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Original article

# Influence of various environmental factors on the growth of children and adolescents in Jeddah, Kingdom of Saudi Arabia

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**Summary.** *Objectives:* To evaluate the association between various environmental factors and the anthropometric measurements of children and adolescents. *Methods:* This retrospective studywasperformed from September 2017 to April 2018 and included 393 children aged 2-18 years. Data were extracted through patient and/or parentinterviews and from medical records of endocrine ambulatory clinics. *Results:* Among underweight children,the proportion of mixed-fed children was the highest, and among normal weight children, most were either bottle-fed or mixed-fed. Most overweight children were mixed-fed, and most obese children were breastfed. Underweight status was noted most commonly in children playing videogames for <2 hours/day, followed by those playing>4 and 2-4 hours/day. Normal weight was noted most commonly in those playing for >4 hours/day, followed by those playing <2 and 2-4 hours/day. Overweight status was noted most commonly in those playing videogames for >4 hours/day, followed by those playing 2-4 and <2 hours/day. Most children playing videogames for <2 hours/day were obese. Mean BMIs were the highest in those who exercised 1-2 times/week. P-values for the association between passive smoking indoors and BMI, weight, and height were 0.045, 0.150, and 0.854, respectively. Regarding socioeconomic status, log BMI values were 1.22, 1.23, and 1.26 in low-, medium-, and high-income families, respectively (P-value, 0.001). *Conclusion:* Children who were bottle-fed in their first year of life, played video games >2 hours/day, did not exercise regularly, were exposed to indoor passive smoking, and had a high socioeconomic status had a higher BMI and weight than their counterparts. (www.actabiomedica.it)

**Key words:** growth, environmental factors, children, adolescent, height

## Introduction

Monitoring a child's growth is an adequate approach for measuring the health and nutrition status of children, with normal growth indicating good health and nutrition conditions (1). Over the past decade, a significant increase in the body mass index (BMI) of children in Jeddah has been noted (2). The estimated average prevalence of obesity in Jeddah is 17.8% (3). Recent studies conducted in three different regions (central, northern, southwestern) of Saudi Arabia showed a noticeable difference in growth rates among children and adolescents (4), which variation may be attributed to genetic heterogeneity and prenatal and postnatal environmental effects (5). Global research supports the putative influence of environmental factors onchildren's growth (4, 5).

Feeding type is associated with growth in children. Breastfed children exhibit lower body weight and height than their bottle-fed counterparts (6). The type

of foods consumed (7, 8); the socioeconomic status (SES) of parents, family size, and maternal education (9); and other environmental factors such as the use of electronic devices, sleep deprivation, participation in physical exercise (10-12), and exposure to smoking (13) all affect children's growth and development.

However, studies comprehensively investigating the relationship between various environmental factors and growth are lacking. Thus, we aimed to identify these factors and their relationship with growth among children and adolescents in Jeddah, Kingdom of Saudi Arabia.

## Methods

### *Study Design*

This retrospective cohort study was conducted in the departments of pediatrics and endocrinology at various ambulatory pediatric endocrine clinics in Jeddah city, Saudi Arabia, between September 2017 and April 2018.This study was conducted in accordance with STROBE (EQUATOR) guidelines.

### *Participants*

The participants were healthy 393 children and adolescents aged between 2 and 18 years. Those below the age of 2 years and above the age of 18 years were excluded from this study. Children with chronic conditions and medical syndromes were also excluded.

### *Data Collection*

Data was collected from interviews with patients and/or their parents and by reviewing clinical medical records through the Phoenix system.

### *Anthropometric Measurements*

Pediatric measurements including height, weight, and BMI were obtained from the medical records of the patients. The standard deviation (SD) values for height and weight were calculated using the growth calculator software "http://growthcalc.chip.org/".

### *Data variables*

Various environmental factors were reviewed, including the type of child nutrition during the first year of life (breast, bottle, or mixed feeding). Data on daily physical activity levels (exercise duration and number of days of exercise per week), time spent on electronic devices and video games per day, and duration of sleep were also reviewed. Additionally, we also reviewed data on the socioeconomic class, which was assessedusingfamily income, number of rooms in a family's residence, and number of family membersand exposure to passive cigarette smoking (evaluated by gauging whether family members smoked indoors or outdoors, and the number of smokers in the household).

### *Definitions*

BMI is the best measure for weight categorization and is defined as the weight in kilograms divided by the height in square meters. Children were grouped according to their BMI values as normal ($5^{th}$ to < $85^{th}$ percentile), overweight ($85^{th}$ to < $95^{th}$ percentile), obese (≥ 95th percentile), or underweight (< 5th percentile) using World Health Organization data (14). The use of video games and electronic devices was measured based on whether children played them for more or less than 2 hours per day (15). The average duration of physical activity and exercise among children is considered to range from 30 to 60 min per day (16). SES was measured by the monthly income of the family, family size, and number of rooms in the house. The monthly income was defined as 'low' if it was 2000-4000 Riyals, 'middle'if it was 5000-9000 Riyals, and 'high' if it was higher than10,000 Riyals (17). Family size was defined as 'small' if there were 3 or fewer members, 'medium'if there were 4-6 members, and 'large' if there were more than 6 members. Houses with 3 rooms or fewer were defined as 'small', those with 4-6 rooms were defined as 'medium', and those with more than 6 rooms were defined as 'large'. The appropriate sleep duration per day for toddlers is between 11 and 14 hours, for preschoolers between 10 and 13 hours, for school-aged children between 9 and 11 hours, and for teenagers between 8 and 10 hours (18). Exposure to smoking is thought to affect children's growth; light

smoking was defined as the smoking of 1 to 9 cigarettes per day, while heavy smoking was the smoking of more than 10 cigarettes/day, according to Ferris et al. 1985 (19).

*Ethical considerations*

Approval for this study was obtained from the Institutional Review Board of King Abdulaziz University Hospital before study implementation. Confidentiality of patient data was maintained according to the Declaration of Helsinki.

*Statistical analysis*

Data were analyzed using the Statistical Package for Social Science (IBM SPSS) version 22. The sample included 393 children treated at medical clinics in Kingdom of Saudi Arabia, Makkah Region. The relationship between environmental factors that affect growth and body measurements was tested using various statistical methods.

One-way analysis of variance and an independent sample t-test were used to test the relationship between environmental factors and body measurements, under the assumption that the continuous data followed a normal distribution depending on the normal curve. Spearman's correlation test was used for ordinal variables to test the relation of environmental factors such as lifestyle and eating habits with BMI, weight, and height. Descriptive statistics were reported as proportions for qualitative variables and statistics were reported as the mean and SD for quantitative variables. Results were considered significant at P <0.05.

## Results

This study included a total of 393 children and adolescents aged between 2 and 18 years. A total of 211 (53.7%) of them were boys, and 182 (46.3%) were girls.

Of all the children who were screened, 100 (25.4%) were bottle-fed, 129 (32.8%) were breastfed, and 164 (41.7%) received mixed feeding (bottle-feedingand breast feeding).

The relationship between feeding types and body mass index (BMI) categories is demonstrated in Table 1. Height categories are explained in Figure 1, and weight categories in Figure 2.

Forthe feeding types, the p-values for group differences were 0.381, 0.018, and 0.009, respectively, for height, weight, and BMI.

**Table 1.** Weight categories among the feeding types in the first year

| Body mass index categories | Type of feeding | | |
|---|---|---|---|
| | Bottle feeding | Breastfeeding | Mixed feeding |
| Underweight | 59<br>21.7% | 89<br>32.7% | 124<br>45.6% |
| Normal weight | 31<br>33.7% | 30<br>32.6% | 31<br>33.7% |
| Overweight | 7<br>31.8% | 7<br>31.8% | 8<br>36.4% |
| Obesity | 3<br>60.0% | 2<br>40.0% | 0<br>0.0% |
| Total | 99<br>25.3% | 129<br>33.0% | 163<br>41.7% |

P-value= 0.018

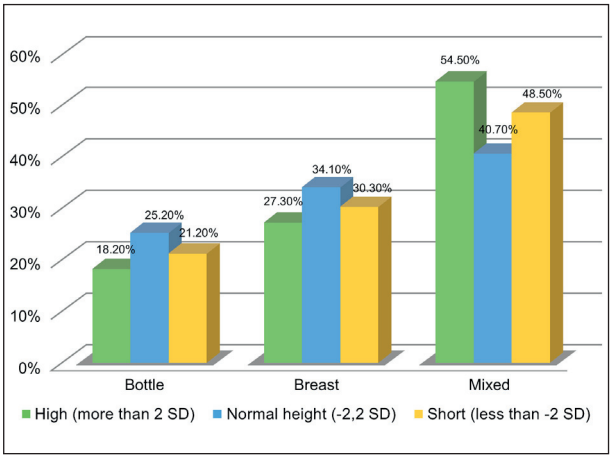


**Figure 1.** Height according to feeding types in the first year
Children who were breastfed or received mixed feeding were taller than bottle-fed children
SD, standard deviation

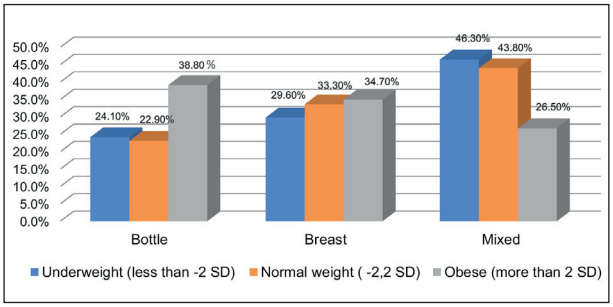


**Figure 2.** Weight according to types of feeding.
children who were bottle-fed had higher weight values than children who were breastfed or received mixed feeding
SD, standard deviation

Regarding video games, 338 (86.2%) children played video games, and 54 (13.8%) did not. A total of 121 (35.8%) children played video games for less than 2 hours per day, 84 (24.9%) played video games for 2-4 hours, and 133 (39.3%) played video games for more than 4 hours. In 127 (34.5%) children, video games interfered with the daily routine, and in 241 (65.5%) children, video games did not interfere with the daily routine.

Details ofBMI categories among children who played video games are demonstrated in Figure 3. The P-values for the weight and height categories were 0.870 and 0.244, respectively.

Details regarding height categories are provided in Figure 4, and those regarding the association between the weight categories and time spent playing videogamesare provided in Figure 5.

Regarding physical activity, 51 (35.4%) children exercised 1-2 times per week, 39 (27.1%) exercised 3-5 times per week, and 54 (37.5%) exercised every day, and their mean BMI values were 19.25, 19.0, and

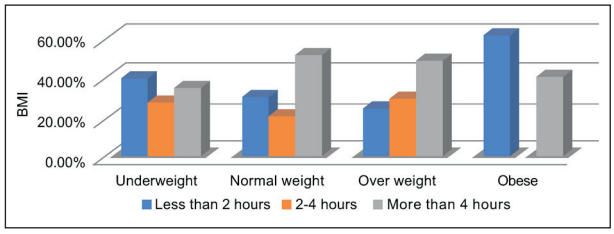


**Figure 3.** BMI according to timespent playing video games
Children who played video games for less than 2 hours/day had lower log BMI values than those in the other groups
BMI, body mass index

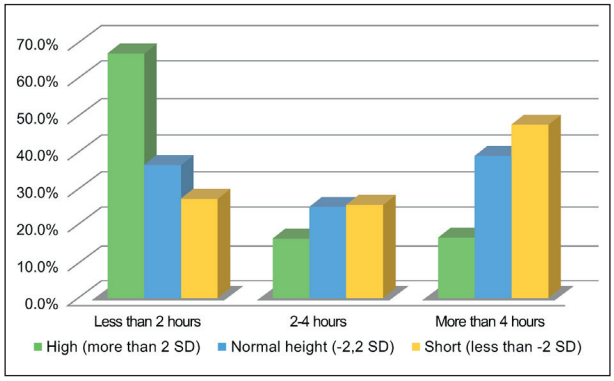


**Figure 4.** Height according to hours spent playing video games
Children who played video games for more than 4 hours/day were shorter than their counterparts in the other groups
SD, standard deviation

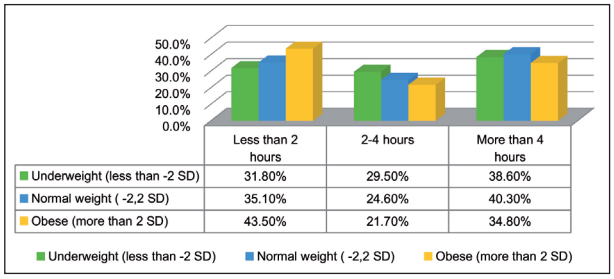


**Figure 5.** Weight according to hours spent playing video games
children who played video games for less than 2 hours/day were underweight or had normal weight, while children who played for 2 hours and more, were overweight or obese
SD, standard deviation

17.40, respectively (P-value of 0.037). The P-value for differences in height was 0.278. Among children who exercised daily, 16 (11.2%) exercised for less than 30 min/day, 69 (48.3%) for 30-60 min/day, and 58 (40.6%) for more than 60 min/day. Their mean weights were 1.3275, 0.0501, and -0.1740, respectively (P-value of 0.029). Forheight, the SDs of the means were -0.1531, -0.5438, and -0.8260, respectively (P-value of 0.251).

As for sleep duration and its effect on growth, 6 (50%) toddlers slept for less than 11 hours/day, and 6 (50%) slept for 11-14 hours/day; 44 (48.4%) preschoolers slept for less than 10 hours/day, and 47(51.6%) for 10-13 hours/day. A total of 76 (35.7%) school-aged children slept for less than 9 hours/day, 132 (62%) for 9-11 hours/day, and 5 (2.3%) for more

than 11 hours/day. Eleven (15.1%) teenagers slept for less than 8 hours/day, 50 (68.5%) for 8-10 hours/day, and 12 (16.4%) for more than 10 hours/day. The mean BMI value of children who slept <8h was 1.2384, for 8-10h was 1.2412, and for >10 h was 1.2195 (P-values of 0.225, 0.730, and 0.512 for BMI, height, and weight, respectively).

Regarding passive smoking exposure, 274 (69.7%) children came from families with no smokers, and 96 (24.4%) had one parent who was a smoker. Both parents of11 children (2.8%) smoked and more than two family members of 12 (3.1%) children were smokers. As for the number of cigarettes smoked per day, 32(27.4%) smokers smoked 1-9 cigarettes per day, 46 (39.3%) smoked more than 10 cigarettes per day, and 39 (33.3%) smoked shisha every day. A total of 68 (56.2%) family members smoked inside the house, and 53 (43.8%) smoked outside the house. The log BMI value for passive smoking inside the house was 1.2656, with P-values of 0.045, 0.150, and 0.854 for BMI, weight, and height, respectively, while the log BMI for passive smoking outside the house was 1.2307. Regarding the number of smokers in the house, the log BMI values were 1.23, 1.31, and 1.27, respectively, in cases with no smokers in the house, cases in which both parents were smokers, and cases in which there were more than 2 smokers in the house, with a P-value of 0.017. The P-values for height and weight were 0.872 and 0.139, respectively.

As for SES and its relationship with growth, 96 (24.4%) of the participants' families had a low income (2000-4000SR), 170 (43.3%) had a medium income (5000-9000SR), and 127 (32.3%) had a high income (>10,000). This was reflected in the log BMI values of 1.22, 1.23, and 1.26, respectively, with a P-value of 0.001. The height P-value was 0.259 and weight P-value was 0.801.

A total of 131 (33.4%) families lived in a property with 3 rooms or fewer, 207 (52.8%) had 4-6 rooms, and 54(13.8%) had more than 6 rooms. The P-values were 0.0001, 0.253 and 0.287 for BMI, weight, and height, respectively. As for family size, 34 (8.7%) children had 3 or fewer members in their families, 269 (68.4%) had 4-6 members, and 90 (22.9%) had more than 6 members. Families with 3 or less members had a log BMI= 1.19, those with 4-6 members had a log BMI=1.23, and those with more than 6 members had a log BMI=1.26, with a P-value= 0.001. The weight and height P-values were 0.691 and 0.995, respectively.

## Discussion

### *Types of Feeding*

Previous studies have shown the relationship between environmental factors and their effect on children's growth. The maintenance of a good nutritional status is crucial to the healthy growth of children and adolescents. Nutrition during the first year of life critically affects children's growth later in life. The provision of nutrition in the first year of life is divided into: breastfeeding, bottle feeding and mixed feeding. Many studies have shown that children who have been breastfed have a lower body weight and shorter body length than their bottle-fed counterparts (6, 20, 21). Similarly, in our study, we found that children who were bottle-fed had higher BMIand weight values than children who were breastfed or received mixed feeding; there was no significant relationship between the height categories and feeding types.

### *Video Games*

In Saudi Arabia, with the increase in the number of children with sedentary lifestyles and the time spent playing video games, children spend less time exercising, playing sports, or performing other activities;this affects their growth negatively by increasing obesity rates and therate of sleep deprivation (10, 11, 22). In Jeddah, in 2016, studies found that 68.4% of children played video games for 2 hours or more and 48% exercise for less than 30 minutes per day. An increased BMI was found among children who spent ≥2 hours per day on electronic devices (15). In comparison, 38.90% of children who played video games for less than 2 hours/day were underweight or had anormal weight, while among children who played for 2 hours and more, 47.60% were overweight and 40% were obese. An increased BMI was observed,over the years, among children who spent more than 2 hours/day playing video games.

*Sleep Duration*

Several studies have demonstrated the relationship between sleep duration and weight. In Korea, a study indicated that a longer sleep duration in adolescents was associated with a lower BMI (12). Another study showed that children who had a short sleep duration had an increased BMI (23). However, our study revealed no significant association between BMI, weight and height categories, and sleep duration.

*Exercise and Physical Activity*

In 2013, a study conducted by Al-Ghamdi in Riyadh, showed positive association between exercise duration and BMI, with BMI increase observed with a decrease in the time spent on physical activities. This study included 397 students, and a notable proportion of children who did not exercise or exercised for less than 30 minutes were either obese or severely obese (16). These findings are similar to our results, in which children who exercised every day for 60 minutes or more had a lower body weight. In our study,a significant association was observed between decreased levels of physical activity and increased body weight and BMI.

*Passive Smoking*

Data from the National Study of Health and Growth in England and Scotland indicate that children's height is associated with the number of smokers in their households, taking birth weight into account. Additionally, an analysis of data on 5,903 children from a study of primary schools in England and Scotland in 1982 showed that the number of cigarettes smoked by parents at home was significantly linked to the attained height of their children (13). The prevalence of smoking in Saudi Arabia ranges from 11.6-52.3% among adults, indicating that many children are at the risk of being exposed to indoor pollutants (24). Our study revealed that children with family members who smoke indoors have a higher BMI than children with family members who smoke outdoors. No effect was observed on weight or height individually. Regarding the number of passive smokers in the house, a high log BMI mean was observed when both parents were smokers, compared to cases in which none or one of the parents was a smoker. No significant association was observed between the number of smokers in the house and the height or weight standard deviations.

*Socioeconomic Status*

The relationship between parents' SES, and children's weight is complicated. Previous studies have shown that a low SES may lead to risky behaviors (lack of physical activity, poor diet, and sedentary lifestyle) and can result in obesity and overweight (25, 26). Similarly, children living in relatively wealthy families are likelyto receive more attention and specialized care from parents who offer a variety of cultural and physical activities and educate them on the virtues of a healthy diet (27).

*Family Income*

In another study performed on 1,072 children in Saudi Arabia, 95% of the obese children came from families with high incomes (28). In less industrialized countries, overweight and obesity are prevalent in families with higher incomes (29). In our previous study, we demonstrated a higher risk of overweight in relation to high family income (30). This could be attributed to the fact that children from high-income families have increased accessibility to fast food and dine out multiple times a week while families with low incomes tend to depend more on homemade meals. The present study's findings align with those ofthe previous studies because higher BMI values were associated with a higher SES, as we observed a directrelationship between SES (in terms of family income and number of rooms) and BMI.

*Family Size*

Children in households with more than 4 members were 1.35 times likelier to be underweight than families with 1-4 members (31). We found that children from families with 4-6 members or more were likelier to have a higher BMI than their counterparts with 3 or fewer family members; this finding contradicts that of the previous study.

*Study limitation*

Our study is limited by the relatively small sample size; therefore, our findings may not be generalizable to the general population of Saudi Arabia. Future studies should include a larger sample size, along with a detailed survey to help understand the magnitude of each factor individually.

## Conclusion

A notable increase in both BMI and weight was found to be more significantly associated with bottlefeeding thanwith breastfeeding or mixedfeeding. Moreover, spending time playing video games, lack of exercise, exposure to indoor passive smoking, and high SES were also associated with increased BMI and weight.

## Recommendation

We recommend the provision of global education for parents, focusing on the benefits of breastfeeding, indoor physical activity, limiting the use of electronic devices and videogames to less than 2 hours/dayand discouraging exposure to indoor passive smoking,to optimize the growth of children and adolescents.

**Conflict of interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

## References


1. Koletzko B, Bhatia J, Bhutta ZA, et al (eds). Pediatric Nutrition in Practice. World Rev Nutr Diet. Basel, Karger; 2015; 113: 1-5. DOI: 10.1159/000360310.
2. Abalkhail B, Shawky S. Comparison between body mass index, triceps skin fold thickness and mid-arm muscle circumference in Saudi adolescents. Ann Saudi Med 2002;22:324-28. DOI: 10.5144/0256-4947.2002.324
3. Washi S, Ageib M. Poor diet quality and food habits are related to impaired nutritional status in 13- to 18-year-old adolescents in Jeddah. Nutr Res 2010;30:527-34. DOI: 10.1016/j.nutres.2010.07.002.
4. El Mouzan M, Foster P, Al Herbish A, et al. Regional variations in the growth of Saudi children and adolescents. AnnSaudi Med2009;29:348-56.DOI: 10.4103/0256-4947.55163
5. de Waal HAD. Environmental factors influencing growth and pubertal development. Environ Health Perspect 1993;101:39-44.DOI: 10.1289/ehp.93101s239
6. Spyrides MH, Struchiner CJ, Barbosa MT, Kac G. Effect of predominant breastfeeding duration on infant growth: prospective study using nonlinear mixed effect models. JPediatr2008;84:237-43.DOI:10.2223/JPED.1797.
7. Vakili R, Kiani MA, Saeidi M, Hoseini BL, Anbarani MA. Junk food consumption and effects on growth status among children aged 6-24 months in Mashhad, Northeastern Iran. IntJPediatr2015;3:817-22. DOI: 10.22038/IJP.2015.4637
8. Amin TT, Al-Sultan A, Ali A. Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. EurJNutr2008;47:310-18. DOI: 10.1007/s00394-008-0727-6
9. Bradley RH, Corwyn RF. Socioeconomic status and child development. AnnuRev Psychol.2002;53:371-99 DOI: 10.1146/annurev.psych.53.100901.135233
10. Subrahmanyam K, Kraut R, Greenfield P, Gross EF. The impact of home computer use on children's activities and development. Future Child2000;10:123-44. DOI: 10.2307/1602692
11. Godfrey R, Madgwick Z, Whyte G. The exercise-induced growth hormone response in athletes. Sports Med 2003;33:599-613. DOI: 10.2165/00007256-200333080-00005
12. Lee BH, Kang S-G, Choi J-W, Lee YJ. The association between self-reported sleep duration and body mass index among Korean adolescents. J Korean Med Sci. 2016;31:1996-2001. DOI: 10.3346/jkms.2016.31.12.1996
13. Rona R, Chinn S, Florey C. Exposure to cigarette smoking and children's growth. IntJEpidemiol. 1985;14:402-09. DOI: 10.1093/ije/14.3.402
14. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser 2000; 894: 1-253.
15. Al-Agha AE, Nizar FS, Nahhas AM. The association between body mass index and duration spent on electronic devices in children and adolescents in Western Saudi Arabia. Saudi Med J.2016;37:436-39. DOI: 10.15537/smj.2016.4.15018
16. Al-Ghamdi S. The association between watching television and obesity in children of school-age in Saudi Arabia. JFamily Community Med. 2013; 20: 83-89.DOI: 10.4103/2230-8229.114767.
17. Al-Agha A, Tatwany B, Aiash D. The effect of socioeconomic status, number of siblings and parental of education on children body mass index at Jeddah, Saudi Arabia: Cross sectional study. Fam Med Sci Res.2015;4: 5. DOI: 10.4172/2327-4972.1000184
18. Hirshkowitz M, Whiton K, Albert SM, et al. National Sleep

Foundation's sleep time duration recommendations: methodology and results summary. Sleep Health2015;1:40-43. DOI: 10.1016/j.sleh.2014.12.010.
19. Ferris BG Jr, Ware JH, Berkey CS, Dockery DW, Spiro A 3rd, Speizer FE. Effects of passive smoking on health of children. Environ Health Perspect1985;62:289-95. DOI: 10.1289/ehp.8562289
20. de Onis M, Onyango AW, Borghi E, Garza C, Yang H; WHO Multicentre Growth Reference Study Group. Comparison of the WHO child growth standards and the CDC 2000 growth charts. J Nutr2007;137:144-448. DOI: 10.1093/jn/137.1.144
21. de Onis M, Onyango AW, Borghi E, Garza C, Yang H; WHO Multicentre Growth Reference Study Group. Comparison of the World Health Organization (WHO) child growth standards and the National Center for Health Statistics/WHO international growth reference: implications for child health programmes. Public Health Nutr 2006;9:942-47. https://www.who.int/childgrowth/publications/Comparison_implications.pdf?ua=1
22. Theintz G, Howald H, Weiss U, Sizonenko P. Evidence for a reduction of growth potential in adolescent female gymnasts. JPediatr1993;122:306-13. DOI: https://doi.org/10.1016/S0022-3476(06)80139-3
23. Taheri S, Lin L, Austin D, Young T, Mignot E. Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. PloS Med 2004;1: e62. DOI: 10.1371/journal.pmed.0010062
24. Bassiony MM. Smoking in Saudi Arabia. Saudi Med J2009;30:876-81. https://pdfs.semanticscholar.org/920a/da7cc70f1231b74acdd7bb6f20512c87b070.pdf
25. Singh G, Kogan M, Van Dyck P, Siahpush M. Racial/ethnic, socioeconomic, and behavioral determinants of childhood and adolescent obesity in the United States: Analyzing independent and joint associations. AnnEpidemiol2008;18:682-95. DOI: 10.1016/j.annepidem.2008.05.001.
26. Davison K, Birch L. Child and parent characteristics as predictors of change in girls' body mass index. IntJObesityRelatMetabDisord2001;25:1834-42. DOI:10.1038/sj.ijo.0801835
27. Tchicaya A, Lorentz N. Relationship between children's body mass index and parents' obesity and socioeconomic status: A multilevel analysis applied with Luxembourg data. Health2014;6:2322. DOI: 10.4236/health.2014.617267
28. Lamb ME, Pleck JH, Charnov EL, Levine JA. A biosocial perspective on paternal behavior and involvement. In: Lancaster JB, Altmann J, Rossi AS, Sherrod LR, editors. Parenting across the lifespan: Biosocial dimensions. Hawthorn, NY: Aldine Publishing Co; 1987. p. 111-42.
29. Jacobi C, Agras WS, Hammer L. Predicting children's reported eating disturbances at 8 years of age. JAmAcadChild Adolesc Psychiatry2001;40:364-72. DOI: 10.1097/00004583-200103000-00017
30. Abdullah A, Alzahrani H, Rajab F, et al. Parental socioeconomic status and occupation in relation to childhood obesity. Int J Med Health Res 2018; 4. DOI.org/10.22271/ijmhr
31. Kavosi E, Rostami ZH, Kavosi Z, Nasihatkon A, Moghadami M, Heidari M. Prevalence and determinants of under-nutrition among children under six. Int J Health Policy Manag2014;3:71-6. DOI: 10.15171/IJHPM.2014.63

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