

The Relationship between 5-Year-Old Children's Weight Percentiles and Their Family Dietary Habits

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Abstract

Background: Childhood Nutrition plays an important role in people's health. The purpose of this study was to investigate the relation between family nutritional status and the body mass index (BMI) of children.

Methods: This observational cross-sectional-analytical study considered documents of 2697 kids with five years of age who were under the auspices of Mashhad University of Medical Sciences, Mashhad, Iran in 2019. Their related documents as well as their nutritional status were registered in the Iranian integrated health information system. Household demographic information including family nutritional information like fruit consumption, vegetable consumption, and daily dairy consumption, fast food consumption per week and type of oil consumed were questioned. Based on the weight percentile, they were categorized in four groups underweight, normal, obesity and overweight.

Results: There were significant differences between the frequencies of the participants' consuming low or high daily amounts (under 2 and more than 2 shares) of the nutritional components (fruit, veg, dairy, and fast food) in each weight category ($P < 0.001$). The frequencies of the consumers of liquid oil, in different weight categories, were also significantly different with the frequencies of those who used a combination of solid and liquid oils ($P < 0.001$). However, there was not a significant relationship between the different consumed nutritional components and the BMI ($P > 0.05$). Moreover, the children's BMI was not significantly correlated with education, smoking and age of mothers.

Conclusion: The results of the study showed that the daily consumption of fruits, vegetables, dairy products, different types of oils consumed and food consumption per week significantly correlated with weight categories of the five-year-old children under study. Therefore, in order to have a healthier population, it is critical to evaluate the nutritional condition of children during this period.

Key Words: Body mass index (BMI), children's nutritional status, Dietary pattern, Five-year-old children, Obesity, Overweight, Pediatric nutrition, Underweight.

* Please cite this article as: Ghafouri M, Ahmadi R, Talebi M, Niroumand S. The Relationship between 5-Year-Old Children's Weight Percentiles and Their Family Dietary Habits. *Int J Pediatr* 2022; 10 (8):16545-16552. DOI: [10.22038/ijp.2022.65044.4918](https://doi.org/10.22038/ijp.2022.65044.4918)

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Received date: Apr.18,2022; Accepted date:Jul.4,2022

1- INTRODUCTION

The increasing prevalence of overweight and obesity in children has significant impacts on their current and future health. This issue could be considered as the health problem for all countries worldwide. The common reason for childhood obesity and obesity is the imbalance between energy intake and consumption. Some of the underlying factors include diet shifts to high-energy foods full of fat and sugar, reduced physical activity due to recent sedentary lifestyles including long-term television watching, transportation changes, and urban living (1).

The nutritional needs of people of the same age and gender are the same all over the world. However, food diversity and its compounds are not the same to meet nutritional needs and are affected by various cultural, social, economic and individual factors. Evaluation of the dietary pattern can provide a comprehensive perspective on the type of food consumption as well as a comprehensive approach to prevent and treat diseases (2).

On the other hand, the pattern of nutrition in Middle East countries, including Iran, is changing rapidly. In terms of chronic nutrition-related diseases, the analysis of the nutritional status of the Iranian society indicates that in addition to malnutrition and food poverty, the nutritional transition period is currently ongoing (3). Nutritional misbehaving is very common in Iran and it is often seen that nutritional concepts in Iran are limited to the consumption of certain foods, leading to deficiencies in micronutrients like iron, iodine, calcium and vitamins. Also, investigations have revealed that among 18% to 20% of children suffer from disorders due to excessive consumption of carbohydrates. It is noteworthy that the per capita consumption of dairy products in Iran (170 g per day) is very low in comparison to the

developed countries (450 grams per day) (4).

The results of the last epidemiological research have indicated an intense dependency of overweight in adolescence and adulthood with childhood obesity (5). According to difficulties of controlling obesity in adulthood, controlling and preventing it in childhood are considered as important issues (6). Moreover, obesity or being overweight in children can cause physical problems and diseases including diabetes, hypertension, mental and psychological problems that would burden further health costs and other unpleasant issues (7). Besides, nutritional imbalance in childhood would lead to delayed sexual maturity, future overweight or underweight and impaired body mass index (BMI) (8).

Therefore, attention to nutritional status plays an important role in children's health and prevention of chronic diseases in their adulthood and thus reduces the health costs. The main purpose of this study was to investigate the effect of family nutritional status and daily consumption of fruits, vegetables, dairy products and fast food on children's weight. Our study results could be helpful for providing health guidelines and increments in family knowledge about the role of family nutrition on children's health.

2- MATERIALS AND METHODS

2-1. Participants

This cross-sectional analytical study included 2697 five-year-old children under the supervision of Mashhad University of Medical Sciences, Mashhad, Iran in 2020, who met the inclusion criteria of the study. All children's demographic information and the related nutritional status of their families were registered in the integrated health information system of the health deputy of Mashhad University of Medical Sciences. Missed information, children with chronic and metabolic diseases

including diabetes, heart disease, hypothyroidism and hyperthyroidism, tuberculosis, cancer, asthma, epilepsy, and kidney disease were excluded.

2-2. Procedure

The documents in the integrated health information system included child gender, mother's age, mother's educational level, mother smoking status, child's weight and family nutritional information including consumption of fruits (Less than 2 shares per day/2 shares and more per day), vegetables (Less than 2 shares per day/2 shares and more per day), daily dairy components (Less than 2 shares per day/2 shares and more per day), fast food (Less than 2 times per week/2 times and more per week), type of oil consumed were noted. Also, the body mass index of children was calculated. According to the guidelines of the World Health Organization, the studied children were divided into four groups based on weight percentile: underweight (<5th percentile), normal weight (5th to less than 85th percentile), overweight (85th percentile to less than 95th percentile) and obese (95th percentile and more).

2-3. Data Analysis

Data analyses were carried out in SPSS software (version 11.5, IBM® SPSS®, Chicago, USA). Data were expressed as mean and standard deviation or frequency and percentages. Chi-square test was

performed to evaluate the relationship between different weight categories and different nutritional consumption patterns. Also, independent sample T-Test and Analysis of variance (ANOVA) were used to compare the relations between the BMI mean and some demographic variables including gender, mother education, mother age and mother smoking. P-values less than 0.05 were considered as statistically significant.

3- RESULTS

3-1. The participants' demographic information

This study was conducted on 2697 five-year-old children whose nutritional information was recorded in the integrated health information system of the health deputy of Mashhad University of Medical Sciences. The demographic characteristics of the study participants are demonstrated in **Table 1**. In this study, 1410 (52.3%) and 1287 (47.7%) were male and female respectively. Our results showed that 189(7%) and 97(3.6%) of participants were overweight and obese, respectively. However, normal weight and underweight status were observed in 1813 (22.2%) and 598 (67.2%) of cases. The educational levels of most of the studied mothers were high school (56.3%) and undergraduate status (24.2%), respectively. Also, most of the mothers (52.9%) were between 30 to 40 years of age.

Table-1: Demographic information of the participants

Variables		Number (Percentage)
Gender	Male	1410 (52.3)
	Female	128 (47.7)
Mother Education	Undergraduate	645 (24.2)
	High school	1519 (56.3)
	Diploma	485 (17)
	Bachelor or higher	66 (2.4)
Mother age	<=20	15 (0.6)
	20-<=30	908 (33.7)
	30-<=40	1426 (52.9)
	40-<=50	338 (12.5)
	>50	10 (0.4)

3-2. Weight, demographic variables, and nutritional consumption

Table 2 demonstrates the frequency of four weight categories based on different nutritional status. Statistical analyses showed that the relationship between weight categories and different nutritional consumptions including fruits, vegetables, dairy products and fast food were meaningful ($P < 0.01$). Most of the cases used under two shares of fruits.

Meanwhile, consumption of dairy products, vegetables and fast foods were more than two shares among all weight categories of the participants. Moreover, there was a statistically significant difference between two types of consumed oils including solid and liquid forms, and their weight categories ($P < 0.01$). And most of the studied children had used combinations of solid and liquid forms of oil.

Table-2: Frequency of different weight categories based on nutritional consumption

Consumption		Underweight	Normal Weight	Overweight	Obesity	P-value
Fruits	Under 2 S.	592 (22.4)	1778 (67.3)	181 (6.9)	89 (3.4)	0.001
	More than 2 S.	6 (10.5)	35 (61.4)	8 (1.4)	8 (1.4)	
Vegetable	Under 2 S.	9 (12.2)	41 (55.4)	14 (18.9)	10 (13.5)	0.001
	More than 2 S.	589(22.5)	17772 (67.6)	175 (6.7)	87 (3.3)	
Diary	Under 2 S.	9 (17.3)	19 (36.5)	14 (26.9)	10 (19.2)	0.001
	More than 2 S.	589 (22.3)	1794 (67.8)	175 (6.6)	87 (3.3)	
Fast food	Under 2 S.	7(18.4)	16 (42.1)	7 (18.4)	8 (21.1)	0.001
	More than 2 S.	591 (22.2)	1797 (67.6)	182 (6.8)	89 (3.3)	
Oil	Solid & liquid oil	592 (22.3)	1790 (67.5)	178 (6.7)	91 (3.4)	0.001
	Liquid oil	6 (13.3)	22 (48.9)	11 (24.4)	6 (13.3)	

S; share. P-values are calculated by Chi-square Test. P values less than 0.05 are considered significant.

3-3. BMI, demographic variables, and nutritional consumption

We, further, evaluated the relationship between the children's BMI and their

demographic variables including their gender and their mothers' education, age and smoking status (**Table 3**).

Table-3: Evaluation of the BMI mean scores based on the demographic variables

Variables		Mean± Standard Deviation	P-value
Gender	Male	15.05±1.54	0.25
	Female	14.90±4.28	
Mother Education	Undergraduate	14.82±1.49	0.25
	High school	15.05±3.98	
	Diploma	14.91±1.64	
	Bachelor or higher	15.45±1.62	
Mother age	<=20	14.89±1.32	0.77
	20-<=30	14.91±1.57	
	30-<=40	15.02±4.09	
	40-<=50	14.99±1.54	
	>50	-	
Mother Smoking	Yes	15.05±1.74	0.77
	No	14.94±3.75	

P-values are calculated by Independent Sample T-Test and ANOVA between the studied groups. P values less than 0.05 are considered as significant.

Although the boys' BMI mean score was higher than that of girls, the analyses showed that there was not any difference between gender of the children and their BMI ($P=0.25$). Also, children of mothers with bachelor's or higher educational degrees had higher BMIs than those of the mothers with lower educational status. But, this relationship was not statistically significant ($P=0.25$). Furthermore, there was not any considerable difference between the children's BMI and the age of their mothers ($P=0.77$) or the smoking status of their mothers ($P=0.77$).

Furthermore, the relationship between consumption of different nutritional components and BMI means is demonstrated in **Fig 1**. As shown in this figure, there was not any significant difference between the children's BMI and their different shares of consumption of fruits ($P=0.85$), vegetables ($P=0.66$), dairy products ($P=0.90$) and fast foods ($P=0.92$). Besides, the BMI mean scores of the children consuming solid oil (14.88 ± 1.95) and combinations of solid and liquid oils (14.98 ± 3.17) were not significantly different ($P=85$).

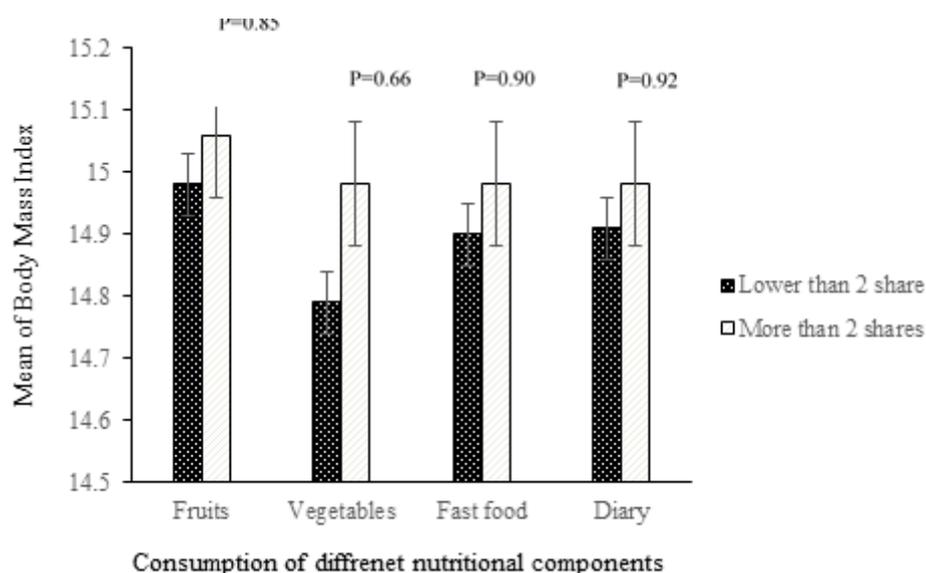


Fig 1: Evaluation of the relationship between the consumption of different nutritional components and the BMI mean scores

4- DISCUSSION

This cross-sectional analytical study investigated the effects of different demographic variables and different consumed nutritional components on weight and BMI of 2696 children with five years of age. In this study, we found that underweight children were frequently more in families with low amounts of fruit consumption. Besides, we found that the

families who consumed higher than two shares of vegetables had a higher frequency of having normal weight children in comparison to families with lower than two shares and the relationship between these factors was statistically significant. However, we found that there was not any significant relationship between BMI and consumption of different nutritional categories. Similar to ours, the findings of a previous cross-

sectional study in 2015 in the United States on 8,580 children aged between 2 to 5 years old revealed that there was no significant difference in the prevalence of overweight and obesity between consumers and non-consumers of natural juices (9).

We found that the studied boys had a higher BMI mean score than the girls, but there wasn't any meaningful relationship between gender frequencies and BMI. A previous research in China on 540 students ranging between 19 and 24 years of age found that the prevalence of weight loss was higher among girl students (62%) who ate more vegetables than boys (47.4%) (10). Besides, another study on 781 Finnish preschool children reported that girls had lower BMIs than boys (11). In our study, most of the studied girls were underweight and most of the boys were in overweight or obese categories of weight. However, this relationship was not found to be significantly meaningful.

We reported that most children were in the categories of normal weight (22.2%) and underweight (67.2%). And children with overweight (7%) and obesity (3.6%) were fewer than those with normal weights. Another investigation on 557 American students ranging from 18 to 56 years of age showed that approximately 33% of students were overweight or obese and 8% were underweight. The information of their diets showed that they had significant differences in consuming cheese, green leafy vegetables or other vegetables with no difference in fat and sweetener intake (12). These differences might be due to different study locations, different cultures of the studied participants and different age ranges of children.

Our results demonstrated that families who consumed more than two shares of dairy products had significantly a higher frequency of normal weight compared with those who consumed lower than two shares of dairy products. Similar to our

results, a previous study on 8950 children aged between 4 to 5 years showed that more milk consumption was associated with overweight and higher BMI of children ($P < 0.05$). On the other hand, children who drank more than three glasses of milk a day were more overweight than children who drank half of two glasses daily (13).

In the present study, a relationship was observed between fast food consumption and children's weight; however, the relationship between fast food consumption and BMI was not significant. Another study on 65,721 children aged 6 to 7 in New Zealand found that fast food consumption (more than three times weekly) was associated significantly with higher BMIs. However, in 189282 adolescents aged 13 to 14 years, no significant relationship was found between fast food consumption (more than three times a week) and BMI. These differences could be due to the differences in participants' age groups (14).

Yet another study on 1489 children living in Lithuania found that children with lower maternal education had higher potential overweight / obesity ratios (15). About the relation of maternal education and BMI, we found that most of the studied mothers (56.3%) had high school or undergraduate education. Although, children with educated mothers (bachelor's or higher educational degrees) had higher BMI but this relation was not statistically significant. Moreover, we found that there were not any significant differences between the age of mothers and BMI of children. Similar to our results, a previously conducted study, as an online program for parents having preschool children, reported that there was no significant difference between BMI and type of children's nutrition, age of children and mothers and educational status of the parents (16).

Interviews with 530 mothers of preschool children in 2018 in five regions of Poland revealed that BMI of children in the western region was higher in comparison to their peers in the other regions (17). They concluded that this issue was due to higher carbohydrate intake and lower fat in western region. In our study, families who listed solid or combined oil as the type of oil used in their household basket had a higher frequency of normal-weight children, and the mean body mass index of children in this group was higher than in the group consuming liquid oil, although this difference was not statistically significant. These differences could be due to the regional differences and the larger sample sizes. About the relationship between smoking and BMI, we didn't find any significant differences between maternal smoking and children's body mass index. However, we observed that the BMI mean score of the children with smoking mothers was higher, though not significantly, than that of the children of non-smoking mothers. A retrospective cohort study among 2,500 children in South Australia showed that any maternal smoking during pregnancy, even if they quit smoking after child birth, resulted in the obesity of children aged four to five years old. Meanwhile, a statistically significant relationship was observed between the number of cigarettes smoked per day in the second half of pregnancy period and the increase in body mass index. However, we didn't investigate the daily numbers of cigarettes consumed by mothers and the studied mothers hadn't precisely answered the questions about their smoking habits. So, the cultural situations might be considered as influential factors in such social medical investigations.

5- CONCLUSION

In this study, the effects of consuming fruits, vegetables, different types of oils, and demographic variables like gender of

the child and mother's education on the body mass index of children were investigated. And it was concluded that there is a possibility of better planning in the nutritional pattern of five-year-old children to prevent the relevant illnesses and issues and to avoid unnecessary complications and health care costs. Further investigations on larger sample sizes with a consideration to the other demographic and socioeconomic factors are recommended.

6- ETHICAL CONSIDERATIONS

Ethics committee of Mashhad University of Medical Sciences approved the study protocol under the ethics code of IR.MUMS.MEDICAL.REC.1398.457. Moreover, the information of the studied participants was kept secret.

7- ACKNOWLEDGMENT

The authors of this paper gratefully thank the vice chancellor of research of Mashhad University of Medical Research, Mashhad Iran for financially supporting this study under the Medical Student Thesis Number of 980471.

8- CONFLICT OF INTEREST

None.

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