Evaluation of the Obesity Contributing Factors in first grade elementary school students from Sari, North of Iran

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Abstract

Background: Obesity in children has raised worries about public health and hygiene. In this study, we intended to evaluate the obesity rate among the children from first grade elementary schools throughout Sari, in the north of Iran. Moreover, we evaluated the possible effects of mother's life conditions on the estimation of obesity in children.

Methods: In this descriptive cross sectional study, the study population included first grade elementary school students in Sari, north of Iran. Sampling was carried out through multi-stage and stratified randomization at level of the target students. Using stadiometer and digital scales, the height and weight were measured. Body Mass Index (BMI) was also calculated. A questionnaire about eating habits and socio-economic status of parents was employed. Data collection was conducted using phone interview with parents as well as the questionnaire's records. Analysis of data was conducted in SPSS v.22 using suitable statistical tests. IBM SPSS

Amos software was utilized for path analysis. $P<0.05$ was considered as statistically significant.
Results: It was observed that 15% of the evaluated cases were obese. There was an association between BMI of the obese cases and lifestyle-related habits. Path analysis revealed significant impression of patient's habitus on the obesity of children.

Conclusions: Our results suggest that the overall prevalence of obesity in Sari was high, which proposes the necessity for serious consideration in the health system, and designing, developing, and implementing preventive approaches with regard to childhood obesity.

Key words: Obesity, overweight, risk factors, elementary students, life-style

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Introduction

Over the course of the past few years, the issue of obesity and overweight has a growing concern among populations worldwide. In the 21st century, this issue has been the most challenging public health problem (1). The prevalence of obesity has been growing remarkably in pediatrics both in developing and developed countries during the past decades. Studies have demonstrated that children within the elementary school −period (6-11 years) have the highest prevalence and risk of being obese and overweight, and this rate has been evaluated to be approximately 18.8% (2, 3).

The challenging issue of obesity and overweight in cases during the period of childhood and teenage years has inappropriate and dangerous ramifications on premature mortality and morbidity as well as physical disability in the future ages of adulthood. Moreover, obesity by itself has been associated with numerous health problems during childhood(4). With respect to the findings of several studies all around the world, obesity during childhood has been related to numerous complications in the future including, hypertension, cardiovascular diseases, increased level of insulin, type 1 and 2 diabetes, reproductive, and orthopedic impairments (5). On the other hand, among the underlying contributing factors for obesity are genetic, metabolic, socioeconomic, cultural, parental and lifestyle, including diet, physical activity, birth weight, nutritional status, supplementary nutrition, type of child's recreation (6). However, the findings about obesity risk factors have been incongruous and inconclusive and various investigations have demonstrated that important factors are genetic background, physical activity (7-10), kind of synthetic milk consumed during neonatal period (11), high birth weight (12-14), hours of television watching (particularly if it is more than 2 hours per day)(15, 16), quality and quantity of regular meals during the day, and obesity and overweight in parents(17-20). On the contrary, some evaluations have observed that none of the previously associated risk factors for obesity were causing this impairment in cases with normal weight and overweight (21-23).

Considering the previous observations about pediatric obesity−related risk factors, it seems that evaluation of risk factors of obesity in children is indispensable with respect to the adverse and dangerous implications of obesity on health issues. Therefore, with regard to the different climatic and cultural differences in Iran and the lack of such a study in Sari (a city in the north of Iran), this study aimed to determine some effective factors in obesity among primary school students in Sari. Moreover, the pattern of parent to child effects about obesity were evaluated.

Examination and methods

In this study, 180 seven year old students were selected via two-stage sampling method from urban areas of Sari. Sari is a city in the Mazandaran province in north Iran and had a population of 2,197 first grade students. In the first stage, 569 elementary schools, both public and private, were chosen, and, in the second stage, through a case-control study, 60 obese (body mass index (BMI) ≥ 85th percentile of Iranian reference) children were selected as the case group, and the primary non-obese students (15th ≤ BMI < 85th percentile) were examined immediately after each obese student. These students who were age- and sex-matched, were selected as the control group. Overall, 120 students were included in the control group. This study was approved by the ethics committee of Islamic Azad University of Sari Medical Sciences. Written informed consent was obtained from parents and oral assent from students.

We used the Iranian reference for BMI percentiles (24). Height was measured by a stadiometer (Seca, Germany) in a standing position with bare feet (precision 0.5cm), and body weight was determined with subjects wearing light clothes and no shoes or socks, using an electronic balance. BMI was calculated as weight (kg) divided by height squared (m2).

Data were collected by questionnaire via direct interview with mothers. Interviews were performed by trained health professionals. The questionnaire included mother-reported information about her child regarding the age, sex, birth weight, birth order, number of family household members, duration of breast feeding, initiation age of complementary food, TV watching hours, playing electronic games, sleep duration, father age, mother age, mother weight, economic status, and parental obesity history. The economic status of family was assessed by having some equipment such as color TV, refrigerators, washing machine, video, computer, video CD, and accessibility to car and private home. In data analysis, economic status was defined as low, moderate, and good based on an average score 3, 4-6, and more than 7, respectively. Physical activity score was evaluated using the modified Baecke et al. questionnaire by asking the pupils (25).

In this study, the path analysis method was used to analyze the data and to evaluate the goodness of fit using the IBM SPSS Amos software. The path analysis is used to test the causal models and requires the setting of the pattern as a causal diagram and helps to identify what we are searching for. In the path analysis, the coefficient of determination is used, hence it is possible to evaluate the suitability of the model. Moreover, using the beta weight, which is called coefficient path in the path analysis, it is possible to determine the effect value of each variable. In addition, path analysis enables us to understand the mechanism of the effect of the variables on each other and to determine how much direct or indirect is the effect of each variable. In other words, path analysis provides a lot of information about the causal processes in a straightforward and understandable way(26).

In the path analysis method, there are several indexes for examining the fit of tested patterns, among which, root mean square error approximation (RMSEA), chi-square ratio to freedom gap (χ^2 /df), and ultimately insignificant quasi-test Chi (P≥0.05) are main indexes of fit model in path analysis. Other indexes such as NFI, CFI and GFI represent the optimal fit pattern in structural equations such as path analysis (27).

Analysis of data was performed via SPSS software version 22 (SPSS, Chicago, IL, USA). To evaluate the normal distribution of the scale variables, the Kolmogorov–Smirnov test was used. The independent sample t-test or Mann-Whitney U test was used to compare groups with continuous variables. Correlation analysis was conducted to analyze the relationship between BMI and characteristics of the cases. Scale data were expressed as mean ± standard deviation (SD). A P value < 0.05 was set to be statistically significant.

Results

In this descriptive cross-sectional study, from 569 elementary school students, a total of 494 children were examined. It was observed that 14% of evaluated cases were obese. Table 1 shows demographic characteristics, children's lifestyle and family income. Most of the evaluated indexes did not have significant difference between the obese and control groups. However, age, BMI, and initiation month of supplementary food were indexes with significant difference.

Table 1. Demographic characteristics, children's lifestyle and income status of the children under study (Part 1)

Characteristic	Case (BMI≥85th percentile) N=74	Control (BMI=5th-85th percentile) N=420	*P* value
Sex			
Girl	40 (54%)	277 (65.95%)	0.123
Boy	34 (46%)	142 (33.81%)	
Delivery Type			
Natural	26 (35.14%)	159 (37.86%)	0.386
Cesarean	48 (64.86%)	256 (60.95%)	
Delivery time			
1	73 (98.65%)	398 (94.76%)	0.525
2	1 (1.35%)	17 (4.05%)	
Number of Siblings			
0	13 (17.57%)	66 (15.71%)	0.192
2	0 (0%)	4 (0.95%)	
3	34 (45.95%)	142 (33.81%)	
4	26 (35.14%)	180 (42.86%)	
5	1 (1.35%)	24 (5.71%)	
6	0 (0%)	4 (0.95%)	
Number of Birth			
0	10 (13.51%)	53 (12.62%)	0.693
1	45 (60.81%)	227 (54.05%)	
2	18 (24.32%)	125 (29.76%)	
3	1 (1.35%)	13 (3.10%)	
4	0 (0%)	4 (0.95%)	
Father Education			
Illiterate	0 (0%)	3 (0.71%)	0.294
Under Diploma	15 (20.27%)	88 (20.95%)	
Diploma	18 (24.32%)	149 (35.48%)	
Upper Diploma and B.Sc.	30 (40.54%)	120 (28.57%)	
M.Sc. and upper than M.Sc.	11 (14.86%)	53 (12.62%)	
Mother Education			
Illiterate	0 (0%)	2 (0.48%)	0.736
Under Diploma	11 (14.86%)	75 (17.86%)	
Diploma	28 (37.84%)	165 (39.29%)	
Upper Diploma and B.Sc.	30 (40.54%)	142 (33.81%)	
M.Sc. and upper than M.Sc.	5 (6.76%)	29 (6.90%)	
Income million (Iranian Taman)			
None	9 (12.16%)	57 (13.57%)	0.637
Less than1.5	36 (48.65%)	221 (52.62%)	
1.5 to 3	25 (33.78%)	119 (28.33%)	
3 to 8	3 (4.05%)	19 (4.52%)	
More than 8	0 (0%)	3 (0.71%)	

Table 1: Demographic characteristics, children's lifestyle and income status of the children under study (Part 2)

Current Employment Status			
Yes	20 (27.03%)	120 (28.57%)	0.575
No	50 (67.57%)	283 (67.38%)	
Employed in the past			
Yes	24 (32.43%)	129 (30.71%)	0.69
No	41 (55.41%)	234 (55.71%)	
Job working hours			
None	50 (67.57%)	292 (69.52%)	0.053
Office time	15 (20.27%)	52 (12.38%)	
Circulatory shift	3 (4.05%)	17 (4.05%)	
Night	0 (0%)	1 (0.24%)	
Sessional	0 (0%)	7 (1.67%)	
Part time	2 (2.70%)	39 (9.29%)	
Other	2 (2.70%)	11 (2.62%)	
Job type			
None	49 (62.22%)	285 (67.86%)	0.236
Home	2 (2.70%)	24 (5.71%)	
Office	8 (10.81%)	33 (7.86%)	
Industry	0 (0%)	5 (1.19%)	
Agriculture	0 (0%)	3 (0.71%)	
Hospital	2 (2.70%)	11 (2.62%)	
Business	1 (1.35%)	17 (4.05%)	
Training	8(10.81%)	32 (7.62%)	
Other	2 (2.70%)	9 (2.14%)	
Number of meals with mother-baked food			
0	5 (6.76%)	27 (6.43%)	0.531
1	0 (0%)	2 (0.48%)	
1-2	1 (1.35%)	9 (2.14%)	
2	5 (6.76%)	21 (5%)	
2-3	5 (6.76%)	55 (13.10%)	
More than 3	57 (77.03%)	305 (72.62%)	
Number of meals eating fast-food per week			
0	49 (66.22%)	280 (66.67%)	0.795
Less than 3	20 (27.03%)	108 (25.71%)	
3 to 6	2 (2.70%)	14 (3.33%)	
More than 6	0 (0%)	6 (1.43%)	
Number of meals eating without parents per week			
0	55 (74.32%)	319 (75.95%)	0.610
Less than3	12 (16.22%)	59 (14.05%)	
3 to 6	1 (1.35%)	16 (3.81%)	
More than 6	3 (4.05%)	12 (2.86%)	
The way of going to school			
Walking	14 (18.92%)	99 (23.57%)	0.741
Transportation vehicles	49 (66.22%)	262 (62.38%)	
Both	8 (10.81%)	50 (11.90%)	
Hours watching TV per day			
Less than 1 hour	17 (22.97%)	79 (18.81%)	0.592
1 to 2 hours	33 (44.59%)	209 (49.76%)	
2 to 4 hours	19 (25.68%)	94 (22.38%)	
More than 4 hours	2 (2.70%)	26 (6.19%)	

Table 1: Demographic characteristics, children's lifestyle and income status of the children under study (Part 3)

Hours using computer per day			
Less than 1 hour	49 (66.22%)	274 (65.24%)	0.490
1 to 2 hours	12 (16.22%)	53 (12.62%)	
2 to 4 hours	0 (0%)	5 (1.19%)	
More than 4 hours	0 (0%)	3 (0.71%)	
Hours using mobile and tablet per day			
Less than 1 hour	49 (66.22%)	283 (67.38%)	0.452
1 to 2 hours	11 (14.86%)	75 (17.86%)	
2 to 4 hours	3 (4.05%)	12 (2.86%)	
More than 4 hours	1 (1.35%)	8 (1.90%)	
Hours spending at home without parents per day			
0	2 (2.70%)	12 (2.86%)	0.810
1 to 3	59 (79.73%)	326 (77.62%)	
3 to 6	10 (13.51%)	58 (13.81%)	
More than 6	2 (2.70%)	23 (5.48%)	
Dried milk consumption			
Never	51 (68.92%)	273 (65%)	0.208
Rarely	1 (1.35%)	40 (9.52%)	
Sometimes	6 (8.11%)	30 (7.14%)	
Usually	2 (2.70%)	23 (5.48%)	
Always	11 (14.86%)	45 (10.71%)	
Activity			
Never	2 (2.70%)	5 (1.19%)	0.106
Rarely	6 (8.11%)	33 (7.86%)	
Sometimes	15 (20.27%)	57 (13.57%)	
Usually	30 (40.54%)	186 (44.29%)	
Always	17 (22.97%)	124 (29.52%)	
Omitting a meal			
Never	46 (62.16%)	281 (66.90%)	0.687
Breakfast	22 (29.73%)	104 (24.76%)	
Breakfast & Lunch	0 (0%)	1 (0.24%)	
Breakfast & Dinner	0 (0%)	1 (0.24%)	
Lunch	1 (1.34%)	9 (2.14%)	
Lunch & Dinner	0 (0%)	1 (0.24%)	
Dinner	3 (4.05%)	20 (4.76%)	
Age*	**7.59±0.494**	**7.47±0.499**	**0.040**
BMI*	**21.83±2.81**	**15.34±1.63**	**<0.001**
Childbirth weight*	3.09±0.93	10.84±0.160	0.670
Childbirth height*	41.83±18.62	43.82±15.96	0.335
Working hours*	11.67±22.93	19.33±17.84	0.328
Months nourishing with mother's milk*	19.39±6.35	18.85±7.93	0.586
Initiation month of supplementary food*	**5.62±2.37**	**6.46±5.25**	**0.027**

Obese cases and controls were 7.59±0.494 and 7.47±0.499 years old, respectively, which was statistically significant (P= 0.040). Moreover, the BMI in obese and control cases demonstrated significant differences (21.83±2.81vs.15. 34±1.63, respectively, P<0.001). |The obese cases were observed to start supplementing with foods earlier than the control group (5.62±2.37 vs. 6.46±5.25, P= 0.027).

ANOVA analysis demonstrated that only job type (P= 0.005), hours of watching TV per day (P= 0.045), and hours of using mobile and tablet per day (P= 0.012) had significant association with the BMI level of the obese children (Table 2). Furthermore, correlation analysis disclosed no significant correlation between the scale data of the patients and their BMI (Table 3).

Table 2. Relationship of different factors with BMI of children

Characteristic of the cases	P value
Sex	0.616
Delivery Type	0.229
Delivery time	0.231
Number of Siblings	0.506
Number of Birth	0.125
Father Education	0.312
Mother Education	0.213
Income million (Iranian Toman)	0.210
Current Employment Status	0.066
Employed in the past	0.736
Job type	**0.005**
Number of meals with mother-baked food	0.997
Number of meals eating fast-food per week	0.061
Number of meals eating without parents per week	0.700
The way of going to school	0.551
Hours watching TV per day	**0.045**
Hours using computer per day	0.390
Hours using mobile and tablet per day	**0.012**
Hours spending at home without parents per day	0.067
Dried milk consumption	0.989
Activity	0.057
Omitting a meal	0.064

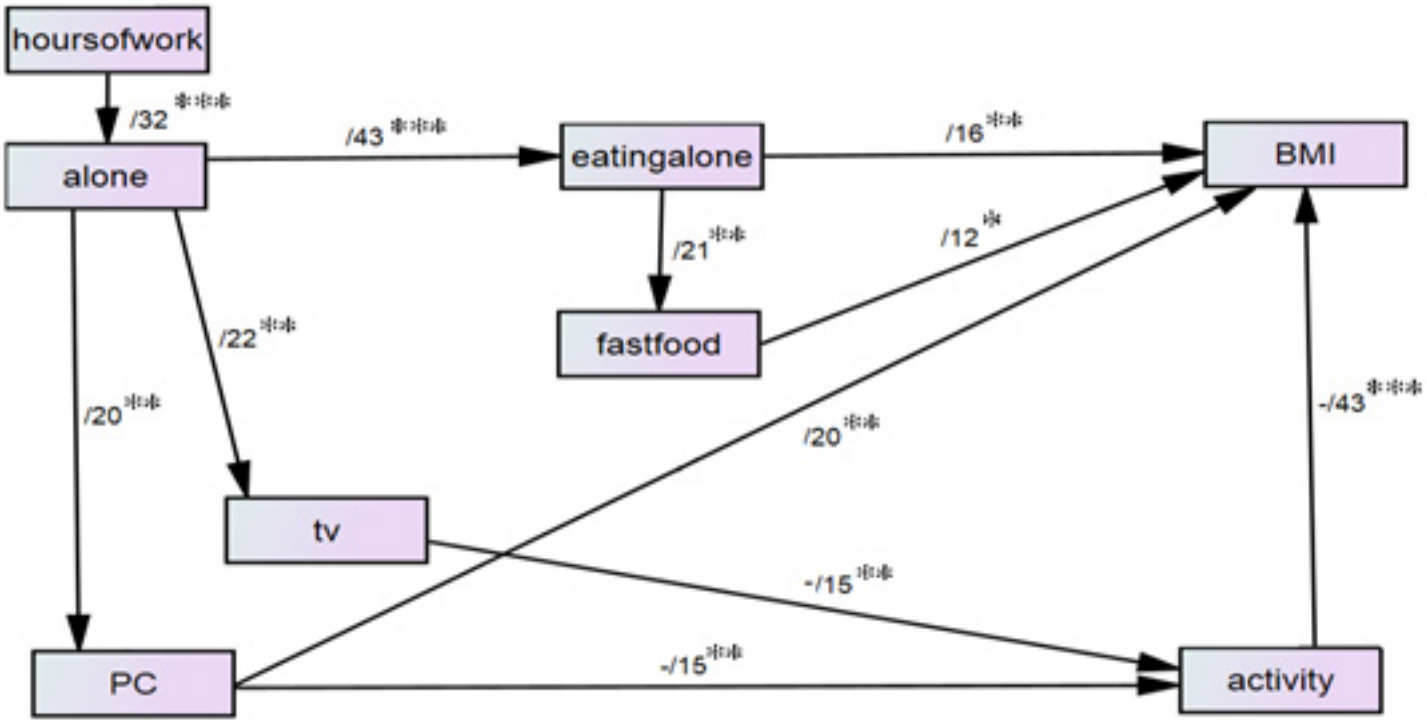
Table 3. Correlation of BMI of children with their characteristics

Characteristic	Pearson's correlation coefficient	P value
Age	0.061	0.606
Childbirth weight	0.071	0.548
Childbirth height	0.113	0.337
Working hours	0.125	0.296
Months nourishing with mother's milk	0.061	0.614
Initiation month of supplementary food	0.168	0.154

In this study, the relationship between mother's employment status and obesity in children was tested and path analysis was used due to the study of cause and effect relationships and control of other possible effective variables. After testing and removing the paths and variables that did not show significant correlation, the path of the relationship between variables in the final model is shown in Figure 1.

Based on these results, parent's duration of work was effective in children's staying alone at home, and children who spend more hours per day alone spend more time watching TV and using computers. Therefore, these kids have less activity and more BMI. Furthermore, children who spent more hours a day at home alone, ate more meals alone and ate more fast-food and, hence, had higher BMI.

Figure 1. The final model of the path analysis model and its standardized effect size.



*Pvalue<0.1; **Pvalue<0.05; ***Pvalue<0.001

The fitting indexes of the model show that this pattern has a good fit. A summary of the fittingindexes of the model and its desirable amount is presented in Tables 4 and 5.

Table 4: Fitting model indexesand their optimal values

Fitting model index	Final model	Favorable value
Chi-squared	22.276	*P* value>0.05
Chi-square statistic to degree of freedom (CMIN/DF)	1.310	≤3
Goodness of fit index (GFI)	0.971	>0.9
Adjusted goodness of fit index (GFI)	0.939	>0.8
Non-normed Fit Index (NFI)	0.863	>0.8
Comparative fitness index (CFI)	0.961	>0.9
Root of mean square error approximation (RMSEA)	0.042	≤0.5

Table 5: Fitting model in path analysis to predict the obesity of (BMI) in students

Variable	Direct effect	Indirect effect	Total effect
Mother's working hours	-	0.020	0.020
Lonely time at home	-	0.063	0.063
The number of meals child eats at home alone	0.158	0.024	0.182
Fast food	0.116	-	0.116
TV	-	0.063	0.063
Computer	0.204	0.066	0.270
Physical activity	-0.428	-	-0.428

Discussion

Over the course of past decades, risk factors of obesity in children have been evaluated to find out the adverse and dangerous factors of obesity on health circumstances. Considering the different lifestyles as well as cultural differences in Iran and the lack of comprehensive and large sample sized study in Sari, this study intended to evaluate contributing risk factors for obesity and being overweight among primary school students in this city. Moreover, we studied the pattern of parent to child effects about obesity in the cases.

In this cross-sectional study, a total of 494 children were examined from 569 elementary school students. We identified that 14% of evaluated cases were obese. We detected that most of the evaluated indexes did not have significant difference between the obese and control groups. However, age, BMI, and initiation month of supplementary food were indexes that indicated significant difference. Obese cases and controls were 7.59±0.494 and 7.47±0.499 years old, respectively, which was statistically significant. Moreover, the BMI in obese and control cases demonstrated significant differences. The obese cases were observed to have started supplementary foods earlier than the control group.

Obesity and being overweight during childhood has been remarkably regarded as a major problem and has been assigned as top priority in the health system in developing and developed countries particularly in recent decades. Numerous studies have been conducted about it, resulting in designing and implementing hygiene programs based on national interventions. To date, obesity and being overweight have been conferred as a major issue in developing countries, eventuating in a bulk of published papers(28-30).

To date, similar investigations have been carried out in other Middle East countries. A study in Iraq has disclosed the prevalence of childhood overweight and obesity to be 1.3% and 22.4%, respectively (31). However, we found that the prevalence of overweight and obesity was approximately 15% in children from Sari, which was higher than that population in Iraq. On the other hand, our findings were almost similar to the findings of some other countries in the vicinity of our region, such as Turkey and the Emirates (32% and 13.7%, respectively) (22, 29). In contrast, the prevalence of obesity in children from industrial cities of China was 26%, was higher than what was found in this study (30). The prevalence of obesity in Rasht, a city near to Sari, was higher than our findings (2).

Considering the evidence mentioned above, the total prevalence of obesity in the student children population from Iran seems to be high, proposing the necessity for serious implementations to counter this problem in the viewpoint of the health system, and a broad range of studies, programs and conducting of effective interventions with respect to reducing the childhood obesity rate.

The results of our study demonstrated significant association of gender and obesity, which is not in accordance with the findings of some other studies(32, 33). However, there are observations about the predominance of childhood obesity in boys (30, 34), as well as in girls (35). These discrepancies could be justified through sampling approaches or cultural and economiccharacteristics of the studied population. Cultures may determine the quality and quantity of paying more attention to boys or girls by the parents, which may affect the fate of children's weight. Nonetheless, it appears that boys are at higher risk for obesity and being overweight generally, implying the spending of particular attention to boys in the childhood period and assign obesity controlling programs to prevent future problems.

Among the important lifestyle-related factors contributing to the prevalence of obesity in children seems to be feeding habits, which is based upon socio-economic and cultural characteristics of the different communities. This problem has been concentrated vastly in several investigations and has also eventuated in designing and developing some strategies and interventions. A significant correlation was indicated between eating fast food and increased prevalence of obesity and overweight in children from Rasht (36), and Yazd (Iran)(37). These studies highlighted the role of high calorie food as one of the most important contributing factors for childhood obesity. Furthermore, it was also found in some other studies that high- calorie foods, fast food, and reduced amounts of vegetable and fruit consumption are important elements of childhood obesity (35, 38, 39).

Path analysis demonstrated that parent's duration of work was effective in children's staying alone at home, and children who spend more hours per day alone spend more time watching TV and using computers. Therefore, these children have less activity and more BMI. Furthermore, children who spent more hours a day at home alone, ate more meals alone and ate more fast-foods and, hence, had higher BMI.

There are some limitations and caveats in this study that need to be addressed. Choosing samples from urban populations, investigation of feeding habits and physical activity based on self-designed questionnaires are among the most important limitations and caveats of our study.

Conclusion

Considering all the facts, this study indicated a high prevalence of obesity in children from Sari, that was significantly related to socio-economic factors such as job type, hours of watching TV per day, and hours using mobile and tablet per day. This study indicates that it is mandatory to pay serious attention to the issue of childhood obesity, conducting a more broad range of studies, investigation of underlying contributing factors, and developing favorable interventions.

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