

Assessment of Obesity, Unhealthy Food Habits, and Nutritional Knowledge of Primary School Children

Shiva Faghhih^{1,2}; Parisa Keshani^{1,*}; Azadeh Salar¹; Seiedeh Hamideh Rajaei¹; Zahra Mirzaei¹; Seyed Mohammad Moosavi¹; Zeynab Hematdar¹

¹Department of Community Nutrition, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, IR Iran

²Health Sciences Research Center, Shiraz University of Medical Sciences, Shiraz, IR Iran

*Corresponding author: Parisa Keshani, Department of Community Nutrition, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, IR Iran. Tel: +98-7137251001, Fax: +98-7137257288, E-mail: keshani_p@sums.ac.ir

Received: November 10, 2014; Accepted: February 20, 2015

Background: Obesity is one of the main risk factors of chronic diseases in adults. Children obesity is related to adulthood obesity. Some studies indicate that there is an association between unhealthy food habits and obesity.

Objectives: This study aimed to evaluate the association between obesity, unhealthy food habits, and nutritional knowledge of primary school children.

Patients and Methods: This cross-sectional survey was carried out to study obesity, unhealthy food habits, nutritional knowledge and measuring weight, height and waist circumference of 221 grade 4 students, selected by cluster sampling in primary schools of Shiraz, southern Iran. Also a questionnaire about their nutritional knowledge, socioeconomic status, and frequency of food consumption was filled out for each of them. The statistical analysis of data was performed using SPSS version 19.

Results: Mean \pm standard deviation of body mass index (BMI) and waist circumference (WC) were 18.50 ± 4.99 (kg/m²) and 63.17 ± 8.12 (cm), respectively. The prevalence of obesity, overweight, and central obesity were 14.97%, 15.45%, 38.3%, respectively. Intake of dairy (1.67 ± 1.12 serving/d) and fruits with vegetables (3.09 ± 1.93 serving/wk) were significantly less than the recommended amounts ($P < 0.001$). The respective frequency of fast food and sweets consumption were 2.37 ± 2.30 (serving/wk) and 18.54 ± 12.42 (serving/wk). Students with better nutritional knowledge had higher BMI and WC and showed no differences in food intakes but fast foods. Moreover, there were no significant differences in food habits among the normal, overweight, and obese students.

Conclusions: The results of our study indicated that high prevalence of obesity among children in fourth grade of primary schools in Shiraz was not the result of unhealthy food habits, but may be affected more by total energy intake or inactivity. Also, it seems that parents' concerns about the health status of their obese children have led to better nutritional knowledge of their youngsters.

Keywords: Children; Obesity; Food Habits; Knowledge

1. Background

The prevalence of childhood overweight and obesity during last decades have been a major concern of health professionals (1). Obese children are at increased risk of being obese in adulthood (2). Obesity is one of the main risk factors of chronic diseases mainly diabetes and cardiovascular disorders (3). Results of a systematic analysis on global prevalence of overweight and obesity in children and adults during 1980-2013, indicated that it has been risen substantially in developing countries, including Iran (4). Obesity is influenced by genetic and environmental factors mainly diet and lifestyle. Nutritional transition has led to higher consumption of animal fat, refined grains, and added sugar among low-income and middle-income countries (5). A number of studies have shown that overweight children consume more sweets and fast-foods, and eat less fruits, vegetables and dairy products compared to their counterparts with normal weight (6-8). Nutritional knowledge is one of the factors

influencing food preferences and dietary habits (9). Results of the previous studies on children indicated that food habits were correlated with nutritional knowledge (10, 11). Also it is shown that dietary habits are established in early ages and may last for the whole life (12). Childhood nutritional status could have lifetime health consequences, and appropriate policymaking is of paramount importance in preventing obesity and reducing unhealthy food habits among children.

2. Objectives

This study aimed to determine the relationships between obesity and food habits as well as nutritional knowledge of primary school children.

3. Patients and Methods

This cross-sectional study was carried out on 221 grade 4 students (109 girls and 112 boys) selected by cluster sam-

pling in 8 elementary schools in Shiraz, Iran. Sample size was calculated based on $\alpha = 0.5$, $\beta = 0.2$ and $r = 0.27$ (13) and then the result was doubled for design effect of cluster sampling. First of all, we randomly chose 2 out of 4 educational districts with 4 schools in each district (2 girl and 2 boy schools), and in each school the studied classes were selected randomly. After explaining the purpose of the study, written informed consent was obtained from all participants' mothers. Anthropometric indexes, including weight, height, and waist circumference (WC) were measured, and body mass index (BMI) was calculated as weight (kg)/height squared (m^2). Weight was measured to the nearest 100 g in light clothing by a digital scale (Glamor, China). Using a non-stretch measuring tape, WC was measured at the narrowest part of the body between the breast and heap to the nearest 0.1 cm. Height was measured barefooted to the nearest 0.1 cm using a non-stretch measuring tape. Overweight and obesity were defined as BMI > 85th and > 95th percentile with respect to age and sex of CDC (Centers for Disease Control and Prevention) curves, respectively (14). WC of more than 90th percentile for age and sex according to national references was considered as central obesity (15, 16). Nutritional knowledge was assessed using a questionnaire consisting of 14 questions. Content validity of the questionnaire was evaluated according to Lawshe (17) by 7 experts. Further analysis was done by converting the nutritional knowledge to an ordinal variable, ≥ 11 expressed as suitable, 6-10 medium, and ≤ 5 weak. Food intakes were evaluated by a 168-item semi-quantitative food frequency questionnaire (FFQ) (18). Socioeconomic status was evaluated by completing the questionnaire, including parent's education and job, household income, family size, etc. All data was gathered via face to face interview and were analyzed using SPSS version 19. We assessed normal distribution of variables using Kolmogorov-Smirnov test. Descriptive results were reported as mean \pm standard deviation, percent, or frequency. One-way ANOVA (Analysis of variance) test was used to assess the relationship among BMI, nutritional knowledge, and food habits. P values less than 0.05 were considered as significant.

4. Results

A total of 221 children, including 109 (49.3%) girls and 112 (50.7%) boys participated in this study. The demographic and socioeconomic statuses of the participants are shown in Table 1. According to Table 1, about half of the mothers and 60% of the fathers had university education, 67% of mothers were housewives, and the average numbers of participants' family size and birth order were 4.12 and 1.76, respectively. Mean \pm SD of BMI and WC were 18.01 ± 3.52 (kg/m^2) and 66.81 ± 9.47 (cm), respectively. Prevalence of obesity was 14.97%, overweight 15.45%, and central obesity 38.3%. Average score of students' nutritional knowledge was 9.27 out of 14 and only 28% of the students had suitable nutritional knowledge (Table 2).

Table 3 shows that the average intake of dairy, fruits plus vegetables, fast foods, sweets, and salty snacks were 2.26 ± 1.18 (serving/d), 3.16 ± 1.88 (serving/d), 1.54 ± 2.16 (serving/wk), 1.84 ± 1.62 (serving/d), and 0.36 ± 0.46 (serving/d), respectively. About half of the students consumed more than 2 serving/d dairy products and just 14.6% took more than 5 serving/d fruits with vegetables. The results of one-sample t test showed that intake of dairy products and fruits with vegetables were significantly less than the recommended serving ($P < 0.001$). According to Table 4, students with better nutritional knowledge had higher BMI and WC, without differences in food intakes but fast foods. Fast food intakes were significantly higher among the students with weak nutritional knowledge compared to those with medium or suitable nutritional knowledge ($P < 0.05$). As shown in Table 5, there were no significant differences in food habits among the normal, overweight, and obese students.

Table 1. Demographic and Socioeconomic Status of Participants

	No. (%)	Mean \pm SD	Range
Gender			
Female	109 (49.3)		
Male	112 (50.7)		
Mothers' education, y			
≤ 5	6 (3.2)		
6-8	23 (12.1)		
9-12	72 (37.9)		
≥ 13	89 (46.8)		
Fathers' education, y			
≤ 5	6 (3.3)		
6-8	13 (7.1)		
9-12	55 (29.9)		
≥ 13	110 (59.8)		
Mothers' job			
Housewife	137 (67.2)		
Worker	13 (6.4)		
Employee	47 (23)		
Self-employment	4 (2)		
Doctor/Engineer	3 (1.5)		
Fathers' job			
Worker	36 (17.6)		
Employee	93 (45.6)		
Self-employment	47 (23)		
Doctor/Engineer	19 (9.3)		
Retired	8 (3.9)		
Family size		4.12 \pm 0.95	2-10
≤ 3	41 (20.5)		
4-5	148 (74)		
≥ 6	11 (5.5)		
Birth order		1.76 \pm 0.96	1-7
1	95 (47.3)		
2-3	101 (50.2)		
≥ 4	5 (2.5)		

Table 2. Anthropometric Indices and Nutritional Knowledge of Children Under Study

	Mean ± SD	Range	Percent (95% CI)
Weight, kg	34.19 ± 8.54	20.6-65.3	
Height, cm	138.73 ± 6.11	122-155	
BMI, kg/m²	18.03 ± 3.52	11.52-33.68	
Normal			69.56 (63.49-75.63)
Overweight			15.45 (10.69-20.21)
Obese			14.97 (10.27-19.67)
Waist circumference, cm	66.81 ± 9.47	50-98.62	
Normal			61.7 (55.29-68.11)
Central Obesity			38.3 (31.89-44.71)
Nutritional knowledge	9.27 ± 2.04	2-14	
≤ 5			3.8
6-10			68.2
≥ 11			28

Table 3. Food Intakes of Children Under Study

Food Groups	Mean ± SD	Range	Percent
Dairy, serving/day	2.26 ± 1.18	0.14-7.21	
< 2			45.4
2-4			45.9
> 4			8.9
Fruits, serving/day	2.27 ± 1.54	0-8.1	
Vegetables, serving/day	0.89 ± 0.61	0-4.43	
Fruits plus vegetables, serving/day	3.15 ± 1.81	0.29-9.8	
< 5			85.4
5-10			14.1
> 10			0.5
Fast foods, serving/week	1.52 ± 2.07	0-8	
Sweets, serving/day	1.84 ± 1.62	0-10.21	
Salty snacks, serving/day	0.36 ± 0.46	0-3.62	

Table 4. Anthropometric Indices and Food Intakes of Students Under Study in Relation to Nutritional Knowledge ^a

	Weak Knowledge	Medium Knowledge	Suitable Knowledge	P Value
BMI, Kg/m²	16.45 ± 2.19 ^b	17.44 ± 3.16 ^c	19.45 ± 3.94 ^c	< 0.001
WC, cm	63.60 ± 5.61	65.05 ± 8.00 ^c	70.97 ± 11.55 ^c	< 0.001
Dairy, serving/d	1.78 ± 0.37	2.23 ± 1.20	2.32 ± 1.12	0.46
Fruits and Vegetables, serving/d	3.55 ± 2.42	3.01 ± 1.61	3.44 ± 2.19	0.28
Fast foods, serving/wk	3.56 ± 2.74 ^b	1.45 ± 2.02 ^b	1.39 ± 2.00 ^b	0.02
Sweets, serving/d	1.12 ± 0.60	1.93 ± 1.64	1.72 ± 1.73	0.33
Salty snacks, serving/d	0.52 ± 0.55	0.37 ± 0.41	0.33 ± 0.58	0.52

^a All values are expressed as mean ± SD.^b P < 0.05.^c P < 0.001.**Table 5.** Food Intakes of Students Under Study in Relation to BMI ^a

	Normal BMI	Overweight	Obese	P Value ^b
Dairy, serving/d	2.25 ± 1.19	2.38 ± 1.17	2.21 ± 1.15	0.85
Fruits and Vegetables, serving/d	3.19 ± 1.80	3.13 ± 1.42	3.05 ± 2.33	0.92
Fast foods, serving/wk	1.62 ± 2.21	1.07 ± 1.46	1.55 ± 1.90	0.43
Sweets, serving/d	1.81 ± 1.42	2.13 ± 1.87	1.77 ± 2.36	0.62
Salty snacks, serving/d	0.34 ± 0.47	0.49 ± 0.45	0.35 ± 0.46	0.28

^a All values are expressed as mean ± SD.^b One way ANOVA.

5. Discussion

Results of our study showed that about 30% of the children were overweight or obese, of whom half were obese. Besides, 38% of the children had central obesity. The results of other studies in Iran indicate the alarming prevalence of overweight and obesity (19-22). For instance, Behzadnia et al. in their 2009-2010 study reported that 27.4%

and 12% of primary school children in Sari (north of Iran) were overweight and obese, respectively (19). Also, Taheri et al. found that 9.6% of children aged from 6 to 11 years in Birjand were overweight, 9.2% had obesity and 15.7% had central obesity (20). Assessing eating habits, we found that about half of elementary school children in Shiraz

did not consume enough dairy, and in 85% of them, the intake of fruits plus vegetables was less than the recommended amount. Besides, unhealthy food habits such as consumption of fast-foods and sweets were common among them. Similar to our findings, Kelishadi et al. reported that average intake of dairy, fruits, and vegetables by the elementary school students in Iran, were 14.03, 8.22, and 7.13 serving/wk, respectively. They also found that the frequency of fast foods consumption was as high as 2 times per week and for sweets it was 10.38 (23). Also results of Esfarjani et al. study on 308 grade 1 primary school children in Tehran showed insufficient consumption of vegetables (123 ± 116 g/d), fruits (343 ± 316 g/d), and dairy products (383 ± 232 g/d). They also reported that intake of drinks and fast foods were 243 ± 178 g/d and 201 ± 113 g/d, respectively (24). According to our findings, 68% of the students had medium, 28% good and about 3% low nutritional knowledge. Choi et al. in Seoul reported that children's average score of nutritional knowledge was 6.8 out of 10 (11), which was consistent with our results. Also, Tallarini et al. found that most of the children and adolescents in Italy had poor nutritional knowledge (25). We found that overweight and obese students had better nutritional knowledge compared to their normal weight counterparts. But there was no relationship between nutritional knowledge and food habits but fast-food intake.

We assume that there is more concern on eating behaviors of obese children with respect to their higher nutritional knowledge. Results of other studies indicated that nutritional knowledge of adolescents did not accord with their BMI (26) or food habits (27). Our results also showed that BMI and WC were not associated with dietary habits. Besides the fact that energy intake and energy expenditure are the main determinants of body weight regulation, numerous studies found the influence of other factors on obesity, including socioeconomic status (19, 28, 29), parental obesity (30-32), breakfast skipping (33-35), and dietary patterns (36). Rodriguez et al. (37) investigated the extent to which dietary intake can explain the differences in weight status, and concluded that it was not easy to find a direct relationship between obesity and snack consumption, nor was it possible to approve the impact of fast food contribution to increasing obesity. Moreover, it was more appropriate to assess the relationship between dietary factors and obesity among the children by working on dietary patterns instead of food groups. Besides, similar studies reported that although under the pressure of parents obese children quit overeating, they may still eat more than normal weight children. Also they tend to underestimate their dietary intake consciously or unconsciously (38).

To the best of our knowledge, there is no study on nutritional knowledge, food choices, and anthropometry indexes combined, as assessed in this study. The most important limitation of our study was the small sample size, for which further studies with larger sample size are warranted. Besides, as our main focus was on the association

between obesity and food choices as well as nutritional knowledge, the total energy intake and physical activity were not assessed, which could have helped improve the study findings. In conclusion, results of our study indicated that high prevalence of obesity among primary school children in Shiraz was not the result of unhealthy food habits and may be affected more by total energy intake or inactivity. Also, it seems that parents' concerns about the health status of their obese children have led to better nutritional knowledge of their youngsters.

Acknowledgements

We would like to thank all participants in this study and the schools' authorities for their valued cooperation regarding collection of the data.

Authors' Contributions

Shiva Faghih: study design, data analysis, and writing the manuscript; Parisa Keshani: study design, data gathering, and revising the manuscript; All other authors helped with data gathering.

Funding/Support

This study was funded by Health Sciences Research Center.

References

- Motlagh ME, Kelishadi R, Ziaoddini H, Mirmoghtadaee P, Poursafa P, Ardalan G, et al. Secular trends in the national prevalence of overweight and obesity during 2007-2009 in 6-year-old Iranian children. *J Res Med Sci*. 2011;**16**(8):979-84.
- Mirmohammadi SJ, Hafezi R, Mehrparvar AH, Rezaeian B, Akbari H. Prevalence of Overweight and Obesity among Iranian School Children in Different Ethnicities. *Iran J Pediatr*. 2011;**21**(4):514-20.
- Kelishadi R, Haghdoost AA, Sadeghirad B, Khajehkazemi R. Trend in the prevalence of obesity and overweight among Iranian children and adolescents: a systematic review and meta-analysis. *Nutrition*. 2014;**30**(4):393-400.
- Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014;**384**(9945):766-81.
- Malik VS, Willett WC, Hu FB. Global obesity: trends, risk factors and policy implications. *Nat Rev Endocrinol*. 2013;**9**(1):13-27.
- Nasreddine L, Naja F, Akl C, Chamieh MC, Karam S, Sibai AM, et al. Dietary, lifestyle and socio-economic correlates of overweight, obesity and central adiposity in Lebanese children and adolescents. *Nutrients*. 2014;**6**(3):1038-62.
- Jodkowska M, Oblacinska A, Tabak I, Radiukiewicz K. Differences in dietary patterns between overweight and normal-weight adolescents. *Med Wieku Rozwoj*. 2011;**15**(3):266-73.
- Bradlee ML, Singer MR, Qureshi MM, Moore LL. Food group intake and central obesity among children and adolescents in the Third National Health and Nutrition Examination Survey (NHANES III). *Public Health Nutr*. 2010;**13**(6):797-805.
- Vereecken C, De Pauw A, Van Cauwenbergh S, Maes L. Development and test-retest reliability of a nutrition knowledge questionnaire for primary-school children. *Public Health Nutr*. 2012;**15**(9):1630-8.
- Grosso G, Mistretta A, Turconi G, Cena H, Roggi C, Galvano F. Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living

- in a rural area of Sicily, South Italy. *Public Health Nutr.* 2013; **16**(10):1827-36.
11. Choi ES, Shin NR, Jung EI, Park HR, Lee HM, Song KH. A study on nutrition knowledge and dietary behavior of elementary school children in Seoul. *Nutr Res Pract.* 2008; **2**(4):308-16.
 12. Fahlman MM, McCaughy N, Martin J, Shen B. Racial and socioeconomic disparities in nutrition behaviors: targeted interventions needed. *J Nutr Educ Behav.* 2010; **42**(1):10-6.
 13. Geoffrey RN. *Biostatistics: The Bare Essentials*. Missouri: Mosby; 1994.
 14. Mahan LK, Escott-Stump S, Raymond JL. *Krause's food & the nutrition care process*. 13th ed USA: Elsevier; 2012.
 15. Dhuper S, Cohen HW, Daniel J, Gumidyala P, Agarwalla V, St Victor R, et al. Utility of the modified ATP III defined metabolic syndrome and severe obesity as predictors of insulin resistance in overweight children and adolescents: a cross-sectional study. *Cardiovasc Diabetol.* 2007; **6**:4.
 16. 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.
 17. Lawshe CH. A quantitative approach to content validity. *Pers Psychol.* 1975; **28**(4):563-75.
 18. Mirmiran P, Esfahani FH, Mehrabi Y, Hedayati M, Azizi F. Reliability and relative validity of an FFQ for nutrients in the Tehran lipid and glucose study. *Public Health Nutr.* 2010; **13**(5):654-62.
 19. Behzadnia S, Vahidshahi K, Hamzeh Hosseini S, Anvari S, Ehteshami S. Obesity and related factors in 7-12 year-old elementary school students during 2009-2010 in Sari, Iran. *Med Glas (Zemica).* 2012; **9**(1):86-90.
 20. Taheri F, Kazemi T, Chahkandi T, Namakin K, Zardast M, Bijari B. Prevalence of Overweight, Obesity and Central Obesity among Elementary School Children in Birjand, East of Iran, 2012. *J Res Health Sci.* 2013; **13**(2):157-61.
 21. Tabesh H, Hosseini SM, Kompani F, Saki A, Firoozabadi MS, Chenary R, et al. Prevalence and trend of overweight and obesity among schoolchildren in Ahvaz, Southwest of Iran. *Glob J Health Sci.* 2014; **6**(2):35-41.
 22. Rahmanian M, Kelishadi R, Qorbani M, Motlagh ME, Shafiee G, Aminae T, et al. Dual burden of body weight among Iranian children and adolescents in 2003 and 2010: the CASPIAN-III study. *Arch Med Sci.* 2014; **10**(1):96-103.
 23. Kelishadi R, Ardalan G, Gheiratmand R, Sheikholeslam R, Majdzadeh SR, Delavari AR, et al. Do the dietary habits of our community warrant health of children and adolescents now and in future? CASPIAN Study. *Iran J Pediatr.* 2005; **15**(2):97-109.
 24. Esfarjani F, Roustae R, Mohammadi-Nasrabadi F, Esmailzadeh A. Major dietary patterns in relation to stunting among children in Tehran, Iran. *J Health Popul Nutr.* 2013; **31**(2):202-10.
 25. Tallarini A, Zabeo A, Ferraretto A. Nutritional knowledge in an Italian population of children, pre-adolescents and adolescents. *Public Health Nutr.* 2014; **17**(3):708-14.
 26. Kersting M, Sichert-Hellert W, Vereecken CA, Diehl J, Beghin L, De Henauw S, et al. Food and nutrient intake, nutritional knowledge and diet-related attitudes in European adolescents. *Int J Obes (Lond).* 2008; **32 Suppl 5**:S35-41.
 27. Mirmiran P, Azadbakht L, Azizi F. Dietary behaviour of Tehranian adolescents does not accord with their nutritional knowledge. *Public Health Nutr.* 2007; **10**(9):897-901.
 28. Bilic-Kirin V, Gmajnic R, Burazin J, Milicic V, Buljan V, Ivanko M. Association between socioeconomic status and obesity in children. *Coll Antropol.* 2014; **38**(2):553-8.
 29. 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.
 30. Cebeci AN, Guven A. Does maternal obesity have an influence on feeding behavior of obese children? *Minerva Pediatr.* 2014.
 31. Kolodziej K, Piaseczna-Piotrowska A, Strzelczyk J. [Environmental conditions and family prevalence of obesity in children]. *Pol Merkur Lekarski.* 2010; **28**(165):195-8.
 32. Yi X, Yin C, Chang M, Xiao Y. Prevalence and risk factors of obesity among school-aged children in Xi'an, China. *Eur J Pediatr.* 2012; **171**(2):389-94.
 33. Dundar C, Oz H. Obesity-related factors in Turkish school children. *ScientificWorldJournal.* 2012; **2012**:353485.
 34. Raiah M, Talhi R, Mesli MF. [Overweight and obesity in children aged 6-11 years: prevalence and associated factors in Oran]. *Sante Publique.* 2012; **24**(6):561-71.
 35. Thibault H, Carriere C, Langevin C, Kossi Deti E, Barberger-Gateau P, Maurice S. Prevalence and factors associated with overweight and obesity in French primary-school children. *Public Health Nutr.* 2013; **16**(2):193-201.
 36. Shang X, Li Y, Liu A, Zhang Q, Hu X, Du S, et al. Dietary pattern and its association with the prevalence of obesity and related cardiometabolic risk factors among Chinese children. *PLoS One.* 2012; **7**(8).
 37. Rodriguez-Ramirez S, Mundo-Rosas V, Garcia-Guerra A, Shamah-Levy T. Dietary patterns are associated with overweight and obesity in Mexican school-age children. *Arch Latinoam Nutr.* 2011; **61**(3):270-8.
 38. Bandini LG, Schoeller DA, Cyr HN, Dietz WH. Validity of reported energy intake in obese and nonobese adolescents. *Am J Clin Nutr.* 1990; **52**(3):421-5.