Original Article

Access this article online

Quick Response Code:

Website: www.jehp.net

DOI: 10.4103/jehp.jehp_440_19

Socioeconomic disparities in unhealthy weight: A need for health promotion among school-aged children

Shahin Soltani, Zhila Kazemi, Ali Kazemi Karyani, Behzad Karami Matin, Mohammad Ebrahimi, Satar Rezaei

Abstract:

INTRODUCTION: Overweight and obesity as a major public health issue can lead to adverse health consequences during the life span. This study aimed to measure socioeconomic inequality in unhealthy weight among school students in Kermanshah, west of Iran.

METHODS: The cross-sectional study measured the socioeconomic-related inequalities in unhealthy weight among 1404 secondary school students aged 11–16 years in Kermanshah in 2018. Unhealthy weight is defined as body mass index of >25 kg/m^2 in the study. Socioeconomic-related inequality in unhealthy weight was calculated using the concentration index (C_n). A logistic regression model was used to estimate the marginal effect of independent variables.

RESULTS: The prevalence of unhealthy weight for the total sample was 0.13 (95% confidence interval [CI]: 0.11–0.14). Of these, the prevalence of unhealthy weight for girls and boys was 0.11 (95% CI: 0.09–0.14) and 0.15 (95% CI: 0.12–0.18), respectively. The value of C_n for the total sample was 0.12 (95% CI: 0.03–0.2), which indicates a higher concentration of unhealthy weight among the high socioeconomic status (SES) students. Two factors of SES (49.11%) and gender (40.08%) had the largest contribution to socioeconomic inequality in unhealthy weight among the study students.

CONCLUSIONS: Socioeconomic-related inequality in unhealthy weight was concentered among high-SES students in the study. Thus, public health policies need to be formulated to change sedentary lifestyles and unhealthy dietary patterns among students with higher SES.

Keywords:

Body mass index, concentration index, inequality, Iran, obesity, socioeconomic status, students

Introduction

Literature shows that socioeconomic-related inequalities in childhood and adolescent obesity have become a major concern among public health policymakers due to its various adverse health consequences. Studies indicate that 30–45 million children and adolescents aged 5–17 years experience obesity worldwide.[1] Studies report high and an increasing rate in the prevalence of obesity among adolescents in the past three decades, so that this rate has increased from 5% to 17.1% among adolescents (12–19 years old). Furthermore, the prevalence of obesity is considered a significant determinant of chronic diseases, so that 23% of the ischemic heart disease, 7%–41% of certain cancers, and 44% of the diabetes burden is attributed to overweight and obesity.[2,3]

In Iran, different studies have been conducted to measure socioeconomic inequalities in obesity. In these studies, two indicators of concentration index (C_n) and slope index of inequality (SII) have been applied to compute socioeconomic inequality in obesity among children and

Research Center for Environmental Determinants of Health, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Address for correspondence:
Dr. Satar Rezaei, Research Center for Environmental Determinants of Health, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran.
E-mail: satarrezaei@gmail.com

Received: 30-07-2019
Accepted: 06-08-2019

How to cite this article: Soltani S, Kazemi Z, Karyani AK, Matin BK, Ebrahimi M, Rezaei S. Socioeconomic disparities in unhealthy weight: A need for health promotion among school-aged children. J Edu Health Promot 2019;8:240.

adolescents. For example, the findings of Izadi *et al*. showed that the prevalence of unhealthy weight is more concentrated among adolescents with lower socioeconomic status (SES) (using C_n). In contrast, the findings of Kelishadi *et al*. using C_n and SII showed pro-poor inequality, in which the place of residence, age, and family history were the largest contributors to the socioeconomic-related inequalities in obesity.[4] Furthermore, Moradi *et al*. reported a positive C_n that shows a higher prevalence of unhealthy weight in groups with higher SES, in which the place of residence and the mothers' education level were two major determinants of inequality.[5]

Previous studies have reported sex differences in socioeconomic inequalities in obesity. Some studies noted that childhood obesity among girls is concentrated in groups with higher SES, but for boys is more prevalent among lower SES groups. However, many studies reported a higher odds ratio for girls than boys in Iran. It is interesting to be noted that the role of parental-level variables is more significant than the child variable in the inequality. For example, Angoorani *et al*.'s study indicated that parental overweight/obesity increases the probability of having poor physical activity among children.[6] Similarly, the findings of Walsh and Cullinan indicated that the parental variables such as mothers' body mass index (BMI), occupation, parental education, smoking, and alcohol consumption are the major drivers of childhood obesity inequalities.[7]

Although previous studies, In Iran, have applied C_n to compute socioeconomic inequalities in obesity, they do not indicate the share of each variable in childhood obesity.[4-6] To fill this gap in the literature, we decompose C_n into separate contributions where the influence of individual-level regressors on the inequality can be measured. Given that children in different age groups show a different pattern of obesity, there is a need to design various studies to measure socioeconomic inequalities in obesity among children and adolescents.[8,9] On the other hand, identifying significant contributors to inequality in younger ages can provide comparable and up-to-date evidence for planners to formulate public policies to prevent obesity in adulthood. To design evidence-based interventions and prioritize actions, unfortunately, there are not considerable studies about the prevalence of childhood obesity and affecting factors in Kermanshah. Thus, we decided to investigate the most important drivers of socioeconomic inequalities in childhood obesity in Kermanshah.

Methods

Data and variables

The cross-sectional study measured the socioeconomic-related inequalities in unhealthy weight among secondary students in Kermanshah in 2018. The study population included all 11–16-year-old students at secondary schools in Kermanshah city in the academic year of 2018–2019. In the study, explanatory variables included age, gender, physical activity, household size, and SES. Furthermore, the outcome variable was unhealthy weight, including both overweight and obesity in the study.

The study was performed using multistage sampling to include the participants in the study. First, in the cluster sampling, Kermanshah city was divided into five geographical sections. Then, in each cluster, at least one girl's school and one boy's school were randomly included in the study. According to the number of students in each section, the samples were determined proportionally. After including the schools in each cluster, the data were collected from all the students through census method. In addition, if the number of samples in a school was not sufficient, more than one school would be included in the study. Overall, 1404 students from 14 secondary schools participated in the study. We developed a questionnaire to collect the required data. The questionnaire consisted of demographic questions (age, sex, grade, and birthplace) and SES variables (assets and education levels). Furthermore, the related data about students' weight and height were gathered with measuring them. BMI was calculated using the following formula:[10]

$$BMI = \frac{Weight\ (kg)}{[Height(m)]^2} \quad (1)$$

In children and adolescence, the Centers for Disease Control and Prevention (CDC) defines overweight as at or above the sex-specific 85th percentile, but less than the 95th percentile.[11] However, obesity is defined as a BMI at or above the sex-specific 95th percentile on the CDC's 2000 BMI-for-age growth charts. In this study, we defined unhealthy weight as a BMI at or above the sex-specific 85th percentile.

Households' assets and income data along with education levels of the head of households were gathered to calculate the SES index. Then, using principal component analysis, the SES index was created and then was divided into five quintiles from the lowest (1st quintile) to the highest (5th quintile) socioeconomic levels.

Measuring socioeconomic inequality in unhealthy weight

The C_n method was applied to calculate the socioeconomic-related inequality in unhealthy weight among the study students in Kermanshah city. The C is according to the concentration curve. Concentration

curve plots the cumulative proportion of population (here students) ranked according to their SES on the X-axes against the cumulative proportion of health outcome (here unhealthy weight) on the Y-axes.

The C is defined twice the area between 45° line that is the line of perfect equality and the concentration curve. The C varies between −1 and +1. A positive (negative) value of the C indicates that outcome variable (unhealthy weight) is concentrated among the groups with high (low)-SES groups. The zero value for the C indicates that unhealthy weight is equally distributed among the different socioeconomic groups. The C is calculated using the following formula:[7]

$$C = \frac{2*\mathrm{cov}(y_i\ r_i)}{\mu} \quad (2)$$

where y_i is the dependent variable (i.e. unhealthy weight) for the student *i*, r_i is the fractional rank of student *i* in the SES distribution, and μis the mean of the dependent variable (i.e. unhealthy weight). As per Wagstaff's suggestion,[12] we used the normalized C by multiplying the C by 1/1 − μ, because the outcome variable (unhealthy weight) is a binary variable.

Decomposing socioeconomic inequality in unhealthy weight

The C was decomposed to identify the contribution of explanatory variables to the measured socioeconomic inequality in unhealthy weight among the participants of the study.[13] We regressed unhealthy weight on a set of *k* explanatory variables using a logit model as:

$$y = \alpha + \sum_k \beta_k x_k + \varepsilon, \quad (3)$$

The C for *y* can be decomposed as follows:

$$C = \sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k + GC_\varepsilon / \mu \quad (4)$$

where β_k is the coefficient of each independent (explanatory) variable (here marginal effect of each explanatory variable calculated from the logit model), $\bar{x}_k$ is the mean of each independent variable, C_k is the C_n for each independent variable, and GC_ε is the generalized C_n for ε.

In equation 4, the $\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k$ component designates the proportion of the measured inequality, C, explained by the systematic variation of the independent variables across SES groups. Therefore, each of independent variables contributes to socioeconomic inequality in unhealthy weight if the variable is unequally distributed by SES and the elasticity of the variable is statistically significant.

In the decomposition, the positive or negative contribution of each independent variable resulted from both the elasticity and the socioeconomic inequality in the distribution of the factor (C_k).

The $\frac{GC}{\mu}$ in Equation 4 formula specifies the proportion of socioeconomic inequality, which is not explained by the independent variables included in the regression model. Similarly, normalized C_n, *NC*, can be decomposed using the following formula:[12]

$$NC = \frac{C}{1-\mu} = \frac{\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k}{1-\mu} + \frac{GC_\varepsilon / \mu}{1-\mu} \quad (5)$$

Furthermore, the Stata software version 14 (StataCorp, College Station, TX, USA) was used to analyze the data in this study.

Results

Descriptive analysis

In this study, 449 (31.98%) boys and 955 girls (68.02%) participated. The mean age of students was 13.16 ± 1.01. All participants attended secondary schools. Of the total of 1404 students who attended secondary schools, 60.19% were in the first grade, 17.74% in the second grade, and 22.08% in the third grade. The prevalence of unhealthy weight for the total sample was 0.13 (95% confidence interval [CI]: 0.11–0.14). Of these, the prevalence of unhealthy weight for girls and boys was 0.11 (95% [CI]: 0.09–0.14) and 0.15 (95% CI: 0.12–0.18), respectively. Furthermore, the participants in the third grade had the higher prevalence of unhealthy weight compared to others (0.16 95% [CI]: 0.12–0.20). Table 1 presents the prevalence of unhealthy weight by characteristics of the total sample.

Socioeconomic inequality in unhealthy weight

The value of C_n for the total sample was 0.12 (95% [CI]: 0.03–0.20). This value shows the higher concentration of unhealthy weight among high-SES adolescents in the study participants. Furthermore, the value of C_n for boys and girls was 0.16 (95% [CI]: 0.02–0.29) and 0.02 (95% [CI]: -0.09 – 0.13), respectively, that indicates inequality in favor of low SES groups.

Decomposition of socioeconomic inequality in unhealthy weight

Table 2 shows the decomposition results of socioeconomic inequality in unhealthy weight. According to the results of the marginal effects, boys were 5% more likely to have unhealthy weight than girls. Children at the second and third grades (8% and 5%, respectively) were more likely to report unhealthy weight compared to those at the first grade. The probability of having

Table 1: Characteristics of the participants in the study

Variables	Total, *n* (%)	Unhealthy weight, *n* (%)
Sex		
Male	495 (35.26)	76 (15.35)
Female	909 (64.74)	108 (11.88)
Grade		
First	845 (60.19)	94 (11.12)
Second	249 (17.74)	39 (15.66)
Third	310 (22.08)	51 (16.45)
Physical activity		
Poor	629 (44.8)	85 (13.51)
Good	775 (55.2)	99 (12.77)
Sex of the head of households		
Male	1337 (95.23)	172 (12.86)
Female	67 (4.77)	12 (17.91)
Age of the head of households (years)		
27-40	381 (27.14)	48 (12.59)
41-50	786 (55.98)	97 (12.34)
>50	237 (16.88)	39 (16.45)
Household size		
2-3 persons	220 (15.67)	44 (20.00)
4-5 persons	1049 (74.72)	127 (12.11)
6 and more persons	135 (9.62)	13 (9.62)
SES		
1st quintile (the lowest)	281 (20.01)	25 (8.89)
2nd quintile	286 (20.37)	35 (12.23)
3rd quintile	278 (19.80)	38 (13.66)
4th quintile	279 (19.87)	41 (14.69)
5th quintile (the highest)	280 (19.94)	45 (16.07)
Total	1404 (100)	184 (13.11)

SES=Socioeconomic status

unhealthy weight was 1% higher in children with poor physical activity than their counterparts with good physical activity. The age of the head of households had a positive association with unhealthy weight, so that children with older head of household were 3% more likely to have unhealthy weight than the youngest group. Household size had a negative relationship with unhealthy weight, in which households with 6 members and over were 9% less likely to have unhealthy weight than the smallest households. In contrast, a positive association was found between SES and the outcome variable. Children at the highest socioeconomic groups were 5% more likely to have unhealthy weight than the groups with the lowest SES.

Regarding the contribution results shown in Table 2, it is evident that SES explained 49.11% of the overall socioeconomic inequality in unhealthy weight among children. Following SES, gender was the second largest contributor to the concentration of unhealthy weight among the rich, so that explained 40.08% of the overall socioeconomic inequality in unhealthy weight.

Discussion

The purpose of our study was to measure socioeconomic-related inequalities in unhealthy weight among school-aged children in Kermanshah. In agreement with the previous studies in Iran, the value of C_n showed that childhood unhealthy weight is concentrated among students with higher SES.[4,5,14] The finding underlines the importance of socioeconomic indices in health status. The decomposition of socioeconomic inequalities suggested SES as the largest contributor to unhealthy weight in school-aged children in Kermanshah. In consistent with our results, the findings of Veghari and Rahmati indicated that urbanization and higher SES can increase the probability of obesity among children.[15] In addition, it is important to note that urbanization, itself, may lead to a sedentary lifestyle among children and their parents. In Moradi *et al*.'s study, following the place of residence, mothers' education had the largest share of inequality in unhealthy weight.[5] In contrast, the findings of Izadi *et al*. indicated that adolescents with lower SES have more probability to overweight/obese than the higher SES groups.

Sex was the second important contributor to socioeconomic inequality in childhood unhealthy weight in this study. The finding implies that girls are more likely to be poor and thin compared to males.[16-19] Accordingly, the burden of unhealthy weight disproportionately is borne by males in this study. This result was consistent with the previous studies in Iran. The studies reported a higher probability of obesity among boys compared to girls.[4,20] Contrary, many studies showed a reverse pattern of obesity among adults in Iran, so that women are more likely to have unhealthy weight than men. According to the results of the present study, poor physical activity may be a significant risk factor of obesity among boys. Other studies noted that parental variables such as higher education and income levels can increase the risk of obesity among children.[21-23] However, Akhavan-Karbasi *et al*.'s study showed the different results in children aged 6–7 years, so that childhood obesity had not a significant association with the sex of children and parental variables such as education and the history of obesity.[24] They found physical activity, TV watching time, and junk food consumption as the major determinates of obesity in children.

In the present study, household size was the third contributor to socioeconomic inequalities in childhood unhealthy weight. Our findings showed that household size had a negative relationship with unhealthy weight, so that children in smaller households are more likely to have a higher BMI than larger ones. This result is probably due to different lifestyles or dietary patterns in larger households.

Table 2: Decomposition of socioeconomic-related inequality in unhealthy weight in the students

Variables	Marginal effects	Mean	Elasticity	Concentration index (Ck)	Absolute contribution	Percentage contribution	Summed percentage contribution
Sex							
Male		0.32					40.08
Female	−0.05	0.68	−0.25	−0.16	0.047	40.08	
Grade							
First		0.60					−2.23
Second	0.08	0.18	0.10	−0.10	−0.011	−9.73	
Third	0.05	0.22	0.08	0.10	0.009	7.50	
Physical activity							
Poor		0.81					0.51
Good	−0.01	0.19	−0.02	−0.03	0.001	0.51	
Sex of the head of households							
Male		0.95					−0.35
Female	0.04	0.05	0.01	−0.03	0.000	−0.35	
Age of the head of households (years)							
27-40		0.27					0.59
41-50	0.00	0.56	−0.02	−0.01	0.000	0.10	
>50	0.03	0.17	0.04	0.01	0.001	0.49	
Household size							
2-3		0.16					19.83
4-5	−0.07	0.75	−0.41	−0.07	0.035	29.80	
6 and more	−0.09	0.10	−0.07	0.15	−0.012	−9.97	
SES							
1st quintile (the lowest)		0.20					49.11
2nd quintile	0.03	0.20	0.05	−0.22	−0.013	−10.85	
3rd quintile	0.04	0.20	0.07	0.00	0.000	0.25	
4th quintile	0.05	0.20	0.07	0.29	0.023	19.57	
5th quintile (the highest)	0.05	0.20	0.07	0.58	0.047	40.14	
Explained					0.127		107.55
Residuals					0.009		−7.55
Total					0.12		100.00

SES=Socioeconomic status

In contrast, physical activity was the most important factor in reducing inequality in childhood unhealthy weight. This result is due to positive C_k for sufficient physical activity and the negative elasticity for all measures of unhealthy weight with respect to sufficient physical activity. In other words, students with sufficient physical activity are more likely to be rich and thin than their counterparts with insufficient physical activity. Furthermore, the decomposition revealed that education levels make a negative contributor to the socioeconomic inequality in unhealthy weight among the participants. The finding implies that students with lower education levels are more likely to be poor and overweight/obese than the others. Consistent with our results, the findings of Quintal and Oliveira indicated that the probability of obesity would decrease with age among adolescents.[25] On the contrary, Ogden *et al*.'s study indicated that the prevalence of obesity has an increasing trend among adolescents aged 12–19 years between 1988–1994 and 2013–2014 in the United States.[26] Overall, considerable studies in Iran show a positive association between overweight/obesity among adolescents. It should be noted that this relationship is stronger among girls than boys.[1,27]

In the study, students with sufficient physical activity were less likely to have unhealthy weight than those with poor physical activity. In addition, education level was identified as a negative contributor to socioeconomic inequalities in childhood unhealthy weight in the study. Given in Table 2, the finding indicates a higher prevalence of unhealthy weight among the students. However, students at the second and third grades were more likely to have unhealthy weight compared to those at the first grade. Likewise, the findings of Rezaei *et al*. showed a positive association between age and obesity.[21] In contrast, Moradi *et al*. reported a lower risk of obesity with increasing age that is inconsistent with our findings.[5]

This study was conducted in an urban setting, but students in rural areas may have different levels of physical activity, SES, and BMI compared to their counterparts in urban settings. The issue may affect

socioeconomic-related inequalities in unhealthy weight in rural students.

Conclusions

The current study demonstrated that socioeconomic inequality in unhealthy weight was concentrated among better-off students. Thus, identifying the risk factors of unhealthy weight in high-SES students should be considered by researchers and policy makers in Iran. Public health policies need to be formulated in order to change sedentary lifestyles and unhealthy dietary behaviors among high-SES students in Iran.

Acknowledgment

This project has been approved by the Ethics Committee of Kermanshah University of Medical Sciences (KUMS) (Ethics code: KUMS. REC.1397.436). Also, we would like to express our appreciation to the Deputy of Research and Technology of KUMS for funding this study.

Financial support and sponsorship

This study was funded by Kermanshah University of Medical Sciences (Code Number: 97413).

Conflicts of interest

There are no conflicts of interest.

References

1. Khazaei S, Nooraliey P, Gholamaliee B, Delavar MK, Khazaei S, Jamorpour S, *et al*. The prevalence of obesity among Iranian adolescents: A meta-analysis study. J Qom Univ Med Sci J 2016;10:78-88.
2. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: A systematic review and meta-analysis of prospective observational studies. Lancet 2008;371:569-78.
3. van Baal PH, Polder JJ, de Wit GA, Hoogenveen RT, Feenstra TL, Boshuizen HC, *et al.* Lifetime medical costs of obesity: Prevention no cure for increasing health expenditure. PLoS Med 2008;5:e29.
4. Kelishadi R, Qorbani M, Heshmat R, Djalalinia S, Sheidaei A, Safiri S, *et al.* Socioeconomic inequality in childhood obesity and its determinants: A blinder-oaxaca decomposition. J Pediatr (Rio J) 2018;94:131-9.
5. Moradi G, Mostafavi F, Azadi N, Esmaeilnasab N, Ghaderi E. Socioeconomic inequality in childhood obesity. J Res Health Sci 2017;17:e00391.
6. Angoorani P, Heshmat R, Ejtahed HS, Motlagh ME, Ziaodini H, Taheri M, *et al*. The association of parental obesity with physical activity and sedentary behaviors of their children: The CASPIAN-V study. J Pediatr (Rio J) 2018;94:410-8.
7. Walsh B, Cullinan J. Decomposing socioeconomic inequalities in childhood obesity: Evidence from Ireland. Econ Hum Biol 2015;16:60-72.
8. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. Lancet 2017;390:2627-42.
9. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. JAMA 2012;307:483-90.
10. Hall DM, Cole TJ. What use is the BMI? Arch Dis Child 2006;91:283-6.
11. Centers for Disease Control and Prevention. About Child and Teen BMI; 2019. Available from: https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html. [Last accessed on 2019 Jan 20].
12. Wagstaff A. The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality. Health Econ 2005;14:429-32.
13. Wagstaff A, Van Doorslaer E, Watanabe N. On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. J Econ 2003;112:207-23.
14. Izadi N, Hashemi-Nazari SS, Rafiee E, Malekifar A, Najafi F. Socioeconomic inequality in overweight/obesity and related factors in adolescents in Kermanshah-Iran. Iran Red Crescent Med J 2017;19 (11); e55588.
15. Veghari GR, Rahmati R. The prevalence of obesity in primary schools of Golestan Province of Iran. Payavard Salamat 2012;5:24-31.
16. Matin BK, Jalilian F, Alavije MM, Ashtarian H, Mahboubi M, Afsar A, *et al.* Using the PRECEDE model in understanding determinants of quality of life among Iranian male addicts. Glob J Health Sci 2014;6:19-27.
17. Kelishadi R, Alikhani S, Delavari A, Alaedini F, Safaie A, Hojatzadeh E, *et al.* Obesity and associated lifestyle behaviours in Iran: Findings from the first national non-communicable disease risk factor surveillance survey. Public Health Nutr 2008;11:246-51.
18. Hajian-Tilaki KO, Heidari B. Prevalence of obesity, central obesity and the associated factors in urban population aged 20-70 years, in the North of Iran: A population-based study and regression approach. Obes Rev 2007;8:3-10.
19. Bakhshi E, Eshraghian MR, Mohammad K, Foroushani AR, Zeraati H, Fotouhi A, *et al.* Sociodemographic and smoking associated with obesity in adult women in Iran: Results from the national health survey. J Public Health (Oxf) 2008;30:429-35.
20. Mirsolimany H, Mokhtari N, Mirhadiyan L, Leili EK. Survey predictors of overweight and obesity in children beginning. J Holist Nurs Midwifery 2015;25:55-62.
21. Rezaei OM, Moodi M, Tiyuri A, Zar Shenas F, Sharifi M. Prevalence of obesity and its relationship with food habits among 10-14 years old school boys in Birjand, 2014: A short report. J Rafsanjan Univ Med Sci 2016;14:1085-94.
22. Jafari-Adli S, Jouyandeh Z, Qorbani M, Soroush A, Larijani B, Hasani-Ranjbar S, *et al.* Prevalence of obesity and overweight in adults and children in Iran; a systematic review. J Diabetes Metab Disord 2014;13:121.
23. Jalilvand M, Kimiagar M, Hosseini S, Rajabzadeh R, Sodmand M, Alavinia S. Obesity prevalence and Related factors in north Khorasan high school students. J North Khorasan Univ Med Sci 2013;4:611-20.
24. Akhavan-Karbasi S, Fallah R, Golestan M, Sadr-Bafghi M. Prevalence and risk factors of obesity and overweight among primary school children in Yazd. J Shahid Sadoughi Univ Med Sci 2009;16:8-13.
25. Quintal C, Oliveira J. Socioeconomic inequalities in child obesity and overweight in Portugal. Int J Soc Econ 2017;44:1377-89.
26. Ogden CL, Carroll MD, Lawman HG, Fryar CD, Kruszon-Moran D, Kit BK, *et al*. Trends in obesity prevalence among children and adolescents in the United States, 1988-1994 through 2013-2014US trends in obesity prevalence in children and adolescents, 1988-2014US trends in obesity prevalence in children and adolescents, 1988-2014. JAMA 2016;315:2292-9.
27. Shakeri M, Mojtahedi Y, Naserian J, Moradkhani M. Obesity among female adolescents of Tehran schools. J Payavard Salamat 2013;6:403-11.