

*Short Communication***Prevalence of underweight, overweight and obesity in preschool children of Tehran, Iran**

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Abstract

BACKGROUND: It is reported that prevalence of overweight and obesity have increased in all age groups, but little is known about prevalence of overweight and obesity in preschool children. Therefore, the purpose of this study was to survey the prevalence of underweight, overweight and obesity in 3-6 year-old Tehranian children in 2009-2010.

METHODS: This cross-sectional study was performed on a total of 756 (378 boys and 378 girls) preschool children aged 3-6. Subjects were selected through stratified sampling from 5 geographic regions of Tehran (east, west, north, south, and center). Body weight and height were measured directly. Underweight, overweight and obesity was defined as Body Mass Index (BMI) \leq 5th percentile (underweight), 5th to 85th percentile (normal weight), 85th to 95th percentile (overweight), and $>$ 95th percentile (obesity); based on recommendation of Centers for Disease Control (CDC) in 2000.

RESULTS: Findings showed that the prevalence of underweight, overweight and obesity was 4.77%, 9.81% and 4.77% in boys and 4.77%, 10.31% and 4.49% in girls, respectively.

CONCLUSIONS: Our findings showed a relatively high prevalence of overweight and obesity in Tehranian preschool children that is a serious problem. This result can be used in clinical setting and preventive programs.

KEYWORDS: Prevalence, Preschool, Obesity, Overweight, Underweight.

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Childhood overweight and obesity is increased in last few decades in developed countries and, to some degree, in other parts of the world.^{1,4} In 1998, the World Health Organization (WHO, 1998) recognized obesity as a major public health epidemic in developed as well as some developing countries.¹ Children with high body mass index (BMI) often become obese adults, and obese adults are at risk for many chronic conditions such as hypertension, dyslipidemia, chronic inflammation, hyperinsulinemia, and orthopedic problems, as well as substantial psychosocial consequences.^{1,3-5} Obese children are stereotyped as unhealthy, academically unsuccessful, socially inept, and lazy.⁶ Low self esteem and behavioral problems were particularly commonly associated with obesity.⁵

Maffei et al.⁷ surveyed the prevalence of overweight and obesity in 2150 Italian children aged 2-6 years and compared their pattern in north and south of the country. They reported that prevalence of overweight was 16.6%, and it was higher in the south than in the north. They also report that prevalence of obesity was 8.0%, and it was higher in the south than in the north of the country. Kaur et al.³ studied the prevalence of overweight and obesity in 1745 Amritsarian preschool children aged 2 to 5 years. They reported that in Amritsarian the overall prevalence of overweight and obesity was 6.4% and 2.0% respectively. In addition, 6.85% boys and 5.97% girls were overweight; 2.06% boys and 1.95% girls were obese. They conclude overweight and obesity among preschool children of Amritsar were lower than

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the preschool children of developed countries.

Mozafari et al.⁸ reported that prevalence of overweight and obesity among Tehranian 6-12 years old school girls was 3.3% and 7.7% respectively. In addition, they found a positive relationship between anthropometric indices and age, type of school, place of living, kind of hobby and self-image. Khaji et al.⁹ showed that in 10-12 years old Tehranian school children prevalence of overweight and obesity was 10.7% and 6.3%, respectively.

However, most recent studies conducted in Tehran focused on adolescents and preadolescents and there was limited research on prevalence of overweight and obesity in preschool children. The early diagnosis and treatment of overweight seems to be crucial to be able to control the obesity epidemic. In addition, frequent monitoring of the prevalence of obesity gives health care personnel the chance to assess the trend of the epidemic, to allow making a comparison between different populations, and to identify categories (age and sex specific) of children at high risk. The aim of present study was to determine the prevalence of underweight, overweight and obesity among 3-6 years old preschool children and comparing the prevalence of underweight, overweight and obesity between boys and girls.

Since the last study in preschool children in Iran was done in 1995, and considering the remarkable changes in life style, eating behaviour and amount of physical activity during the last decade in this age group, it seems to be important to survey the prevalence of weight disorders in this population.

Methods

This sixteen month cross-sectional study was performed on Tehranian preschool children

aged 3-6 years (from May 2007 to September 2008). A total of 756 (378 boys and 378 girls) preschool children recruited in this study. Subjects were selected through stratified sampling from 5 geographic regions of Tehran (east, west, north, south and center). Body weight and height were measured by trained persons in the morning. Body weight (in kilograms) was measured to the nearest 0.1 kg with an electronic scale. Body height was measured to the nearest 0.5 cm using stadiometer with the child stood erect against a wall with barefoot; and heels, buttocks and head clung to the wall. The subjects were dressed with light clothes and wore no shoes throughout the measurements. BMI (kg/m^2) was calculated as the ratio of the body weight (in kg) to the square of height (in meter). The cut-off points were as follows: BMI \leq 5th percentile (underweight), BMI $>$ 5th to BMI \leq 85th percentile (normal weight), BMI $>$ 85th to BMI \leq 95th percentile (overweight), and BMI $>$ 95th percentile (obesity); based on definitions of Centers for Disease Control (CDC) in 2000.^{10, 11}

Data were analyzed by the SPSS software version 16 (IBM company, United States). Independent t-student test was used to compare underweight, overweight and obesity prevalence between boys and girls. Statistical significant was set at $\alpha < 0.05$.

Results

A total of 756 preschool children aged 3-6 years old (378 boys, 378 girls) participated in this study. Baseline characteristics of children are summarized in table 1. Comparison of baseline characteristics indicated that there are significant differences between all variables except for age ($P = 0.101$) in boys and girls. In table 2 results of baseline characteristics of

Table 1. Baseline characteristics of children.

Characteristics	Boys(n=378)	Girls(n=378)	All(756)	P
Age (year)	4.61(0.1.04)	4.48(1.03)	4.55(1.04)	0.101
Height (m)	1.09(8.52)	1.07(8.08)	1.08(8.34)	0.004*
Weight (Kg)	19.47(5.78)	18.26(4.29)	18.87(5.12)	0.001*
BMI (Kg/m^2)	15.92(3.22)	15.51(2.26)	15.72(2.79)	0.048*

Definitions: BMI; Body Mass Index, * significant level, $\alpha < 0.05$.

Table 2. Baceline characteristics of children in different age groups.

Characteristics	Boys (n = 378)				Girls (n = 378)			
Age(year)	3(n = 70)	4(n = 98)	5(n = 118)	6(n = 92)	3(n = 77)	4(n = 116)	5(n = 108)	6(n = 77)
Height(m)	99.38(6.24)	1.06(5.39)	1.11(5.50)	1.17(5.88)	98.07(4.56)	1.05(5.01)	1.12(5.26)	1.15(5.38)
Weight(kg)	15.14(2.73)	17.86(3.60)	20.56(6.52)	23.10(5.71)	14.72(2.07)	16.85(2.85)	20.56(4.55)	20.70(4.04)
BMI(kg/m ²)	15.35(2.56)	15.59(2.07)	16.11(4.30)	16.45(3.00)	15.28(1.68)	15.13(2.06)	16.19(2.60)	15.37(2.38)

children are summarized in different age groups. The total prevalence of underweight, overweight and obesity in boys and girls; in addition to different age groups are summarized in table 3. This table indicates the prevalence of underweight, overweight and obesity in boys was 4.77(n = 18), 9.81(n = 37) and 4.77(n = 18) respectively; and also was 4.76(n = 18), 10.31(n = 39) and 4.49(n = 17) in girls, respectively. The prevalence of obesity was highest at 6 years of age among boys (4.34%) and at 4 years among girls (5.55%).

Discussion

The purpose of this study was to provide data on the prevalence of underweight, overweight and obesity among Tehranian preschool children. To our knowledge, this is the first study surveyed the prevalence of underweight, overweight and obesity among this population in Tehran. The results of the present study demonstrated that prevalence of underweight,

overweight and obesity in boys were 4.77%, 9.81% and 4.77 %, and 4.76%, 10.31% and 4.49% in girls, respectively.

There are different methods for measuring overweight and obesity in population based studies in preschool children. Center for Disease Control and Prevention (2000, 2008)^{10, 11} uses the BMI cut-off points of $\leq 5^{\text{th}}$ percentile for underweight, 85^{th} - 95^{th} percentile for overweight and $> 95^{\text{th}}$ percentile for obesity. In a global study, De Onis¹² et al used values of >2 SDs and >3 SDs for defining overweight and obesity of preschool children. In addition, Joret et al.¹³ used BMI $\geq 90^{\text{th}}$ percentile (z score = 1.28) for indicating overweight and BMI $\geq 97^{\text{th}}$ percentile (z score = 1.90) for obesity in French preschool children.¹⁴ These differences between methods could affect the results. Studies that used 85^{th} - 95^{th} percentile BMI and $> 95^{\text{th}}$ percentile for figuring out the prevalence of overweight and obesity reported before in table 4.

With reviewing the prevalence of obesity

Table 3. Prevalence of underweight, normal weight, overweight and obesity in Tehranian children aged 3-6 years.

Groups	Underweight	Normal weight	Overweight	Obese*
Boys in age group				
3(n = 70)	4.28(3)	81.42(57)	10.00(7)	4.28(3)
4(n=98)	3.06(3)	82.65(81)	10.20(10)	4.08(4)
5(n = 117)	4.27(5)	81.19(95)	10.25(12)	4.27(5)
6(n = 92)	4.34(4)	81.52(75)	7.84(7)	6.52(6)
Total(377+1 miss)	4.77(18)	80.63 (304)	9.81(37)	4.77(18)
Girls in age group				
3(n = 77)	3.89 (3)	81.81(63)	10.38(8)	3.89 (3)
4(n = 116)	5.17 (6)	80.17(93)	10.34 (12)	4.31 (5)
5(n = 108)	5.55(6)	80.55(87)	9.259(10)	4.62(5)
6(n = 77)	3.89(3)	81.81(63)	10.38(8)	3.89(3)
Total(378)	4.76 (18)	80.42 (304)	10.31 (39)	4.49 (17)

Data are presented in %(n).

* The cut-off points were as follows: BMI $\leq 5^{\text{th}}$ percentile (underweight); BMI $> 5^{\text{th}}$ to $\leq 85^{\text{th}}$ percentile (normal weight); BMI $> 85^{\text{th}}$ to $\leq 95^{\text{th}}$ percentile (overweight); and BMI $> 95^{\text{th}}$ percentile (obesity).

Table 4. Comparison of the rate of overweight and obesity in present study with data reported in other literature.

Study	Population	n	age (yr)	sex	Date	Overweight	obesity
Present study	Iran-Tehran	756	3-6 yr	boy	2010	9.81%	4.77%
				girls	2010	10.31%	4.49%
Onis (2000)(17)	Iran	11 139	0-4.99		1995	3.3%	---
	Japan	7308	0-4.99		1978-81	1.6%	
	Africa	4471000	< 5 y	both	1995	3.9%	
	Asia	10 643000	< 5 y	both	1995	2.9%	
	Developing countries	17 56100	< 5 y	both	1995	3.3%	
	Latin America and Caribbean	2429000	< 5 y	both	1995	4.4%	
	United States	6413	0.17-4.99	both	1988-1994	4.5%	
	Global	-----	3-6 yr	both	1990	3.2%	5.2%
Onis(2010)(12)	Global	About 200 million		both	2010	5.6%	7.7%
	Global	-----		both	2020	7.3%	10.9%
	Africa	-----			2010	7.4%	9.5%
	Africa				2020	10.6%	14.8%
	Asia	-----			2010	4.9%	---
Béatrice(13)	France	1780	4 yr	boys	2007	7.0 %	---
				girls	2007	11.2%	----
MMWR *(15)	USA	about 1 million			1998	-----	12.4%
					2008	-----	14.5%
Reilly(16)	British	1031	24month	both	1999	15.8%	6.0%
	British	1013	49month		1999	20.3%	7.6%
	British	972	61month		1999	18.7%	7.2%

Abbreviations: n, Number of subjects. MMWR, Morbidity and Mortality Weekly Report.

and overweight in recent years, as cited in table 4, it could be concluded the prevalence of obesity and overweight is increasing in preschool children compared to previous 2 decades. This trend is the same as in other populations such as children, adolescence, and adults. As cited in table 4, in the report of national nutritional surveys¹⁷ in 1995, prevalence of overweight in Iranian preschool children was 3.3% more than Japanese and Asian populations and was the same as developing countries; moreover, it was lesser than Latin American and Caribbean children. But our finding shows that the prevalence of overweight and obesity now is more than 1995. The main reasons for these results may be nutritional habits, inactivity and life styles of families. In some papers multiple reasons have been reported for increasing obesity and overweight in preschool children in recent decades. However, in developing countries, the extent of this increase still

remains unknown.¹⁷

Jouret et al.¹³ reported that history of overweight or diabetes in family, overweight in the first 2 year of life, and watching television are associated with overweight at 4 years old children. They also concluded, there is a significant association between energy consumption and overweight in boys but not for girls.

One study found a relationship between inactivity and overweight in preschool-aged boys but not in girls.²¹ Other studies documented similar effects of watching television on being overweight among preschool-aged children. Therefore this may be concluded that one common reason of overweight and obesity in preschool children is inactivity and television viewing.²² Then, reducing excess television viewing among children has been proposed as a national health objective for 2010.^{18, 22, 23} Other recommendations could be enhancing regular physical activity in preschool age

children. These programs may help preventing the development of overweight and obesity and also, decrease risk of inactivity related chronic disease such as diabetes, cardiovascular disease and so on in future.

In a global population based study, 450 nationally representative cross-sectional surveys from 144 countries were analyzed for overweight and obesity of preschool children.¹² In this study which published in 2010, it is estimated that about 43 million children (35 million in developing countries) are overweight and obese; and 92 million are at risk of overweight. Results of this study indicated that worldwide prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7 % in 2010. In 2020, this trend is expected to reach 9.1% or 60 million. The estimated prevalence of childhood overweight and obesity in Africa in 2010 was 8.5% and is expected to reach 12.7 % (95% CI: 10.6%, 14.8%) in 2020. Therefore, as the findings of worldwide studies show, overweight and obesity has increased considerably since 1990. Moreover, as table 4 indicates the prevalence of overweight and obesity in present study are more than global reports and some other studies.

Some countries have been to some extent successful in preventive policy against prevalence of obesity and overweight. De Onis and Blossner¹⁷ surveyed the prevalence of obesity among low-income American, preschool-aged children and concluded that obesity increased steadily from 12.4% in 1998 to 14.5% in 2003, but subsequently remained essentially unchanged, with 14.6% prevalence in 2008. Some other studies surveyed the relationship between food intake such as juice and BMI and did not found any relationship between them.^{19, 21} However, Welsh et al.¹² concluded that reducing consumption of sweetened drink is one strategy to manage the weight of preschool children. A study of 16 preschool chil-

dren 4 to 6 years old with poor regulation of energy intake found that the most powerful determinant of the amount of food consumed at meals was the amount served.²⁵

Reducing childhood obesity will require an effective prevention strategy that focuses on environments and policies promoting physical activity and a healthy diet in families, child care centers, and communities. Some countries showed significant gender differences in overweight and obesity prevalence in children. But in this study there was not any difference between boys and girls.

The limitation of this study was the descriptive nature of the study. In our study, we could not show any association between obesity and its risk factors such as inactivity, unhealthy diet, parental obesity, and socioeconomic states of families. Also there is rare information to compare the result of present condition with the past one. We recommend other studies in this field especially on this certain group in Iran.

Conclusion

In comparison to the result of the last study in this age group (preschool children) which had done in Iran in 1995, our finding showed prevalence of underweight, overweight and obesity in Tehranian preschool children is increasing. Considering the relationship between childhood and adult obesity and deleterious consequences of overweight and obesity on health, it seems a serious problem and needs special attention. This result can be used in clinical setting and preventive programs.

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Conflict of Interests

Authors have no conflict of interests.

Authors' Contributions

AF participated in preparing the manuscript and was responsible for the data analysis, and interpretation of results. AG carried out the design and coordinated the study, participated in most of the experiments and had valuable suggestions for preparing the manuscript. MK participated in most of the experiments and was responsible for coordinating the data gathering process. AS helped in preparing the manuscript and reviewed the data analysis and interpretation of results. All authors have read and approved the content of the manuscript.

References

1. Padez C, Fernandes T, Mourao I, Moreira P, Rosado V. Prevalence of overweight and obesity in 7-9-year-old Portuguese children: trends in body mass index from 1970-2002. *Am J Hum Biol* 2004; 16(6): 670-8.
2. Zimmermann MB, Gubeli C, Puntener C, Molinari L. Overweight and obesity in 6-12 year old children in Switzerland. *Swiss Med Wkly* 2004; 134(35-36): 523-8.
3. Kaur N, Sidhu SK, Sidhu SH. Prevalence of overweight and obesity in preschool children of amritsar, Punjab. *Anthropologist* 2010; 12(3): 221-4.
4. Kazemi T, Taheri F. Prevalence of overweight and obesity in 7 to 18 year-old children in Birjand/Iran. *Iran J Pediatr* 2009; 19(2): 135-40.
5. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007-2008. *JAMA* 2010; 303(3): 242-9.
6. Hill AJ, Silver EK. Fat, friendless and unhealthy: 9-year old children's perception of body shape stereotypes. *Int J Obes Relat Metab Disord* 1995; 19(6): 423-30.
7. Maffei C, Consolaro A, Cavarzere P, Chini L, Banzato C, Grezzani A, et al. Prevalence of overweight and obesity in 2- to 6-year-old Italian children. *Obesity (Silver Spring)* 2006; 14(5): 765-9.
8. Mozafari H, Nabaei B. Assessment of underweight and overweight in elementary school-girls in Tehran. *Payesh Journal* 2001; 1(4): 15-9.
9. Khaji A, Khodaii SH, karbakhsh M, Faeghi A, Aziz S, Firoozian A, et al. Blood pressure and obesity in young adolescents in Tehran. *Iranian Journal of Pediatrics* 2006; 16(1): 45-50.
10. Centers for disease control and prevention. Washington, DC: Department of Health and Human Services; 2000.
11. Toshke AM, Kurth BM, von Kries R. The choice of cutoffs for obesity and the effect of those values on risk factor estimation. *Am J Clin Nutr* 2008; 87(2): 292-4.
12. de Onis M, Blossner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. *Am J Clin Nutr* 2010; 92(5): 1257-64.
13. Jouret B, Ahluwalia N, Cristini CH, Dupuy M, Nègre-Pages L, Grandjean H, et al. Factors associated with overweight in preschool-age children in southwestern France. *Am J Clin Nutr* 2007; 85(6): 1643-9.
14. Mamelie N, Munoz F, Grandjean H. Fetal growth from the AUDIPOG study. I. establishment of reference curves. *J Gynecol Obstet Biol Reprod (Paris)* 1996; 25(1): 61-70.
15. Sharma AJ, Grummer-Strawn LM, Dalenius K, Galuska D, Anandappa M, Borland E, et al. Obesity Prevalence Among Low-Income, Preschool-Aged Children - United States, 1998-2008. *MMWR* 2009; 58(28): 769-73.
16. Reilly JJ, Dorosty AR, Emmett PM. Prevalence of overweight and obesity in British children: cohort study. *BMJ* 1999; 319(7216): 1039.
17. de Onis M, Blossner M. Prevalence and trends of overweight among preschool children in developing countries. *Am J Clin Nutr* 2000; 72(4): 1032-9.
18. Spear BA, Barlow SE, Ervin C, Ludwig DS, Saelens BE, Schetzina KE, et al. Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics* 2007; 120 Suppl 4: S254-S288.
19. Riddick H, Kramer-LeBlanc C, Bowman SA, Davis C. Is fruit juice dangerous for children? U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. [online]. Mar 1997, Available from: <http://www.adaevidencelibrary.com/worksheet.cfm>
20. Alexy U, Sichert-Hellert W, Kersting M, Manz F, Schoch G. Fruit juice consumption and the prevalence of obesity and short stature in german preschool children: results of the DONALD Study. Dortmund Nutritional and Anthropometrical Longitudinally Designed. *J Pediatr Gastroenterol Nutr* 1999; 29(3): 343-9.
21. Trost SG, Sirard JR, Dowda M, Pfeiffer KA, Pate RR. Physical activity in overweight and nonoverweight preschool children. *Int J Obes Relat Metab Disord* 2003; 27(7): 834-9.
22. Burdette HL, Whitaker RC. A national study of neighborhood safety, outdoor play, television viewing, and obesity in preschool children. *Pediatrics* 2005; 116(3): 657-62.

23. Health and Human Services Dept. Healthy People 2010: Understanding and Improving Health. Washington, DC: Government Printing Office; 2000.
24. Welsh JA, Cogswell ME, Rogers S, Rockett H, Mei Z, Grummer-Strawn LM. Overweight among low-income preschool children associated with the consumption of sweet drinks: Missouri, 1999-2002. *Pediatrics* 2005; 115(2): e223-e229.
25. Mrdjenovic G, Levitsky DA. Children eat what they are served: the imprecise regulation of energy intake. *Appetite* 2005; 44(3): 273-82.