ORIGINAL ARTICLE ÖZGÜN ARAŞTIRMA

# The Association Between Obesity, Being Overweight and Socio-economic Status Among School-Age Children Living in Big Cities

## Büyük Şehirlerde Yaşayan Okul-Çağı Çocuklarında, Obezite, Kilolu Olmak ve Sosyo Ekonomik Durum Arasındaki İlişki

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### Abstract

**Introduction:** Obesity has become a serious health concern worldwide. Risk factors of obesity are different in urban and rural areas. The aim of this study was to determine the risk factors related to obesity and being overweight among children in low and high socio-economic groups in a big metropolitan city, Istanbul.

**Materials and Methods:** A cross-sectional study was carried out on 490 school-age children between 5 and 15 years. Low and high socio-economic groups were determined according to socio-economic status (SES). Socio-demographic characteristics of children were collected from the parents.

**Results:** The effect of having frequent snacks rich in carbonhydrates (p=0,001) and sedentary lifestyles (p=0,001) on BMI was significant in both SES groups. In high SES group, BMI of the <10 years boys was significantly higher than that of the <10 years girls; Boys also had higher BMI at both age groups of either younger or older than 10 years. In low SES group, girls were significantly more overweight than boys. High family income, high paternal BMI and consuming energy rich products increased the obesity risk in children 1,560 times (OR: 1,560, %95 CI: 1,046-2,326), 2,015 times (OR: 2,015, %95 CI: 1,092-3,720), and 4,33 times (OR: 4,330, %95 CI: 2,897-6,472), respectively.

**Conclusions:** As conclusion, high family income, high paternal BMI and consuming energy rich products incre-ased the obesity risk. We suggest that every community has own characteristics but boys tend to have high BMIs in families with high SES.

**Keywords**
Childhood, obesity, overweight, socio-economic status

**Anahtar kelimeler**
Çocukluk çağı, obezite, fazla kilolu olma, sosyo ekonomik statü

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### Öz

**Giriş:** Obezite dünya çapında ciddi bir sağlık sorunu haline gelmiş olup, obezitenin risk faktörleri kentsel ve kırsal alanlarda farklılık göstermektedir. Bu çalışmanın amacı, büyük bir metropol olan İstanbul'da düşük ve yüksek sosyo ekonomik gruptaki öğrencilerde obezite ve fazla kilolu olma ile ilgili risk faktörlerini belirlemek-tir.

**Gereç ve Yöntem:** Enine kesitli çalışma 5-15 yaş arası 490 okul çağı çocuğu üzerinde gerçekleştirildi. Sosyo ekonomik duruma (SES) göre düşük ve yüksek sosyo ekonomik gruplar belirlendi. Çocukların sosyo demografik özellikleri ebeveynlerden toplandı.

**Bulgular:** Karbonhidrat bakımından zengin sık ara öğün yemenin (p=0,001) ve hareketsiz yaşam tarzının (p=0,001) VKİ üzerindeki etkisi her iki SES grubunda anlamlıydı. Yüksek SES grubunda, <10 yaşındaki erkek çocukların BMI'si <10 yaşındaki kızlarınkinden anlamlı derecede yüksekti; Erkekler ayrıca 10 yaşından küçük veya daha büyük her iki yaş grubunda daha yüksek BMI'ye sahipti. Düşük

SES grubunda, kızlar erkeklerden önemli ölçüde daha fazla kiloluydu. Yüksek aile geliri, yüksek baba BMI ve enerji açısından zengin ürünler tüketmek çocuklarda obezite riskini 1.560 kat (OR: 1.560,% 95 CI: 1.046-2.326), 2.015 kat (OR: 2.015,% 95 CI: 1.092-3.720), ve 4,33 kez (OR: 4,330,% 95 CI: 2,897-6,472).

**Sonuç:** Sonuç olarak, yüksek aile geliri, yüksek baba BMI ve enerji açısından zengin ürünler tüketmek obezite riskini artırmıştır. Her topluluğun kendine has özellikleri olduğunu, ancak erkek çocukların yüksek SES'li ailelerde yüksek BMI'lere sahip olduğunu düşünüyoruz.

## Introduction

Recently, obesity has become a serious health concernwith increasing prevalence and important consequences in all pediatric age groups, in both sexes and in all socio-economical levels, worldwide. Genetic susceptibility, environment, socio-economic status and individual lifestyle factors are believed to play important roles for the development of obesity; although, their importance may differ between individuals and countries (1-3).

Many countries constitute their health policies by determining their own demographic characteristics, risk factors and high risk groups. Various population-based programs and policies are developed to improve countries' health policies (4, 5). In this study, we aimed to investigate the rate and other associated factors of obesity and overweight among 5 -15 years old school-age children in low and high socio-economic groups in a big metropolitan city, Istanbul.

## Material and Methods

### *Study Population and Data Collection*

The study was designed as a cross-sectional study and randomly selected 490 school-age children between 5 and 15 years old who were followed in the well child follow-up clinic of a university hospital were included in this study. Children were divided into two groups as living in low and high socio-economical status (SES). Family income measures were based on per capita annual income of household by dividing gross annual income of the family by household size. Per capita family income tertiles were used to indicate low and high SES.

Our research was approved by the Ethics Committee of Acibadem University (2019-9/18). This study was conducted according to the principles of Declaration of Helsinki, 1989.

During the study, height and weight of each child was recorded and body mass index (BMI) was calculated. Weight was measured with a scale and height with a stadiometer (Seca, Germany) for children fully undressed or while wearing light clothes in an upright position without shoes. BMI values were calculated as weight divided by height squared (kg/$m^2$).

Overweight and obesity were determined by comparing calculated BMIs to International Obesity Task Force (IOTF) cut-offs (6). Childhood weight, height and BMI values were converted to centile levels for age and sex by Centers for Disease Control and Prevention, BMI charts. Obesity is described as a BMI greater than the 95th. centile for age and sex growth charts, overweight is classified as a BMI-for-age between the 85th. and 95th. centiles. Children with metabolic and/or endocrine disease and underweight children were excluded from the study.

### *Questionnaires*

Children were admitted to the study after being volunteered by their parents. Written informed consent was obtained from all parents. A questionnaire was filled out for each patient. An inquiry form including questions such as duration of breastfeeding, parental education level, number of siblings, type of school attended (state or private), timing of breakfast and lunch (at home or school) was filled out by questioning the parents. The assessment of participants' social and demographical characteristics were based on the data from the questionnaires. Age, gender and parental obesity parameters were also recorded.

## Results

Main sociodemographic characteristics are summarized in Table 1. Study population composed of total 490 children; 243 of them (49,6%) were girls and 247 (50,4%) were boys. Ages were between 5-15,4 years; mean age was 9,26±2,64 years. 61,8% (n=303) of the children had normal BMI, 23,1% (n=113) were overweighted and 15,1% (n=74) were obese. 51,6%

of the patients were from the high socio-economical status and 48,3% were from the low SES. 43,5% (n=213) of the patients had only breast-milk in the first 4-6 months, 508% (n=249) had both breast-milk and formula, and 5,7% (n=28) had only formula. Breast-feeding or formula feeding had no significant effect on obesity in either high SES group (p=0,238) or low-middle SES group (p=0,611). 42,7% of the children attended private school and 57,3% attended public school. Type of school was not effective on obesity (p=0,886). 60% (n=294) had a sibling. Having a sibling did not have a significant effect on obesity in high (p=0,59) or low SES (p=0,16) groups. 78,8% had breakfast at home. No significant effect was found

Table 1. Socio-demographic characteristics

| | | |
|---|---|---|
| **Age (years); n(%)** | **<10 years** | 292 (59,6) |
| | **≥10 years** | 198 (40,4) |
| | Min-Max (Median) | 5-15,4 (9,01) |
| | Mean ± SD | 9,26±2,64 |
| **Gender; n(%)** | **Female** | 243 (49,6) |
| | **Male** | 247 (50,4) |
| **Birthweight (gr)** | Min-Max (Median) | 2500-4000 (3250) |
| | Mean ± SD | 3287,33±349,71 |
| **Height (cm)** | Min-Max (Median) | 105-182 (137) |
| | Mean ± SD | 137,86±15,81 |
| **Weight (kg)** | Min-Max (Median) | 14-101 (33) |
| | Mean ± SD | 36,54±14,61 |
| **BMI (kg/m$^2$); n(%)** | **Normal** | 303 (61,8) |
| | **Overweight** | 113 (23,1) |
| | **Obese** | 74 (15,1) |
| | Min-Max (Median) | 12,7-33 (18) |
| | Mean ± SD | 18,79±3,66 |
| **Type of feeding in 4-6 months; n(%)** | **Only formula** | 28 (5,7) |
| | **Only breastfeeding** | 213 (43,5) |
| | **Beastfeeding and formula** | 249 (50,8) |
| **Total breastfeeding period (months)** | Min-Max (Median) | 1-36 (9) |
| | Mean ± SD | 10,40±6,38 |
| **Family income; n(%)** | **High** | 253 (51,6) |
| | **Low** | 237 (48,4) |
| **School; n(%)** | **Private** | 209 (42,7) |
| | **Public** | 281 (57,3) |
| **Sibling; n (%)** | **Yes** | 294 (60,0) |
| | **No** | 196 (40,0) |
| **Breakfast; n(%)** | **At home** | 386 (78,8) |
| | **At school** | 104 (21,2) |
| **Consuming energy rich products; n(%)** | **Yes** | 193 (39,4) |
| | **No** | 297 (60,7) |
| **Sedentary behavior >2 hrs/day; n(%)** | **Normal** | 128 (42,1) |
| | **Overweight** | 67(58,9) |
| | **Obese** | 48(65,1) |

on obesity (high SES, p=0,481, low SES p=0,079). Statistically significant correlation was observed between children's BMI and sedentary behavior as screen time and watching TV/computer more than 2 hours/day (p=0,001) (Table 1).

The rate of obesity was 15,4% (n=39) and the rate of being overweight was 25,7% (n=65) among the high SES group. The rate of obesity was 14,8% (n=35) and the rate of being overweight was 20,3% (n=48) in the low SES group. Socio-economical status was not significantly related to the children's risks of being obese or overweight (p=0,311). In the following tables, the relation between SES and BMI of the children will be evaluated by various subgroups differing from age and gender (Table 2).

In both high and low SES groups, those having frequent carbohydrate snacks daily had significantly higher BMI (p=0,001) (Table 3) (Figure 1). In high SES group, BMI of the <10 years boys was significantly higher than that of the <10 years girls; this significance was more prominent for high SES group (p=0,001) than low SES group (p=0,078) (Figure 2). Boys also had higher BMI at both age groups of either younger or older than 10 years. In low SES group, we noticed that girls were significantly more overweight than boys; however, obesity was again more significant in boys in this SES group (Table 4) (Figure 3).

In high SES group, maternal BMI was positively correlated with the children's BMI with 16,2% statistical significance. (r=0,162; p=0,005; p<0,01). In low SES group, paternal BMI was positively correlated with the children's BMI with 28% statistical significance. (r : 0,280; p=0,001; p<0,01) (Table 5).

A backward (conditional) logistic regression analysis was performed for the determination of independent variables affecting the childhood obesity

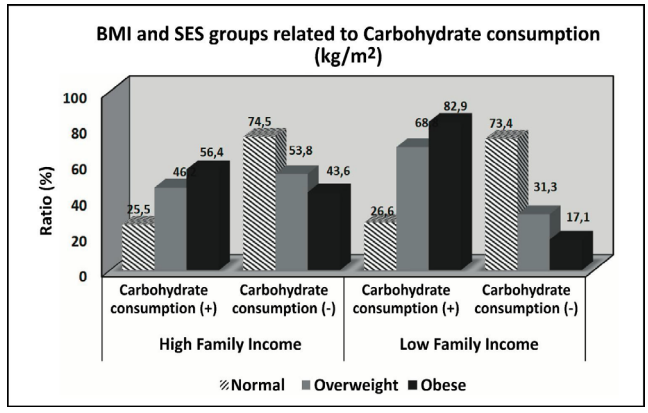


**Figure 1.** Comparison of BMI and gender related to SES groups and Carbohydrate consumption.

Table 2. The relation between family income and BMI

| | | High family income (n=253) | Low family income (n=237) |
|---|---|---|---|
| | | n (%) | n (%) |
| **BMI (kg/m²)** | **Normal** | 149 (58,9) | 154 (65,0) |
| | **Overweight** | 65 (25,7) | 48 (20,3) |
| | **Obese** | 39 (15,4) | 35 (14,8) |
| | **p** | [a]0,311 | |

[a]Pearson ki-kare test

Table 3. Comparison of BMI in different SES groups related to having frequent snacks rich in carbonhydrates

| | | High family income | | Low family income | |
|---|---|---|---|---|---|
| | | Energy rich products (+) | Energy rich products (-) | Energy rich products (+) | Energy rich products (-) |
| | | n (%) | n (%) | n (%) | n (%) |
| **BMI (kg/m²)** | **Normal** | 38 (25,5) | 111 (74,5) | 41 (26,6) | 113 (73,4) |
| | **Overweight** | 30 (46,2) | 35 (53,8) | 33 (68,8) | 15 (31,3) |
| | **Obese** | 22 (56,4) | 17 (43,6) | 29 (82,9) | 6 (17,1) |
| | **[a]p** | **0,001**** | | **0,001**** | |

[a]Pearson ki-kare test **p<0.01

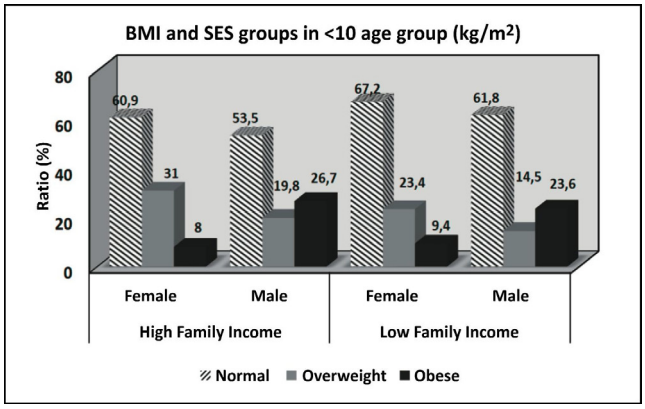


**Figure 2.** Comparison of BMI with SES groups in <10 age group.

and being overweighted. Statistically significant variables selected from univariate analysis such ads gender, age, high family income, high paternal BMI, maternal BMI, total breastfeeding period (months), mothers' education level, fathers' education level, breakfast and consuming energy rich products were entered as the independent variables to the analysis. High family income increased the obesity risk in children 1,560 times (OR: 1,560, %95 CI:1,046-2,326). High paternal BMI also increased the childhood obesity risk as 2,015 times (OR:2,015, %95 CI:1,092-3,720), while consuming energy rich products increased the childhood obesity risk as 4,33 times (OR:4,330, %95 CI:2,897-6,472) (Table 6).

Table 4. Comparison of BMI with family income in different age groups

| | | | High family income | | Low family income | |
|---|---|---|---|---|---|---|
| | | | Female (n=87) | Male (n=86) | Female (n=64) | Male (n=55) |
| | | | n (%) | n (%) | n (%) | n (%) |
| **<10 Years** | **BMI (kg/m²)** | **Normal** | 53 (60,9) | 46 (53,5) | 43 (67,2) | 34 (61,8) |
| | | **Overweight** | 27 (31,0) | 17 (19,8) | 15 (23,4) | 8 (14,5) |
| | | **Obese** | 7 (8,0) | 23 (26,7) | 6 (9,4) | 13 (23,6) |
| | | **p** | [a]0,004** | | [a]0,078 | |
| | | | **Female (n=42)** | **Male (n=38)** | **Female (n=50)** | **Male (n=68)** |
| **≥10 Years** | **BMI (kg/m²)** | **Normal** | 30 (71,4) | 20 (52,6) | 26 (52,0) | 51 (75,0) |
| | | **Overweight** | 11 (26,2) | 10 (26,3) | 16 (32,0) | 9 (13,2) |
| | | **Obese** | 1 (2,4) | 8 (21,1) | 8 (16,0) | 8 (11,8) |
| | | **p** | [b]0,026* | | [a]0,023* | |
| | | | **Female (n=129)** | **Male (n=124)** | **Female (n=114)** | **Male (n=123)** |
| **Total** | **BMI (kg/m²)** | **Normal** | 83 (64,3) | 66 (53,2) | 69 (60,5) | 85 (69,1) |
| | | **Overweight** | 38 (29,5) | 27 (21,8) | 31 (27,2) | 17 (13,8) |
| | | **Obese** | 8 (6,2) | 31 (25,0) | 14 (12,3) | 21 (17,1) |
| | | **[a]p** | 0,001** | | 0,033* | |

[a]Pearson ki-kare test, [b]Fisher-Freeman-Halton Test
*p<0,05 **p<0,01

Table 5. Comparison of children's BMI with parental BMI in different family income levels

| | High family income | | Low family income | |
|---|---|---|---|---|
| | Children's BMI | | Children's BMI | |
| | r | p | r | p |
| Maternal BMI | 0,168 | 0,007** | 0,058 | 0,372 |
| Paternal BMI | 0,111 | 0,080 | 0,279 | 0,001** |

r: Pearson korelasyon katsayısı
**p<0.01

*Statistical Analysis*

All analyses were performed using NCSS (Number Cruncher Statistical System) 2007 (NCSS, LLC Kaysville, Utah, USA) programs. Data were expressed as mean ± standard deviation (SD) for continuous variables. Pearson's chi-squared test and Fisher's Freeman Tests were used to analyse categorical variables. Pearson's correlation analyses was used for comparison of children's BMI and parental BMI. A backward (conditional) logistic regression analysis was performed for the determination of independent variables affecting the childhood obesity and being overweighted. The results were evaluated against a 95% confidence interval and $p<0.05$ was considered significant.

## Discussion

Childhood obesity is an important public health issue with increasing prevalence among school children and adolescents over the past 3 decades (1,2,3). International data regarding childhood obesity varies by age, gender, race, ethnicity, socio-economical status and other factors. Obesity among youth can have immediate health effects as well as longer-term consequences during adulthood (4). Eneli and Dele Davies (5) reported in a worldwide study that in 77% of the countries analyzed, the prevalence rate for children who were overweight was at least 10%. A previous multinational study estimated that 23,8% of the boys and 22,6% of the girls in developed countries and 12,9% of boys and 13,4% of girls in developing countries were overweight or obese in 2013 (1).

İstanbul is a point of intersection among Eastern European, Mediterranian and Middle East countries where people from different cultural and socio-economical levels live together. In our study, the rate of being overweight was 23,1% and the rate of obesity was 15,1%. This pattern was closer to that seen in developed countries and Mediterranian countries (7). Studies performed between 2000 and 2010 in different regions of Turkey, are demonstrated varying prevalence rates of 10,3%-17,6% and 1,9%-7,8% for being overweight and obesity, respectively, in children aged between 6-16 years old (8). When obesity rates in Istanbul province were compared to that of the smaller cities and rural areas of the country, obesity risk was observed to be quite high and showed parallelism with the rates of urban areas of developed countries (9,10).

Although prevalence of obesity has increased in both boys and girls, the causes and consequences differ between the sexes. Gender related differences in factors associated with obesity change worldwide. Females are more likely tend to be obese than males during the second decade of their life in the previous studies; however, boys from different ethnical and racial groups might have higher risks of obesity (11). A recent European Youth Heart Study suggested that male sex confers a higher risk of obesity in adolescence (12).

In the group, younger than 10 years, the obesity rates were found to be significantly higher in boys in both SES groups in this study. Similiarly, 24.9% of the boys and 24.2% of the girls who are at the 2nd grade in Turkey are overweight and obese according to COSI-TUR (The WHO European Childhood Obesity Surveillance Initiative) 2016 Survey has been carried out with the participation of 11732 students (primary school, 2nd grade students) from 585 primary schools in 79 provinces (excluding Şırnak and Hakkari), in cooperation with the Republic of Turkey Ministry of National Education in Turkey (13). Boys from both SES

Table 6. The logistic regression analysis for the determination of independent variables affecting the childhood obesity and being overweighted

| | p | Odds Ratio | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower | Upper |
| High family income | 0,029* | 1,560 | 1,046 | 2,326 |
| Maternal BMI (normal) | 0,037* | | | |
| Maternal BMI (overweight) | 0,959 | 0,988 | 0,631 | 1,548 |
| Maternal BMI (obese) | 0,025* | 2,015 | 1,092 | 3,720 |
| Consuming energy rich products | 0,001** | 4,330 | 2,897 | 6,472 |

[a]Variable(s) entered on step 1: Gender, age, family income, paternal BMI, maternal BMI, Total breastfeeding period (months), mothers' education level, fathers' education level, breakfast, Consuming energy rich products. *p<0,05 **p<0,01

groups might have easier access to computer games in Istanbul; thus, they might have more sedentary lifestyles. In the group older than 10 years, boys were again significantly tend to be more obese than girls in the higher SES; however, being overweight was more common in adolescent girls in the lower SES group. Parents might try to have their overweight teenage daughters to lose some weight before they become obese, in order to have a better outlook before marriage in Turkey. Another reason that female adolescents have less obesity might be caused from the gender differences in body satisfaction and well-being. Studies have suggested that females express stronger dislike of their obese peers than males, and that obese females are rated more negatively than obese males. While both males and females with a high BMI wish to be thinner, females may be more vulnerable to the obesity-related victimization (14).

Most of the studies that investigated the association between SES and obesity in children suggest inconsistent results which vary by gender, age and whether the child lived in the urban or rural country (15). Overall, obesity in children appears to be predominantly a problem of the rich in low and middle income countries; whereas, it affects mostly people of lower SES in the developed countries (16,17,18). Wang et al. (16) studied the obesity prevalence published in the past 25 years which were performed on school children from 25 countries and pre-school children from 42 countries. They pointed out that obesity and being overweight has increased more dramatically in economically developed countries and in urbanized populations. Interestingly, high socio-economic status was not significantly related to the children's risks of being obese or overweight due to the univariate analysis but was significant in logistic regression analysis in this study; thus, SES was a major determinant of obesity in a big metropolitan city. Like developed countries.On the other hand, in univariate analysis, boys from the families with high SES are tend to be more obese than the boys from the families with low SES.

Important determinants of childhood obesity between ages of 5-15 years old include parental unawareness and lack of knowledge about nutrition, parental obesity, lifestyle and socio-economic factors in most studies. Residence in metropolitan cities is another risk factor for childhood obesity. Increasingly sedentary lifestyle in big cities, increased indoor activities as television viewing, internet, computer games, and other screen habits, poor facilities for physical activity, lack of open spaces and playgrounds, unsafe neighborhoods for outdoor activities, increasing pressure on children to perform in academics are some of the risk factors in big cities (17).We also found out that BMI increased significantly as the children had more sedentary lifestyles independent of socio-economical status in our sample of urban children.

Exposure to commercial food advertisements and easier access to unhealthy food products are also common risk factors for obesity in urban than rural areas. Independent of the SES, children having snacks rich in carbohydrates (sugar-sweetened beverages, packed sweet and floury foods) more than 2 times a day had higher BMI in our study. In COSI-TUR 2016 Survey, it was reported that 29.6% of children consume salty snacks (potato chips, corn chips, cookies) some days (1-3 days a week) and 10.7% consume beverages containing sugar for 4-6 days a week. Besides, 36.3% of the children consume sugar bars and chocolate, (1-3 days a week) and 25.3% of the children consume biscuits, cakes and cookies every day (13). Factors such as breast-feeding, education level of the mother and the father, attending a public or private school, having breakfast and lunch at home or at school and having a sibling did not have significant effects on overweight or obesity in our metropolitan city of İstanbul.

Data from two cross sectional studies showed that parental overweight or obesity was another independent risk factor for childhood obesity and that maternal BMI, in particular, was a significant predictor of BMI in children (19). Most overweight children have a familial form of obesity, with one or two obese parents. Obesity may be more normative and family pressure to lose weight may be less for these children when head of the household is obese. Ogden et al. (20) reported that that lower levels of income are not generally associated with childhood obesity. The association differs by sex, race and probably over time and complex.

And differences in the head of household education level are more consistent across subgroups than differences by income. Head of the household is generally the father in low SES groups as in our country. Interestingly, we found statistically significant relation between paternal BMI and childhood obesity in the

low SES group. However; we found a positive relation between maternal BMI and obesity in the higher SES group, where both parents are usually equally effective on the child. Familial patterns of food selection and intake, exercise, and selection of leisure activity, including amount of television watching in the family are also important factors.

As conclusion, high family income increased the obesity risk in children 1,560 times, high paternal BMI also increased the childhood obesity risk as 2,015 times and consuming energy rich products increased the childhood obesity risk as 4,33 times. In high SES group, BMI of the <10 years boys was significantly higher than that of the <10 years girls; In low SES group, girls were significantly more overweight than boys; however, obesity was again more significant in boys in low SES group. In high SES group, maternal BMI was positively correlated with the children's BMI but in low SES group, paternal BMI was positively correlated with the children's BMI. These results are partly in coincidence with the other countries whether developed or developing. We suggest that every community has own characteristics but boys tend to have high BMIs in families with high SES. Healthy eating habits and maintenance of regular physical activity through parental initiative, school policies and social support interventions are the most important strategies in managing childhood obesity. Commercial food advertisements for unhealthy food products, especially on television, must be counteracted. High-risk screening and effective community educational programs on healthy eating habits are needed in developing countries.

*Ethics*

**Ethics Committee Approval:** The study was approved by Medical School Ethical Committee.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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