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Original Article

Risk factors affecting obesity development in high school students: a community based case-control study

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Abstract

Aim: Obesity which is described as a "global epidemics" and qualified as "excessive accumulation of fat impairing health" by the World Health Organization is an important public health problem affecting children and adolescents as well as adults. The aim of this study was to determine the factors that affected obesity in high school students in a city center.

Material and Methods: A total of 386 students including 193 subjects and 193 controls were included in this case-control study. The data were collected by applying a questionnaire which questioned socio-demographic properties, eating and physical activity behaviors and factors which were considered to have an impact on body weight. Descriptive statistics were evaluated using chi-square and logistic regression analysis. A p value of <0.05 was considered statistically significant.

Results: In univariate analysis, presence of an obese person in the family/neighborhood, way of transportation to school, thoughts and wish of best friend of the same sex related to body weight and desire for weight loss were defined as variables which were associated with obesity. In multivariate regression analysis, it was found that presence of an obese person in the family/neighborhood, transportation to school by vehicle and having a best friend of the same sex who wanted the subject to stay at the same weight could be predictors of obesity. In the obese group, regarding oneself as obese and desire to lose weight were more common.

Conclusion: In this study, it was found that presence of an obese person in the family/neighborhood, transportation to school by vehicle and having a best friend of the same sex who wanted the subject to stay at the same weight were significant risk factors in terms of obesity. However, levels of perceiving oneself as obese and desire to lose weight were found to be higher in the obese group. Consumption of unhealthy food in the home environment should be prevented by performing awareness studies for parents. In addition, physical exercises performed together by family members will be helpful for adolescents in terms of developing healthy lifestyle behaviors.

Keywords: Adolescents, risk factors, obesity

Introduction

Obesity is a clinical condition that occurs because of increased adipose tissue when energy intake outweighs energy consumption (1). Obesity, which is described as a global epidemic and qualified as "excessive accumulation of fat impairing health" by the World Health Organization (WHO) is an important public health problem that affects children and adolescents, as well as adults (2, 3).

One of the most commonly used methods in the description of obesity is percentile values. According to the WHO's standards, adolescents with a body mass index above the 95th percentile by age and gender are defined as obese and adolescents with a body mass index (BMI) between the 85th and 95th percentiles are defined as overweight (4).

Children, who used to spend their leisure time playing outside, currently spend more time in front of a television or computer through the influence of technological developments and changes in the social structure. In addition, change in eating behaviors also leads to an increase in the prevalence of obesity in adolescents

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(5). Families,' and especially parents' eating behaviors influence children's and adolescents' eating behaviors. Children's and adolescents' changing eating behaviors may influence body weights. The insistence of parents on eating, take-home foods, high-energy foods, carbonated beverages, snacks, and low physical activity are noted as predisposing factors for obesity (6). Spending too much time with the television, computer, and cellular phones, and not sparing enough time or inability to spare enough time for energy-consuming play has an important role in the development of obesity (3). Obesity can be prevented or treated with adequate and balanced nutrition, as well as with regular physical exercise (6).

Obesity is a common health problem affecting 25-30% of children and adolescents. Obesity predisposes individuals to the development of many chronic diseases. Studies have reported that obesity also negatively influences psychosocial and emotional health status in addition to its association with morbidities including diabetes, respiratory system diseases, coronary heart disease, hypertension, and cancer (7).

The fact that a significant portion of individuals who were obese during childhood and adolescence are also obese during adulthood, and morbidity and mortality related to obesity are increased in adulthood, indicate the importance of obesity in childhood and adolescence, and that it is a problem that should be addressed primarily in preventive healthcare services (8).

Adolescence is a sensitive and important period during which lifestyles are acquired and attitudes and behaviors are obtained in the process of transfer from childhood to adulthood. Important duties fall to families and teachers in bringing proper behaviors to adolescents during this period (9).

The aim of this study was to determine the factors that influenced the occurrence of obesity in high-school students in a city center.

Material and Methods

Type and sample of the study

In this case-control study, the study group consisted of all obese subjects selected in a cross-sectional study that was conducted to determine the prevalence of obesity in the same population one year ago (cases, n=193) (10). The control group was selected using the simple random sampling method among individuals of the same sex and age group who studied in the same class as the obese students among the students, who were found to be normal in the prevalence study (695 students).

Data collection method

Each subject was matched with a control. The mean age was found as 16.0±1.1 years in the case group and 16.0±1.1 in the control group (p=1.000). There was no difference between the case group and control group in terms of sex (p=1.000). The mean BMI was found as 27.1±2.4 kg/m^2 in the case group and 21.6±1.6 kg/m^2 in the control group (p<0.001).

After the students were informed about the study, data were collected by administering a questionnaire, which was prepared by the investigators and applied in advance through face- to-face interviews. Preapplication of the questionnaire was performed with the participation of 20 students in another school that did not participate in the study. Studies in the literature were used when preparing the questionnaire (11-13). The questionnaire consisted of a total of 42 questions including 20 questions that interrogated the sociodemographic properties of students, nine questions about the nutritional and physical activity characteristics, and 13 questions investigating factors thought to put pressure on body weight. The following were interrogated in order to evaluate factors thought to put pressure on body weight: how the mother, father, closest friend of the same sex perceived the participant [options=normal weight, abnormal weight (lean or overweight)] and how they wished to see the participant (options=maintaining normal weight, being lean or overweight); family pressure related to eating; opinion related to body weight; satisfaction with body weight; desire to lose weight and if they had used any method for losing weight previously.

The necessary approval was obtained from Süleyman Demirel University School of Medicine Clinical Researches Ethics Committee before the study was initiated (Decision date: 01.03.2017, Decision number: 46). The students and parents were informed about the study during the study and verbal consent was obtained from the students, and verbal and written consents were obtained from the parents.

Statistical Analysis

The data were evaluated using the Statistical Packages for the Social Sciences (SPSS) version 17.0 (SPSS Inc.,

Table 1. Distribution of the case and control groups by sociodemographic properties

Sociodemographic properties		n	%[a]	Case group n (%[a])	Control group n (%[a])	p
Chronic disease	No	368	95.3	183 (94.8)	185 (95.9)	0.629
	Yes	18	4.7	10 (5.2)	8 (4.1)	
Health perception	Very good/good	297	76.9	145 (75.1)	152 (78.8)	0.580
	Moderate	82	21.2	45 (23.3)	37 (19.2)	
	Poor/very poor	7	1.9	3 (1.6)	4 (2.1)	
Which child	First[b]	192	49.7	95 (49.2)	97 (50.3)	0.733
	Middle	78	20.2	42 (21.8)	36 (18.6)	
	Final	116	30.1	56 (29.0)	60 (31.1)	
Presence of sibling	Present	355	92.0	179 (92.7)	176 (91.2)	0.574
	Absent	31	8.0	14 (7.3)	17 (8.8)	
Family type	Nuclear family	327	84.7	165 (85.5)	162 (83.9)	0.601
	Extended family	51	13.2	23 (11.9)	28 (14.5)	
	Broken family	8	2.1	5 (2.6)	3 (1.6)	
Presence of an obese individual in family/immediate environment	Yes	242	62.7	141 (73.1)	101 (52.3)	<0.001
	No	144	37.3	52 (26.9)	92 (47.7)	
Income level perception	Good-very good	222	57.5	117 (60.6)	105 (54.4)	0.235
	Moderate	151	39.1	72 (37.3)	79 (40.9)	
	Poor-very poor	13	3.4	4 (2.1)	9 (4.7)	
Balance of income and expenses	Income is less than expenses	42	10.9	18 (9.3)	24 (12.4)	0.137
	Income is equal to expenses	233	60.4	111 (57.5)	122 (63.2)	
	Income is more than expenses	111	28.8	64 (33.2)	47 (24.4)	
Maternal age	Below 40	141	36.5	74 (38.3)	67 (34.7)	0.459
	Above 40	245	63.5	119 (61.7)	126 (65.3)	
Paternal age	Below 45	182	47.2	94 (48.7)	88 (45.6)	0.541
	45 and above	204	52.8	99 (51.3)	105 (54.4)	
Maternal education status	5 years and below	122	31.6	49 (25.4)	73 (37.8)	0.002
	6-11 years	156	40.4	76 (39.4)	80 (41.5)	
	12 years and above	108	28.0	68 (35.2)	40 (20.7)	
Paternal education status	5 years and below	64	16.6	29 (15.0)	35 (18.1)	0.063
	6-11 years	139	36.0	61 (31.6)	78 (40.4)	
	12 years and above	183	47.4	103 (53.4)	80 (41.5)	
Maternal employment status	Employed	124	32.1	73 (37.8)	51 (26.4)	0.016
	Unemployed/retired	262	67.9	120 (62.2)	142 (73.6)	
Paternal employment status	Employed	344	89.1	172 (89.1)	172 (89.1)	0.999
	Unemployed/retired	42	10.9	21 (10.9)	21 (10.9)	
Place where the subject lived for the longest time	City	240	62.2	136 (70.5)	104 (53.9)	0.001
	District/town/village	146	37.8	57 (29.5)	89 (46.1)	
Total		386	100.0	100.0	193 (100.0)	193 (100.0)

[a]Column percentage

[b]Single children were considered the first child

Chicago, IL, USA) and descriptive analyses, Chi-square and logistic regression analyses were performed. In the hypotheses tests, p values below 0.05 in a confidence interval of 95% were considered statistically significant. The Hosmer-Lemeshow test was used in terms of compatibility of the logistic regression model, and a p-value for the test above 0.05 was considered a model with a high predictive value.

Results

The distribution of the case and control groups by sociodemographic characteristics is shown in Table 1. The frequency of the presence of obese individuals in the family or immediate environment was higher in the case group (73.1%) compared with the control group (52.3%) (p<0.001). The case and control groups showed differences in terms of maternal education (p=0.002); the rate of the subjects whose mothers had received education for 12 years and longer was higher in the case group. The rate of the subjects whose mothers worked was higher in the case group (37.8%) compared with the control group (26.4%) (p=0.016). The rate of the subjects who lived in cities for longer durations was higher in the case group (70.5%) compared with the control group (53.9%) (p=0.001).

The distribution of the case and control groups by nutritional, exercise/activity characteristics is shown in Table 2. The rate of the subjects whose nutritional perception was very good/good was lower in the case group (47.7%) compared with the control group (60.6%) (p=0.011). The rate of the subjects who found daily physical activity level inadequate was higher in the case group (42.0%) compared with the control group (28.5%) (p=0.006). The rate of the subjects who arrived school by vehicle was higher in the case group (62.7%) compared with the control group (26.4%) (p<0.001).

The distribution of the case and control groups by the factors that put pressure on body weight is shown in Table 3. The proportion of the subjects who had normal body weight according to the mother, father, closest friend of the same sex and closest friend of the opposite sex was lower in the case group compared with the control group (p<0.001, p<0.001, p<0.001, p<0.001,

Table 2. Distribution of the case and control groups by nutritional characteristics and exercise/activity characteristics

Nutritional characteristics and exercise/activity characteristics		Number	Percentage[a]	Case group n (%[a])	Control group n (%[a])	p
Eating perception	Very good/good	209	54.1	92 (47.7)	117 (60.6)	0.011
	Moderate/poor/very poor	134	45.9	101 (52.3)	76 (39.4)	
Fast food consumption	Yes	343	88.9	173 (89.6)	170 (88.1)	0.627
	No	43	11.1	20 (10.4)	23 (11.9)	
Skipping a meal	Yes	276	71.5	141 (73.1)	135 (69.9)	0.499
	No	110	28.5	52 (26.9)	58 (30.1)	
Having a snack between meals	Yes	344	89.1	170 (88.1)	174 (90.2)	0.513
	No	42	10.9	23 (11.9)	19 (9.8)	
Daily time spent watching TV	2 hours and less	328	8.0	162 (83.9)	166 (86.0)	0.569
	2 hours and more	58	15.0	31 (16.1)	27 (14.0)	
Daily time spent playing digital plays	2 hours and less	269	69.7	143 (74.1)	126 (65.3)	0.060
	2 hours and more	117	30.3	50 (25.9)	67 (34.7)	
Fitness center membership	No	342	88.6	175 (90.7)	167 (86.5)	0.200
	Yes	44	11.4	18 (9.3)	26 (13.5)	
Perception of adequacy of daily physical activity	Adequate	250	64.8	112 (58.0)	138 (71.5)	0.006
	Not adequate	136	35.2	81 (42.0)	55 (28.5)	
Transport to school	By walking	214	55.4	72 (37.3)	142 (73.6)	<0.001
	By vehicle	172	44.6	121 (62.7)	51 (26.4)	
Total		386	100.0	193 (100.0)	193 (100.0)	

[a]Column percentage

respectively). The proportion of subjects whose closest friend of the same sex wished the subject to stay at the same body weight was higher in the case group (88.1%) compared with the control group (80.3%) (p=0.036). The case and control groups showed a significant difference in terms of family pressure related to eating (p<0.001); the proportion of subjects who had no pressure was higher in the case group. The case and control groups

Table 3. Distribution of the case and control groups by factors that put pressure on body weight

Factors which put pressure on body weight		Number	Percentage[a]	Case group n (%[a])	Control group n (%[a])	p
According to the mother's opinion	Normal	254	65.8	104 (53.9)	150 (77.7)	<0.001
	Not normal	132	34.2	89 (46.1)	43 (22.3)	
According to the mother's wish	Should maintain the current body weight	346	89.6	170 (88.1)	176 (91.2)	0.316
	Other[b]	40	10.4	23 (11.9)	17 (8.8)	
According to the father's opinion	Normal	275	71.2	119 (61.7)	156 (80.8)	<0.001
	Not normal	111	28.8	74 (38.3)	37 (19.2)	
According to the father's wish	Should maintain current body weight	360	93.3	179 (92.7)	181 (93.8)	0.685
	Other[b]	26	6.7	14 (7.3)	12 (6.2)	
According to the opinion of the closest friend of the same sex	Normal	278	72.0	117 (60.6)	161 (83.4)	<0.001
	Not normal	108	28.0	76 (39.4)	32 (16.6)	
According to the wish of the closest friend of the same sex	Should maintain the current body weight	325	84.2	170 (88.1)	155 (80.3)	0.036
	Other[b]	61	15.8	23 (11.9)	38 (19.7)	
According to the opinion of the closest friend of the opposite sex	Normal	271	70.2	112 (58.0)	159 (82.4)	<0.001
	Not normal	115	29.8	81 (42.0)	34 (17.6)	
According to the wish of the closest friend of the opposite sex	Should maintain the current body weight	327	84.7	166 (86.0)	161 (83.4)	0.479
	Other[b]	59	15.3	27 (14.0)	32 (16.6)	
Family pressure related to eating	No pressure	273	70.7	146 (75.6)	127 (65.8)	<0.001
	Pressure in the direction of eating	80	20.7	20 (10.4)	60 (31.1)	
	Pressure in the direction of not eating	33	8.6	27 (14.0)	6 (3.1)	
Opinion related to body weight	Lean	18	4.7	2 (1.1)	16 (8.3)	<0.001
	Normal	153	39.6	29 (15.0)	124 (64.2)	
	Obese	215	55.7	162 (83.9)	53 (27.5)	
Body weight satisfaction	Satisfied	94	24.3	21 (10.9)	73 (37.8)	<0.001
	Undecided/ indifferent	120	31.1	61 (31.6)	59 (30.6)	
	Not satisfied	172	44.6	111 (57.5)	61 (31.6)	
Desire to lose weight	Wishes to lose weight	268	69.4	167 (86.5)	101 (52.3)	<0.001
	Does not wish to lose weight	118	30.6	26 (13.5)	92 (47.7)	
Use of a method to lose weight	Used previously	210	54.4	125 (64.8)	85 (44.0)	<0.001
	Not used previously	176	45.6	68 (35.2)	108 (56.0)	
Total		386	100.0	100.0	193 (100.0)	193 (100.0)

[a]Column percentage

[b]Other: pressure in the direction of being lean or overweight

showed a difference in terms of opinion about own body weight (p<0.001), and the difference arose from the subjects who considered themselves obese. Satisfaction with body weight was significantly different between the case and control groups (p<0.001); the proportion of subjects who were not satisfied with their own body weight was higher in the case group. The proportion of the subjects who desired to lose weight was higher in the case group (86.5%) compared with the control group (52.3%) (p<0.001). The proportion of subjects who had used a method for losing weight previously was higher in the case group (64.8%) compared with the control group (44.0%) (p<0.001).

The variables that were found to be significant in the univariate analyses were included in logistic regression model, and the factors that influenced the state of being obese were evaluated. The prediction of the model was considered high because the p-value of the Hosmer-Lemeshow test that was used for the model was found as 0.795. Among the variables included in the model, the presence of an obese individual in the family/immediate environment (OR=1.9, 95% CI:[1.1-3.4]; p=0.026), transport to school by vehicle (OR=3.0, 95% CI:[1.6-5.6]; p<0.001), and wish of the closest friend of the same sex that the subject maintains the same body weight (OR=4.5, 95% CI:[2.1-9.5]; p<0.001) were found to be probable predictors of obesity. In the obese group, the levels of finding oneself obese (OR=11.7, 95% CI:[5.7-23.9]; p<0.001) and desiring to lose weight (OR=2.5, 95% CI:[1.2-5.5]; p=0.018) were found to be higher (Table 4).

Discussion

In this study, high-school students who were obese and non-obese were compared using sociodemographic properties, physical activity characteristics, and factors that were thought to put pressure on body weight, and the factors that influenced the development of obesity were determined.

In our study, it was found that the presence of an obese individual in the family or immediate environment increased the development of obesity by 1.9-fold. The results in the literature are compatible with our study.

Table 4. Results of the logistic regression model

Variables included in the analysis		p	OR (95% CI)
Presence of an obese individual in the family/immediate environment (Reference: None)	Yes	0.026	1.9 (1.1-3.4)
Maternal education status (Reference : Below 12 Years)	12 Years and above	0.459	0.7 (0.3-1.6)
Maternal employment status (Reference: Unemployed/ Retired)	Employed	0.503	1.3 (0.6-2.6)
Place where the subject lived for the longest time (Reference: District/Town/Village)	City	0.235	1.5 (0.8-2.7)
Eating perception (Reference: Good)	Moderate-poor	0.925	1.0 (0.6-1.8)
Perception of daily physical activity adequacy (Reference: Adequate)	Not adequate	0.360	0.7 (0.4-1.4)
Transport to school (Reference: By walking)	By vehicle	<0.001	3.0 (1.6-5.6)
According to the mother's opinion (Reference: Normal)	Not normal	0.112	1.9 (0.9-4.1)
According to the father's opinion (Reference: Normal)	Not normal	0.550	0.8 (0.4-1.7)
According to the opinion of the closest friend of the same sex (Reference: Normal)	Not normal	0.322	1.4 (0.7-3.0)
According to the wish of the closest friend of the same sex (Reference: Other*)	Maintaining the current body weight	<0.001	4.5 (2.1-9.5)
According to the opinion of the closest friend of opposite sex (Reference: Normal)	Not normal	0.787	1.1 (0.5-2.3)
Family pressure related to eating (Reference: No pressure-pressure in the direction to eating)	Pressure in the direction to not eating	0.136	2.4 (0.8-7.2)
Opinion related to body weight (Reference: Lean-Normal)	Obese	<0.001	11.7 (5.7-23.9)
Desire to lose weight (Reference: No desire to lose weight)	Wishes to lose weight	0.018	2.5 (1.2-5.5)
Body weight satisfaction (Reference: Satisfied-Undecided/Indifferent)	Not satisfied	0.226	0.7 (0.3-1.3)
Use of a method for losing weight (Reference: Not used previously)	Used previously	0.174	0.6 (0.3-1.2)

*Other: Pressure in the direction of being lean or overweight

Studies have reported that parents with normal body weights have obese children with a rate of 7%, obese mothers or fathers have obese children with a rate of 40%, and obese parents have obese children with a rate of 80% (14). In a study conducted by Metinoğlu et al. (15) in Kastamonu provincial center in elementary schools, it was found that the frequency of obesity increased in children who had an obese individual in their family, and a significant correlation was found between the presence of an obese individual in the family and BMI. In the study conducted by Cındık et al. (16) in Adana with children aged between 5 and 17 years, and in the study conducted by Ulutaş et al. (17) in a pediatrics clinic with 218 children, it was found that the frequency of obesity in the family was higher in the obese group compared with the control group. It is a known reality that children and adolescents see their parents or other members in the family as role models. Family members' lifestyles and being a model for adolescents in terms of physical activity are very important in fighting obesity. Another point is families' eating behaviors. Family members have an important impact on children's and adolescents' eating behaviors (18). When foods including snacks, high-calorie foods and take-home foods are consumed excessively instead of healthy foods, the occurrence of obesity in a significant portion of family members is unavoidable.

In this study, it was found that transport to school by vehicle increased the development of obesity by 3-fold. Similarly, in a thesis study conducted by Gezgin (19) with students aged between 6 and 18 years, and a thesis study conducted by Turgut (20) in Erzurum, the frequency of obesity was found to be higher in subjects who went to school by vehicle. In a study conducted by Uskun et al. (12) with primary school students, it was found that obese students arrived at schools by walking a shorter distance. This finding indicates that immobility is an important factor in the development of obesity and easy physical activities, including walking, which can be performed by everybody, are important in the control of body weight. Therefore, it is considerably important to encourage adolescents to walk to school and to perform other easy physical activities.

In this study, it was found that being obese increased the state of considering oneself obese by 11.7-fold. In a study conducted by Uskun and Şabaplı (13) with high-school students, it was found that four out of every five obese adolescents considered themselves overweight. The accurate perception of body weight by obese individuals may be predicted to be a facilitative factor in terms of fighting obesity.

In this study, the state of being obese was found to increase the desire to lose weight by 2.5-fold. In the literature, it has been reported that success is obtained easier in treatment of obese individuals who wish to lose weight (6). Therefore, the desire to lose weight may be considered an important factor that increases motivation in the process of fighting obesity.

The results can be generalized to the whole population because the case and control groups included in this study consisted of subjects who were previously selected by the authors of this study among students who studied in high-schools in Isparta provincial center and who participated in a study conducted with a sample that represented the population, and the controls were selected from among the students with normal body weight in the same study. This study which was planned and conducted as a case-control study represented the limitations of case-control studies. In these types of studies, it is difficult to state that causes occur before outcomes. This leads to limitations in interpretations related to causality.

Outcome and recommendations

When considered in terms of its outcomes, obesity is a sophisticated morbidity that causes numerous diseases and shows a trend of rapid increase. Specifying the factors that may lead to excessive weight gain in adolescents is important in terms of fighting obesity. In this study, it was found that the presence of an obese individual in the family/immediate environment, transport to school by vehicle, and desire of the closest friend of the same sex that the subject maintains the same body weight were significant risk factors in terms of obesity. However, the levels of considering oneself obese and wishing to lose weight were found to be higher in the obese group. The desire to lose weight may be considered a facilitative factor in treatment compliance in obese individuals.

Important duties fall to parents in bringing positive eating behaviors for adolescents. Therefore, the consumption of unhealthy foods in the home environment should be prevented by conducting awareness studies directed to parents. In addition, physical activities performed by family members together will be supportive for adolescents in developing healthy lifestyle behaviors.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of the Süleyman Demirel University School of Medicine (01.03.2017/46).

Informed Consent: Written and verbal informed consent was obtained from the parents of the patients who participated in this study.

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