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ORIGINAL ARTICLE

Disordered Eating and its Association with Overweight and Health-Related Quality of Life Among Adolescents in Selected High Schools of Tehran

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Abstract This study aimed to determine the association between disordered eating and overweight and also health-related quality of life (HRQOL) among adolescents in high schools of Tehran. The participants were 465 adolescents, aged 14–17 years. After anthropometric measurements, body mass index-for-age and body weight status were determined using World Health Organization cut offs. The Eating Attitudes Test-26 (EAT-26) and Pediatric Quality of Life Inventory (PedsQL^{TM}4.0) were used to assess disordered eating and HRQOL, respectively. Disordered eating was prevalent in 18.9 % of adolescents, with higher prevalence in girls (26.4 %) compared to boys (11.8 %; χ^2:16.29, $p < 0.05$). Disordered eating was associated with overweight in girls ($\chi^2 = 11.07$, $p < 0.05$), but not in boys ($\chi^2 = 2.01$, $p = 0.16$). Disordered eating was associated with poor HRQOL especially in psychosocial domains of HRQOL. Considering the high prevalence of disordered eating and its association with overweight and poor HRQOL, preventive interventions targeting adolescents are recommended.

Keywords Disordered eating · Overweight · Obesity · Health-related quality of life · Adolescents

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Introduction

Disordered eating comprises a wide spectrum of abnormal eating behaviors of different severity, with eating disorders ranking at the extreme end of it. Fear of fatness, unhealthy weight control behaviors and preoccupation thinking about food are examples of disordered eating, yet these unhealthy behaviors do not warrant meeting the diagnostic criteria for eating disorders [1]. Using the latest edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [2], two main groups of eating disorders can be determined: Threshold eating disorders and other specified feeding and eating disorders (OSFED) [3]. Threshold eating disorders encompass severe disorders that are accompanied by extreme manifestations such as anorexia nervosa, bulimia nervosa and binge eating disorder. On the other hand, there are some milder abnormal eating behaviors which do not meet the diagnostic criteria of eating disorders and fall into the category of OSFED, which is a heterogeneous category including atypical anorexia nervosa, bulimia nervosa of low frequency and/or limited duration, binge eating disorder of low frequency and/or limited duration, purging disorder, and night eating syndrome. Although the OSFED group has lower severity than the threshold eating disorders group, it can still cause significant clinical distress and has the potential to influence health [2, 3].

Disordered eating is associated with a number of health threatening behaviors such as smoking, alcohol and drug

use, depression, high level of anxiety and suicide [4–6]. Further, disordered eating in adolescents was found to be related to insufficient nutritional intakes, growth retardation, high risk of binge eating and having difficulties in weight reduction, due to weight fluctuations [7]. Recently, there are studies indicating that disordered eating is associated with the two extremes of eating and weight-related problems, namely eating disorders [7] and obesity [8–10] in adolescents. Considering the health implications of disordered eating, there is the urgent need to identify individuals who have disordered eating to facilitate interventions for early prevention of this condition.

The development of eating disorders begins between 10 and 20 years of age [11], indicating that adolescents may have by then developed some form or the other of disordered eating. There is a body of evidence reporting the high prevalence rates of disordered eating among adolescents in Western countries [12–15]. Socio-cultural factors including exposure to the Western ideal of thinness and rapid economic development, industrialization, urbanization, shifting of gender roles and societal norms were all found to be risk factors that associated with development of eating disorders; however, eating disorders are not limited to the Western cultures [16, 17]. According to existing studies [8, 18–20], the prevalence of disordered eating in Asian countries ranges from 5.1 % (in Hong Kong) [18] to 44.7 % (in Kuwait) [8]. While some East-Asian countries such as Hong Kong, Japan and South Korea reported lower prevalence compared to Western countries [18–20], Middle Eastern countries such as Jordan, and the United Arab Emirates (UAE), Kuwait and Palestine reported similar or even higher prevalence of disordered eating among adolescents, compared to Western societies [8]. In this regard, previous studies conducted among Iranian female adolescents reported high prevalence of disordered eating [21, 22] comparable to the prevalence rates reported in Western and Middle Eastern countries [8, 12–15]. Nobakht and Dezhkam [21] conducted a study on 3,100 adolescent girls aged 15–18 years in Tehran and found that about one-fourth (24.0 %) of them had disordered eating.

While number of existing studies that have investigated disordered eating focused on adolescent girls [12, 14], studies on adolescent boys are limited; however, others have reported higher prevalence of disordered eating among adolescent boys compared to girls in some countries [8, 20]. Current studies documented disordered eating in Iranian adolescents are mainly focused on females [21, 22] and there is lack of evidence about disordered eating among adolescent boys. Considering the limited studies regarding disordered eating among Tehranian adolescents, it is important to determine the current status of disordered eating among both adolescent girls and boys residing in Tehran, which is the aim of our study.

As stated earlier, disordered eating has been linked to several health related risks including obesity. Overweight and obesity are problems showing fast increasing trend among Tehranian adolescents [23]. According to results of a survey of Iranian school children (6–18 years) from 30 provinces of Iran, about one in five of the students (20.2 % of girls and 22.9 % of boys) were overweight and obese [24]. While the prevalence of overweight and obesity was high, adolescents were found to use several weight control strategies which ranged from healthy eating behaviors (e.g. increasing the intake of fruit and vegetables and decreasing the intake of sweetened beverages) to unhealthy weight control behaviors such as dieting, skipping meals, purging and using laxatives and diet pills [25, 26]. The findings from the Eating Among Teens (EAT) project, conducted in the United States indicated that after 5 and 10 years follow up, the body mass index (BMI) of adolescents who reported dieting or using unhealthy weight control behaviors increased more compared to those who did not use any weight control behaviors [27, 28]. After 5 years, those adolescents who used unhealthy weight control behaviors were at higher risk for becoming overweight, binge eating with loss of control and extreme weight-control behaviors, compared to those who did not use any unhealthy weight control behaviors [27]. Furthermore, skipping meals and reporting eating very little in both sexes and using diet pills in girls and using food substitutes in boys were the specific unhealthy weight control behaviors that predicted more increase in BMI of adolescents after 10 years follow up [28]. These findings suggest that disordered eating predisposes adolescents to weight gain over time [27, 28]. Hence, early detection and prevention of disordered eating in adolescence may serve as one of the key strategies to overcome obesity problem. There is a lack of evidence regarding the association between disordered eating and overweight and obesity among Iranian adolescents.

Obesity is accompanied by several health consequences that negatively affect physical health and psychosocial functioning in adolescence [29, 30]. The high prevalence of obesity in addition to its health consequences has made it a public health concern in recent years. In spite of the increasing number of studies in the context of adolescence obesity from developed countries, some related issues have been understudied and need more scientific exploration in developing countries; disordered eating is one of these issues. As mentioned earlier in addition to obesity, disordered eating has been shown to be associated with several psychosocial health related risks [5, 6] that may affect health related quality of life (HRQOL) in adolescents. Using the world health organization (WHO) definition for health; HRQOL is defined as multidimensional construct which encompasses at least three main dimensions including physical, psychological and social well-being of

an individual [31]. Evaluating HRQOL of adolescents is important as it serves as an outcome indicator in evaluating health-care interventions and treatments, understanding the burden of disease, identifying health inequalities, allocating health resources, and in epidemiological studies and health surveys [32]. Considering the potential influence and consequences of disordered eating on adolescent health, specifically in psychosocial domain [5, 6, 33], it is important to explore whether disordered eating is associated with HRQOL as an outcome measure of health in adolescents. Hence, the current study aimed to determine the association between disordered eating and overweight and obesity and also to investigate the implications of disordered eating in relation to HRQOL among adolescents in selected high schools of Tehran.

Methods

Participants

The participants of this study were 14–17 year-old adolescents with a mean age of 15.55 ± 0.94 years. Multistage sampling method was used to select the adolescents with different socio-economic classes. To do so, Tehran was divided to three demographically diverse zones, i.e. the North, Center and South zones, which are representative of upper, middle and lower socio-economic classes respectively. After listing all districts in the three geographical zones, using simple random sampling method, one district was selected from each geographical zone. All high schools in each selected district were listed and two high schools (one female and one male high school) were randomly selected from each district. Hence, a total of six high schools (three schools for each gender) were selected. Iranian high schools include three grades/classes. From the six high schools, for each school three classes (first, second and third grade) were selected randomly both for boy and girl- i.e. overall 18 classes were selected and all the students of these classes were invited to participate in this study. Adolescents with any chronic mental or physical disease (such as cancer, diabetes, heart disease, kidney disease) were excluded from the study. From a total of 485 adolescents who were invited, 465 agreed to participate in the study giving a response rate of 95.8 %.

Measurements

Anthropometric Measurements

The SECA weighing scale and SECA body meter were used to measure body weight and height of adolescents respectively. Body weight was recorded to the nearest 0.1 kg and height was recorded to the nearest 0.1 cm. To determine BMI-for-age (BMI Z-score) of adolescents, the WHO Anthro (version 3.2.2) and macros software were used. Body weight status of participants was determined using the World Health Organization cut offs (WHO 2007) [34]. In this study, adolescents were categorised as the non-overweight group (BMI-for-age ≤ 1SD) and the overweight group (BMI-for-age > 1SD).

Pediatric Quality of Life Inventory Version 4.0 Questionnaire (PedsQL^{TM}4.0)

Health-related quality of life (HRQOL) of adolescents was assessed using the Pediatric Quality of Life Inventory version 4.0 questionnaire (PedsQL^{TM}4.0) [35]. The PedsQL^{TM}4.0 is a self-administered questionnaire which includes 23 items in four subscales: (i) Physical Functioning, (ii) Emotional Functioning, (iii) Social Functioning and (iv) School Functioning [35]. A five-point scale from zero to four was used for scoring answers for each item, where the choice of an answer for "never a problem" was given a zero point and "almost always a problem" was given four points. In the next step, items were scored reversely as (0 = 100, 1 = 75, 2 = 50, 3 = 25 and 4 = 0); hence, a higher score showed a better HRQOL. Reliability and validity of the Persian version of the PedsQL^{TM}4.0 as a generic instrument to measure HRQOL of adolescents in Iran has been reported [36]. In the current study, the internal consistency (Cronbach's α) was 0.88.

Eating Attitudes Test-26 (EAT-26)

Disordered eating in adolescents was assessed using the Eating Attitudes Test-26 (EAT-26) questionnaire [37]. The EAT-26 questionnaire includes 26 items with three subscales including (i) dieting, (ii) bulimia and food preoccupation and (iii) oral control. Each item is responded to on a six-point Likert scale ranging from "always" to "never" and the answer is given a score ranging from zero to three. To calculate the score of each item, except for item 26, each item response was given a score of zero for 'Sometimes', 'Rarely' and 'Never', a score of one for 'Often', a score of two for 'Usually' and a score of three for 'Always'. Item number 26 is scored reversely. A total score of 20 and above was classified as at-risk of eating disorders (disordered eating). In the current study, the internal consistency (Cronbach's α) was 0.78.

Data Collection

Ethics approvals were obtained from the Medical Research Ethical Committee of the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia (UPM) and from the

Table 1 Prevalence of disordered eating and mean total EAT scores among adolescents

	Total n = 465	Girls n = 227	Boys n = 238
Disordered eating		n (%)	
Yes	88 (18.9 %)	60 (26.4 %)	28 (11.8 %)
No	377 (81.1 %)	167 (73.6 %)	210 (88.2 %)
		Mean ± SD	
Total EAT score	12.26 ± 8.98	14.59 ± 9.19	10.05 ± 8.20

Research Institute for Endocrine Sciences (RIES) of Shahid Beheshti University of Medical Sciences in Tehran, Iran. Both adolescents and their parents were asked to sign informed consent forms. Adolescents were then assessed for anthropometric measurements by the researchers, following which the PedsQL and EAT-26 questionnaires were distributed to the adolescents for completion after each questionnaire was explained for them by the researchers. The researchers were present for clarifying or answering any possible questions during data collection.

Statistical Analysis

Data were analyzed using the SPSS software version 19.0. Independent samples *T* test was used to compare continuous variables between gender and overweight groups. To compare the percentage of categorical variables in different groups, Chi square test was used. To determine the relationships between continuous variables, linear regression was used. To determine the association between two categorical variables, Chi square test was used. Statistical significance was set at $p < 0.05$.

Results

Table 1 shows the prevalence of disordered eating and mean of total EAT-26 scores among the adolescents. Of 465 adolescents, 18.9 % of them had disordered eating with a mean total EAT score of 12.26 ± 8.98. Mean total EAT score in girls was significantly higher than in boys ($t = 5.61$, $p < 0.05$). The prevalence of disordered eating in girls (26.4 %) was over two fold that of boys (11.8 %) ($\chi^2 = 16.29$, $p < 0.05$).

Mean BMI-for-age, HRQOL total and subscale scores and body weight status have been reported previously [38]. Figure 1 represents the prevalence of overweight/obesity among the adolescents. The prevalence of overweight/obesity was 35.7 % in girls and 41.2 % in boys, but was not significantly different ($\chi^2 = 1.48$, $p = 0.22$). Overall, more than one-third of adolescents were overweight or obese (38.5 %).

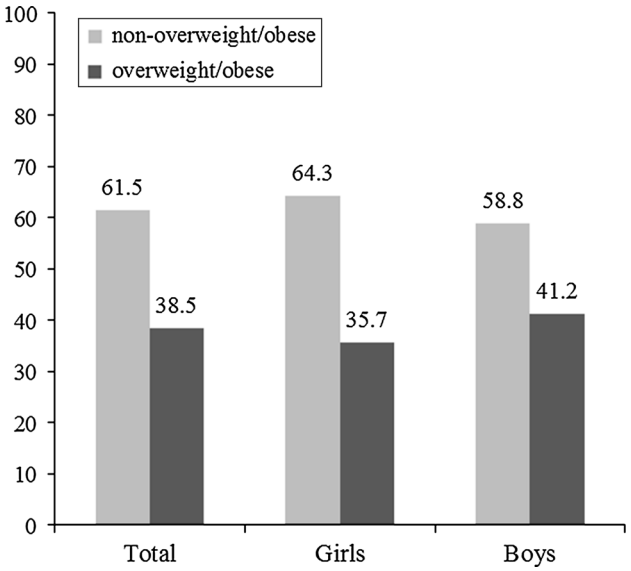

Fig. 1 Prevalence of overweight/obesity among adolescents

Table 2 Prevalence of disordered eating in non-overweight and overweight groups of adolescents

	Disordered eating	
	Yes n (%)	No n (%)
Total (n = 465)		
Non-overweight	41 (14.3)	245 (85.7)
Overweight	47 (26.3)	132 (73.7)
Girls (n = 227)		
Non-overweight	28 (19.2)	118 (80.8)
Overweight	32 (39.5)	49 (60.5)
Boys (n = 238)		
Non-overweight	13 (9.3)	127 (90.7)
Overweight	15 (15.3)	83 (84.7)

Disordered Eating and Overweight and Obesity

Table 2 shows the prevalence of disordered eating in non-overweight and overweight groups of adolescents. The prevalence of disordered eating was significantly higher in overweight adolescents (26.3 %) compared to non-overweight adolescents (14.3 %; $\chi^2 = 10.20$, $p < 0.05$). However, the higher prevalence of disordered eating in overweight adolescents was only significant in adolescents girls ($\chi^2 = 11.07$, $p < 0.05$), but not in adolescent boys ($\chi^2 = 2.01$, $p = 0.16$).

Table 3 Risk of being overweight in adolescents with disordered eating vs. those without disordered eating

Factor	OR	95 % CI
Total		
Without disordered eating	1	
With disordered eating	2.128	(1.331–3.402)
Girls		
Without disordered eating	1	
With disordered eating	2.752	(1.500–5.049)
Boys		
Without disordered eating	1	
With disordered eating	1.766	(0.799–3.900)

As a whole, those adolescents who had disordered eating were 2.13 times more likely to be overweight compared to those without disordered eating (OR 2.128, 95 %CI 1.331–3.402). Further analysis in girls and boys showed however that the higher risk of being overweight in those adolescents who had disordered eating was significant only in adolescent girls but not in boys (Table 3).

Results of simple linear regression analysis showed that total EAT score contributed significantly towards BMI-for-age in adolescent girls ($\beta = 0.32$; $t = 4.97$, $p < 0.05$), but not in boys ($\beta = 0.10$; $t = 1.47$, $p = 0.14$). In adolescent girls, the R-square of 0.10 showed that 10.0 % of the variances in BMI-for-age of adolescent girls can be explained by the total EAT score ($F = 24.71$, $p < 0.05$).

Disordered Eating and HRQOL

Table 4 compares the total and subscale scores of HRQOL between adolescents with disordered eating and adolescents without disordered eating. As a whole, the total and all subscale scores of HRQOL were significantly lower in adolescents with disordered eating compared to those without the condition (t value range 2.75–5.21, $p < 0.05$). Further analyses by gender showed that in adolescent girls, emotional functioning and social functioning of HRQOL were poorer among adolescent girls who had disordered eating compared with those who did not have disordered eating ($t = 2.05$ and $t = 2.31$ respectively; $p < 0.05$). As for adolescent boys, emotional functioning and school functioning of HRQOL were poorer in adolescent boys who had disordered eating compared to those who did not have the disorder ($t = 3.68$ and 3.08 respectively; $p < 0.05$). These findings indicate that disordered eating is associated with poor HRQOL in different aspects of HRQOL in both adolescent girls and boys.

Results of simple linear regression analysis showed that disordered eating significantly contributed towards HRQOL in both adolescent girls ($\beta = -0.17$; $t = -2.63$, $p < 0.05$) and boys ($\beta = -0.27$; $t = -4.31$, $p < 0.05$). In the model for adolescent girls, the R-square of 0.03 showed that 3.0 % of the variances in HRQOL of the adolescent girls can be explained by total EAT score ($F = 6.93$, $p < 0.05$). In the model for adolescent boys, the R-square of 0.07 showed that 7.0 % of the variances in HRQOL of adolescent boys can be explained by total EAT score ($F = 18.59$, $p < 0.05$). The findings indicate that adolescents with higher risk of disordered eating were more likely to have poor HRQOL compared to those with a lower risk, especially in boys.

Table 4 Mean HRQOL total and subscale scores in adolescents with disordered eating and adolescents without the condition

	Disordered eating		t value
	No	Yes	
Total (n = 465)			
Physical functioning	85.97 ± 12.06	81.50 ± 14.09	2.75*
Emotional functioning	71.95 ± 17.36	60.74 ± 21.40	5.21*
Social functioning	88.50 ± 12.49	81.99 ± 19.94	2.93*
School functioning	77.18 ± 15.21	70.45 ± 18.19	3.59*
HRQOL total score	81.56 ± 11.21	74.70 ± 13.96	4.30*
Girls (n = 227)			
Physical functioning	81.53 ± 13.23	78.70 ± 14.15	1.40
Emotional functioning	64.73 ± 17.97	57.75 ± 24.12	2.05*
Social functioning	86.95 ± 13.72	79.83 ± 22.44	2.31*
School functioning	73.71 ± 15.07	72.00 ± 16.52	0.74
HRQOL total score	77.36 ± 11.81	72.93 ± 15.27	2.03*
Boys (n = 238)			
Physical functioning	89.49 ± 9.73	87.50 ± 12.15	0.99
Emotional functioning	77.69 ± 14.53	67.14 ± 11.90	3.68*
Social functioning	89.74 ± 11.29	86.61 ± 12.18	1.37
School functioning	79.93 ± 14.79	67.14 ± 21.28	3.08*
HRQOL total score	84.90 ± 9.48	78.46 ± 9.84	3.37*

* $p < 0.05$

Discussion

In the current study, about one in five of adolescents had disordered eating. The prevalence of disordered eating in adolescent girls was twice as in adolescent boys. This finding is in line with the results of previous studies in different countries such as Greece, Hong Kong, Jordan, Libya, Palestine, Syria, and Turkey which reported higher prevalence of disordered eating in female compared to male adolescents [8, 13, 18, 39]. Compared to adolescent boys, higher prevalence of disordered eating in adolescent girls may be due to higher level of dissatisfaction regarding body weight and shape in these girls [40].

The prevalence of disordered eating among adolescent girls in the current study was 26.4 %, which is similar to the prevalence found in a previous study conducted among adolescent girls in Tehran (24.16 %) [21]; our findings indicate that disordered eating is more prevalent among adolescent girls in Tehran compared to their adolescent counterparts in Tabriz (16.7 %) [22]. There is lack of evidence regarding the prevalence of disordered eating among adolescent boys in Iran and existing studies regarding disordered eating focus mainly on adolescent girls [21, 22]. However, our findings showed that more than one in ten adolescent boys (11.8 %) in Tehran had disordered eating. The prevalence of disordered eating among adolescent boys in the current study (11.8 %) is higher than that of adolescent boys in Hong Kong (3.9 %) [18], similar to adolescent boys in Greece (12.8 %) [13] and lower than in other Middle Eastern countries such as Jordan (20.1 %), Palestine (23.2 %), United Arab Emirates (29.8 %) and Kuwait (47.3 %) [8]. Although the findings of current study indicate that the prevalence of disordered eating was higher in Tehranian adolescent girls compared to adolescent boys; this condition is a health concern in both boys and girls in this age group. Hence, to curtail the development of eating disorders, it is advised to screen adolescents to identify those with disordered eating.

This study showed that disordered eating was associated with overweight and obesity in adolescent girls but not in adolescent boys. In other words, overweight and obese adolescent girls were more likely to have disordered eating compared to their non-overweight non-obese counterparts. In a longitudinal study, using unhealthful weight-control behaviors predicted overweight and obesity in adolescents after 5 years [27]. In the current study, the prevalence of overweight and obesity was higher in adolescent boys compared to their female counterparts. However, the prevalence of disordered eating was lower in adolescent boys compared to adolescent girls. This may be due to social pressures for thinness in adolescent girls, which may lead to unhealthy eating behaviors among overweight and obese adolescent girls in an attempt to reduce weight. On the other hand, adolescent boys usually prefer a more muscular body and a bigger body size [41]. Findings of a qualitative study conducted among adolescents in Tehran showed that "positive self-image" in overweight and obese adolescent boys was one of the barriers for lifestyle modification [42]. Most overweight and obese adolescent boys stated that they were satisfied with their "big" body size [42]; hence, it is less likely that overweight adolescent boys adopt unhealthy eating behaviors which aim to reduce weight. Therefore, body image is an important factor which can explain why disordered eating is associated with overweight in adolescent girls but not in adolescent boys. In future studies, body image should be included as an important factor that needs to be focused on with a view to improving unhealthy eating behaviors.

Based on the results of this study, adolescents with disordered eating had poorer HRQOL compared to adolescents without disordered eating. Our findings are consistent with results of a study conducted among college students in Turkey [43] and another study conducted among 11–17 years old German adolescents which reported lower HRQOL scores for adolescents with disordered eating behaviors compared to adolescents without disordered eating behaviors [44]. In our study, the association between disordered eating and poor HRQOL was observed in emotional functioning and social functioning subscales of HRQOL in girls and emotional functioning and school functioning subscales of HRQOL in boys. These three subscales of HRQOL contribute to the psychosocial health score of HRQOL. Previous studies report that disordered eating is associated with psychosocial health related factors such as depression, sleep disturbances, self-esteem and anxiety [5, 6, 45]. The associations between disordered eating and psychosocial health related factors reported in previous studies [5, 6, 45] contribute to the adverse effect of disordered eating on psychosocial health related subscales of HRQOL rather than the physical subscale of HRQOL.

To our knowledge, this is the first study reporting the prevalence of disordered eating among adolescent boys in Iran, and also demonstrating the association between disordered eating and HRQOL in both Iranian adolescent girls and boys. However, there are some limitations that need to be mentioned; due to the cross-sectional nature of this study, we cannot make causal inferences about associations between disordered eating and overweight and HRQOL. Secondly, the participants of this study were limited to high school students in Tehran. Considering the high prevalence of disordered eating in the current study, conducting more studies including adolescents from other provinces of Iran is recommended. National studies would be more conclusive and can depict the situation of the disordered eating problem in Iranian adolescents more accurately.

Summary

In summary, about one in five of the adolescents in the high schools of Tehran had disordered eating. The prevalence of disordered eating was higher in adolescent girls compared to adolescent boys. More than one-third of adolescents were overweight or obese. Disordered eating was associated with overweight and obesity in adolescent girls, but not in boys. Disordered eating was associated with poor HRQOL especially in the psychosocial domains of HRQOL in both adolescent girls and boys. The association between disordered eating and physical and psychological

health of adolescents, indicates that more attention should be paid on this health problem among Iranian adolescents. To prevent problems related to eating behaviors in adulthood, evaluation of disordered eating in adolescents needs to be prioritized as an effective approach for the early detection of those adolescents who are at risk of developing eating disorders.

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