into account it could be concluded that participation in physical activity and exercise in Greece was generally low, both in absolute and comparable terms.

More specifically, Eurobarometers that examined total physical activity found the majority of Greeks (50 %–82 %) to participate in little or no occupational and leisure-time physical activity (Tab. 2). On the contrary, the minority (24 %–44 %) seemed to participate in little or no physical activity in their household (Tab. 2). The studies that examined leisure-time physical activity found that prevalence of sedentariness ranged from 50 % to 69 % in samples taken from the capital of Athens and from 39 % to 81 % in national samples (Tab. 2). The two studies that examined both work type and leisure time physical activity found 75 %–81 % nationwide to be sedentary. Additionally, the Eurobarometers that examined exercise and sports found a large proportion of 81 % participating less than twice per week in 1999 and a declining trend of non-participants from 2002 to 2005 (75 % vs. 57 %). These extended ranges mentioned above were common in other countries, as well. Depending upon definition, 25 %–60 % of US adults have been considered sedentary (Dishman 1996).

On the other hand, a steep decline was documented by the Eurobarometers in the range of Greek non-participants in vigorous physical activities, moderate physical activities and walking from 24 %–61 % in 2002 to 3 %–28 % in 2005. However, these results should be treated with cautiousness until they are supported by other studies, as well. Exceptional low levels of sedentary behaviour were shown by Greek army recruits and army personnel (24 %). This could be attributed to the demands of their occupation and their young age. However, an inactive lifestyle was evident in a great proportion of university students (41 %–54 %), which is in accordance with international findings. In a review, Irwin (2004) concluded that more than half of university students in the US, Canada, China and 40 % in Australia were insufficiently active to derive health benefits.

In comparative terms, the prevalence of physical activity and exercise in Greece during the 1990s and 2000s seemed to be one of the lowest in the EU. However, recent studies have shown a promising upward trend only for sports and exercise. Possible explanations might be the organisation of the Olympic Games in Greece during 2004 and also the winning of Euro 2004 by the Greek national football team and first and second places of the Greek national basketball team in the European and World championships. This is clearly evident in the comparison between Eurobarometer 60.0 and Eurobarometer 62.0 (Exercise & Sports), which were conducted just before and after the above events, respectively.

The main reasons for participation were health, weight control, fitness, and stress management. Lack of leisure time was the main perceived barrier to increasing levels of physical activity and exercise. The above reasons and barriers should be taken into serious consideration in the design and implementation of campaigns to promote physical activity.

Most of the studies revealed Greek women to be sedentary in higher proportions than men (see Tab. 2). In a review, Trost et al. (2002) found the same trend in a large number of studies from different countries. Greek female students seemed to exercise less than male students and less frequently, a feature also identified by Irwin (2004) in his review of university students from different countries. Moreover, men seemed to exercise more frequently and more vigorously than women.In the Attica region single people were more likely to be physically active compared to those who were married or divorced/widowed. Lastly, people living in rural areas were more likely to be physically active than those living in urban areas. The findings of nationally representative data highlight higher non-participation rates among lower education levels. In accordance, Trost et al. (2002) found that in a large number of studies socioeconomic, occupational and educational status were associated with physical activity. Additionally, the above conclusions were also confirmed by national US surveys (USDHHS 1996). However, no statistically significant associations were found between physical activity levels and education level, annual income or socio-economic status in the Attica region.

People in physical demanding occupations seemed to refrain from physical activities during their leisure time. A possible explanation might be that those who get physically tired by their work might not wish to engage in more physical activities in their leisure time. Greece had the highest proportion of workers in physical demanding occupations (Haftenbeger et al. 2002), possibly due to the large numbers of manual workers and farmers in the country. Nevertheless, it would be misleading to attribute the low levels of physical recreations in Greece only to the high prevalence of manual work, since inactivity is also common among university students who are mainly involved in a sedentary type of work/study.

Conclusions

The main findings of this review were:

– This is the first review concerning physical activity in Greece.

– Participation in physical activity and exercise in Greece was generally low. Recent data seems promising for sports and exercise participation.
– In comparative terms, the prevalence of physical activity and exercise in Greece during the 1990s and 2000s was one of the lowest in the EU.
– The main reasons for participation were health, weight control, fitness, and stress management.
– Lack of leisure time was the main perceived barrier to increasing levels of physical activity and exercise.
– Influencing factors of physical activity seemed to be age, gender, income, type of work, marital status, residence and educational background.

Recommendations

This review has shown that a sedentary lifestyle is a major public health problem for Greece. Policy makers and researchers should work towards its solution. When introducing new national policies or attempting interventions to enhance physical activity participation, policy makers should be fully aware of its prevalence in the population and the country's relative position to other countries. According to De Almeida et al. (1999), the low prevalence of physical activity in Southern European countries may reflect the absence of programmes to promote it. Thus, promotion of physical activities should be organised in a systematic way. The data and conclusions presented in this paper could serve the above need. Information from this review could also assist in the design and implementation of physical activity interventions by maximising their efficiency. Additionally, it could be utilised for future comparisons or evaluations of policies or interventions. Recommendations for policy makers and researchers follow in light of the conclusions of this review.

Recommendations for policy makers:
– Specific policies and strategies should be addressed to the whole population placing emphasis on increasing participation rates.
– Campaigns should be designed and implemented with the aim to promote participation and not simply to inform the public. They should emphasize reasons of health, fitness and weight control to enhance participation.
– Specific strategies should be suggested for those with a lack of leisure time. The disadvantaged groups (e.g. women, less educated) should also be given extra attention because of their propensity to inactivity.

Recommendations for future research:
– Intervention studies should be employed in order to test the efficiency of policies, strategies and campaigns.
– Longitudinal studies should be utilised in order to evaluate trends in physical activity participation and the long-term effects of campaigns.
– A clear pattern of who is considered physically active and inactive should be determined according to internationally established criteria in order to have more valid and reliable data.
– Studies should not concentrate only on leisure time physical activities but on the total physical activity profile of each participant.

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