

# Nutritional factors in etiology of childhood obesity

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## Abstract

One of the most important factors in childhood obesity is nutrition. There are a lot of factors that also effect nutrition status and behaviours of children. Factors such as the historical process of food consumption, changes in available foods, inability to manage energy intake, nutritional behaviors of the family, food types that kept at home, maternal nutritional status during pregnancy and breastfeeding are all closely related to obesity in children. In this review, it was aimed to examine the effect of nutritional factors on etiology of childhood obesity. In order to prevent and treat obesity both nutritional status and factors effecting it should be taken into consideration. Childhood obesity is not easy to treat and to improve treatment and success rate, new nutritional approaches should be developed. Dietitians have a major role in nutritional status, nutritional behaviors of children and diagnosis, treatment and monitoring of childhood obesity.

## Introduction

As of the 21st century, obesity, which has become a global health problem, has also become widespread in children. Childhood obesity, which requires a complex and versatile approach, has been an important issue for healthcare workers due to the lack of an easy solution [1]. And nutritional problems faced by children and adolescents related to nutrition are similar across the world [2].

The World Health Organization (WHO) states that most boys and girls in developing countries enter adolescence with undernourishment, as well as a growing number of mildly obese and obese children and adolescents in both low and high-income countries [3]. Being overweight affects the social life, physiological state and psychological health of the child in the long term [4]. Aside from the health problems associated with childhood obesity are, social and environmental problems patients face should be taken into consideration during treatment process [5]. Healthy eating and proper nutritional behaviors positively affect children's body composition and health and reduce cognitive stress and psychological problems [6]. Increase in overweight and obesity prevalence among children and adolescents is an important community health problem and it is related to nutritional behavioral factors. [7].

In this review, it was aimed to examine the effect of nutritional factors on etiology of childhood obesity.

## Childhood obesity

In the assessment of obesity in children and adolescent populations, BMI (Body Mass Index) is used as a screening tool but not for diagnostic purposes. In children aged 2 to 20 years, body composition evaluated according to the CDC (Centers for Disease Control and Prevention) percentile values of BMI for age and BMI for sex. If BMI percentile value for age is between 85-95 the child is considered as "overweight" and if BMI value is over 95 it is considered as "obese" [8]. As a result of a study of obesity in 634 children aged 6-12 years, it was found that 8.8% of the children were overweight and 3.1% were obese and that

obesity was associated with using transportation vehicles, fast food intake, inadequate physical activity and low fruit and vegetable intake [9].

In our country (Turkey), different reference values are used to assess obesity frequency in children and adolescents. According to results of Surveillance on Growth Monitoring in School Aged Children in Turkey (TOÇBİ, 2011) the overweight and obesity rates of children 6-10 years old are 14.3% and 6.5%, respectively [10]. As a result of Childhood Obesity Surveillance Initiative in Turkey (COSI-TUR, 2016), overweight and obesity rates were found as 14.6% and 9.9% in children between 7-8 years, respectively [11].

In a study, nutritional behavior and physical activity of 800 overweight and obese children (10-14 years) were investigated. It was determined that 20.4% of males were overweight, 10.3% of them were obese, of females 9.7% were overweight, and 22.5% were obese. Obesity prevalence was found to be significantly higher in girls and at younger ages. In addition, skipping the main meals especially in the case of breakfast skipping or long time between meals, extra snacks consumption, irregular eating behaviors and the increase in outside food consumption were found to have a significant relationship with being overweight and obesity. Obesity prevalence was found to be significantly higher in children who never consume green vegetables or fruits, daily consume soft drinks, bakery products, chocolate, fried foods. Also 26.6% of children were found to be sedentary, and physical activity level was significantly correlated with obesity prevalence [7].

In addition, in children younger than 2 years, the World Health Organization (WHO) offers guidelines for the head circumference, height, body weight, and suggests the use of these guidelines. And children with measured values 98th percentile and above are considered

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obese [8]. It is known that obese children are tending to be obese adults, in addition to that BMI assessment should be done correctly and children should not be diagnosed with obesity by mistake. For this, it is also necessary to determine whether the excess weight of the child is really caused by fat tissue or muscle tissue. The amount of muscle and fat tissue of children varies according to sex and ethnicity [5-13].

Identification of nutritional status of children and adolescents, especially in developing countries, has a great importance in the upbringing of healthy individuals [14]. When nutritional status of children and adolescents is evaluated, body weights and height lengths should be measured; weight loss and gain, growth retardation, physical activity should be recorded; the number of daily meals and the foods consumed at these meals should be evaluated, sexual development and girls' menstruation history should be taken [15].

Many nutrition related health problems, such as hypertension, type 2 diabetes, dyslipidemia, insulin resistance, sleep apnea, asthma, and non-alcoholic liver fatigue used to occur only in adults. However, nowadays these nutrition related health problems are common in children due to obesity which is also a nutrition related health problem. However, the problems caused by the obesity in pediatric cases are not limited to physical and physiological. These children also face psychological problems such as depression, anxiety, lack of self-confidence, and sometimes eating disorders [5-12]. Obesity has a greater association with many chronic diseases than with hunger, poverty, smoking and alcohol use [5].

### Nutritional factors in etiology of childhood obesity

Adequate and balanced nutrition for children and adolescents is important; but in this period undesirable nutritional behaviors such as skipping meals and applying the wrong diet can be observed. It is anticipated that nutritional behavior is related to nutrition information and that individuals educated on healthy nutrition will have healthy nutritional practice [16].

In the treatment of childhood obesity, the main purpose of lifestyle modification practice is to change the body composition. However, it is not known exactly how much these practices will affect food consumption and energy intake [17]. Nutritional status and practiced diets are one of the most important causes of increase of obesity in children and adolescents. Factors such as the historical process of food consumption, changes in available foods, inability to manage energy intake, nutritional behaviors of the family, food types that kept at home, maternal nutritional status during pregnancy and breastfeeding are all closely related to obesity in children [1-18].

### The historical process of food consumption

The prelatric period diets and modern-day diets are completely different from each other. In addition, inhabited life, the standing out of a sedentary lifestyle, easy access to foods, and especially the altered living conditions, such as the spread and consumption of processed foods, have led to serious changes in body composition and an increase in the prevalence of obesity in children [19].

The most important differences between the diets in the old times and modern-day diets are high pulp content, low energy content, containment of various nutrients and long chained fatty acids. In the paleotic period, the proportion of n-6 / n-3 fatty acids taken from the diet were 1: 1, it is 15-17:1 nowadays [20]. In the earlier periods, eating practices based on vegetables and fruits, fish-lean meats and oil seeds were on the forefront of nutrition. As a result of settling and

agricultural applications, nutritional practices transferred to a grain-based diet. Over time, vitamin mineral deficiencies and high-energy intake diets have come to the forefront. As a result, consumption of high-energy foods started to establish. In addition to this, the energy used for getting or accessing to foods today, is very low compared to the energy taken with foods [5-13].

### Changes in available foods

Today, the foods served in restaurants and cafes are high in energy, salt, sugar and fat content, and low in pulp. Also including children's menus, portions of served foods are large in these menus. All of these are associated with childhood obesity. In addition to these, despite the increased production of energy-rich foods such as various fast foods, snacks, sweets, energy needs of children remain constant. For this reason, consumption of these foods is related to obesity during childhood as well [19].

In a study, fast food consumption and obesity rates in 201 (12-18 years) adolescents were aimed to evaluate. And it was found that 19% of adolescents were mildly obese and consumed fast food  $1.5 \pm 1.33$  times per week. As a result, fast food consumption was found to be an important nutritional factor in the occurrence and prevalence of obesity in adolescents [21].

One thousand six hundred twenty-six children (7-16 years) were included in a study which was conducted for assessment of fast food consumption, obesity and hypertension seen in children. Food consumption records and anthropometric measurements of the children were taken. According to the data collected, it was found that 11.1% of the children were obese, 19.7% of them had abdominal fat and 9.0% had hypertension. Obesity prevalence was significantly higher in males than females and nearly half of males (51.9% of males and 43.6% of females) consumed fast food regularly during the last 3 months [22].

In a study conducted with 1349 overweight and obese children. And children were treated with a diet in which sugary drinks, candies, snacks and fast food were excluded. The diet was applied for one year under the nutritional practices of childhood obesity treatment program. Because of the practice, a decrease in BMI values was observed in both girls and boys [23].

### Inability to manage energy intake

Children are insufficient to control the energy they intake. However, children exposed to malnutrition can be conditioned for excessive nutrient intake independent of their hunger and satiety feelings [20]. In addition, as children learn by observing their surroundings, food intake in large portions pushes children to food intake in large portions too. In addition, children who are constantly fed with large portions or excessive feeding, may be overweight and obese in time due to developing habits to eat large portions or eating excessively. The educational status and orientation of the parents affects the child's eating habits and the prevalence of obesity in children [5,19]. Fast food consumption of children that are oriented by their parents actively is lower [13].

Weker [24] found that obese children (n = 236) intended to investigate the effects of nutritional factors on obesity and found that familial factors and environmental conditions had an effect on childhood obesity. In addition, a statistically significant correlation was found between obesity and education level of mothers and obesity frequency of fathers [24].

Zhao et al. (2017) aimed to determine obesity frequency and fast food consumption of children in their study. And they found that children of college or university graduated mothers less fast food and had a lower prevalence of obesity [22].

In a study conducted by reaching 13396 adolescents (aged from 67 to 11 years) from 6781 families, the effect of maternal education, purchasing power, and status at work on adolescents' nutritional behavior was examined. It has been determined that the education status of the mother and the status of the workplace are related to the nutritional status and that the children of these mothers have a higher average height length according to their age. In addition, even if they had BMI differences, it was observed that the difference in BMI between boys and girls was lower in children of mothers with higher educational status. Also, fast-food consumption rates found to be higher in boys whose mothers had higher education levels [25].

### Nutritional behaviours of the family

Another factor that is effective on the nutritional behaviors of children is the nutritional behavior and nutritional attitudes of the family [5-26]. The role of family in childhood obesity, a major public health problem, is great. For this reason, families should be reached, and education should be provided to families to be able to have the right nutrition practices [27].

Family-related factors such as the number of people in the family, the child having younger brother, and the mother's nutrition habits are known to affect the health of the child [28]. Family-oriented lifestyle modification practices cause significant changes in lifestyle and nutrition habits among obese children. In addition, this practice reduces the desire to eat excessively in children and affects the blood parameters positively [17].

In a study of how families' nutrition and activities affected children, it was observed that unhealthy nutritional behaviors, habits and inactivity of the families affected their children's behavior. It was also found that families with unhealthy eating habits and behaviors had less activity and that children of these families exhibited similar behaviors and consumed more foods that has high energy, saturated fat and salt. It was also determined that the proportion of overweight and obese children was higher among these children. As a result of the study, it was concluded that the family has a great influence on the child's nutritional and physical activity behaviors and has a serious role in the development of childhood obesity [29].

In a study that investigated effects of family's nutritional status on children's nutritional status, 698 children (6-12 years) and their families were included. The results of the study showed that the eating habits and energy intake of the families and the children were similar, and the relationship was statistically significant [26].

The fact that either or both parents of a child is/are being obese is a sign that the child will also tend to become obese [5,12]. In particular, these parents may be able to restrict the food intake of their children because they are concerned that their children will be fat. And as a result, they may cause their children to get more nutrients by creating an adverse reaction. Especially if the mother and father do not exhibit the right nutritional behavior themselves, the situation gets serious. To control children's energy intake and nutritional behaviors, parents either use food as a reward or restrict their children's access to high-nutrient energy content. In both cases, children want to consume more of these foods, resulting in the opposite outcome [12,20]. Other factors, such as eating together meals, number of meals, meal time, etc.,

are also effective in childhood obesity. Children who consume meals together with their family eat healthier [19,30].

In a study of the relationship between the frequency of meal consumption of adolescents and their families' and their prevalence of obesity, 890 adolescents (12-13 years) were included. Obesity prevalence was found to be significantly higher in girls who consumed evening meals alone in terms of the data obtained in the study, but it was found that there was no meaningful relationship in boys [31].

In another study, the relationship between the anxiety of the parents on the body weight of their children, the food intake of children, the food at home, the meal times of family, and the nutrition practices of families on their children were examined. Within the scope of the study, 1448 adolescents (12-15 years) and their families were reached. Twelve percent of the families said they thought their children were fat, while 27% said they were concerned about the weight of their children. Children of disconcerting families reported that they consumed less energy-high foods, having less of these foods in their homes, and that their families listened less frequently while shopping and cooking compared to other children. However, it has been determined that anxious families are not found to have or consume more fruits and vegetables at home and did not plan mealtimes [32].

When treatment of childhood obesity and reduction of prevalence is aimed to improve family related factors maternal and paternal involvement is included. But there is an important role for grandparents in the nutritional status and behaviors of children [33]. In a study conducted, it was determined that grandparents had an important effect on children's nutritional status and behaviors and physical activity levels as well as their parents [33,34].

### Food types that kept at home

The presence of unhealthy, energy-rich and nutritious foods at home causes children to consume more of this type of food and develop nutritional habits of consuming higher energy foods over the years to come [35].

Contradictorily, the prevalence of obese children is higher in lower income families compared to families with higher income levels. The reason for this situation is related to purchase and consumption of foods high in energy content in low-income families [5-19].

In a study conducted with the participation of 1157 adolescents in which factors affecting childhood obesity were examined, participants were asked about height, body weight, socio-demographic characteristics, nutrient intake, and physical activity behaviors. According to the data from the study overweight and obesity rates were related with in low and high-income families, mothers working outside house, those whose both parents were obese, those who spent a long time against TV, those who had high energy intake, those who had low physical activity, those who had insufficient powder intake, those who skip breakfasts more and those who have low and high fat intake. It is also found that as the energy intake increases the obesity rate increases and as the vegetable consumption increases fiber intake increases, obesity rate decreases. Adolescents with moderate economic status were found to have lower risk of being overweight / obese than adolescents with low and high socioeconomic status [36].

In study conducted to assess food safety, 55 pairs of mothers and children were included and 65.4% of mothers and 43.6% of children stated that food safety and foods stored at home were insufficient. Statistically significant relationships were found between food safety,

stored food at house and fast food consumption of mothers and children, eating as a family, conscious eating and binge eating behaviors. At the end of the study, it was decided that the food at home and the safety of these foods affected the eating habits of the children [37].

In a study conducted, it was determined that the families struggled to have healthy eating behaviors for themselves and their children, but the home environment and environmental factors did not support this [27]. In another study of the relationship between home nutrition environment and childhood obesity, 669 children and their families were reached, and nutritional status and body weights were examined. As a result of the study, it was found that the consumption of vegetables and fruits of children was significantly higher when their parents set an example and they are supported, but when there were unhealthy foods at home, vegetable and fruit consumption of children were found to be significantly lower [38].

## Maternal nutritional status during pregnancy and breastfeeding

Although the mechanisms behind maternal nutritional status during pregnancy and breastfeeding and childhood obesity are not clearly explained, maternal feeding is thought to be directly related to childhood obesity [12-20]. In particular, factors such as the cultural structure of the population mother lives in, the economic level of the family affects the mother's nutritional status and behaviors as well as the nutritional status and behavior of the child during pregnancy, breastfeeding and growth periods [19].

In a study in which the effects of pregnancy and lactation-related factors on obesity in children were examined, body weights were evaluated according to the height of 690 children aged 0-12 months. It was determined that 12.9% of the children were overweight and 9.7% were obese. It was found that as the BMIs of the parents and the weight gain in pregnancy increases, the weight of the children increases. And it was determined that the first six months of breastfeeding had protective effects on obesity in these children. As a result of the study, breastfeeding and weight gain in pregnancy are affecting childhood obesity as well as genetic factors and they are modifiable factors directly effecting childhood obesity [39].

## Conclusion

Childhood obesity is a health problem that affects children's health negatively as physiologically, socially and psychologically, and needs to be intervened and treated as soon as possible in order to improve their health. It is also a risk factor for adulthood obesity and many chronic diseases in adults.

The policies to be followed for treatment should include national and international approaches. However, when the reasons for childhood obesity are taken into consideration, requirement of multidisciplinary approaches emerges. In addition to this, it is also very important to improve the environmental conditions, give education and to provide lifestyle changes.

One of the main causes of childhood obesity is nutrition. And factors affecting nutritional status and nutrition-related factors. Dietitians have a great duty in evaluation and improvement of these factors. And they should be able to implement correct approaches and nutritional practices during diagnosis and assessment of childhood obesity. Dieticians should actively take part in epidemiologic studies, national or international politics and practices to improve this situation.

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