





## Household socioeconomic status in relation to childhood general and central obesity in Farrokhshahr, Iran

Asma Salari-Moghaddam<sup>(1)</sup> , Parisa Hajhashemi<sup>(2)</sup>, Reyhane Basirat<sup>(3)</sup>,  
Seyed Mohammad Mousavi<sup>(1)</sup>, Amin Salehi-Abargouie<sup>(4)</sup>,  
Bagher Larijani<sup>(5)</sup>, Ahmad Esmailzadeh<sup>(6)</sup> 

### Original Article

#### Abstract

**BACKGROUND:** Although the association between socioeconomic status (SES) and general/central obesity has extensively been examined, limited data are available in this regard among children. The aim of this study was to examine the association between household SES and obesity among children.

**METHODS:** This cross-sectional study was done in Farrokhshahr, Iran, among primary school children aged 6-12 years in 2009. SES was examined using participants' and their parents' oral responses to a pretested questionnaire. In the current study, participants were classified based on tertiles of SES score to low, medium, and high SES categories. General as well as central obesity was defined based on age- and sex-specific national cut-off points.

**RESULTS:** Comparing individuals in the highest versus lowest tertile of SES, there was no significant difference in mean waist circumference (WC), but those in the middle tertile of SES had greater means of body mass index (BMI) than those in the lowest tertile after controlling for potential confounders ( $16.19 \pm 0.27$  vs.  $15.27 \pm 0.27$  kg/m<sup>2</sup>,  $P = 0.002$ ). We observed a greater chance of general obesity for those in the highest tertile of SES compared with those in the lowest tertile [odds ratio (OR): 4.00, 95% confidence interval (CI): 1.53-10.59,  $P_{\text{trend}} = 0.004$ ]. No significant association was seen between SES and central obesity, either before or after controlling for potential confounders.

**CONCLUSION:** We found that children in the highest SES class had a greater chance of general obesity than those in the lowest SES class. There was no significant association between SES and central obesity.

**Keywords:** Obesity, Overweight, Socioeconomic Status, Children, Anthropometry

*Date of submission:* 10 June 2018, *Date of acceptance:* 12 May 2019

#### Introduction

Obesity has been defined as excess body fat.<sup>1</sup> Childhood obesity is a major public health problem in both developed and developing countries.<sup>2</sup> It affects 16% of children in the United States (US).<sup>3</sup> Data from national studies among Iranian children

**How to cite this article:** Salari-Moghaddam A, Hajhashemi P, Basirat R, Mousavi SM, Salehi-Abargouie A, Larijani B, et al. **Household socioeconomic status in relation to childhood general and central obesity in Farrokhshahr, Iran.** ARYA Atheroscler 2019; 15(5): 211-7.

1- PhD Candidate, Students Scientific Research Center AND Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Tehran, Iran

2- PhD Candidate, Department of Community Nutrition, School of Nutrition and Food Sciences, Isfahan University of Medical Sciences, Isfahan, Iran

3- PhD Candidate, Department of Clinical Nutrition, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

4- Assistant Professor, Nutrition and Food Security Research Center AND Department of Nutrition, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

5- Professor, Endocrinology and Metabolism Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

6- Professor, Obesity and Eating Habits Research Center, Endocrinology and Metabolism Molecular-Cellular Sciences Institute AND Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Tehran AND Food Security Research Center AND Department of Community Nutrition, School of Nutrition and Food Sciences, Isfahan University of Medical Sciences, Isfahan, Iran

Correspondence to: Ahmad Esmailzadeh, Email: [a-esmailzadeh@tums.ac.ir](mailto:a-esmailzadeh@tums.ac.ir)

have reported that 16% of girls and 13% of boys are overweight or obese.<sup>4</sup> Childhood obesity increases the risk of being obese in adulthood such that 80% of overweight adults were overweight in their adolescence period.<sup>5</sup> It has also been shown that overweight children are at increased risk of cardiovascular diseases (CVDs) and metabolic disorders.<sup>6</sup>

The exact etiology of childhood obesity remains unknown. Several factors including household socioeconomic status (SES) has been regarded as a probable cause of childhood obesity.<sup>7</sup> High prevalence of childhood obesity has been reported among household with poor SES.<sup>8-10</sup> In developed countries it has also been shown that individuals with high household SES were less likely to be affected by overweight compared with those with low household SES, whereas the opposite is true in developing countries.<sup>11-13</sup>

Some studies in developing countries like India<sup>14</sup> and Pakistan<sup>15</sup> have even shown a high prevalence of childhood obesity among families with high SES. However, some others have shown contradictory findings. Overall, data on the association of SES and childhood obesity are limited in Iran. As SES might influence body weight through its effects on dietary intakes, it seems that it is an important factor in obesity prevalence. The present study was conducted to determine the association between SES and childhood obesity in a group of Iranian children.

## Materials and Methods

This study was financially supported by Isfahan University of Medical Sciences, Isfahan, Iran (project number: 288270). This cross-sectional study was done among primary school students of Farrokhsahr, Iran, aged 6-12 years in 2009. We recruited 380 students for the current study. Multi-stage cluster random sampling method was used to select participants from different socioeconomic districts of Farrokhsahr. At first, we randomly selected 3 schools (out of 8 in the whole city) in which boys were being trained. Within each school, we randomly chose one class from each grade, from which some students, proportionally to size, were randomly chosen to participate in the current study using simple random selection. The same process was also done for schools in which girls aged 6-12 years were being educated. All participants and their parents provided informed written consent. The study was ethically approved by the Research Council of Food Security Research Center, Isfahan University of Medical Sciences.

Measurement of height was done using a metal ruler in standing position without wearing shoes while shoulders were relaxed. Weight was measured in light clothing using a calibrated scale. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Subjects were defined as generally overweight and obese based on age- and sex-specific BMI cut-off points suggested by World Health Organization (WHO).<sup>16</sup> Individuals with a BMI between the 85<sup>th</sup> and < 95<sup>th</sup> percentile were defined as overweight and those with a BMI of  $\geq$  95<sup>th</sup> percentile were considered as obese. Central obesity was defined as waist circumference (WC)  $\geq$  75<sup>th</sup> percentile age- and sex-specific cut-off points of WC suggested for Iranians.<sup>17</sup>

SES was examined using parents' oral responses to a pretested questionnaire. The questionnaire contained some questions and the SES was defined based on scoring of the variables. The questions and the assigned scores were as follows: father and mother's education (lower than 12-year formal education = 5, higher than 12-year formal education = 8), father's occupation (engineer = 7, self-employed = 10, employee/lettered = 8, farmer/laborer = 5), mother's occupation (housewife = 1, employed = 8), income (lower than 3000000 Iranian Rials (IRRs) = 1, 3000000 to 5000000 IRRs = 5, more than 5000000 IRRs = 7), home ownership (rental = 1, owner = 5), car type (no car = 1, low price cars = 4, medium price cars = 6, high price cars = 8). Then, participants were classified based on tertiles of SES score to low, middle, and high SES. Physical activity was assessed using a validated physical activity questionnaire for Iranian children (PAQ-C) which was completed by the parents.<sup>18</sup> Participants' activity was categorized into three categories of light, moderate, and heavy based on tertiles of physical activity score.<sup>18</sup> Assessment of age and sex was also done using a questionnaire.

General characteristics of study participants across tertiles of SES were expressed as mean  $\pm$  standard deviation (SD) for continuous variables and percentage for categorical variables. To examine the differences across categories, we used analysis of variance (ANOVA) for continuous variables and chi-square test for categorical variables. In case of non-normally distributed variables, we applied Kruskal-Wallis test. Participants were categorized based on household SES into three categories of low, middle, and high SES. Adjusted means for BMI and WC by tertiles of SES were compared using analysis of covariance (ANCOVA) and presented as mean  $\pm$  standard error (SE). Binary

logistic regression analysis was used to assess SES in relation to general and abdominal obesity in crude and multiple-adjusted models. First, we controlled for age and gender. In the second model, further adjustments were done for physical activity. Additional potential confounders including breakfast consumption (consumer vs. non-consumer), number of meals per day, and number of family members were adjusted for in the final model. P for trends was determined by considering tertiles of SES as ordinal variables in the logistic regression analysis. All statistical analyses were done using the SPSS software (version 15, SPSS Inc., Chicago, IL, USA). P-values less than 0.050 were

considered as statistically significant.

## Results

General characteristics of study participants across different categories of SES are presented in table 1. Subjects in the lowest tertile of SES had lower BMI and were less likely to be educated, and more likely to have a father with low education and a mother with being employed. As expected, individuals with low SES had lower income and low percentage of them owned a house and car compared with those with a high SES. Distribution of participants in terms of gender and physical activity was not significantly different.

**Table 1.** Characteristics of study participants across tertiles of socioeconomic status (SES)\*

Variables	Low SES 34 (25-36) <sup>†</sup>	Middle SES 40 (37-43) <sup>†</sup>	High SES 49 (44-58) <sup>†</sup>	P**
Number (%)	96 (35.0)	93 (33.9)	85 (31.1)	-
Male gender	46 (47.9)	49 (52.7)	44 (51.8)	0.785
Age (year)	9.47 ± 1.25	9.11 ± 1.56	9.11 ± 1.34	0.126
BMI (kg/m <sup>2</sup> )	15.51 ± 2.97 <sup>‡</sup>	15.95 ± 2.42	16.64 ± 3.14	0.029
WC (cm)	58.80 ± 5.30	58.90 ± 5.50	59.60 ± 6.40	0.630
Maternal education				< 0.001
< 12-year formal education	86 (89.6)	71 (76.3)	36 (42.4)	
> 12-year formal education	10 (10.4)	22 (23.7)	49 (57.7)	
Father's education				< 0.001
< 12-year formal education	95 (99.0)	84 (90.3)	34 (40.0)	
> 12-year formal education	1 (1.0)	9 (9.7)	51 (60.0)	
Maternal occupation				< 0.001
Housewife	16 (16.7)	16 (17.2)	41 (48.2)	
Teacher/employee	80 (83.3)	77 (82.8)	44 (51.8)	
Father's occupation				< 0.001
Engineer	41 (42.7)	52 (55.9)	16 (18.8)	
Self-employed	1 (1.0)	19 (20.4)	64 (75.3)	
Employee/lettered	8 (8.3)	11 (11.8)	5 (5.9)	
Farmer/laborer	46 (47.9)	11 (11.8)	0 (0)	
Income (*1000 tomans)				< 0.001
< 300	74 (77.1)	26 (28.0)	2 (2.4)	
300-500	21 (21.9)	58 (62.4)	49 (57.6)	
> 500	1 (1.0)	9 (9.7)	34 (40.0)	
Home ownership (non-owner)	56 (58.3)	27 (29.0)	7 (8.2)	< 0.001
Having car	15 (15.6)	56 (60.2)	79 (92.9)	< 0.001
Physical activity				0.490
Light	35 (36.5)	32 (34.4)	22 (25.9)	
Moderate	27 (28.1)	32 (34.4)	29 (34.1)	
Heavy	34 (35.4)	29 (31.2)	34 (40.0)	
Breakfast consumption	71 (26.7)	68 (25.6)	61 (22.9)	0.700
Number of meals per day	3 (2-6) <sup>†</sup>	3 (2-6)	3 (2-5)	0.180 <sup>‡</sup>
Family members (≥ 4)	83 (27.0)	80 (29.5)	78 (28.8)	0.420

\* Data are expressed as mean ± standard deviation (SD) or n (%); \*\* Obtained from ANOVA or chi-square test, where appropriate; † P < 0.050 compared with the high SES group; ‡ Median (min-max); ‡ Obtained from Kruskal-Wallis test; SES: Socioeconomic status; BMI: Body mass index; WC: Waist circumference

**Table 2.** Crude and adjusted mean scores of body mass index (BMI) and waist circumference (WC) across tertiles of socioeconomic status (SES)

Variables	Low SES 34 (25-36) <sup>†</sup>	Middle SES 40 (37-43) <sup>†</sup>	High SES 49 (44-58) <sup>†</sup>	P
BMI (kg/m <sup>2</sup> )				
Number (%)	96 (35.0)	93 (33.9)	85 (31.1)	-
Crude	15.51 ± 0.26	15.95 ± 0.21	16.64 ± 0.28	0.029
Model 1 <sup>*</sup>	15.38 ± 0.27 <sup>λ</sup>	16.00 ± 0.27 <sup>λ</sup>	16.70 ± 0.29 <sup>λ</sup>	0.005
Model 2 <sup>**</sup>	15.40 ± 0.27 <sup>λ</sup>	16.00 ± 0.27 <sup>λ</sup>	16.66 ± 0.29 <sup>λ</sup>	0.008
Model 3 <sup>***</sup>	15.27 ± 0.27 <sup>λ</sup>	16.10 ± 0.27 <sup>λ</sup>	16.66 ± 0.28 <sup>λ</sup>	0.002
WC (cm)				
Number (%)	96 (35.0)	93 (33.9)	85 (31.1)	-
Crude	58.80 ± 0.51	58.90 ± 0.60	59.60 ± 0.62	0.620
Model 1 <sup>*</sup>	58.40 ± 0.52	59.00 ± 0.53	59.80 ± 0.56	0.210
Model 2 <sup>**</sup>	58.40 ± 0.52	59.10 ± 0.53	59.70 ± 0.56	0.240
Model 3 <sup>***</sup>	58.30 ± 0.53	59.20 ± 0.53	59.80 ± 0.55	0.150

All analyses were conducted using analysis of covariance (ANCOVA) with Bonferroni post hoc test. Data are presented as mean ± SE; <sup>†</sup> Median (min-max); <sup>\*</sup> Adjusted for age and gender; <sup>\*\*</sup> Adjusted for variables included in model one plus physical activity; <sup>\*\*\*</sup> Adjusted for all variables in model 2 plus breakfast consumption, number of meals a day, and numbers of family member; <sup>λ</sup> Values which do not share common superscripts are significantly different using Bonferroni post hoc test (P < 0.050). The BMI in those with low SES was significantly lower than children living in high SES families. Children with low and high SES families were not significantly different compared to those with middle SES in terms of their BMI.

SES: Socioeconomic status; BMI: Body mass index; WC: Waist circumference; SE: Standard error

Crude and adjusted means of BMI and WC across different categories of SES are shown in table 2. In crude model, comparing individuals in the highest versus lowest tertile of SES, there was no significant difference in mean WC; however, those in the highest tertile of SES had greater means of BMI than those in the lowest tertile after adjustment for potential confounders (16.66 ± 0.28 vs. 15.27 ± 0.27 kg/m<sup>2</sup>, P = 0.002).

Crude and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for general and central obesity across different categories of SES are provided in table 3. In the crude model, we

observed a greater chance for general obesity in the highest tertile of SES compared with the lowest tertile (OR: 2.78, 95% CI: 1.18-6.54). When we adjusted for age and gender, the association between SES and general obesity became stronger (OR: 3.14, 95% CI: 1.31-7.55). Additional controlling for physical activity did not affect the findings (OR: 3.13, 95% CI: 1.30-7.52). Further adjustments for other potential confounders strengthened the association (OR: 4.00, 95% CI: 1.53-10.59). No significant association was seen between SES and central obesity, either before or after controlling for potential confounders.

**Table 3.** Crude and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for general and central obesity across tertiles of socioeconomic status (SES)

Variables	Low SES 34 (25-36) <sup>†</sup>	Middle SES 40 (37-43) <sup>†</sup>	High SES 49 (44-58) <sup>†</sup>	P <sub>trend</sub> <sup>£</sup>
General overweight/obesity				
Number (%)	96 (35.0)	93 (33.9)	85 (31.1)	-
Crude	1.00	1.29 (0.51-3.29)	2.78 (1.18-6.54)	0.016
Model 1 <sup>*</sup>	1.00	1.39 (0.54-3.59)	3.14 (1.31-7.55)	0.008
Model 2 <sup>**</sup>	1.00	1.40 (0.54-3.61)	3.13 (1.30-7.52)	0.009
Model 3 <sup>***</sup>	1.00	1.85 (0.66-5.20)	4.00 (1.53-10.59)	0.004
Central obesity				
Number (%)	96 (35.0)	93 (33.9)	85 (31.1)	-
Crude	1.00	1.13 (0.50-2.55)	1.48 (0.66-3.29)	0.330
Model 1 <sup>*</sup>	1.00	1.16 (0.51-2.65)	1.54 (0.68-3.45)	0.290
Model 2 <sup>**</sup>	1.00	1.17 (0.51-2.67)	1.52 (0.67-3.42)	0.300
Model 3 <sup>***</sup>	1.00	1.27 (0.54-2.95)	1.60 (0.69-3.67)	0.410

<sup>†</sup> Median (min-max); <sup>\*</sup> Adjusted for age and gender; <sup>\*\*</sup> Adjusted for variables included in model one plus physical activity; <sup>\*\*\*</sup> Adjusted for all variables in model 2 plus breakfast consumption, number of meals a day, and numbers of family member; <sup>£</sup> P-value for trends was determined by considering tertiles of SES as ordinal variables in the logistic regression analysis; SES: Socioeconomic status

## Discussion

In this cross-sectional study, we examined the relationship between SES and general and central obesity among a sample of Iranian children. We found a positive association between SES, BMI, and overweight/obesity. Children in the high SES class had higher BMI and greater chance for overweight and obesity. To the best of our knowledge, this study is among the first studies that examined this association among Iranian children.

Childhood obesity is a public health concern.<sup>2</sup> The incidence of childhood obesity is increasing in both developed and developing countries.<sup>6</sup> Childhood obesity has important consequences for health during both childhood and adulthood life.<sup>19</sup> Therefore, prevention of childhood obesity is essential. We observed a positive association between SES and obesity. These observations were in line with the earlier results reported from Vietnam, Colombia, Sri Lanka, and Iran.<sup>20-23</sup> In a school-based cross-sectional study among Indian adolescent school children, a positive association between SES and BMI was observed.<sup>24</sup> An earlier study in Ukraine reported that higher social class was associated with elevated BMI.<sup>25</sup> In addition, in a cross-sectional study among 1860 children aged 5-12 years in Pakistan, rapid rise in overweight and obesity was observed, especially among affluent urban population.<sup>15</sup> Likewise, a population-based cross-sectional study among elementary school children in northeastern Romania showed that the prevalence of overweight and obesity was higher among children with high SES than those with low SES.<sup>26</sup> A systematic review of obesity and SES in developing countries also showed a positive association between SES and obesity among children.<sup>27</sup> In contrast to our findings, some studies did not confirm these findings. A study by Noh *et al.* among Korean children and adolescents indicated that low SES was significantly associated with overweight and obesity.<sup>10</sup> In a cross-sectional study in Korea, adolescent males in low SES class had a greater probability of either overweight or underweight.<sup>28</sup> It has been shown that low SES was indirectly associated with increased risk of overweight and obesity through low intake of fruit and vegetables among adolescent girls.<sup>29</sup>

We found no association between SES class and central obesity among children. In a cross-sectional study among adolescents aged 10-17 years in rural South Africa, those from the highest SES class had about twofold greater chance of being overweight/obese and centrally obese than those in

the lowest category of SES class.<sup>30</sup> Furthermore, in a study among school-aged children and adolescents in Poland, abdominal obesity was positively associated with SES.<sup>31</sup> However, some studies have suggested that low SES may increase the risk of central obesity.<sup>32</sup> Different findings might be explained by the discrepancy in subjects' characteristics including age and gender, study sample size, lack of controlling for several confounders, the number of SES indicators as well as study location in terms of urban or rural areas.

Our study has some strengths as well as limitations. One of the strength points of this study is considering the role of potential confounders in data analysis. Unlike several prior studies, we considered several measures of the SES indicators, while earlier studies have mostly defined SES based on two or three variables and therefore, all aspects of SES have not been considered in these publications. Several limitations also need to be considered when interpreting the findings. First, due to cross-sectional nature of the present study, causality cannot be established. Second, the sample size in the current study was small. Further studies with larger sample size might be needed to confirm our findings. Third, dietary intakes can definitely influence the association between SES and overweight/obesity. We were unable to consider children's dietary patterns as a covariate in the current study. However, one might consider dietary intakes as a mediator between SES and obesity. Fourth, although we controlled for several potential confounders, residual confounding cannot be excluded. In addition, as the present study was performed among children only, the findings cannot be generalized to the adult population.

## Conclusion

We found that children in the high SES class had a greater chance of being overweight/obese than those in the low SES class. Therefore, socioeconomic determinants should be considered when implementing preventive interventions in childhood overweight and obesity.

## Acknowledgments

This study was financially supported by Isfahan University of Medical Sciences (project number: 288270).

## Conflict of Interests

Authors have no conflict of interests.

## References

1. Flegal KM, Tabak CJ, Ogden CL. Overweight in children: Definitions and interpretation. *Health Educ Res* 2006; 21(6): 755-60.
2. Lakshman R, Elks CE, Ong KK. Childhood obesity. *Circulation* 2012; 126(14): 1770-9.
3. Karnik S, Kanekar A. Childhood obesity: A global public health crisis. *Int J Prev Med* 2012; 3(1): 1-7.
4. Kelishadi R, Ardalan G, Gheiratmand R, Majdzadeh R, Hosseini M, Gouya MM, et al. Thinness, overweight and obesity in a national sample of Iranian children and adolescents: CASPIAN Study. *Child Care Health Dev* 2008; 34(1): 44-54.
5. Patton GC, Coffey C, Carlin JB, Sawyer SM, Williams J, Olsson CA, et al. Overweight and obesity between adolescence and young adulthood: A 10-year prospective cohort study. *J Adolesc Health* 2011; 48(3): 275-80.
6. Oliveira AM, Oliveira AC, Almeida MS, Oliveira N, Adan L. Influence of the family nucleus on obesity in children from northeastern Brazil: A cross-sectional study. *BMC Public Health* 2007; 7: 235.
7. Singh GK, Kogan MD, Van Dyck PC, Siahpush M. Racial/ethnic, socioeconomic, and behavioral determinants of childhood and adolescent obesity in the United States: Analyzing independent and joint associations. *Ann Epidemiol* 2008; 18(9): 682-95.
8. Langnase K, Mast M, Muller MJ. Social class differences in overweight of prepubertal children in northwest Germany. *Int J Obes Relat Metab Disord* 2002; 26(4): 566-72.
9. Danielzik S, Czerwinski-Mast M, Langnase K, Dilba B, Muller MJ. Parental overweight, socioeconomic status and high birth weight are the major determinants of overweight and obesity in 5-7 y-old children: Baseline data of the Kiel Obesity Prevention Study (KOPS). *Int J Obes Relat Metab Disord* 2004; 28(11): 1494-502.
10. Noh JW, Kim YE, Oh IH, Kwon YD. Influences of socioeconomic factors on childhood and adolescent overweight by gender in Korea: Cross-sectional analysis of nationally representative sample. *BMC Public Health* 2014; 14: 324.
11. Ji CY, Cheng TO. Prevalence and geographic distribution of childhood obesity in China in 2005. *Int J Cardiol* 2008; 131(1): 1-8.
12. Julia M, van Weissenbruch MM, de Waal HA, Surjono A. Influence of socioeconomic status on the prevalence of stunted growth and obesity in prepubertal Indonesian children. *Food Nutr Bull* 2004; 25(4): 354-60.
13. Zhang YX, Wang SR. Rural-urban comparison in prevalence of overweight and obesity among adolescents in Shandong, China. *Ann Hum Biol* 2013; 40(3): 294-7.
14. Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M. Factors affecting prevalence of overweight among 12- to 17-year-old urban adolescents in Hyderabad, India. *Obesity (Silver Spring)* 2007; 15(6): 1384-90.
15. Mushtaq MU, Gull S, Abdullah HM, Shahid U, Shad MA, Akram J. Prevalence and socioeconomic correlates of overweight and obesity among Pakistani primary school children. *BMC Public Health* 2011; 11: 724.
16. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* 2007; 85(9): 660-7.
17. Kelishadi R, Gouya MM, Ardalan G, Hosseini M, Motaghian M, Delavari A, et al. First reference curves of waist and hip circumferences in an Asian population of youths: CASPIAN study. *J Trop Pediatr* 2007; 53(3): 158-64.
18. Faghihmani Z, Nourian M, Nikkar AH, Farajzadegan Z, Khavariyan N, Ghatrehsamani S, et al. Validation of the child and adolescent international physical activity questionnaires in Iranian children and adolescents. *ARYA Atheroscler* 2009; 5(4): 1-4.
19. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med* 1997; 337(13): 869-73.
20. Tang HK, Dibley MJ, Sibbritt D, Tran HM. Gender and socio-economic differences in BMI of secondary high school students in Ho Chi Minh city. *Asia Pac J Clin Nutr* 2007; 16(1): 74-83.
21. McDonald CM, Baylin A, Arsenault JE, Mora-Plazas M, Villamor E. Overweight is more prevalent than stunting and is associated with socioeconomic status, maternal obesity, and a snacking dietary pattern in school children from Bogota, Colombia. *J Nutr* 2009; 139(2): 370-6.
22. Wickramasinghe VP, Lamabadusuriya SP, Atapattu N, Sathyadas G, Kuruparanantha S, Karunarathne P. Nutritional status of schoolchildren in an urban area of Sri Lanka. *Ceylon Med J* 2004; 49(4): 114-8.
23. Maddah M, Nikooyeh B. Obesity among Iranian adolescent girls: Location of residence and parental obesity. *J Health Popul Nutr* 2010; 28(1): 61-6.
24. Kotian MS, GK S, Kotian SS. Prevalence and determinants of overweight and obesity among adolescent school children of South Karnataka, India. *Indian J Community Med* 2010; 35(1): 176-8.
25. Friedman LS, Lukyanova EM, Serdiuk A, Shkiryak-Nizhnyk ZA, Chislovska NV, Zvinchuk AV, et al. Social-environmental factors associated with elevated body mass index in a Ukrainian cohort of children. *Int J Pediatr Obes* 2009; 4(2): 81-90.
26. Mocanu V. Prevalence of overweight and obesity in urban elementary school children in northeastern

- Romania: Its relationship with socioeconomic status and associated dietary and lifestyle factors. *Biomed Res Int* 2013; 2013: 537451.
27. Dinsa GD, Goryakin Y, Fumagalli E, Suhrcke M. Obesity and socioeconomic status in developing countries: A systematic review. *Obes Rev* 2012; 13(11): 1067-79.
28. Noh JW, Kim YE, Park J, Oh IH, Kwon YD. Impact of parental socioeconomic status on childhood and adolescent overweight and underweight in Korea. *J Epidemiol* 2014; 24(3): 221-9.
29. You J, Choo J. Adolescent Overweight and Obesity: Links to Socioeconomic Status and Fruit and Vegetable Intakes. *Int J Environ Res Public Health* 2016; 13(3).
30. Kimani-Murage EW, Kahn K, Pettifor JM, Tollman SM, Klipstein-Grobusch K, Norris SA. Predictors of adolescent weight status and central obesity in rural South Africa. *Public Health Nutr* 2011; 14(6): 1114-22.
31. Gurzkowska B, Kulaga Z, Litwin M, Grajda A, Swiader A, Kulaga K, et al. The relationship between selected socioeconomic factors and basic anthropometric parameters of school-aged children and adolescents in Poland. *Eur J Pediatr* 2014; 173(1): 45-52.
32. Chao CY, Shih CC, Wang CJ, Wu JS, Lu FH, Chang CJ, et al. Low socioeconomic status may increase the risk of central obesity in incoming university students in Taiwan. *Obes Res Clin Pract* 2014; 8(3): e201-e298.