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Network Associations Among Body Image, Lifestyle, Body Mass Index, and Quality of Life in Adolescents

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Abstract

Background: Body image is known as an important factor affecting different aspects of adolescents' health; however, its relationship with lifestyle, body mass index (BMI), and health-related quality of life (HRQoL) in Iranian adolescents has not been addressed in a conceptual model.
Objectives: This study aimed to investigate the network associations among body image, lifestyle, BMI, and HRQoL in adolescent boys and girls.
Methods: The present study examined 760 adolescents (15 - 18 years) from Tehran. Adolescents reported their weight and height, according to which the participants' BMIs were calculated. The adolescents' body image, lifestyle, and HRQoL were assessed using a set of questionnaires, including the Body Image Scale for Youth (BISY), Modifiable Activity Questionnaire (MAQ), Eating Habits Checklist, Eating Attitudes Test (EAT-26), and Pediatric Quality of Life Inventory (PedsQL^{TM}).
Results: The participants' mean age and BMI were 16.5 $\pm$ 1.0 years and 22.4 $\pm$ 4.6 kg/m^2, respectively. More than one-third of boys (39.9%) and less than a quarter of girls (22.6%) were overweight/obese. In the final model, body image was significantly and directly associated with physical activity, disordered eating, eating habits, and HRQoL in both genders ($P < 0.05$). Moreover, body image was directly correlated with screen time in boys ($P = 0.012$) and BMI in girls ($P = 0.001$). Body image was indirectly correlated with BMI by the mediating role of disordered eating in girls. Moreover, body image was indirectly associated with HRQoL by the mediating role of physical activity and eating habits in both genders and screen time only in boys.
Conclusions: The network associations among body image, lifestyle, BMI, and HRQoL revealed a gender-specific pattern among the study population. Body image was a significant determinant of lifestyle and HRQoL in both genders and excessive weight in girls. The present findings would contribute to designing and implementing relevant health promotion interventions.

Keywords: Body Image, Lifestyle, Physical Activity, Disordered Eating, Eating Habits, Body Mass Index, Obesity, Health-Related Quality of Life, Adolescents

1. Background

Body image is a multidimensional construct encompassing perceptual, affective, cognitive, and behavioral components (1). Adolescence is accompanied with puberty, physical changes, and identity development, making it a critical period in shaping a positive or negative body image (2). Both fat talk and weight-related bullying during adolescence have been associated with an overemphasis on body weight and appearance and consequently the development of body dissatisfaction and a negative body image (3). Relevant evidence suggests weight concerns and body dissatisfaction have been associated with overweight/obesity in adolescents, specifically girls (4, 5).

It is also documented that negative body image is associated with obesity-related lifestyle factors, including low levels of physical activity, unhealthy eating habits, and disordered eating (6, 7). Previous studies documented the significant relationship between body image and health-related quality of life (HRQoL) (8, 9). According to the existing evidence, lifestyle components, including physical activity and eating habits, have been significantly associated with obesity and HRQoL (10-12). Hence, lifestyle factors may play a mediating role in the association between body im-

age and other outcomes, including body mass index (BMI) and HRQoL.

Previous studies investigated the relationship between body image and other variables such as BMI, lifestyle, and HRQoL per se; however, no study has examined their relationship in a model. Furthermore, most of the previous studies were conducted in Western countries; hence, limited information is available for non-Western countries with different cultural values. Culture is an essential determinant of body image (13-15); it is necessary to replicate previous findings in non-Western countries, including Iran. The correlational studies addressing the relationship between body image with obesity, lifestyle, or perceived health in Iran only assessed one aspect of body image, either body dissatisfaction or disordered eating, and did not use a comprehensive tool encompassing different dimensions of this construct (16-18). As body image is a multidimensional construct (1), a multifaceted scale would provide a more accurate and comprehensive assessment of this concept. Given the lack of evidence in the literature, the present study used a comprehensive tool to assess body image and further investigate its network relationship with lifestyle factors, BMI, and HRQoL in adolescent boys and girls. The findings would clarify the direct and indirect relationships among studied variables and provide a valuable grounds for future interventions to improve different aspects of adolescents' health.

2. Methods

2.1. Participants

The research participants encompassed 760 adolescents (aged 15 - 18 years) residing in Tehran, who were selected using a multi-stage sampling method. To select the participants from various socio-economic backgrounds, Tehran was divided into two geographical areas, north, and south. Then a simple random sampling method was used, and one district was selected from each geographical area. After preparing the list of high schools in each selected area, four schools were selected from each district using a simple random sampling method.

2.2. Measurements

The adolescents self-reported demographic information, including age, gender, history of diseases, weight, height, parental characteristics such as marital status, levels of education, and job. The participants' BMI was calculated as weight (kg) divided by the square of height (m^2). The BMI-for-age national percentiles were used to determine the adolescents' body weight status. Underweight, normal weight, overweight, and obesity were defined as BMI $<$ 5th percentile, $\geq$ 5th to $<$ 85th percentile, $\geq$ 85th percentile to $<$ 95th percentile, and $\geq$ 95th percentile, respectively. The adolescents' body image, lifestyle, and HRQoL were assessed using a set of questionnaires, including The Body Image Scale for Youth (BISY), Modifiable Activity Questionnaire (MAQ), Eating Habits Checklist, Eating Attitudes Test (EAT-26), and Pediatric Quality of Life Inventory (PedsQL^{TM}).

The BISY is a 52-item scale assessing body image in nine dimensions, including personal capacities, the priority of health and spirituality, appearance importance in the future, appearance importance in social interactions, perceived cultural values, social models, perceived social support, body evaluation, and emotions and behaviors. The validity and reliability of this questionnaire were assessed and confirmed. Exploratory factor analysis (EFA) also confirmed the construct validity of the scale. The ICC and Cronbach's alpha values for the whole scale were 0.805 and 0.896, respectively.

The MAQ was used to assess the adolescents' physical activity. The findings of a previous study reported the good validity and reliability of this questionnaire in the Iranian population (19). Moreover, the adolescents' eating habits were assessed using a researcher-made checklist with items on skipping main meals, snacking, eating companions, and frequency of fast foods, high-calorie beverages, and unhealthy snacks. An expert panel of nutritionists assessed the content validity of this checklist. The Iranian version of the EAT-26 also assessed the participants' disordered eating. Previous studies also documented the acceptable validity and reliability of the Iranian version of this questionnaire (20).

The Iranian version of the PedsQL was used to assess HRQoL. This questionnaire encompasses 23 items and four subscales (namely physical functioning, emotional functioning, social functioning, and school functioning). Previous findings confirmed the validity and reliability of the Iranian version of this questionnaire (21). The scoring procedure of the questionnaires is presented in Appendix 1.

The Ethics Committee of the Research Institute for Endocrine Sciences (RIES), affiliated with the Shahid Beheshti University of Medical Sciences, approved the study. All adolescents submitted their written informed consent.

2.3. Statistical Analysis

Mean $\pm$ standard deviation was used to describe continuous variables. Independent samples *t*-tests were used to compare the continuous variables between boys and girls. Frequency and percentage were reported for categorical data. The chi-squared test was used to compare the distributions of categorical variables in boys and girls. The

path analysis was used to assess the model fit, and fit indices such as χ^2/df; root mean square error of approximation (RMSEA), comparative fit index (CFI), incremental fit index (IFI), and goodness of fit index (GFI) were calculated and reported to measure the model's adequacy. The collected data were analyzed using SPSS and AMOS software version 21.

3. Results

Table 1 presents the participants' descriptive statistics. The participants' mean age and BMI were 16.5 $\pm$ 1.0 years and 22.4 $\pm$ 4.6 kg/m^2, respectively. The mean BMI was significantly higher in girls (23.4 $\pm$ 4.9 kg/m^2) than in boys (21.4 $\pm$ 3.9 kg/m^2). Moreover, there was a significant difference between the boys and girls regarding the distribution of body weight categories($P < 0.001$). Above one-third of boys (39.9%) and below a quarter of girls (22.6%) were overweight/obese; however, there was no significant difference in the two groups' parental characteristics.

Table 2 shows the participants' mean body image, lifestyle factors, and HRQoL scores. There were significant differences between boys and girls in terms of lifestyle factors, including physical activity, screen time, and eating habits. Although the EAT-26 total score was higher in girls than boys, this difference was not statistically significant. In general, 18.9% of the adolescents had disordered eating. The percentage of disordered eating was higher in girls (21.5%) than in boys (16.6%); however, the difference was not statistically significant ($P = 0.081$). The physical and emotional subscale scores and HRQoL total score were significantly higher in boys than girls.

Table 3 shows the correlation coefficients for the relationship between body image total score and other variables. The BISY total score was significantly associated with physical activity, eating habits, EAT-26, and HRQoL total scores in both genders. Moreover, the BISY total score was significantly associated with screen time and BMI in boys and girls, respectively.

Figure 1 illustrates the conceptual model of the relationships among body image, lifestyle factors, BMI, and HRQoL. The fit indices of the proposed model were investigated and reported in boys and girls separately. The fit indices of the proposed model were acceptable in boys (χ^2/df = 2.38, RMSEA = 0.059 (0.019 - 0.099), CFI = 0.96, IFI = 0.96, TLI = 0.86, GFI = 0.99), and girls (χ^2/df = 2.14, RMSEA = 0.056 (0.007 - 0.099), CFI = 0.98, IFI = 0.98, TLI = 0.92, GFI = 0.99). The final models are depicted in Figure 2A and B for boys and girls, and standardized estimations are noted above each path. Continuous lines represent significant relationships. In boys, negative body image had a significantly negative relationship with HRQoL ($P < 0.001$), while its relationship with BMI was not significant ($P = 0.254$). Moreover, negative body image was significantly correlated with all lifestyle factors, including disordered eating ($P < 0.001$), screen time ($P = 0.012$), physical activity ($P = 0.020$), and eating habits ($P < 0.001$). Except for disordered eating, all lifestyle factors, including screen time ($P = 0.035$), physical activity ($P = 0.031$), and eating habits ($P = 0.003$), were significantly correlated with HRQoL. There was no significant relationship between BMI and HRQoL ($P = 0.574$).

Regarding the girl participants, negative body image had a significantly positive relationship with BMI ($P = 0.001$) and a significantly negative relationship with HRQoL ($P < 0.001$). Except for screen time, negative body image had significant relationships with all lifestyle factors, including disordered eating ($P < 0.001$), physical activity ($P = 0.011$), and eating habits ($P < 0.001$). Except for disordered eating, all lifestyle factors, including screen time ($P = 0.020$), physical activity ($P < 0.001$), and eating habits ($P < 0.001$), had significant relationships with HRQoL. Disordered eating had a significantly positive association with BMI ($P = 0.042$); however, there was no significant relationship between BMI and HRQoL ($P = 0.147$).

4. Discussion

This study examined the network associations among body image, lifestyle, BMI, and HRQoL in adolescent boys and girls. Findings indicated that body image is significantly associated with physical activity, eating habits, disordered eating, HRQoL in both sexes, screen time only in boys, and BMI only in girls. Moreover, body image has been indirectly associated with BMI by mediating role of disordered eating only in girls. Additionally, it was indirectly associated with HRQoL by mediating roles of lifestyle factors, including physical activity, screen time, and eating habits.

According to the research findings, except for screen time in girls, body image was significantly associated with all lifestyle factors in boys and girls. There was a significant inverse relationship between negative body image and physical activity, indicating lower physical activity levels in adolescents with more negative body image. Consistent with the present findings, both cross-sectional and longitudinal studies have reported significant relationships between body image and moderate and intense activities in adolescents (6, 7, 22). A previous study indicated that different aspects of body image, such as weight stigma, appearance evaluation, fears of negative appearance evaluations, and weight bias internalization, were significantly associated with the enjoyment and avoidance of physical activity and sports in undergraduate students (23). Moreover, negative body image was significantly associated with screen time in the boys participating the present study. Previous

Table 1. Participants' Body Weight Status and Demographic Information [a]

	Boys (n = 398)	Girls (n = 362)	P-Value
Age (y)	16.5 ± 1.1	16.5 ± 1.0	0.794
BMI (kg/m^2)	21.4 ± 3.9	23.4 ± 4.9	< 0.001
Body weight status			< 0.001
Underweight	11 (2.8)	24 (6.6)	
Normal-weight	228 (57.3)	256 (70.7)	
Overweight	75 (18.8)	53 (14.7)	
Obese	84 (21.1)	29 (8.0)	
Parents' marital status			0.155
Divorced/widowed	18 (4.5)	25 (6.9)	
Married	380 (95.5)	337 (93.1)	
Maternal education			0.291
Primary	56 (14.1)	66 (18.2)	
Secondary	156 (39.2)	133 (36.8)	
Academic degree	186 (46.7)	163 (45.0)	
Maternal working status			0.321
Housewife	299 (75.1)	283 (78.2)	
Student/employed	99 (24.9)	79 (21.8)	
Paternal education			0.687
Primary	68 (17.1)	69 (19.0)	
Secondary	132 (33.2)	123 (34.0)	
Academic degree	198 (49.7)	170 (47.0)	
Paternal working status			0.498
Employee/labor	134 (33.7)	128 (35.4)	
Self-employed	227 (57.0)	193 (53.3)	
Retired/unemployed	37 (9.3)	41 (11.3)	

[a] Values are expressed as mean ± SD and No. (%).

findings in other countries have frequently documented the relationship between screen time and body dissatisfaction in youth (24, 25); however, body image and screen time have been addressed as an outcome and an independent variable, respectively. The use of the Internet, especially using social media and social networks mainly focusing on individuals' appearance, can adversely affect an individual's perception of his/her physical appearance by providing increased opportunity for social comparison (26). These types of media provide teens with many opportunities to compare their physical appearance with others, which in turn increases the likelihood of dissatisfaction with body in this group. Considering the present and previous findings, the relationship between screen time and body image seems to be bi-directional.

Moreover, negative body image in this study had a significant inverse relationship with the total score of eating habits in both genders, implying that adolescents with more negative body image have unhealthier eating habits. Furthermore, according to the present findings, negative body image had a significantly positive relationship with disordered eating in both genders. In line with these findings, in a 5-year follow-up, body dissatisfaction was a significant predictor of high levels of dieting, unhealthy and very unhealthy weight control behaviors, and binge eating in both boys and girls (6).

In the present study, the relationship between body image with BMI and weight status was significant only in girls, which could be due to gender differences in the internalization of ideal body patterns in girls and boys. Existing evidence has documented gender differences in adolescents' body image. In adolescent girls, thinness, and a

Table 2. Mean Body Image, Lifestyle Factors, and Health-Related Quality of Life Scores in Boys and Girls [a]

	Boys (n = 398)	Girls (n = 362)	P-Value
BISY total score	31.4 ± 10.0	34.9 ± 12.9	< 0.001
Personal capacities	24.7 ± 17.9	31.6 ± 22.6	< 0.001
Priority of health and spiritually	14.8 ± 17.1	22.0 ± 20.8	< 0.001
Appearance importance in the future	25.0 ± 22.2	34.8 ± 22.6	< 0.001
Appearance importance in social interactions	67.3 ± 24.9	60.4 ± 25.7	< 0.001
Perceived cultural values	76.6 ± 20.8	79.1 ± 20.9	0.098
Social models	48.6 ± 23.3	44.9 ± 24.8	0.035
Perceived social support	43.4 ± 19.6	46.5 ± 20.2	0.030
Body evaluation	16.9 ± 16.7	19.7 ± 18.2	0.031
Emotions and behaviors	19.1 ± 19.0	23.8 ± 19.3	0.001
Leisure-time physical activity (MET h/week)	18.8 ± 24.7	11.2 ± 16.8	< 0.001
Screen time (h/day)	3.0 ± 1.6	2.6 ± 1.7	0.007
Eating habit total score	78.2 ± 10.2	76.7 ± 10.9	0.040
EAT-26 total score	12.7 ± 8.7	13.5 ± 9.2	0.175
Dieting	6.5 ± 5.8	7.0 ± 6.6	0.267
Bulimia and food preoccupation	1.5 ± 2.4	1.5 ± 2.6	0.737
Oral control	4.7 ± 3.5	5.0 ± 4.1	0.254
HRQoL total score	77.1 ± 15.1	70.0 ± 16.1	< 0.001
Physical functioning	84.2 ± 14.6	72.2 ± 17.5	< 0.001
Emotional functioning	67.5 ± 23.2	58.1 ± 23.1	< 0.001
Social functioning	80.7 ± 19.7	79.2 ± 20.7	0.283
School functioning	71.5 ± 20.6	69.0 ± 20.7	0.094

Abbreviations: BISY, Body Image Scale for Youth; Eat-26, Eating Attitudes Test; HRQoL, health-related quality of life.
[a] Values are expressed as mean ± SD.

Table 3. Correlation Between Body Image and Other Variables, Including Lifestyle Factors, Body Mass Index, and Health-Related Quality of Life

	Boys (n = 398)		Girls (n = 362)	
	r	P-Value	r	P-Value
Leisure-time physical activity (MET h/week)	-0.12	0.014	-0.13	0.017
Screen time (h/day)	0.13	0.011	0.07	0.164
Eating habit total score	-0.30	<0.001	-0.26	<0.001
EAT-26 total score	0.22	<0.001	0.22	<0.001
BMI (kg/m^2)	0.06	0.201	0.17	0.001
HRQoL total score	-0.52	<0.001	-0.66	<0.001

Abbreviations: Eat-26, Eating Attitudes Test; HRQoL, health-related quality of life.

muscular body in boys indicates the features of an ideal body, and the lack of these features has been associated with body dissatisfaction (27). Furthermore, a linear correlation exists between body dissatisfaction and BMI in girls; underweight girls had the highest body satisfaction. However, in boys, the correlation between body dissatisfaction and BMI was U-shaped (28, 29); hence, both overweight and underweight boys showed dissatisfaction with their body size. The overweight boys tended to lose weight, and the underweight and normal-weight ones also tended to reach

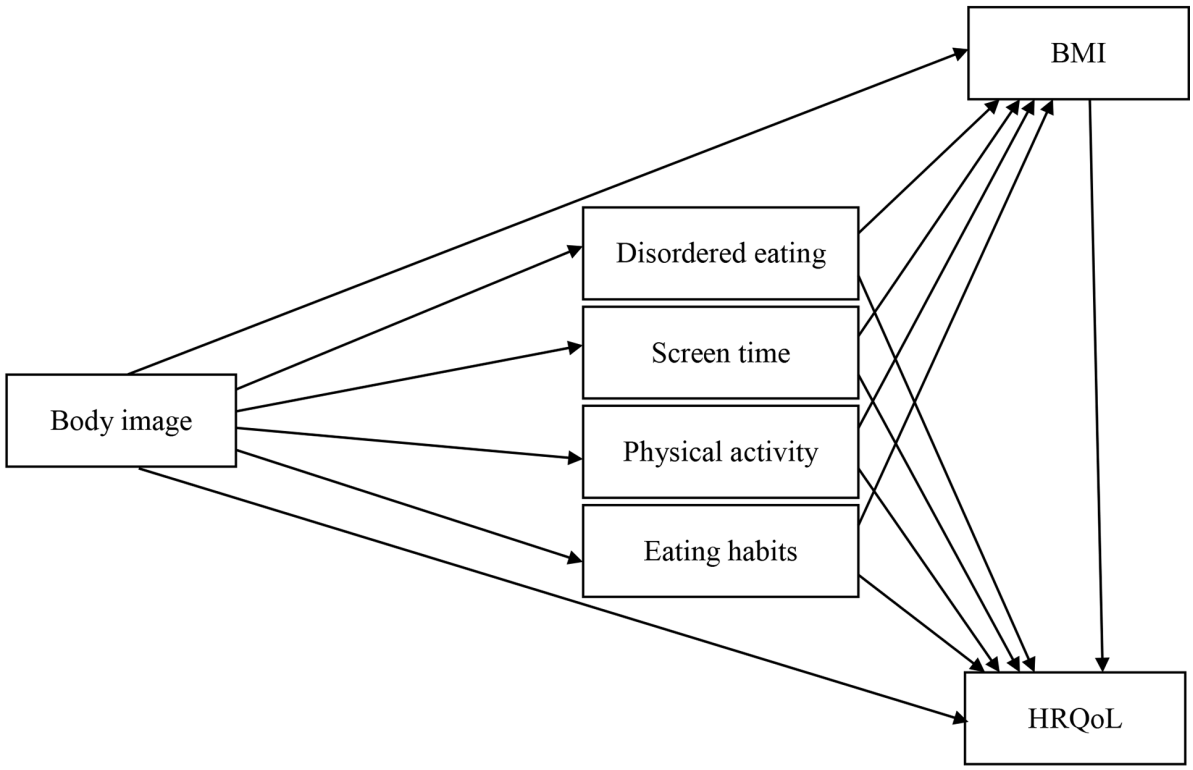

Figure 1. Conceptual model for the relationship among body image, lifestyle factors, body mass index (BMI), and health-related quality of life (HRQoL).

larger body sizes (28, 30). According to previous studies, boys prefer a muscular body and desire a bigger body size; however, these studies failed to distinguish between large body sizes due to increased muscle mass or fat mass (31).

Moreover, a qualitative study in Iran showed that some overweight boys had a positive body image and believed that being overweight is accompanied with resistance to physical trauma and disease and increased physical strength (32). Accordingly, while being overweight/obese is perceived undesirable by all girls, it is desirable for a group of overweight boys. These different perceptions in boys can distort the relationship between overweight and negative body image.

In addition to the direct and significant correlation of body image with BMI in girls, body image is indirectly associated with BMI by the mediating role of disordered eating. This finding is in line with those of a previous longitudinal study suggesting that dieting and unhealthy weight-control behaviors could predict an increase in BMI five years later (33). Moreover, BMI and fat percentages were higher in current and past dieters than non-dieters (34). It was reported that adolescents who dieted frequently or infrequently were more susceptible to binge eating and, consequently, were more likely to gain excessive weight (35).

According to the present findings, body image was significantly correlated with HRQoL in both genders. The relationship between body image and HRQoL was the strongest in the model. In line with these findings, previous studies have also documented that perceived health in adolescents can be influenced by physical appearance and body image (36). Similarly, body image was the strongest significant predictor of HRQoL in children and adolescents (8). Previous findings have frequently demonstrated the relationship between body dissatisfaction with sleep impairment, sadness/loneliness, peer stress, depression, and low self-esteem (9, 37-39). The aforementioned problems would contribute to the impairment of adolescents' emotional and social functioning and explain how negative body image may result in poorer HRQoL in adolescents.

To the best of our knowledge, this is the first study addressing the network relationships among body image, BMI, lifestyle factors, and HRQoL in Iranian boys and girls. The present study also suffered from some limitations. The required data was collected during the COVID-19 pandemic. The school classes were online during this period; hence, the accurate measurement of adolescents'

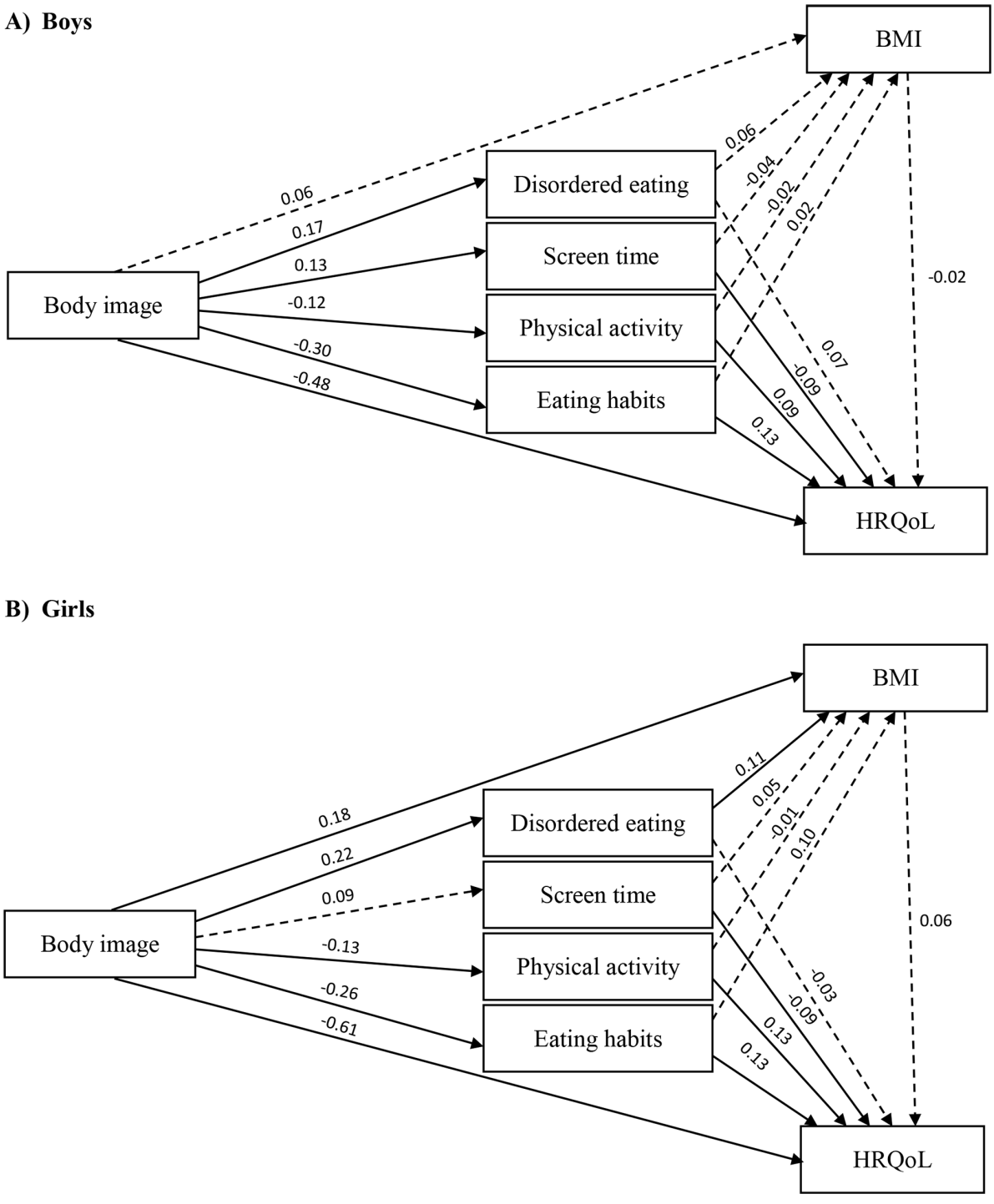

Figure 2. Final models after testing the relationship among body image, lifestyle factors, body mass index (BMI), and health-related quality of life (HRQoL) (A boys and B girls).

height and weight was not possible, and the adolescents were asked to self-report their weight and height. Accordingly, the under- and over-reporting of anthropometric data should be considered in interpreting the findings. Moreover, the participants were limited to the adolescents residing in Tehran, which would limit the generalizability of the findings.

4.1. Conclusions

There was a gender-specific pattern in the relationships among body image, lifestyle factors, BMI, and HRQoL. In boys, body image had a significant direct relationship with all lifestyle components and HRQoL. Moreover, body image had a significant indirect relationship with HRQoL through mediating role of the lifestyle factors. However, body image had no direct or indirect relationship with BMI in boys. In girls, except for screen time, body image was significantly correlated with all components of lifestyle, BMI, and HRQoL. Moreover, body image had significant indirect relationships with BMI mediated by eating disorders and with HRQoL mediated by lifestyle factors, including physical activity, and eating habits. In conclusion, although body image improvement is assumed as an effective strategy for weight management only in girls, it would be an effective strategy for lifestyle modification and HRQoL improvement in both boys and girls.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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Footnotes

Authors' Contribution: Study concept and design: S. J. F., P. A., and F. A.; acquisition of data: S. J. F.; analysis and interpretation of data: S. J. F. and F. Z.; drafting of the manuscript: S. J. F.; critical revision of the manuscript for important intellectual content: F. Z. (1), F. Z. (2), F. A., and P. A.; statistical analysis: S. J. F.; study supervision: F. A. and P. A.

Conflict of Interests: Nothing to disclose.

Data Reproducibility: The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Ethical Approval: This study was approved by the Ethics Committee of the Research Institute for Endocrine Sciences (Code: IR.SBMU.ENDOCRINE.REC.1399.003; Retrieved from link: ethics.research.ac.ir/EthicsProposalView.php?id=122190).

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Informed Consent: All adolescents submitted their written informed consent.

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