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Effect of Socio-Demographic Factors, Health Literacy, and Mothers' Nutritional Literacy on Obesity-Related Behaviors among Female Adolescents; A Cross-Sectional Study

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ABSTRACT

Aims Obesity in adolescent is associated with several negative outcomes. This study aimed to determine factors associated with obesity among female students during the COVID-19 pandemic.

Instrument & Methods In this descriptive correlational study, a convenience sample of female adolescent students of high schools in Tabriz, Iran (322 students who were classified as obese or overweight) was selected between January and May 2021. An online self-administered questionnaire was distributed through the Shad platform. The survey package included socio-demographic questions, health literacy measures for adolescents, an inventory of determinants of obesity-related behaviors in adolescents, and mother's nutritional literacy. Multiple regression analysis examined associated factors with obesity using SPSS 133. The study adhered to the STROBE guidelines for reporting.

Findings The mean score of obesity-related behaviors was moderate (124.18±22.35). Participants' mean scores in the domains of lack of support, unhealthy nutrition, physical inactivity, and perceived inability were more than average. Adolescents' health literacy mean score was moderate (167.43±20.06). Mother's occupation (β=15.73; 95% CI: 7.54 to 23.92; p<0.001) and mother's nutritional literacy (β=-0.88; 95% CI: -1.50 to -0.27; p=0.005) were statistically significant predictors of the obesity-related behavior.

Conclusion Mothers' nutritional literacy plays a pivotal role in shaping adolescents' behaviors related to obesity; thus, empowering mothers with appropriate knowledge and skills in the field of healthier lifestyles and improving the overall well-being of adolescents is essential.

Keywords Adolescent; Behavior; Health Literacy; Mothers; Obesity; Overweight

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Introduction

The growing prevalence of obesity and overweight among adults, children, and adolescents can be described as a widespread and urgent health crisis [1]. Several negative outcomes are associated with obesity in children and adolescents, including increased risk of cardiovascular disease or type 2 diabetes mellitus [2]. Furthermore, obese children and adolescents tend to remain obese into adulthood, which shows why prevention measures should be prioritized [3].

The prevalence of childhood obesity in Iran is greater than in South East Asia, Africa, and Europe [4], accounting for 8% of children under five years of age [5] and 9.3% and 8.1% of adolescent boys and girls, respectively in 2019 [4, 6].

Biological, genetic, developmental, environmental, and behavioral factors are associated with obesity [7]. Socio-ecological model (SEM) can provide a theoretical framework for understanding the factors that lead to childhood and adolescent obesity [8, 9]. The SEM model includes several levels of influence, including the individual (e.g. genetics, biology, knowledge, attitudes, beliefs, and behaviors), the interpersonal (family, peers, social networks, and associations), the institutional (regulations, rules, and organizations), the community (social networks, norms, and standards), and the policy level (local, national, and international policies and laws) levels [8, 10]. When it comes to preventing obesity in young children, the initial approach typically involves utilizing behavioral strategies as the primary method of implementation [11]. According to a systematic review, low physical activity and time spent on TV and computer games were the most prevalent behavioral factors related to obesity and overweight in Iranian high school students [12]. The consumption of ultra-processed foods has also been linked to obesity and adiposity parameters in longitudinal and cross-sectional studies [13, 14]. Iranian children over-consume processed food containing high amounts of sugar and/or fats, with girls consuming higher quantities of a range of sweet and savory ultra-processed foods than boys [6].

Socio-demographic factors, individual skills, and family contexts all contribute to adolescents' obesity [15].

Parents, especially mothers, play a very important role in the development of children's diets, as they are responsible for transmitting dietary patterns and habits as well as making food available [16]. The environment that parents create for their children can promote healthy eating habits and appropriate weight, or it can lead to overweight and unhealthy eating [17].

Mothers serve as role models for children's eating behaviors. The level of nutrition knowledge that mothers possess can influence the dietary habits of their children [18]. Increasing mothers' awareness has been used as a solution in recent years to prevent diseases and promote health in children.

In terms of personal social determinants of health, health literacy is viewed as an essential construct by international organizations and studies [19]. Health literacy influences healthy behaviors, access to health and social services, health outcomes, health-related inequality, and long-term care management [20]. It is a critical component of understanding and addressing adolescent obesity [21, 22]. Poor health literacy can lead to a lack of knowledge about the negative health effects of obesity and how to prevent it [23].

Socio-demographic factors also can increase unhealthy lifestyle choices, such as an unhealthy diet, which can cause obesity and other health issues [24]. Additionally, poverty and lack of education can lead to limited access to healthy food options, and consequently obesity and poor health risks [25]. It is essential that adolescents have access to accurate and comprehensive information about obesity causes and consequences, as well as healthy lifestyle choices [26]. Thus, it is important to ensure that adolescents have access to the necessary information to make informed decisions about their health and well-being [27].

While health literacy contributes significantly to adolescents' quality of life, it is more crucial for those with chronic health conditions, like obesity [22]. The level of knowledge and understanding of families regarding nutrition and healthy eating habits can affect the dietary choices made in the household, which in turn can contribute to the development of obesity in adolescents [28]. In this regard, mothers' nutrition literacy can play a significant role in influencing adolescent obesity [29]. According to a study in Italy, mother-child communication and mother's monitoring (interpersonal level variables of SEM) were found as significant factors in predicting healthy behaviors [15]. Prevention of overweight and obesity in adolescents is essential to preserving their lives and preparing them for success as adults. Therefore, it is necessary to assess the health literacy of adolescents and their mothers, identify behavioral factors related to obesity, and determine whether health literacy and social and demographic factors affect behavioral factors related to obesity in obese and overweight adolescents. Thus, this study aimed to determine behavioral factors related to obesity and its related factors in obese and overweight adolescents.

Instrument and Methods

Study design

We employed a descriptive correlational study design to examine obesity-related behaviors and their determinants among female adolescents in 2021. The study adhered to the STROBE guidelines for reporting. The present research project was approved by the Vice-Chancellor for Research and

the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1399.986).

Participants

The study targeted obese or overweight female adolescents studying in high schools in Tabriz city one of the largest cities in northwest Iran. Students were selected by a random cluster sampling of schools, followed by a random sampling of classes within each school. This study is a component of a larger investigation on health literacy, specifically focusing on the body mass index (BMI) of 1184 female students. The sample size of 1184 was determined based on the findings of a pilot study, considering a 95% confidence interval, 80% test power, α=0.05, β=0.2, and r=0.16 (with). Sampling was done between January and May 2021.

Due to the prevailing COVID-19 epidemiological situation, the survey was distributed using the native social platform named Shad. This platform is a communication and educational software that was launched following the spread of COVID-19 due to the absence of students in schools in Iran. All students used this platform to pursue their courses. Participants were required to meet the following criteria: 1) currently studying in secondary schools, 2) no chronic diseases, such as diabetes (based on the student's self-report), and 3) no use of a specific medicine (based on the student's self-report). Participants who left more than 20% of the questions on each scale unanswered and were on a special diet were excluded from the study.

Tools

A socio-demographic questionnaire containing 13 items about age, mother's age, grade level, parent's education, parent's employment, income, chronic disease, and BMI was used.

Health Literacy Measure for Adolescents (HELMA)

The HELMA developed by Ghanbari *et al.* [30] consists of 44 items embraced in eight domains, including access to information (five items), reading (five items), understanding (ten items), appraisal (five items), implementation (four items), communication (eight items), self-efficacy (four items), and calculation (three items). This questionnaire aims to assess a person's ability to deal with health information in a specific way, based on a Likert scale of 1 to 5: never (1), rarely (2), sometimes (3), mostly (4), and always (5). It has been used in many studies [31-33]. In the present study, Cronbach's alpha coefficient and the intra-class correlation coefficient (ICC) for HELMA were 0.87 and 0.82, respectively.

Inventory of Determinants of Obesity-Related Behaviors in Adolescents (IDOBA)

The 44-item IDOBA was developed by Amiri *et al.* to determine the factors that contribute to obesity-related behaviors among adolescents [34]. This scale includes the following subscales: 1) Inactivity and unhealthy nutrition; 2) Stress-induced behaviors; 3) Perceived inability; 4) Perceived lack of threat; 5) Perceived priority of educational achievement; 6) Perceived acceptability; 7) Motivation loss; and 8) Lack of support. Additionally, it asks about chronic diseases related to obesity-related behaviors or weight gain among adolescents. Additionally, the survey asked about chronic diseases affecting the adolescents' obesity-related behaviors or weight gain over the past six months. Additionally, the subjects were asked about their experiences with weight control and their satisfaction with their previous attempts to lose weight. The validity of IDOBA has been evaluated in multiple studies (alpha coefficients between 0.81 and 0.88) [35, 36].

Nutrition Literacy Assessment Questionnaire for Adults (EINLA)

The EINLA is a tool adapted for the Iranian population to assess the nutrition literacy of mothers [37]. The questionnaire consists of 35 items divided into five domains, including general nutrition knowledge (ten items), reading and comprehension of nutrition information (six items), food group identification (ten items), calculation of food units (three items), and nutrition calculation and label reading (six items). One point is given for each correct answer, and no points are deducted for incorrect answers. According to the recommendations of the reviewer for content validity, the correct answers to the calculation area were given one point, while incorrect or "don't know" answers were deducted zero. The score range is from 0 to 35, and the cut-off point is 24, meaning that a score above 24 indicates sufficient nutrition literacy, while a score lower than 24 indicates insufficient nutrition literacy. The Cronbach's alpha coefficient of this questionnaire has been reported as 0.73 by Hemati *et al.* [38]. The validity of the survey package was confirmed by an expert panel consisting of 12 faculty members from the Tabriz University of Medical Sciences.

Statistical analysis

Data were analyzed using SPSS 13 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were computed for all variables, including frequencies, means, and standard deviations (SD). The Kolmogorov-Smirnov test was conducted to examine the distribution of data. The HELMA and IDOBA variables were found to be normally distributed, with skewness and kurtosis indices less than ±2 [39]. The Pearson correlation coefficient, t-test, ANOVA, and multiple linear regression were used to analyze the data.

In the next step, variables significantly related to obesity-related behaviors ($p<0.2$) (potential confounding variables), along with health literacy and mother's nutritional literacy (independent variables), and obesity-related behaviors (dependent variable) were entered into the general linear model. All assumptions of linear regression analysis (linearity, normality, and independence of error terms, as well as multicollinearity of independent variables using the variance inflation factor of

tolerance) were examined. A p<0.05 was considered significant. The regression coefficient and 95% confidence intervals were reported to consider the strength of the association.

Findings

A total of 322 female overweight or obese adolescents with their mothers recruited from high schools in Tabriz City participated in the study. The mean age of students was 15.27±1.24 years, ranging from 12-18 years. Most families of students had moderate financial status (%56.5, n=182). Furthermore, 6.2% (n=20) of participants experienced chronic diseases, such as diabetes, hypertension, asthma, and anemia. Other socio-demographic characteristics of participants are presented in Table 1. The total mean score of obesity-related behaviors was 124.18±22.35.

The mean scores of subdomains of obesity-related behaviors are presented in Table 2.

Table 1. Socio-demographic characteristics and their association with behavioral factors related to obesity (n=332)

Parameter	No.(%)	Obesity-related behavioral factors Mean(SD)	F or t-value	p-Value
Age		15.27(1.24)	t=0.21	0.71
Father's Education				
Primary School and less	55(17.5)	130.01(22.41)	F=-2.74	0.33
High school and diploma	157(48.8)	127.06(18.73)		
University education	108(33.7)	124.23(17.91)		
Mother's education				
Primary School and less	109(33.9)	129.88(20.43)	F=-3.15	0.52
High school and Diploma	131(40.7)	125.41(18.81)		
University education	82(25.5)	122.81(20.15)		
Father's employment status				
Unemployed/retired	42(13.0)	121.61(18.27)	F=-2.12	0.17
Employee	60(18.60)	127.86(19.31)		
Wage day worker	44(13.7)	124.09(18.96)		
Freelance	176(54.7)	128.80(20.26)		
Income				
>expenditure	31(9.6)	122.90(17.40)	F=0.43	0.29
=Expenditure	182(56.5)	127.63(20.25)		
<expenditure	109(9.6)	126.90(17.40)		
Mother's employment status				
Employed	95(29.5)	140.85(13.67)	t=2.14	0.001
Housewife	227(70.5)	127.18(19.87)		
Chronic disease				
Yes	33(10.2)	128.85(18.33)	t=0.49	0.61
No	289(89.8)	126.42(19.59)		

Table 2. Distribution of obesity-related behaviors among Students (n=332)

Parameters	Mean(SD)	Minimum	Maximum
Total score of behavioral factors of obesity	124.18(22.35)	44	195
Domains of obesity-related behaviors			
Unhealthy nutrition and physical inactivity	27.70(5.89)	8	38
Stress-related eating	7.93(3.18)	3	15
Perceived inability	9.73(2.91)	3	15
Perceived lack of threat	6.20(2.24)	2	10
Priority of educational achievement	14.24(5.49)	5	25
Perceived acceptability	20.58(4.26)	5	25
Motivation loss	25.08(5.47)	7	35
Lack of support	29.45(4.27)	9	51

The mean score of health literacy of 322 participants was 167.43±20.06. The mean scores of domains of health literacy are presented in Table 3. The mean score of nutritional health of mothers was 18.30±3.79 and only ten mothers (3.7%) had desirable nutritional health. The results of univariate analysis (independent t-test, one-way ANOVA, and Pearson correlation coefficient) showed a significant relationship between the behavioral factors related to obesity and mother's occupation (p<0.001), health literacy (p=0.02), and mother's nutritional literacy (p<0.001).

Finally, the variables that showed a statistically significant relationship with the behavioral factors related to obesity scores were adjusted as independent variables, and the behavioral factors related to health as dependent variables were entered into the general linear model. The adjusted general linear model's result showed that mother's occupation and nutritional literacy were statistically significant predictors of the variable behavioral factors related to health; working mothers compared to mothers who were housewives (β=15.73; 95% CI: 7.54 to 23.92; p<0.001) and mothers with higher health literacy compared to lower level of nutritional literacy (β=-0.88; 95% CI: -1.50 to -0.27; p=0.005; Table 4).

Table 3. Mean score of health literacy of students and nutritional health of their mothers (n=322)

Parameters	Mean (SD)
Health literacy total	167.43(20.06)
Health literacy domains	
Access to information	19.78(3.83)
Reading	20.01(4.11)
Understanding	42.75(6.55)
Appraisal	21.49(3.51)
Implementation	15.48(3.37)
Communication	30.68(4.26)
Self-efficacy	15.70(3.55)
Calculation	1.55(0.80)
Mother's nutritional health total	18.30(3.79)
Nutritional health domains	
General nutrition knowledge	7.33(1.68)
Comprehension of nutrition information	4.38(1.13)
Food group identification	3.05(1.20)
Calculation of food units	1.52(0.84)
Nutrition calculation and label reading	2.01(1.27)

Table 4. Predictors of behavioral factors related to obesity based on the general linear model (n=332)

Parameter	B (95% confidence interval)	p-value
Mother's Job (Reference: Housewife	15.73(7.54 to 23.92)	<0.001
Health literacy	-0.071(-0.16to 3.86)	0.12
Mother's nutritional literacy	-0.88(-1.50 to-0.27)	0.005

Discussion

This study assessed factors related to obesity among overweight/obese female adolescents in Iran and showed that the mean score of obesity-related behaviors was moderate. Participants' mean scores in the domains of lack of support, unhealthy nutrition and physical inactivity, and perceived inability were determined as high, indicating more unhealthy behaviors related to obesity in these fields. Parental support plays a crucial role in shaping an adolescent's lifestyle and health-related behaviors. It includes providing guidance, encouragement, and resources necessary for maintaining a healthy lifestyle [40]. Parental involvement in promoting physical activity and healthy dietary habits is vital for preventing and managing obesity in adolescent behaviors [15]. Unhealthy diet and inactivity among adolescents have become significant concerns in recent years. The combination of these factors can lead to various health issues and have long-lasting effects on the overall well-being of young individuals [41].

The consequences of unhealthy nutrition and physical inactivity in adolescence are far-reaching. In the short term, adolescents may experience low energy levels, poor concentration, and diminished academic performance [42]. They may also face challenges in their social lives, as low self-esteem and body image issues can arise due to weight-related concerns [12]. In the long term, the health implications can be even more severe [43]. Adolescents who engage in unhealthy eating habits and lead sedentary lifestyles are more likely to carry these habits into adulthood, increasing their risk of developing chronic diseases later in life [3]. Additionally, the impact on mental health should not be underestimated, as poor nutrition and physical inactivity can contribute to depression, anxiety, and other psychological disorders.

Adolescents' perceived inability to control obesity is a complex issue influenced by genetic, socioeconomic, and social factors. Recognizing the consequences of this perception is vital to implementing effective interventions [44]. By empowering adolescents with education, supportive environments, and mental health support, it is possible to help them overcome this perceived inability and pave the way for healthier futures [45]. Furthermore, the results of this study showed that the mean score of adolescents' health literacy was moderate. Adolescent health literacy can play a role in reducing the prevalence of obesity as it provides adolescents with the knowledge and skills necessary to make informed decisions about their health [15, 22]. Adolescents with higher health literacy are more likely to be aware of the health risks associated with obesity and make decisions that can reduce the prevalence of obesity in this age group [21].

Adolescents whose mothers had low levels of nutritional literacy and adolescents who had low health literacy were more likely to have obesity-related behaviors. Consistent with our findings, previous studies have shown that mothers play a crucial role in shaping their children's health and well-being, and their level of nutritional literacy can significantly influence adolescents' behaviors related to obesity [15, 29]. Parents' obesity-related knowledge, attitudes, and practices play a crucial role in promoting children's healthy lifestyles and maintaining healthy body weight [16, 46] When mothers possess a high level of nutritional literacy, they are more likely to provide nutritious meals and snacks for their children [17]. This, in turn, positively influences adolescents' food preferences and encourages them to adopt healthier eating habits. On the other hand, although several studies have reported that mothers who possess adequate nutritional literacy are more likely to make informed decisions while grocery shopping and decipher nutrition labels [18], compare products, and select healthier options [16], our findings revealed that only 3% of mothers could be able to calculate nutrition units of foods and read its labels. Chein *et al.* argued that mothers' knowledge enables them to avoid purchasing excessive sugary snacks, processed foods, and sugary beverages, reducing their adolescents' exposure to such items [46].

Along with other studies [21, 23, 47], we showed that adolescents' health literacy was significantly related to obesity-related behaviors. Unhealthy food choices, such as excessive consumption of sugary beverages, fast food, and processed snacks, can lead to weight gain and subsequent obesity [13, 14]. Teenagers are highly influenced by their peers, and unhealthy food choices among friends can perpetuate poor eating

habits [48]. Educating adolescents about the importance of a balanced diet and regular physical activity can help prevent obesity and its associated health risks [49].

In our research, adolescents whose mothers were employed exhibited lower mean scores of obesity-related behaviors. This discovery sheds light on the potential influence of maternal employment on the health behaviors of teenage children. Having a mother working non-standard or long hours is associated with childhood obesity. Maternal employment might reduce time spent with children, and it can lead to unhealthier eating habits and sedentary behavior among children, thereby increasing childhood obesity [50].

Considering the increasing number of women entering the workforce, understanding the effects of maternal employment on the health behaviors of their children is crucial for both policymakers and healthcare professionals [51]. This finding suggests that maternal employment can have a positive impact on the prevention and management of obesity-related behaviors among teenagers. Several explanations can be proposed to understand the correlation between maternal employment and lower rates of obesity-related behaviors in adolescents. Employed mothers may serve as role models for their children, promoting healthier lifestyle choices and behaviors. Furthermore, the increased financial resources and access to healthcare that come with maternal employment may contribute to better health outcomes for teenagers.

By addressing the limited knowledge, impact of misinformation, and peer influence, healthcare providers can empower adolescents to make healthier food choices. Through nutrition education, we can prevent the onset of obesity, reduce the risk of chronic diseases in adulthood, and promote a healthier future generation. Efforts must be made to prioritize nutrition education in schools, homes, and communities to ensure the well-being of our adolescents. By understanding the importance of nutritional literacy and its impact on food choices, meal planning, grocery shopping, and nutritional education, parents and policymakers can work together to develop effective interventions and programs aimed at reducing adolescent obesity rates. Empowering mothers with the necessary knowledge and skills will contribute to healthier lifestyles and improved overall well-being for adolescents.

The high prevalence of obesity in adults in many countries renders weight reduction a tremendous challenge; therefore, it is advisable that children be considered the priority population for such intervention strategies as enhanced physical activity and improved diet. Preschool institutions and schools are appropriate places for the implementation of these interventions.

One of the strengths of this study is its simultaneous examination of both adolescents and their mothers. Random cluster sampling from female high schools in Tabriz can be mentioned as another strength of the study.

The present study had a limitation related to the online data gathering, which was influenced by the ongoing COVID-19 pandemic. This situation could have potentially affected the validity of the collected data. Another limitation of the present study is the large number of items included in the questionnaires used.

Conclusion

Adolescent healthy lifestyle plays a crucial role in combating the rising rates of obesity among teenagers. Also, mothers' nutritional literacy plays a pivotal role in shaping adolescents' behaviors related to obesity.

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Ethical Considerations: The present research was approved by the Vice-Chancellor for Research and the Ethics Committee of Tabriz University of Medical Sciences (ethics code: ID IR.TBZMED.REC.1399.986). The research goals, anonymity of participants, voluntary participation, and the study information, were first verbally explained to the participants, and then they read and signed a written informed consent and the research method followed the Helsinki Declaration.

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