

Ethnic Differences in Body Mass Index, Weight and Height Among School Children in the North of Iran

İran'ın Kuzeyinde Okul Çağındaki Çocuklar Arasında Vücut Kütle Endeksi, Ağırlık ve Boy Açısından Etnik Farklılıklar

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Abstract

Objective: Overweight and obesity are common health problems among adolescents. This study was set up to evaluate these problems and certain socio-demographic-related factors among three ethnic groups as represented by primary school children in northern Iran in 2010.

Materials and Methods: This was a descriptive and cross-sectional study performed on 7433 students (Fars-native=3268, Turkman=2852, Sisstani=1313) from 112 schools in urban and rural areas. The schools and students were chosen by cluster and stratified sampling. The data were collected by interviewers for all samples throughout the study. Overweight and obesity were identified on the basis of the BMI cut-off Centers for Disease Control and Prevention (CDC) values (in excess of the 85th and 95th percentiles, respectively). SPSS 16.0 software for Windows was used for the analysis.

Results: Linear regression analyses revealed that weight, height and BMI increased by 2.70 kg, 4.62 cm and 0.42 kgm⁻², respectively, in boys (p=0.001) and 3.12 kg, 5.19 cm and 0.52 kgm⁻², respectively, in girls (p=0.001) for each year increase in age. In total, overweight was identified in 8.4% of those studied, while obesity was common in 14.1% of students. The rates of overweight and obesity were significantly different among all three ethnic groups (p=0.001). These rates were higher among the Fars-native individuals and lower among the Sisstani individuals as compared with the other groups. Logistic regression analyses showed that the risk of overweight and obesity was 2.104 (1.769-2.502, CI: 95%) fold greater in the Fars-native as compared with the Sisstani ethnic group and 2.297 (1.911-2.761, CI 95) fold greater in the good economic group as compared with the poor economic group.

Conclusion: One out of seven primary school children in northern Iran suffers from obesity and overweight, although the rates differed among the three ethnic groups examined. This study emphasizes the importance of public health training about obesity for children, especially those living in urban areas and those from high-income families.

Key Words: Ethnicity, Iran, Obesity, Overweight, School children

Özet

Amaç: Fazla kilolu ve obez ergenlerde daha sık sağlık sorunları görülmektedir. Bu çalışma, 2010 yılında kuzey İran'da ilkököl çocuklarından örneklenen üç etnik grup arasında bu sorunlar ve bazı sosyo-demografik faktörleri değerlendirmek için gerçekleştirilmiştir.

Gereç ve Yöntem: Bu çalışma, kentsel ve kırsal alanlarda 112 okulda (Fars-yerli=3268, Türkmen=2852, Sisstani=1313) toplam 7433 öğrenci üzerinde yapılan tanımlayıcı ve kesitsel bir çalışmadır. Okullar ve öğrenciler küme ve tabakalı örnekleme yöntemi ile seçilmiştir. Veriler çalışma boyunca anketörler aracılığı ile toplanmıştır. Fazla kiloluluk ve şişmanlık BMI kesme CDC değerleri (sırasıyla 85 ve 95 persentilleri aşan) kriteri ile saptanmıştır. İstatistik analizi için SPSS 16.0 yazılımı kullanılmıştır.

Bulgular: Lineer regresyon analizi kilo, boy ve BMI; kızlarda, erkeklerden (p=0.001) sırasıyla, 3.12 kg, 5.19 cm ve 0.52 kgm⁻² ve 2.70 kg, 4.62 cm ve 0.42 kgm⁻² her yıl daha fazla artış göstermiştir. Obezite öğrencilerde %14.1 yaygın iken toplam, şişmanlık çalışılanlarda %8.4 olarak tespit edilmiştir. Aşırı kilo ve obezite oranları her üç etnik grup (p=0.001) arasında anlamlı derecede farklı bulunmuştur. Bu oranlar Fars-yerli bireyler arasında daha yüksek ve diğer gruplar ile karşılaştırıldığında Sisstani bireyler arasında daha düşük bulunmuştur. Lojistik regresyon analizinde obezite riskini daha iyi ekonomik durumdaki Fars-yerli (1.769-2.502, CI: %95) 2.104 kat olduğu durum ile karşılaştırıldığında Sisstani etnik grubu için 2.297 (1.911-2.761, CI: %95) kat daha fazla olduğu gösterilmiştir.

Sonuç: Oranları incelendiğinde üç etnik grup arasında farklılık olmasına rağmen kuzey İran'da yedi ilköğretim okulu çocuğundan biri, obezite ve aşırı kiloluktan muzdariptir. Bu çalışma, kentsel alanlarda yaşayanlar ve yüksek gelirli ailelerden gelenler, özellikle çocuklar için obezite ile ilgili halk sağlığı eğitiminin önemini vurgulamaktadır.

Anahtar Kelimeler: Etnisite, İran, Obezite, Okul çocukları, Şişmanlık

Received: October 18, 2011 / **Accepted:** January 20, 2012

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doi:10.5152/eajm.2012.05

Introduction

Obesity and overweight are well known health problems that affect adults in Iran [1, 2] and other developing countries [3], but data on this problem and its social variation among children are still scarce. Adolescence seems to be one of the critical periods for the development of obesity. Development during this period is related to health status in adulthood [4].

A recent study [5] showed that overweight and obesity have been increasing in frequency among Iranian adolescents. One outcome of this trend is an alarming increase in the prevalence of metabolic syndrome among the Iranian population [2].

A strong relationship between socio-demographic factors and obesity has been shown in some studies [6, 7], but our findings in northern Iran did not support such a relationship. Data on childhood overweight and obesity and the possible role of social inequality may help to establish a program to prevent chronic disease in adulthood.

Ethnic obesity differences have been investigated in the United States [8, 9]. A study [10] in Sri Lankan and Australian children reported that genetic factors affect secular growth. Rush et al. [11] recommended using FFM (Free Fat Mass) instead of BMI (Body Mass Index) while Fredriks et al. [12] believed that separate growth charts should be used for Moroccan and Turkish children living in the Netherlands.

Among the 1,600,000 individuals in the Golestan province (north of Iran), 43.9% and 56.1% are living in urban and rural areas, respectively. Agriculture is the most common job among individuals living in rural areas, such as the Fars-native, Turkman and Sisstani [13].

This research was conducted to compare the BMI distribution among three ethnic groups (Fars-native, Turkman and Sisstani) as represented by primary school children in northern Iran. We attempted to analyze socio-demographic factors, such as economic status, location and the influence of gender, on weight gain in those children.

Materials and Methods

This was a descriptive and cross-sectional study carried out on 7433 primary school children (Fars-native=3268, Turkman=2852, Sisstani=1313) from 112 schools in cities and villages in the north of Iran. The schools and students were chosen by cluster and random sampling, respectively. The estimated sample size at the national level was based on the stratification of respondents by urban/rural, gender and ethnicity after they were recruited from 14 district areas. The calculated sample sizes dictated that at least 2401 respondents were needed for a 95% confidence level. With regard to cluster-sampling methods, the sample size enlarged to three

times the baseline sample size. For each child, a questionnaire containing questions on the relevant social-economic conditions (e.g., ethnicity, gender, location and economic status) was completed.

Descriptive statistics on weight, height and BMI measurements were recorded. The estimations of the prevalence of overweight and obesity were based on the cut-off CDC values (in excess of the 85th and 95th percentiles, respectively) [14].

Economic status: The economic ranking of the families in this study was assessed on the basis of 12 items and principles. On the basis of those 12 items, the socio-economic status of the child's family was classified as 1) good, 2) intermediate or 3) poor.

The ethnic groups in this study were divided to four groups: 1) Fars-native: This ethnic group is the natural inhabitant of this province. 2) Turkman: Inter-marriage between this ethnic group and other ethnic groups was rare; therefore, this ethnic group can be recognized as a pure race. 3) Sisstani: These individuals immigrated from Sisstani and Bluchestan provinces (the east of Iran) many years ago.

For the anthropometric measurements, the children were in light dress and without shoes. All measurements were performed in the morning. Body-weight was measured to the nearest 0.1 kg using a balanced-beam scale, and height was measured to the nearest 0.5 cm with the subject standing up and the head, back, and buttocks on the vertical area of the height-gauge.

SPSS 16.0 software was used for data analysis. The Chi-2 test and multinomial logistic regression were used for analysis. P-values under 0.05 were considered to indicate statistical significance. Unwilling subjects were excluded from the study.

Results

Linear regression analysis revealed that weight, height and BMI increased by 2.70 kg, 4.62 cm and 0.42 kgm⁻², respectively, for each year increase in age in boys (p=0.001) and by 3.12 kg, 5.19 cm and 0.52 kgm⁻², respectively, in girls (p=0.001) (Table 1).

The overall prevalence of overweight and obesity was 8.4% and 14.1%, respectively. These ratios in males were 8.6% and 15.3%; in females, these ratios were 8.1% and 12.6%. The prevalence of obesity differed significantly among the three ethnic groups (p=0.001), with a higher prevalence among the Fars-native and a reduced prevalence among the Sisstani. When comparing males and females, the prevalence of obesity among the Fars-native ethnic group was 1.5% (p=0.263); in the Turkman ethnic group, this value was 5% (p=0.003); in the Sisstani ethnic group, this value was 1.4% (p=0.319) (Table 2).

Table 1. Mean and standard deviation of BMI among primary school children in northern Iran based on ethnicity

| Sisstani (1313) | | | | Turkman (2852) | | | | Fars-Native (3268) | | | | Age (Year) | | | |
|-----------------|--------------|--------------|------------|----------------|-----|---------------|--------------|--------------------|--------------|-----|---------------|--------------|-------------|--------------|-----------|
| N | Female (573) | | Male (740) | | N | Female (1429) | | Male (1423) | | N | Female (1479) | | Male (1789) | | |
| | N | Mean (SD) | N | Mean (SD) | | N | Mean (SD) | N | Mean (SD) | | N | | Mean (SD) | N | Mean (SD) |
| 156 | 57 | 14.59 (1.71) | 99 | 15.20 (2.23) | 348 | 160 | 15.14 (2.78) | 188 | 15.12 (2.07) | 377 | 167 | 15.38 (2.58) | 210 | 15.67 (2.45) | 6 |
| 219 | 87 | 15.47 (2.25) | 132 | 15.42 (1.93) | 568 | 273 | 14.98 (2.05) | 295 | 15.42 (1.73) | 535 | 254 | 15.34 (2.13) | 281 | 15.92 (2.27) | 7 |
| 252 | 101 | 15.68 (3.01) | 151 | 15.54 (1.97) | 532 | 261 | 16.04 (2.61) | 271 | 16.66 (2.75) | 605 | 290 | 16.42 (2.97) | 315 | 16.10 (2.46) | 8 |
| 256 | 130 | 15.61 (2.15) | 126 | 15.88 (2.05) | 591 | 311 | 16.38 (2.79) | 280 | 16.69 (2.33) | 679 | 299 | 17.06 (3.36) | 380 | 16.68 (2.96) | 9 |
| 279 | 133 | 16.38 (2.74) | 146 | 16.00 (2.46) | 561 | 301 | 17.22 (2.88) | 260 | 17.26 (2.43) | 690 | 272 | 17.62 (3.57) | 418 | 17.31 (3.19) | 10 |
| 151 | 65 | 16.84 (2.35) | 86 | 16.55 (2.22) | 252 | 123 | 17.48 (3.11) | 129 | 17.09 (2.46) | 382 | 197 | 17.38 (3.43) | 185 | 17.99 (4.90) | 11 |

Table 2. The distribution of BMI among primary school children in northern Iran based on ethnicity

| Gender | Ethnicity | CDC BMI Distribution | | | | Total |
|--------|-------------|----------------------|-------------|------------|------------|-------|
| | | <5% | 5-85% | 85-95% | >=95% | |
| Male | Fars-native | 405 (22.6) | 918 (51.3) | 153 (8.6) | 313 (17.5) | 1789 |
| | Turkman | 326 (22.9) | 718 (50.5) | 143 (10.0) | 236 (16.6) | 1423 |
| | Sisstani | 235 (31.8) | 403 (54.5) | 45 (6.0) | 57 (7.7) | 740 |
| | Total | 966 (24.5) | 2039 (51.6) | 341 (8.6) | 606 (15.3) | 3952 |
| Female | Fars-native | 337 (22.8) | 786 (53.1) | 119 (8.1) | 237 (16.0) | 1479 |
| | Turkman | 372 (26.0) | 776 (54.3) | 115 (8.1) | 166 (11.6) | 1429 |
| | Sisstani | 169 (29.5) | 322 (56.2) | 46 (8.0) | 36 (6.3) | 573 |
| | Total | 878 (25.2) | 1884 (54.1) | 280 (8.1) | 439 (12.6) | 3481 |

The results of logistic regression analyses showed that the risk of overweight or obesity was 2.104 (1.769-2.502 CI 95%)-fold higher in the Fars-native as compared with the Sisstanish ethnic group, 1.893 (1.581-2.260 CI 95%)-fold higher in the Turkman as compared with the Sisstanish ethnic group, 1.203 (1.078-1.341, CI 95%)-fold higher in males compared with females, 1.382 (1.240-1.541, CI 95%)-fold higher in urban compared with rural areas, and 2.297 (1.911-2.761, CI 95)-fold higher in those from families of good socio-economic status as compared with those from families classified as of poor socio-economic status (Table 3).

The results of logistic regression analysis adjusted for economic status showed that the risk of overweight and obesity was 1.817 (1.520-2.173 CI 95%)-fold higher in the Fars-native as compared with the Sisstanish ethnic group, 1.745 (1.458-2.088 CI 95%)-fold higher in the Turkman as compared with the Sisstanish ethnic group, 1.209 (1.083-1.351, CI 95%)-fold higher in males compared with females and 1.804 (1.961-1.222, CI 95%)-fold higher in urban as compared with rural areas (Table 4).

In boys, the BMI distribution was consistent with the CDC value reported for the Turkman ethnic group, but it was

higher in the Fars-native group and lower in the Sisstanish ethnic group. In girls, the BMI distribution was higher than the reported CDC value in the Fars-native and Turkman ethnic groups among girls older than 8 years old. This value was lower in the Sisstanish ethnic group (Figure 1, 2).

Discussion

Our results clearly indicate that the prevalence of overweight and obesity was high among primary school children in northern Iran.

The prevalence of adolescent overweight and obesity increased during the last decade in Iran [15]. Recent evidence suggests that Iran is in the nutrition transition phase and that the outcome of this trend will be a rapid increase in obesity and chronic disease [16]. Obesity is currently a well known health problem in northern Iran [17].

The few studies evaluating obesity in adolescents have demonstrated a considerably high prevalence in developing countries. A study among 21,111 school children aged 6-18 years in Iran found the prevalence of overweight and obesity to be 8.8% and 4.5%, respectively, according to the CDC cut-

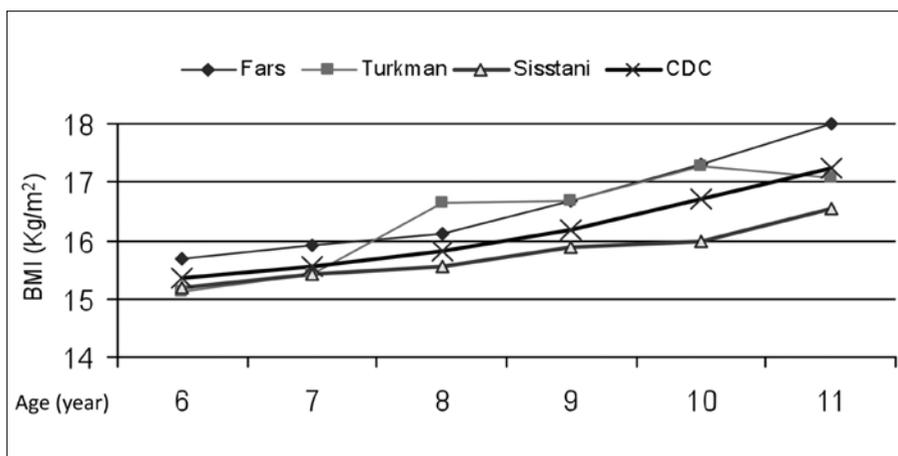


Figure 1. The comparison of boys' BMI distribution between three ethnic groups and CDC value.

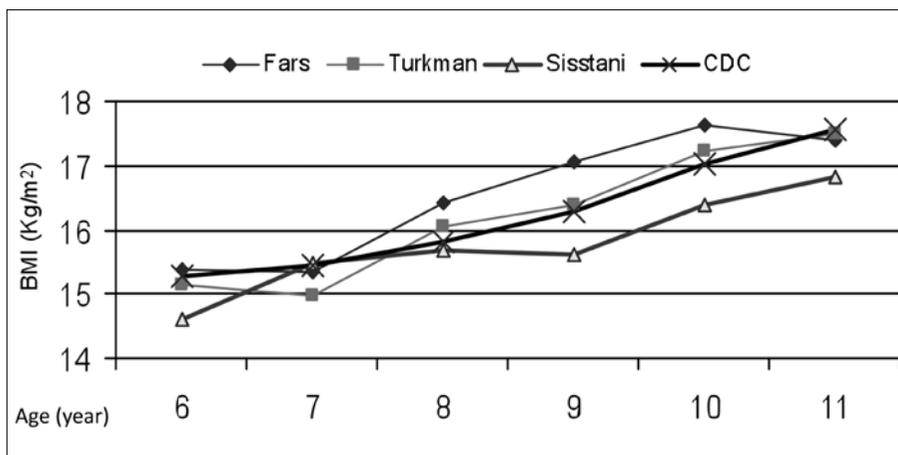


Figure 2. The comparison of girls' BMI distribution between three ethnic groups and CDC value.

offs [18]. In another study [19] on 3- to 18-year-old children in Tehran, the prevalence of obesity was 5.2%. One study performed to evaluate risk factors for atherosclerosis among 2- to 18-year-old children in Isfahan (a capital city in Iran), according to the National Center for Health Statistics (NCHS) criteria, found that 8% of children were overweight [20]. The prevalence of obesity in Kuwait is the highest among all the countries of the Arab Peninsula [21]: obesity (13.1% of girls and 14.7% of boys) and overweight (31.8% of girls and 30% of boys) were extremely common among 10- to 14-year-old adolescents when the CDC reference guidelines were applied [22]. In a study with 898 adolescent girls in the United Arab Emirates, according to the CDC criteria, 14% of subjects were overweight and 9% were obese [23]. In Bahraini school children, according to the IOTF criteria, the overall prevalence of obesity was 15% and 18% in boys and girls, respectively [24]. Among Saudi Arabian male school children aged 6-18 years, 15.8% were obese according to the CDC criteria [25].

Compared with these studies, the prevalence of obesity in our study was higher than in other regions of Iran and other countries in the same region.

In the present study, the mean BMI and prevalence of obesity differed among three ethnic groups: the Fars-native, Turkman and Sisstani. The prevalence of overweight was higher among Mexican-American school children than among other ethnic groups in San Antonio, Texas [26]. Children living in the U.S., especially African-American and Hispanic children, are becoming heavier than other children [27]. Childhood overweight rapidly increased in the United States from 1986 to 1998, especially among African-American and Hispanic populations [28].

The role of economic status or ethnicity in growth differences in northern Iran has not been clarified. Previous studies [29, 30] reported growth differences among ethnic groups living in the north of Iran. In our study, as a result of logistic regression analyses, the association between obesity

Table 3. Odds ratios obtained from logistic regression for overweight and obesity among primary school children in northern Iran. Confidence Interval (CI)

| Risk factor | Variable | OR (95% CI) | P value |
|-----------------|----------------|---------------------|---------|
| Ethnicity | Sisstani (Ref) | (1) | |
| | Fars-native | 2.104 (1.769-2.502) | 0.001 |
| | Turkman | 1.893 (1.586-2.260) | 0.001 |
| Gender | Female (Ref) | (1) | |
| | Male | 1.203 (1.078-1.341) | 0.001 |
| Location area | Rural (Ref) | (1) | |
| | Urban | 1.382 (1.240-1.541) | 0.001 |
| Economic Status | Poor (Ref) | (1) | |
| | Intermediate | 1.686 (1.489-1.909) | 0.001 |
| | Good | 2.297 (1.911-2.761) | 0.001 |

Table 4. Odds ratios obtained from logistic regression with adjustment for economic status for overweight and obesity among primary school children in northern Iran. Confidence Interval (CI)

| Risk factor | Variable | OR (95% CI) | P value |
|---------------|----------------|---------------------|---------|
| Ethnicity | Sisstani (Ref) | (1) | |
| | Fars-native | 1.817 (1.520-2.173) | 0.001 |
| | Turkman | 1.745 (1.458-2.088) | 0.001 |
| Gender | Female (Ref) | (1) | |
| | Male | 1.209 (1.083-1.351) | 0.001 |
| Location area | Rural (Ref) | (1) | |
| | Urban | 1.084 (0.961-1.222) | 0.189 |

and ethnicity remained unchanged, despite adjustment for economic status. Therefore, obesity differences among these three ethnic groups may be related to socio-economic status. The Wang study in the United States [31] showed that income disparities are not likely to effectively reduce racial disparities in obesity. Gordon-Larsen [32] believes that efforts to reduce overweight disparities between ethnic groups must look beyond income and education and focus on other factors, such as environment, conception, biology and socio-culture.

In the present study, superior economic status was a strong risk factor for obesity, which may have been more powerful in the urban population as compared with the rural population. Our results are consistent with some previous studies in Iran [30] and other countries [6, 7]. The prevalence of adolescence obesity increased more in the low socio-economic status group than in the other groups over a 7-year study period [33].

Indeed, we found that boys are more at risk for obesity than girls. Studies in Tehran showed that overweight is more

prevalent in girls than boys [19]. A similar gender disparity in the prevalence of obesity and metabolic syndrome was also found among Iranian adults [34]. We cannot explain why obesity is more prevalent in boys than girls, but social factors, ethnicity and food behavior may play a role. A previous study performed from 1997 to 2007 [35] showed that physical growth in both genders is not similar; hence weight increased in boys but remained unchanged in girls. Another study [29] reported that growth patterns differed among ethnic groups in this area.

In conclusion these data highlight obesity as a health problem among primary school children in northern Iran. Obesity is more common in boys than girls and in Fars-native individuals as compared with those of other ethnic groups. Social differences are associated with differences in the prevalence of obesity among these residents. The present findings emphasize the importance of providing health education to children, especially those in urban areas and from high-income families living in the north of Iran. However, more detailed studies are needed to clarify why male school children are more prone to overweight and obesity.

Acknowledgments

The authors would like to thank the medical and administrative staff in the Primary Health Care Centers of Golestan University of Medical Sciences for their valuable assistance with the field work. We also thank the Research Deputy of the University for supporting this project financially.

Conflict of interest statement: The authors declare that they have no conflict of interest to the publication of this article.

References

1. Veghari G, Mansurian AR. Obesity Among Mothers In Rural Golestan-Iran (south - east of Caspian sea). *Iranian Journal of Public Health* 2007; 36: 71-6.
2. Azizi, F, Rahmani, M, Emami, et al. Cardiovascular risk factors in an Iranian urban population: Tehran lipid and glucose study (phase 1). *Sozial- und Praventivmedizin* 2002; 47: 408-26. [\[CrossRef\]](#)
3. Popkin, BM. The nutrition transition and obesity in the developing world. *Journal of Nutrition* 2001; 131: 871S-3S.
4. Mijailovic, V, Micic, D, Mijailovi, M. Effect of childhood and adolescent obesity on morbidity in adult life. *Journal of Pediatric Endocrinology & Metabolism* 2001; 14: 1339-44.
5. Ayatollahi, SMT. Size and obesity pattern of South Iranian adolescent females. *Annals of Human Biology* 2003; 30: 191-202. [\[CrossRef\]](#)
6. Sibai AM, Hwalla N, Adra N, et al. Prevalence of and covariates of obesity in Labanon: finding from the first epidemiological study. *Obes Res* 2003; 11: 1353-61. [\[CrossRef\]](#)
7. Musaiger AO. Overweight and obesity in the Eastern Mediterranean Region: can we control it? *East Mediterr Health J* 2004; 10: 789-93.

8. Freedman DS, Khan LK, Serdula MK, et al. Racial and ethnic differences in secular trends for childhood BMI, weight, and height. *Obesity* (Silver Spring) 2006; 14: 301-8. [\[CrossRef\]](#)
9. Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA* 2006; 295: 1549-55. [\[CrossRef\]](#)
10. Wickramasinghe VP, Cleghorn GJ, Edmiston KA, et al. Impact of ethnicity upon body composition assessment in Sri Lankan Australian children. *J Paediatr Child Health* 2005; 41: 101-6. [\[CrossRef\]](#)
11. Rush EC, Puniani K, Valencia ME, et al. Estimation of body fatness from body mass index and bioelectrical impedance: comparison of New Zealand European, Maori and Pacific Island children. *Eur J Clin Nutr* 2003; 57: 1394-401. [\[CrossRef\]](#)
12. Fredriks AM, van Buuren S, Jeurissen SE, et al. Height, weight, body mass index and pubertal development references for children of Moroccan origin in The Netherlands. *Acta Paediatr* 2004; 93: 817-24. [\[CrossRef\]](#)
13. Statistical Center of Iran .Population and Housing Census. Available from URL: [<http://www.amar.org.ir/default.aspx?tabid=52>].
14. Kuczmarski, RJ, Ogden CL, Grummer-Strawn LM. CDC growth charts: United States. *Advance Data* 2000; 314: 1-27.
15. Hosseini, M, Carpenter, RG, Mohammad, K, Jones, ME. Standardized percentile curve of body mass index of Iranian children compared to the US reference. *International Journal of Obesity and Related Metabolic Disorders* 1999; 23: 783-6. [\[CrossRef\]](#)
16. Ghassemi, H, Harrison, G, Mohammad, K. An accelerated nutrition transition in Iran. *Public Health Nutrition* 2002; 5: 149-55. [\[CrossRef\]](#)
17. Veghari G, Sedaghat M, Joshaghani H, et al. Obesity in the north of Iran (South-East of the Caspian Sea) *Bangladesh Med Res Counc Bull* 2010; 36: 100-3.
18. Kelishadi R, Ardalan G, Gheiratmand R, et al. Thinness, overweight and obesity in a national sample of Iranian children and adolescents: CASPIAN Study. *Child Care Health Dev* 2008; 34: 44-54.
19. Mohammadpour-Ahranjani, B, Rashidi A, Karandish M, et al. Prevalence of overweight and obesity in adolescent Tehrani students, 2000-2002: an epidemic health problem. *Public Health Nutrition* 2004; 7: 645-8. [\[CrossRef\]](#)
20. Kelishadi R, Hashemipour M, Sarraf-Zadegan N, et al. Trend of atherosclerosis risk factors in children of Isfahan. *Asian Cardiovascular Thorac Annals* 2001; 9: 36-40.
21. Moussa MA, Shaltout AA, Nkansa-Dwamena D, et al. Factors associated with obesity in Kuwaiti children. *European Journal of epidemiology* 1999; 15: 41-9. [\[CrossRef\]](#)
22. Al-Isa, A. N. Body mass index, overweight and obesity among Kuwaiti intermediate school adolescents aged 10-14 years. *European Journal of Clinical Nutrition* 2004; 58: 1273-7. [\[CrossRef\]](#)
23. Al-Hourani HM, Henry CJ, Lightowler HJ. Prevalence of overweight among adolescent females in the United Arab Emirate. *American Journal of Human Biology: The Official Journal of the Human Biology Council* 2003; 15: 758-64. <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2214.2007.00744.x/full-b31#b31> [\[CrossRef\]](#)
24. Al-Sendi AM, Shetty P, Musaiger AO. Prevalence of overweight and obesity among Bahraini adolescents: a comparison between three different sets of criteria. *European Journal of Clinical Nutrition* 2003; 57: 471-4. [\[CrossRef\]](#)
25. Al-Nuaim AR, Bamgboye EA, Al-Herbish A. The pattern of growth and obesity in Saudi Arabian male school children. *International Journal of Obesity and Related Metabolic Disorders: Journal of the International Association for the Study of Obesity* 1996; 20: 1000-1005.
26. Park MK, Menard SW, Schoolfield J. Prevalence of overweight in a triethnic pediatric population of San Antonio, Texas. *Int J Obes Relat Metab Disord* 2001; 25: 409-16. [\[CrossRef\]](#)
27. Dwyer JT, Stone EJ, Yang M, et al. Prevalence of marked overweight and obesity in a multiethnic pediatric population: findings from the Child and Adolescent Trial for Cardiovascular Health (CATCH) study. *J Am Diet Assoc* 2000; 100: 1149-56. [\[CrossRef\]](#)
28. Strauss RS, Pollack HA. Epidemic increase in childhood overweight, 1986-1998. *JAMA* 2001; 286: 2845-8. [\[CrossRef\]](#)
29. Veghari G, Golalipour MJ. The Comparison of Nutritional Status Between Turkman and Non-Tutkman Ethnic Groups in North of IRAN. *Journal of Applied Sciences* 2007; 7: 2635-40. [\[CrossRef\]](#)
30. Veghari G, Asadi J, Eshghinia S. Impact Of Ethnicity Upon Body Composition Assessment In Iranian Northern Children. *Journal of Clinical and Diagnostic Research* 2009; 1779-83.
31. Wang Y, Zhang Q. Are American children and adolescents of low socioeconomic status at increased risk of obesity? Changes in the association between overweight and family income between 1971 and 2002. *Am J Clin Nutr* 2006; 84: 707-16.
32. Gordon-Larsen P, Adair LS, Popkin BM. The relationship of ethnicity, socioeconomic factors, and overweight in US adolescents. *Obes Res* 2003; 11: 597. [\[CrossRef\]](#)
33. Moore DB, Howell PB, Treiber FA. Changes in overweight in youth over a period of 7 years: impact of ethnicity, gender and socioeconomic status. *Ethn Dis* 2002; 12: 83-6.
34. Azizi F, Emami H, Salehi P, et al. Cardiovascular risk factors in the elderly: the Tehran Lipid and Glucose Study. *J Cardiovasc Risk* 2003; 10: 65-73. [\[CrossRef\]](#)
35. Veghari G, Saeedi M. The comparative study of body mass index distribution among preschool children in a 7 years period in north of Iran. *Journal of Applied Sciences* 2007; 7: 2681-5. [\[CrossRef\]](#)