

PEER RELATIONS LINKING OVERWEIGHT AND OBESITY, AND MEDIATOR FACTORS AMONG TURKISH ADOLESCENTS

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ABSTRACT

Depending on the individual's body height and frame structure and body weight, obesity is considered both as a socially accepted norm in a society and as exceeding the accepted upper limits. The present study aimed to determine the associations between overweight and obesity, peer relationships, and nutritional and physical activity behaviour among Turkish adolescents. A cross-sectional study was conducted in Ankara, and the sample consisted of 402 adolescents (171 boys and 231 girls) aged between 12 and 17 years. A physical examination was conducted to collect anthropometric measurements (height, weight, BMI, and body fat using bio-impedance analysis), and detailed information was collected on adolescents' behaviour (Peer Relationship Scale with four sub-scales of commitment, trust and identification, self-disclosure, and loyalty), diet (24h recall dietary questionnaire), physical activity, self-reported weight, parental attitudes, and socio-economic

circumstances. BMI was evaluated using IOTF cut-off points, and simple mediation analyses were performed using ordinary least squares path analysis by the PROCESS macro for SPSS. The results showed that according to the weight status by BMI using IOTF cut-offs, thinness was more prominent in girls (9.5%), overweight was higher in girls (19%), while obesity was higher in boys (8.8%). Total body fat percentage was found to be higher in girls in all weight groups ($p < 0.001$). The Peer Relationship Scale and, commitment, self-disclosure, and loyalty sub-scales were found to be statistically significant ($p < 0.001$); girls tend to have higher scores except for the loyalty sub-scale. According to the results, self-reported and actual weight differences were found to be significant in both sexes ($p < 0.001$), and among IOTF weight groups overweight girls tended to report their weight approximately 2 kg lower than their actual weight and obese girls more than 5 kg lower. In conclusion, the mediation analysis showed that fat percentage, self-reported weight difference, and BMI were significant predictors of Peer Relationship Score where fat percentage partially mediated the relationship between the Peer Relationship Scale and BMI, and full mediation effect of self-reported weight difference was also significant. The relation of the high level of fat accumulation and overweight/obesity with Peer Relationship Scores and its sub-domains should be carefully monitored.

Keywords: *Peer Relationship; BMI; obesity; mediation analyses; adolescence; Turkey*

INTRODUCTION

It is known that prevalence of overweight and obesity in children and adolescents has been increasing prominently throughout the world, including Turkey [31]. Obesity has two different definitions – a social definition and a medical definition. The social definition is related to the accepted norms in a given society, while the medical definition is related to the more than acceptable upper limit of the individuals' weight for their height and frame. Various studies have reported on the factors associated with overweight and obesity. Health risks associated with obesity such as coronary heart disease, high blood pressure, raised concentration of plasma low-density cholesterol, and high levels of non-insulin-dependent diabetes mellitus have been reported. These relationships differ between populations and are even more complicated if environmental factors associated with different levels of modernization are considered [5, 8, 27]. Understanding the role of stress in obesity and associated risk factors is also complicated. A neuroendocrine link between stress and day-

to-day levels of adrenaline may play an intermediary role in fat distribution and risk of morbidity. Moreover, stress-associated lifestyle changes due to modernization can also be stressful because of the social perception of obesity [27]. Social relationships have been proposed as a significant factor shaping obesity risk [3]. Monitoring of changes in obesity prevalence is also important for the effectiveness, improvement, and maintenance of future intervention programs to prevent and treat obesity [22].

The transition from childhood to adolescence brings various major structural changes in the individual in terms of social context and norms. In this transition period, peer relations become more prominent as adolescents spend more time with each other, and fundamentals of friendship and groups are often constituted by similarity [2]. Peer relationships can be considered one of the most important characteristics of adolescence which contribute to adolescents' health and well-being [2]. Peer relationships can also be acknowledged as a major part of the adolescent period's rapidly enhancing social and emotional growth that is significant in the context of establishing peer ties [29]. Interactions between friends and peers affect adolescents' body perception by appearance-related conversations, modelling of friends' dieting behaviour, and perceptions of friends' appearance-related attitudes [30]. Current models of the etiology of weight gain as the reason for obesity strongly favour individual and community-level factors, dietary and exercise decisions and proximate food environments. Limited emerging evidence indicates that interpersonal factors such as friendships may also have a critical influence on weight outcomes [3]. In this transition period, obesity affects many social-emotional dimensions such as peer relationships, social emotional learning skills, self-esteem, and exclusion in the context of adolescence [1, 7, 9, 12, 15]. There is strong evidence that overweight and obesity are associated with poor physical fitness, and children and adolescents who have a poor physical level show low muscular strength and cardiorespiratory endurance, low motor skills and low coordination performance [19]. Monitoring changes in obesity prevalence is also important for the effectiveness, improvement, and maintenance of future intervention programmes to prevent and treat obesity [22].

This study aimed to determine the associations between overweight and obesity, peer relationships, and nutritional and physical activity behaviours among Turkish adolescents.

MATERIALS AND METHODS

Sample

This cross-sectional study was conducted in public secondary and high schools during the 2017 fiscal year in Ankara – the capital city of Turkey – under the permit of the Ministry of Education and local area boards. Ethics permission was taken from the Ankara University Ethics Committee following the precepts of the Declaration of Helsinki. Written consent was taken from all participants' parents, and participation of adolescents was voluntary. The sample consisted of 402 adolescents (171 boys and 231 girls) aged between 12 and 17 years.

Measurements

A highly standardized physical examination was conducted to collect anthropometric measurements, and detailed information was collected on adolescents' behaviour, diet, physical activity, parental attitudes, and socio-economic circumstances. Parents' education and occupations were determined. A 24h-recall dietary questionnaire was conducted and self-reported weight was recorded. Height was measured to the nearest millimetre using a stadiometer (Seca 713, Postfach, Germany). Weight was measured to the nearest 100 g using Tanita SC330S (Tanita Corp., Japan). BMI was calculated using IOTF cut-offs by age and sex [4]. Fat percentage was estimated using bioimpedance analyser Tanita SC330S. Peer Relationship Scale (PRS) [13] was used to determine adolescent peer relations. PRS is a 5-point Likert-type questionnaire including 18 questions, grouped into four sub-scales – commitment, trust and identification, self-disclosure, and loyalty [13].

Statistics

Frequency tables were used to show the distribution of the nominal and ordinal scaled variables. Descriptive statistics of the discrete and continuous variables are given with arithmetic means and standard deviations. Correlations are given to show the relations among variables. Simple Mediation analyses were performed to show direct indirect and total effects by using ordinary least squares path analysis by the PROCESS macro for SPSS (IBM, Chicago, IL, USA).

RESULTS

Table 1 presents the parental background of the sample. The majority of both fathers and mothers had middle and high school degrees which were followed by university and graduate degrees among fathers, and illiteracy or elementary education among mothers, respectively. The occupations of the parents are grouped into four: high, middle 1, middle 2, and low according to income groups.

Table 1. Parental characteristics of the sample

	Father		Mother	
	N	%	N	%
Education				
Illiterate and elementary	70	17.8	131	32.8
Middle and high school	223	56.6	196	49
University and graduate	101	25.6	73	18.3
Occupation				
High	34	8.5	4	1
Middle 1	75	18.8	32	8
Middle 2	146	36.5	43	10.8
Low	145	36.3	320	80.2

Table 2 presents the weight status by BMI using IOTF cut-offs. The normal weight category was found to be similar in both sexes, but thinness was more prominent in girls (9.5%). Overweight was higher in girls (19%), while obesity was higher in boys (8.8%).

Table 2. Thinness, overweight, and obesity percentages using IOTF cut-offs by age and sex

	Boys		Girls	
	N	%	N	%
Thin	11	6.4	22	9.5
Normal	115	67.3	159	68.8
Overweight	30	17.5	44	19
Obese	15	8.8	6	2.6

Total body fat percentage according to bioimpedance analysis was found to be higher in girls in all weight groups, showing greater fat deposits. ANOVA test results were found to be statistically significant between groups ($F;77.363$, $p < 0.001$) as well (Table 3).

Table 3. Fat % by IOTF weight status

	Boys			Girls		
	N	Mean	SD	N	Mean	SD
Thin	11	4.76	1.636	22	14.19	3.41
Normal	115	11.21	3.545	159	22.60	4.66
Overweight	30	19.35	5.55	44	32.40	3.07
Obese	15	30.53	5.73	6	41.10	2.44

Table 4 presents the Peer Relationship Scores and sub-scales by sex. According to the independent sample t-test, the results showed that peer relationship scale and, commitment, self-disclosure, and loyalty sub-scales were found to be statistically significant between sexes ($p < 0.001$). Girls tend to have higher scores except for the loyalty sub-scale.

Table 4. Peer Relationship Scale by sex

	Boys			Girls			<i>p</i>
	N	Mean	SD	N	Mean	SD	
Peer Relationship Scale	171	61.37	10.89	231	66.01	11.37	.000
Commitment	171	31.51	5.52	231	34.29	5.16	.000
Trust and Identification	171	14.52	3.18	231	15.05	3.42	.113
Self-disclosure	171	7.66	3.00	231	9.74	3.40	.000
Loyalty	171	7.68	3.13	231	6.93	2.96	.014

Table 5 presents the peer relationship scores and sub-scales by sex and IOTF weight status. T-test results showed that among the thin/normal group total peer relationship scale, commitment, and self-disclosure ($p < 0.001$) were found to be statistically significant between sexes. Moreover, among the overweight/obese group self-disclosure ($p < 0.001$), commitment, and loyalty ($p < 0.05$) were statistically significant.

Table 5. Peer relationship components by weight status using IOTF cut-offs

	Thin/Normal				Overweight/Obese			
	Boys (n=126)		Girls (n=181)		Boys (n=45)		Girls (n=50)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Peer Relationship Scale	61.6**	10.59	66.25	11.37	60.71	11.81	65.14	11.44
Commitment	31.41**	5.44	34.34	5.11	31.78*	5.79	34.10	5.40
Trust and identification	14.71	3.11	15.13	3.38	13.98	3.35	14.78	3.59
Self-disclosure	7.91**	3.03	9.72	3.43	6.96**	2.8	9.84	3.32
Loyalty	7.56	3.01	7.07	2.99	8.00*	3.47	6.42	2.81

Mann-Whitney U test results showed that self-reported and actual weight differences between IOTF weight groups were found to be statistically significant in both sexes ($p < 0.001$). Overweight girls tend to report their weight almost 2 kg lower than their actual weight, while in obese girls the difference increases to more than 5 kilograms (Table 6).

Table 6. Self-reported weight (kg) difference from measured weight by IOTF weight status

	Boys			Girls		
	N	Mean	SD	N	Mean	SD
Thin	7	1.47	1.42	14	0.55	1.49
Normal	72	0.42	2.03	108	-0.65	1.70
Overweight	12	-0.25	2.12	33	-2.06	3.58
Obese	7	-2.24	1.40	4	-5.43	3.36

Table 7 presents the birthweight and selected behavioural variables of the sample and by weight status. Approximately 10% of the sample was born with lower birthweight than normal. Almost one-quarter of the low-birth-weight girls were found to be in the overweight/obese weight group (24.0%). The results showed that more boys were smoking cigarettes (13.8%), and the overweight/obese group tended to smoke less in both sexes. The sample showed poor dietary habits; 15.7% of boys and 30.9% of girls frequently skipped their main meals, and the tendency to frequently and sometimes skipped main meals was higher among girls in all weight categories. Energy and protein intakes present the dietary profile in general. The energy intake per day did not meet the recommended daily allowances in either sexes. Almost half of the sample were not getting sufficient energy intake. In terms of protein intake, 46.5% of

boys and 47.2% of girls were able to get daily allowances within the normal range. Also, 61.4% of the boys and 79.4% of the girls had no out-of-school physical activity.

Table 7. Birthweight, smoking habit, dietary behaviour, and physical activity by IOTF weight status

Birthweight	thin/normal		overweight/obese		whole sample	
	Boys	Girls	Boys	Girls	Boys	Girls
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
< 2500 g	12.7 (8)	7 (7)	7.1 (2)	24 (6)	11.0 (10)	10.4 (13)
> 2500 g	87.3 (55)	93 (93)	92.9 (26)	76 (19)	89.0 (81)	896 (112)
Smoking						
Yes	16.7 (19)	8.3 (12)	5.3 (2)	6.8 (3)	13.8 (21)	7.9 (15)
No	83.3 (95)	91.7 (133)	94.7 (36)	93.2 (41)	86.2 (131)	92.1 (174)
Skipping meals						
Yes	14.4 (17)	31.3 (47)	19.5 (8)	29.5 (13)	15.7 (25)	30.9 (60)
Sometimes	64.4 (76)	49.3 (74)	51.2 (21)	56.8 (25)	61.0 (97)	51.0 (99)
No	21.2 (25)	19.3 (29)	29.3 (12)	13.6 (6)	23.3 (37)	18.0 (35)
Energy/day						
Low	37.9 (44)	41.9 (65)	75.6 (31)	54.8 (23)	47.8 (75)	44.7 (88)
Normal	60.3 (70)	55.5 (86)	24.4 (10)	42.9 (18)	51.0 (80)	52.8 (104)
High	1.7 (2)	2.6 (4)	–	2.4 (1)	1.3 (2)	2.5 (197)
Protein/day						
Low	10.3 (12)	20 (31)	14.6 (6)	31 (13)	11.5 (18)	22.3 (44)
Normal	39.7 (46)	48.4 (75)	65.9 (27)	42.9 (18)	46.5 (73)	47.2 (93)
High	50 (58)	31.6 (49)	19.5 (8)	26.2 (11)	42.0 (66)	30.5 (60)
Physical Activity Level						
0 h/week	60.7 (71)	80 (124)	63.4 (26)	77.3 (34)	61.4 (97)	79.4 (158)
< 3 h/week	9.4 (11)	8.4 (13)	9.8 (4)	6.8 (3)	9.5 (15)	8.0 (16)
> 3 h/week	29.9 (35)	11.6 (18)	26.8 (11)	15.9 (7)	29.1 (158)	12.6 (25)

Table 8. Correlation matrix of variables

	W Diff	PRS	Commit	Trust-Id	Self-Disc	Loyalty	Smoking	Fat%	PA/Week	Skip Meal	Energy	Protein	Birthw
BMI	-.365**	0.02	0.06	-0.01	0.03	-0.03	0.02	.706**	0.08	-0.10	-.183**	-0.09	-0.09
W Diff	1.00	-.142*	-.156*	-.166**	-0.12	0.07	-0.01	-.372**	0.04	0.12	0.04	0.00	0.04
PRS		1.00	.840**	.800**	.767**	.497**	0.02	.136**	0.05	-.135*	0.04	0.02	-0.02
Commit			1.00	.598**	.493**	.139**	-0.05	.185**	0.07	-.121*	0.04	0.01	0.00
Trust-Id				1.00	.517**	.247**	-0.01	0.04	0.01	-0.05	0.04	0.03	-0.05
Self-Disc					1.00	.303**	0.07	.204**	0.00	-.123*	0.07	-0.03	-0.01
Loyalty						1.00	.109*	-0.10	0.03	-0.09	-0.05	0.05	0.00
Smoking							1.00	-.116*	0.06	-0.03	-0.11	-0.04	0.04
Fat%								1.00	-0.07	-.153**	-.114*	-.136*	-0.07
PA/Week									1.00	-.136*	0.04	.146**	0.04
Skip Meal										1.00	0.05	0.02	-0.10
Energy											1.00	.450**	0.07
Protein												1.00	-0.06

**p < 0.01, *p < 0.05.

Table 8 presents the correlation analyses results between variables. A negative correlation was found between smoking and fat percentage ($p < 0.05$). Physical activities per week and birth weight had no significant correlations with other variables. According to the results, there was a correlation between fat percentage and self-reported weight difference ($p < 0.001$), fat percentage and BMI ($p < 0.001$), self-reported weight difference and BMI ($p < 0.001$). On the other hand, no relation was found between Peer Relationship Score and fat percent ($r = .095$; $p = .065$) (Table 8).

Multiple regressions were calculated to predict Peer Relationship Score based on fat percentage, self-reported weight difference and BMI. A significant regression equation was found ($(3.253) = 4.121$, $p = < 0.01$), with an R^2 of 0.04. The predicted Peer Relationship Score is equal to $74.109 + .230$ (fat percent) $- .731$ (self-reported weight difference) $- .696$ (BMI). Fat percentage, self-reported weight difference and BMI were all significant predictors of Peer Relationship Score. All variance inflation factors were between 1 and 5, which means correlations between independent variables were not high.

In step 1 of the mediation model, the regression of Peer Relationship Scale on BMI, ignoring the mediator, was not significant, $b = 0.008$, $t(400) = 0.481$, $p > 0.05$ (Figure 1). Step 2 showed that the regression of Peer Relationship Scale on fat percentage was significant, $b = 0.106$, $t(400) = 2.754$, $p < 0.01$. Step 3 of the mediation process showed that the mediator (fat percentage) controlling for the Peer Relationship Scale was significant $b = 0.303$, $t(399) = 20.113$, $p < 0.001$. Step 4 of the analysis revealed that controlling for the mediator (fat percentage), the Peer Relationship Scale score was significant $b = -0.024$, $t(399) = -2.068$, $p < 0.05$. Indirect effect of the Peer Relationship Scale on BMI with the mediator was also significant ($b = 0.106 \times 0.303 = 0.0320$; $BootLLCI = 0.003$; $BOOTULCI = 0.015$). It was found that fat percentage partially mediated the relationship between the Peer Relationship Scale and BMI.

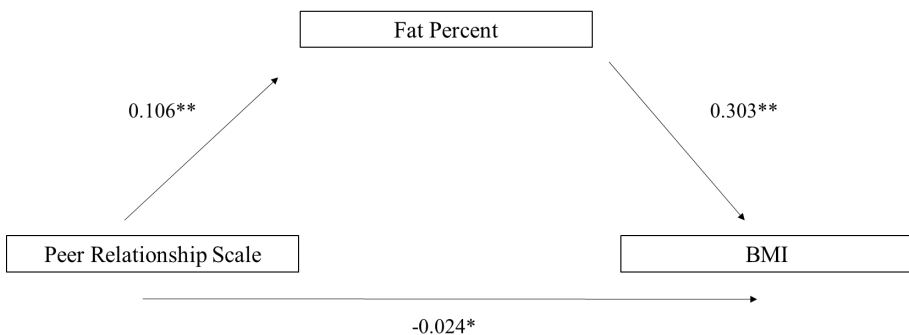


Figure 1. Mediation model between Peer Relationship Scale, fat percentage, and BMI.

In step 1 of the mediation model, the regression of Peer Relationship Scale on BMI, ignoring that the mediator was not significant was $b = -.011$, $t(255) = -.600$, $p > 0.05$ (Figure 2). Step 2 showed that the regression of Peer Relationship Scale on the mediator, self-reported weight difference, was significant $b = -.030$, $t(255) = -2.288$, $p < .05$. Step 3 of the mediation process showed that the mediator (self-reported weight difference), controlling for Peer Relationship Scale, was also significant $b = -.553$ $t(254) = -6.433$, $p = <0.001$. Step 4 of the analysis showed that controlling for the mediator (Self-reported Weight Difference), peer scores was not a significant predictor of BMI, $b = -.028$ $t(254) = -1.552$, $p = 0.122$. Indirect effects of Peer Relationship Scale on BMI showed that the full mediation effect of self-reported weight difference was significant (Effect = $-.030 \times -.553 = .016$, BootLLCI = 0.001 – BootULCI = .031).

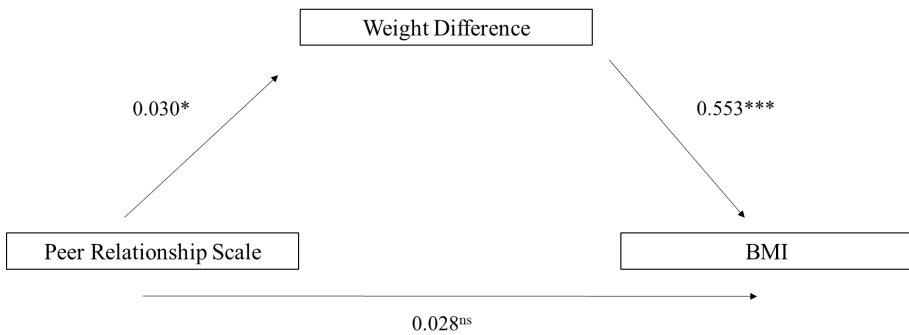


Figure 2. Mediation model between the Peer Relationship Scale, self-reported weight difference and BMI.

DISCUSSION

Considering the expectations of adolescents, social acceptance, love and respect from their close environment, caring for their ideas, self-esteem, desire to succeed, desire to be beautiful/handsome and independent are the main. It is noteworthy that such factors as body image become more prominent in this period, and the height and weight of the adolescent are of great importance [14]. It has been emphasized that body image is especially influential in friendship relationships. Studies have shown that obese children experience various psycho-social problems in this context; overweight and obese adolescents have more negative experiences in social and emotional terms [6, 7]. Various studies have shown that overweight and obese adolescents' social-emotional learning skills are lower than of their normal weight peers [1], they have lower

self-esteem [7], they are loved less [12], experience more social exclusion [15], and face serious psychosocial complications [9]. Moreover, peer relationships during adolescence are one of the factors that affect adolescents' social-emotional infrastructure. Adolescence is a developmental period when peer relationships are more important and valuable than other types of relationships [18]. Strauss and Pollach [26] have concluded that obese children have fewer friends than normal children, and obese children are less popular than normal-weight children. In the study conducted by Pearce et al. [18], it was concluded that obese girls had fewer boyfriends in their romantic relationships compared to their normal-weight peers, and they were not satisfied with their absence. Children see themselves as the main source of their obesity, are criticized by their peers, and are excluded from activities [15]. Obese adolescents are more exposed to peer bullying and have fewer romantic relationships than their normal-weight peers. In this context, obese girls experience more victimization compared to obese boys and, as the prevalence of obesity among female adolescents' increases, the rate of exclusion and maltreatment by their peers' also increases [18].

The present study consistently showed that weight status among adolescents has an impact on various behaviours related to diet, physical activity, and peer relationships. It has been known that sex differences in peer relationship processes increase across development. These age-related increases are multiply determined and likely driven by both biological and social forces [20]. Consequently, pubertal timing and associated changes in hormone levels during adolescence are related to sex-typed attributes, including aggression and social as well as emotional distress. Social influences may have unique effects on sex-typed processes or may augment sex differences elicited by biological factors. According to the gender intensification theory [10], the physical changes of puberty prompt socialization agents to increase pressure for sex-typed behaviour [20]. First, girls and boys differ in the structure of their peer interaction. Various studies have reported the frequency of group interactions among young children, as well as evidence that also emerges for a sex difference in social conversation and self-disclosure. Observational studies focused on adolescent period have shown that girls spend more time in social conversation. As a conclusion, there are sex differences in the structure and content of adolescent behaviour with peers. Rose and Rudolph [20] proposed Implications of Sex Differences in Relationship Processes, a model that exposure to same-sex peers contributes to the development of sex-typed peer relationship processes, including peer relationship styles, coping processes with stress,

and related provisions. In these peer relationship processes, sex differences are hypothesized to influence girls' and boys' emotional and behavioural development. In this context the model suggests that sex differences in emotional and behavioural adjustment can be partially accounted for by sex differences in the peer relationship mechanisms, which are developed at least in part by exposure to same-sex peers. Present findings indicate the diverse array of sex differences in different domains of peer relationships. Commitment, self-disclosure, and loyalty ($p < 0.001$) sub-scales were found to be statistically significant between sexes, while differences in trust and identification were non-significant.

As it has been mentioned before, weight and fat accumulation have an impact on peer relationship, among thin/normal group total peer relationship scale, commitment, and self-disclosure ($p < 0.001$) were found to be statistically significant between sexes; furthermore, among the overweight/obese group self-disclosure ($p < 0.001$), commitment, and loyalty ($p < 0.05$) were found to be different among Turkish adolescents. St. George et al. [25] have reported that, based on African American adolescent data, the relationship between motivation, emotional support by peers and parents, and moderate to vigorous physical activity might be more effectively integrated into obesity treatment and prevention. Their findings indicated that weight status moderated the effects of motivational variables (controlled, autonomous and regulatory) on physical activity, adolescents with greater emotional support from peers were more active – parent support was not significant. Mjaavatn et al. [17] reported study results based on 14–15-year-old Norwegian adolescents that boys and girls have preferences towards the same values and characteristics but to a different degree. For example, both sexes value highly peers' social skills, but girls value them higher. They suggested that, according to their study results, boys seemed to appreciate peers' performances to a higher degree. Salvy et al. [21] suggested that promoting and maintaining positive behavioural health trajectories is related with the specific mechanisms underlying the effects of peers on youths' eating and physical activity, and adolescents' peer networks in prevention and intervention efforts might be critical. Adolescents' perception of their friends' eating and activity behaviours could influence theirs. Overweight adolescents tend to affiliate with overweight peers and have greater energy intake. Therefore, they seem to have such norms about nutrition and activity which reinforce obesogenic behaviour related with weight status. By reviewing empirical evidence, Salvy et al. [21] concluded that the prevalence of paediatric obesity has sharply increased, and accordingly, the interest in the impact of social environment on adolescent's nutritional and activity

behaviours has also increased. In the presence of peers, the energy intake also increases, excluding in exceptional situations when socio-evaluative concerns are high and when the peers exhibit healthy nutritional behaviours. Positive peer relationships foster involvement in physical activity, while in negative peer relationships –often with overweight and obese adolescents – difficulties and loneliness appear to deter adolescents from being active.

The present findings indicate the more sedentary physical activity status among adolescents (PA = 0 h/week 71.4%; PA < 3 h/week 8.7%; PA > 3 h/week 19.9%). WHO Obesity Report of 2017 [32] reports that most overweight or obese children now live in developing countries where the rate of increase has been much higher than in developed countries and regions, largely because of changes in dietary practices and increasingly sedentary lifestyles [11]. Young people spend approximately 60% of their waking time sitting, which makes sedentary behaviour the most common behaviour (besides sleep) in children and adolescents. The steepest increase in sedentary behaviour occurs during the onset of puberty, and it eventuates with negative physical, psychological, and socioemotional health outcomes.

While there is considerable cross-national variation, some populations are characterized by obesity prevalence between 5% and 10%, with its levels generally the highest in southern European and Mediterranean countries [16, 32]. The present findings indicate the increasing obesity prevalence among Turkish adolescents. Overweight prevalence in boys is 17.5% and in girls 19%, while obese boys make up 8.8% and girls 2.6%, respectively. The Health Behaviour in School-aged Children (HBSC) survey is a WHO collaborative cross-national study that monitors the health behaviours, health outcomes, and social environments of boys and girls aged 11, 13, and 15 years in every four years. The most recent (2013/2014) survey was conducted in 42 countries across Europe. Based on the most recent population estimates, the HBSC reported that over 1.4 million 11–15-year-olds in the countries and regions represented in this report were obese. The numbers are much higher when overweight and obesity are combined, with an average prevalence of 19% across all countries and regions in 2014 (24% for boys and 14% for girls). It should be noted that the data are based on self-reported height and weight and may therefore underestimate the true situation [11].

Self-reported heights and weights are often used in place of actual measurement to assess the health and nutritional status of adolescents in population surveys. Researchers have suggested that individuals may have lacked information about their weight and height in all surveys. Studies conducted

by Shiely et al. [23] in 1998, 2002, and 2007 showed that Irish adults had lower weight and higher height predictions, and no changes were reported during the time. Similar results were found in adolescents. A Japanese study showed that adolescent boys perceived themselves as thin and girls as overweight [24]. Australian adolescent boys and girls perceived themselves taller and thinner [28]. Self-reported weight was within 5 kg of measured weight in 85% of the non-overweight/obese adolescents. For overweight adolescents, this fell to 62% [28]. The common point reached by researchers from different countries is that different factors play a role in body perception and that individuals often perceive themselves as taller and thinner. In the present study among the Turkish adolescents, overweight girls tend to report their weight almost 2 kg lower than their actual weight, whereas in obese girls, the difference increases to more than 5 kilograms. In addition to accuracy and reliability issues, various studies have shown that girls tend to bias their weight particularly during the adolescent period due to self-esteem.

Limitations of the present study should be noted. The data was cross-sectional, and it is unclear what the individual changes would be during the entire adolescent period. However, the present study provides strong evidence about the nature of the relationship between adolescent weight status, bioimpedance variables, peer relationship sub-domains and socio-economic status among Turkish adolescents.

In conclusion, the present findings indicate that, according to mediation analysis, fat percentage, self-reported weight difference, and BMI were significant predictors of Peer Relationship Score where fat percentage partially mediated the relationship between Peer Relationship Scale and BMI. Indirect effects of Peer Relationship Scale on BMI showed that the mediation effect of self-reported weight difference was also significant. The negative effect of the high level of fat accumulation and overweight/obesity on Peer Relationship Scores and its sub-domains should be carefully monitored in adolescents. It has been known that inequalities in obesity and obesity-related behaviours have generally persisted over time, with those from lower-affluence backgrounds reporting less healthy diets, lower levels of physical activity, and more time spent watching TV. Even in countries and regions in which inequalities have reduced over time, improvements tend to be slower among the most disadvantaged groups [11]. Perez-Sousa et al. [19] have reported that physical fitness plays a major role as a mediator in the relationship between weight status and health-related quality of life. Therefore, monitoring and intervening in health-related behaviours among adolescents with related programmes can reverse

overweight/obesity and improve peer relations. Furthermore, to clarify the effects of behavioural peer relationship factors that penetrate nutrition, self-esteem and fat accumulation mechanisms among adolescents, more longitudinal study results are needed for better understanding.

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