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Effects of maternal dietary patterns and maternal obesity on children's obesity

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ABSTRACT

Aim: The effects of dietary patterns and dietary statuses of mothers on childhood obesity have not been understood clearly yet. This study aims to evaluate the dietary patterns of mothers and their dietary statuses on the obesity of children.

Material and Method: This cross-sectional study included 295 mothers and their children, who were 2-6 years old. The participants' anthropometric measurements were carried out and the frequency of food consumption was also collected from the mothers in the study.

Results: In the study, it was determined that the children of the participating mothers, who had high levels of income and education, had higher probabilities of being overweight/obese. Overweight/obesity in children was found to be significantly associated with maternal overweight/obesity (B=4.04, p<0.001).The results of our analyses demonstrated that maternal bread, rice, and sugar intake was strongly correlated with children's obesity (B=3.65, p<0.001; B=3.17, p<0.001; B=8.32, p<0.001). In terms of the cards that were shown to the children, it was determined that the children preferred unhealthy snacks, such as biscuits, wafers, and carbonated drinks, more frequently rather than healthy food while preferring watching television and playing games on computers rather than physical activities.

Conclusion: As the variables of income level, education level, BMI values, and consumption of bread, rice, and sugar in mothers were increased, it was determined that the probability of obesity in children, who were 2-6 years old, also increased. These results indicated hopeful outcomes in terms of preventing obesity in children by keeping the dietary patterns of mothers under control.

Keywords: Maternal obesity, childhood obesity, maternal food consumption

INTRODUCTION

The prevalence of childhood obesity has been increasing in every country. The World Health Organization (WHO) stated that approximately 42 million children and adolescents were affected by overweight or obesity in 2013 (1). According to the data of Turkey Nutrition and Health Survey 2010, it was determined that the prevalence of obesity was 8.5% for 0-5 years old children while the prevalence of children with overweight was 17.9% in addition to the total ratio of 26.4% for children with overweight and obesity (2). As a result of an obesity prevalence study, which was conducted by Olaya et al. (2017) in 7 European countries, it was determined that Turkey was ranked the 2nd (3).

Obesity can result in short-term and long-term outcomes. Children with overweight and obesity are at risk of hyperlipidemia, hypertension, insulin resistance, and Type 2 diabetes (4). Furthermore, children with overweight and obesity are candidates for adults with obesity in the future. Childhood obesity also increases the prevalence of chronic diseases in adulthood (5).

Various factors, such as genetic factors, metabolic influences, physical activity, nutrition, environmental elements, socioeconomic factors, and physiological factors, increase the prevalence of obesity (6,7). The skills that are gained during childhood influence children's choices of food, attitudes toward food, and nutritional habits in the future. Attitudes of family members toward food and the interactions within families also play significant roles in children's healthy choices and weight gains (8-10). In numerous studies, the relationships between the anthropometric measurements of children and parents have been

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investigated. In this study, we aimed to investigate the effects of a mother's nutritional patterns and nutritional status on children's obesity, which was considered lacking in the literature.

MATERIAL AND METHOD

The study was carried out with the permission of Ankara University Ethics Committee (Date: 04.09.2014, Decision No:183/12). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Study Design and Data Collection

The data of the study were collected from 295 mothers, who were between 20 and 45 years old, and their children, who were between 2 and 6 years old. The mothers and children in the study visited the Primary Health Service Center in Ankara. All the families with children in this age group were contacted by phone and were informed about the study. The subjects were asked to volunteer to participate in the study and were asked to direct their children to the Primary Health Service Center. Informed consent was obtained from the mothers.

Anthropometric Measurements

The anthropometric measurements of the study were collected to evaluate the nutritional status of the subjects. The body weights and heights of the children were also recorded. Accordingly, the body mass indices (BMI) were calculated in kg/m². In the measurements, all the children stood barefooted against a vertical wall and their heights were measured by using a stadiometer with the closest interval of 0.1 cm. The body weights of the children were measured while they were wearing lightweight clothes by using a digital scale with a closest interval of 0.1 kg, which was zeroed before the initiation of the weight measurements. Considering the WHO growth reference data (11), 3 weight categories were created, which covered normal (>5th percentile to <85th percentile), overweight (>85th percentile to <95th percentile), and obesity categories (≥ 95th percentile). The weight measurements of the mothers were conducted by using electronic scales with the closest interval of 0.1 kg while their heights were measured with light clothes and without shoes by using a wall-mounted stadiometer with the closest interval of 0.1 cm. The body mass indices were calculated according to the WHO standards. The underweight category covered the BMI values less than 18.5 kg/m² while the normal weight category covered the BMI values between 18.5 and 24.9 kg/m². The BMI values that were between 25.0 and 29.9 kg/m² were categorized as overweight while the BMI values that exceeded 29.9 kg/m² were affected by obesity (12).

Evaluation of Food Consumption Frequency

The data for the diet of the mothers were collected by using a food-frequency questionnaire. In the evaluation of the food consumption frequency, the recommendations in the Dietary Guidelines for Turkey-Specific Nutrition Guide (13). According to the data that were obtained in the study, the food consumption of the subjects was classified into 3 groups as consuming less than the recommended amounts, consuming as much as the recommended amounts, and consuming more than the recommended amounts.

Investigation of Preferences of Children toward Nutrition and Physical Activities

To investigate the preferences of children toward nutrition and physical activities, 10 cards were prepared. Of these, 8 cards presented images of healthy and unhealthy food while 2 cards presented images of physical activities. In the investigation process, the children in the study were shown the cards and asked about their preferences in the food and physical activities in the cards. Then, the responses of the children were recorded.

Statistical Analyses

The statistical analyses in the study were conducted by using SPSS 21 (Statistical Package for Social Sciences) software for Windows. The normality tests for the continuous variables were conducted by the Kolmogorov-Smirnov test. Accordingly, it was determined that all of the continuous variables had normal distributions ($p>0.05$). For the data with normal distributions, the descriptive statistics were presented as mean±standard deviation. On the other hand, the categorical data were presented in figures (percentages). The one-sample t-test was used to evaluate the differences in mean values of the children's anthropometric measurements. Furthermore, a logistic regression analysis was conducted to test the hypothesis that certain demographic variables and the number of daily food consumptions of mothers could affect children's BMI values. The suitability of the data set for logistic regression analysis was tested by using the Hosmer Lemeshow test, where it was determined that the data set was suitable for logistic regression analysis ($p=0.153$). Accordingly, the Nagelkerke R-squared value of the model was determined as 0.893 while the classification success of the model was determined as 95.8%. For all the statistical comparisons, the level of significance was regarded as 5% ($p<0.05$).

RESULTS

The descriptive data of the children in the study were presented in **Table 1**. Accordingly, it was determined that 49.2% of the children were females while 50.8% of the children were males. The mean age of the children was

calculated as 4.2±1.2 years. The difference between the heights and body weights of female and male children was not statistically significant (p>0.05). However, the difference between the BMI values of male and female children was statistically significant and the values were statistically higher in male children (p=0.001).

Table1. Descriptive statistics of the children according to the variable of gender

Variables	Males	Females	p*	Total
N (%)	150 (50.8)	145 (49.2)		295
Age	3.9±1.3	4.2±0.9	0.182	4.2±1.2
Height (cm)	102.1±9.0	104.4±9.3	0.141	103.1±9.2
Weight (kg)	17.3±3.6	17.4±3.5	0.845	17.3±3.5
BMI (kg/m²)	16.8±1.7	16.0±1.4	0.001	16.4±1.6

*One sample t test

The descriptive statistics for the mothers were presented in **Table 2.** Accordingly, it was determined that the mean age of the mothers was 32.7±5.04 years while the mean BMI value of the mothers was 27.3±4.2 kg/m². Additionally, it was determined that 59% of the mothers were affected by overweight or obesity while most of them had moderate-level incomes (49.5%) in addition to 45.4% of the mothers who had undergraduate degrees.

Table 2. Descriptive statistics of the mothers

Age and anthropometric measurement (mean±standard deviation)	
Age (years)	32.7±5.04
Height (cm)	163.2±6.1
Weight (kg)	67.4±10.4
BMI (kg/m²)	27.3±4.2
BMI category, N (%)	
Normal	121 (41.0)
Overweight/obese	174 (59.0)
Income level, N (%)	
Low	90 (30.5)
Moderate	146 (49.5)
High	59 (20.0)
Maternal education, N (%)	
High school and lower	131 (44.4)
Undergraduate	134 (45.4)
Graduate and above	30 (10.2)

A logistic regression analysis was conducted to test the hypothesis that certain demographic variables and daily nutritional amounts of mothers could affect the BMI values of children. The results of this analysis were presented in **Table 3.**

In the study, it was determined the children, whose mothers had income levels above the minimum wage in Ankara, and had education levels of high school and above, had 1.87 and 0.58 times higher probabilities of affecting by overweight/obesity, respectively (p<0.05).

It was further determined that the children, whose mothers were affected by overweight/obesity, had 4.04 times higher probabilities of affecting by overweight/obesity. Additionally, it was discovered that male children had 2.46 times higher probabilities of affecting by overweight/obesity compared to female children (p<0.001).

According to the recommendation of Dietary Guidelines for Turkey-Specific Nutrition Guide, the children, whose mothers had high levels of daily bread, rice, and sugar consumption, 3.65, 3.17, and 8.32 times higher probabilities of affecting by overweight/obesity, respectively.

Table3. Results of logistic regression analysis

Items	Children's BMI levelsa		p
	Normal Weight	Overweight/ obese ExpB (Lower-Upper of 95% CI)	
Demographic variables			
Maternal Income (above the minimum wage compared to those who are not)	1.00 (Ref.)	1.87 (1.04-3.35)	0.036
Maternal Education (having high school degree compared to those who do not)	1.00 (Ref.)	0.58 (0.10-1.11)	<0.001
Maternal Age	1.00 (Ref.)	0.98 (0.93-1.04)	0.576
Maternal BMIb (obese/ overweight compared to those who are not)	1.00 (Ref.)	4.04 (2.41-6.75)	<0.001
Gender of children (males compared to females)	1.00 (Ref.)	2.46 (1.48-4.08)	<0.001
Age of children	1.00 (Ref.)	0.89 (0.72-1.10)	0.290
Daily maternal food intakec (over-consuming compared to those who do not)			
Milk	1.00 (Ref.)	0.71 (0.42-1.20)	0.200
Cheese	1.00 (Ref.)	0.50 (0.23-1.01)	0.083
Meat	1.00 (Ref.)	1.02 (0.58-1.79)	0.944
Legumes	1.00 (Ref.)	1.43 (0.88-2.33)	0.153
Egg	1.00 (Ref.)	1.23 (0.75-2.04)	0.412
Bread	1.00 (Ref.)	3.65 (1.98-6.72)	<0.001
Rice	1.00 (Ref.)	3.17 (1.62-6.22)	<0.001
Vegetables	1.00 (Ref.)	1.19 (0.72-1.65)	0.501
Fruits	1.00 (Ref.)	1.09 (0.63-1.91)	0.752
Sugar	1.00 (Ref.)	8.32 (4.61-15.02)	<0.001
Fat	1.00 (Ref.)	1.19 (0.73-1.94)	0.481

a The dependent variable is categorized as normal and overweight/obese while BMI z-score is calculated by using WHO growth charts (overweight/obese defined as BMI percentile ≥85th-<95th, normal weight defined as BMI percentile ≥15th-<85th).
bMaternal BMI is categorized as normal and overweight/obese (normal as BMI<25 kg/m², overweight/obese as BMI≥25 kg/m²).
cWhile evaluating the frequency of food consumption, the amounts recommended in the Dietary Guidelines for Turkey were taken as the reference.

In the study, it was aimed to determine the preferences of children by presenting them with cards that included healthy and unhealthy preferences. Accordingly, it was determined that the BMI values of the mothers and the preferences of children in diet and physical activity were

similar (p<0.05). In the analysis, it was discovered that most of the children preferred biscuits instead of yogurt, wafers instead of apples, carbonated beverages instead of ayran, cola instead of milk in addition to preferring watching television and playing games on computers instead of riding bicycles and playing basketball (**Table 4**).

Table 4. Relationships between BMI values of the mothers and the preferences of children in diet and physical activity

Cards	Which is healthier?	Maternal BMI levelsa		p
		Normal weight	Overweight/ obese	
1	Boiled potatoes (n, %)	51 (42.1)	91 (52.3)	0.086
	Fried potatoes (n, %)	70 (57.9)	83 (47.7)	
2	Honey (n, %)	75 (62.0)	116 (66.7)	0.408
	Chocolate Spread (n, %)	46 (38.0)	58 (33.3)	
3	Fruits (n, %)	90 (74.4)	122 (70.1)	0.423
	Cake (n, %)	31 (25.6)	52 (29.9)	
4	Biscuit (n, %)	83 (68.6)	114 (65.5)	0.581
	Yoghurt (n, %)	38 (31.4)	60 (34.5)	
5	Nuts (n, %)	72 (59.5)	115 (66.1)	0.248
	Chips (n, %)	49 (40.5)	59 (33.9)	
6	Wafer (n, %)	85 (70.2)	122 (70.1)	0.980
	Apple (n, %)	36 (29.8)	52 (29.9)	
7	Carbonated drink (n, %)	80 (66.1)	120 (69.0)	0.606
	Ayran (n, %)	41 (33.9)	54 (31.0)	
8	Cola (n, %)	99 (81.8)	126 (72.4)	0.062
	Milk (n, %)	22 (18.2)	48 (27.6)	
9	Watching TV (n, %)	82 (67.8)	122 (70.1)	0.668
	Cycling (n, %)	39 (32.2)	52 (29.9)	
10	Playing games on computers (n, %)	74 (61.2)	107 (61.5)	0.953
	Playing basketball (n, %)	47 (38.8)	67 (38.5)	

aMaternal BMI is categorized as normal and overweight/obese (normal as BMI<25 kg/m2, overweight/obese as BMI≥25 kg/m2).

DISCUSSION

Childhood is a critical period for developing obesity. The dietary patterns gained in this period can affect the whole life. The dietary patterns of mothers, dietary status, and food preferences also pose examples for children to gain healthy dietary patterns. The current study is the one of the rare that comprehensively examined the effects of maternal dietary patterns and dietary status on children with obesity.

In this study, although the heights and body weights of male and female children were determined to be similar, the BMI values of male children were higher compared to the BMI values of female children in statistically significant terms (p=0.001). Similarly, in previous studies, it was reported that the BMI values of male children were higher compared to female children (14-16). In a study conducted in Portugal, it was reported that 8.2% of the children in the 3-10 years old group were affected by obesity (15) while a study that was conducted in Germany reported that 4.4% of the children in the 2-7 years old group were affected by obesity (16). In another study in China, it was reported that the prevalence of obesity in a group that contained children and adolescents was 5.6% (17). In the current study, 10% of the children, which is a significant portion, were affected by obesity.

The most important causes of childhood obesity include calorie intake more than the spent calories and lack of physical activity. The factors that cause children to take more calories than necessary include working mothers and high levels of income. When mothers work, they may not spare time for preparing meals. In a study conducted by Gershuny and Fisher (18), it was reported that the mothers who did not work cooked more frequently compared to mothers who worked. Additionally, it was reported that because children were not under the sound care of their mothers, they were more inclined to prefer unhealthy food and did less physical activities (19, 20). Several studies also reported that the access of children became easier as the income levels of mothers were increased in addition to increased frequencies of consuming ready-made meals (18, 21, 22). In the current study, it was determined that the probability of children affecting by obesity was increased as the income and education levels of the mothers were increased.

Similar to numerous previous studies, in the current study, it was determined that the children, whose parents were affected by overweight/obesity, were also affected by overweight and obesity (14-16, 23, 24).

The results indicated that the dietary patterns of parents were especially vital for the dietary patterns of children. Several studies reported that the dietary patterns of parents and children were related to each other (25-27). In a study conducted by Tang et al. (28), it was reported that the mother's consumptions of grains, vegetables, and snacks were positively related to the BMI values of children. In the current study, it was determined that the children, whose mothers consumed high levels of bread, rice, and sugar, had higher probabilities of affecting by overweight/obesity.

Various studies reported that children who were younger than 8 years old preferred sweet drinks, candies, bread, and snacks with high carbohydrate contents instead of healthy food such as vegetables, fruits, and whole grains (29, 30). It was also determined that children preferred spending time watching television and using computers (31,32). In the current study, it was determined that the children preferred unhealthy snacks, such as biscuits, wafers, and carbonated beverages, more frequently compared to healthy foods while preferring watching television and playing computer games instead of doing physical activities.

CONCLUSION

The results of this study demonstrated that maternal body weight and dietary patterns were significantly related to children with overweight/obesity. Especially, maternal consumption of bread, rice, and sugar had positive effects on children with overweight/obesity. Mothers with obesity were a predictor of obesity in children. Maternal dietary habits might play a role in the development of young children's dietary patterns. Mothers should also be encouraged to improve their dietary knowledge, and healthy foods should be made available in an easier way, which can allow mothers to guide their children to develop beneficial dietary patterns and to achieve a fine nutritional status..

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Ankara University Ethics Committee (Date: 04.09.2014, Decision No:183/12).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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