Prevalence of underweight, overweight and obesity among high-school girls in Sistan va Baluchistan

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معدَّل انتشار نقص الوزن وزيادة الوزن والبدانة بين فتيات المدارس الثانوية في سيستان، ولاية بلوجستان

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الخلاصــة: كشفت هذه الدراسة الوصفية معدَّل انتشار نقص الوزن وزيادة الوزن والبدانة بين 725 من فتيات المدارس الثانوية اللاتي تتـراوح أعمارهن بين 14 و18 عاماً في سيستان، ولاية بلوجستان، في جمهورية إيران الإسلامية. وقد استخدم الباحثون الشرائح المئوية لمنسب كتلة الجسم الخاصة بمركز مكافحة الأمراض والوقاية منها للتعرف على أن معدَّل انتشار نقص الوزن (16.2٪) وزيادة الوزن 8.6٪ والبدانة 1.5٪. وقد كانت هذه المعدلات مشابهة للمعدلات التي حصل عليها الباحثون باستخدام معايير منظمة الصحة العالمية، والمسح الوطني الأول لفحص الصحة والتغذية، وفريق العمل الدولي المعني بالبدانة. إن تواتر نقص الوزن بين فتيات المدارس الثانوية في هذه الولاية أعلى مما هو عليه لدى معظم البلدان ولدى الأجزاء الأخرى من جمهورية إيران الإسلامية.

ABSTRACT This descriptive study determined the prevalence of underweight, overweight and obesity among 752 high-school girls aged 14–18 years in Sistan va Baluchistan province, Islamic Republic of Iran. Using the Centers for Disease Control and Prevention body mass index percentiles, the prevalences of underweight, overweight and obesity were 16.2%, 8.6% and 1.5% respectively. These rates were similar to the ones obtained using World Health Organization, First National Health and Nutrition Examination Survey, and International Obesity Task Force criteria. The frequency of underweight in high-school girls in this province is higher than most countries and other parts of the Islamic Republic of Iran.

Prévalence du déficit pondéral, du surpoids et de l'obésité chez des jeunes filles suivant des études secondaires dans la province de Sistan va Baluchistan

RÉSUMÉ Cette étude descriptive a déterminé la prévalence du déficit pondéral, du surpoids et de l'obésité chez 752 filles âgées de 14 à 18 ans suivant des études secondaires dans la province de Sistan va Baluchistan (République islamique d'Iran). La prévalence du déficit pondéral, du surpoids et de l'obésité, calculée sur la base des percentiles de l'indice de masse corporelle définis par les *Centers for Disease Control and Prevention*, était respectivement de 16,2 %, 8,6 % et 1,5 %. Ces taux étaient similaires à ceux obtenus sur la base des critères de l'Organisation mondiale de la Santé, de la première étude NHANES (*National Health and Nutrition Examination Survey*) et de l'*International Obesity Task Force*. La fréquence du déficit pondéral chez les jeunes filles suivant des études secondaires dans cette province est plus élevée que dans la plupart des pays et des autres parties de la République islamique d'Iran.

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Introduction

Obesity has reached epidemic proportions globally. But in developing country populations the increasing rate of obesity often coexists with existing problems of undernutrition and wasting [1,2]. The nutrition transition in the Islamic Republic of Iran is occurring rapidly and obesity is an emerging problem, particularly in urban areas and for women. Nevertheless, malnutrition, manifested by stunting, underweight and wasting, in preschool children is still a significant problem [3].

According to information from the World Health Organization (WHO), 20% of the world's population consists of teenagers, 84% of whom live in developing countries [4]. Adolescence is a specific period with many anatomical and physiological changes [5]. Many studies have shown that adolescence is a critical period in predicting the development of obesity as well as its short- and long-term complications [6]. Overweight and obesity are risk factors for numerous conditions [7] while underweight is a manifestation of malnutrition that can lead to malfunction of a variety of body systems [8].

In the Islamic Republic of Iran there are few data on the prevalence of underweight, overweight and obesity, especially among high-school girls. The prevalence of overweight and obesity in Iranian young women has been reported to be low: 22% and 16% respectively in urban and rural areas of Kerman among 15–39-year-olds [9] and over 19% in adolescent women in Islamshahr [10]. There are, however, great differences between different provinces [11]. Recent estimates show the prevalence of obesity in this country to be increasing at alarming rates [12].

Compared to other provinces of the Islamic Republic of Iran, Sistan va Baluchistan in the south-east of the country is relatively economically deprived. According to a report of the Iranian Ministry of Health and Medical Education and the United Nations Children's Fund in 1998, malnutrition in preschool children was a significant problem in the province. The Anthropometric Nutritional Indicators Survey in 1998 showed rates of stunting, underweight and wasting to be 34.5%, 22.2% and 7.5% respectively [13]. In the absence of data about the nutritional status of girls in the province, we determined the prevalence of underweight, overweight and obesity among high-school girls in Sistan va Baluchistan province.

Methods

Sample

In this cross-sectional study, a sample of 752 girls 14–18 years was selected from high-school students of 8 cities of Sistan va Baluchistan province by cluster sampling over 4 months during the 2005–06 education year. Based on a pilot study, with a prevalence of obesity of 12%, 95% confidence interval and $d = 0.024$ the sample size of 752 subjects was calculated according to the following formula: $n = [(z1 − α/2) × P(1 − P)]/d^2$.

A total of 22 high schools were selected based on the size of the population in each of the 8 cities (Zahedan 5; Zabol 5; Iranshahr 3; Chabahar 2; Khash 3; Saravan 2; Sarbaz 1; and Nikshahr 1). In each cluster (high school), students were selected randomly.

Data collection

Body weight and height were measured using digital scales (Seca, Germany) and a non-stretch tape fixed to a flat vertical wall. Body mass index (BMI) was calculated as weight (kg)/height² (m²).

Underweight, overweight and obesity in 5 age bands (14–14.9, 15–15.9, 16–16.9, 17–17.9 and 18–18.9 years) were deter-

mined using reference growth charts from the National Center for Health Statistics/Centers for Disease Control and Prevention (CDC) [14]. The cut-offs were BMI: ≤ 5th percentile (underweight); > 5th to ≤ 85th percentile (normal weight); > 85 to ≤ 95th percentile (overweight); and > 95th percentile (obesity) [15–17].

Data were calculated and compared using standards from the International Obesity Task Force (IOTF), the First National Health and Nutrition Examination Survey (NHANES I) and WHO. The IOTF standards for overweight in these age groups were BMI: 23.66–28.87 kg/m² (14–14.9 years); 24.17–29.29 kg/m² (15–15.9 years); 24.54–29.56 kg/m² (16–16.9 years); 24.85–29.84 kg/m² (17–17.9 years); 25–30 kg/m² (18–18.9 years). Cut-offs for obesity for the above age groups were BMI: > 28.87 kg/m²; 29.29 kg/m²; 29.56 kg/m²; 29.84 kg/m²; 30 kg/m² respectively [18]. The NHANES I cut-offs were BMI: 85th < 95th percentile (overweight); ≤ 95th percentile (obesity) [19]. The WHO cut-offs were BMI: < 5th percentile (underweight); ≥ 5th ≤ 85th percentile (normal); > 85th < 95th percentile (overweight); ≥ 95th percentile (obesity) [20].

Analysis

Data in each age group were summarized as frequencies and 95% confidence intervals (CI) of girls. The mean BMI and 95% CI were calculated at each cut-off. Statistical analysis was performed using *SPSS*, version 11. $P < 0.05$ was considered significant.

Results

A total of 752 female students were enrolled in the study. Their mean age was 16.4 [standard deviation (SD) 1.3] years, range 14–18; mean weight was 48.9 (SD 8.9) kg, range 22–100 kg; mean height was 156.4 (SD 7.2) cm, range 120–180 cm; and mean BMI was 20.0 (SD 3.45) kg/m², range 10–42.7 kg/m².

Based on the CDC cut-offs, the frequency of underweight in the whole sample was 16.2% (95% CI: 13.6%–18.8%), normal weight was 73.7% (95% CI: 70.6%–76.8%), overweight was 8.6% (95% CI: 6.6%–10.6%) and obesity was 1.5% (95% CI: 0.6%–2.4%) (Table 1). The prevalence of underweight at age 18–18.9 years (21.0%) was higher, but not significantly so, than other age groups.

Table 2 compares the overweight and obesity according to IOFT and NHANES I cut-offs. The prevalences of overweight and obesity using IOTF cut-offs [8.8% (95% CI: 6.8%–10.8%) and 1.5% (95% CI: 0.6%–2.4%) respectively] were very similar to those using NHANES I cut-offs [8.4% (95% CI: 6.4%–10.4%) and 1.5% (95% CI: 0.6%–2.4%) respectively]. These were also similar to the values calculated by CDC cut-offs. The prevalence of underweight using NHANES cut-offs, however, was higher than with CDC cut-offs: 23.8% (95% CI: 20.8%–26.9%).

The highest rate of overweight was observed in girls aged 14 years (10.8%) and for obesity it was age 17 years (1.9%) using NHANES I cut-offs (Table 2). The lowest rate of overweight was at age 15 years (7.1%) and for obesity at age 14 years (0%) based on NHANES I cut-offs. The proportions with the lowest and highest rates of overweight and obesity were not significantly different ($P > 0.05$) using the different standards.

The Spearman correlation test showed a significant positive correlation between age and BMI ($r = 0.10$, $P = 0.004$).

On the basis of WHO's BMI-for-age criteria [20], the results showed that 10.1%, 80.1%, 8.4% and 1.5% of the female high-school students were underweight, normal,

Table 1 Prevalence of underweight, normal, overweight and obesity in high-school girls in Sistan va Baluchistan province according to Centers for Disease Control cut-offs [14]

Age (years)	Total no.	Underweight[a]			Normal[b]			Overweight[c]			Obesity[d]		
		No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)
14–14.9	37	6	16.2	14.3 (13.2–15.4)	26	70.3	19.3 (18.5–20.2)	5	13.5	24.8 (23.7–25.9)	0	0.0	0
15–15.9	156	17	10.9	15.4 (15.0–15.7)	123	78.8	19.3 (18.9–19.6)	14	9.0	25.2 (24.7–25.7)	2	1.3	30.5 (25.7–35.2)
16–16.9	185	32	17.3	15.8 (15.5–16.2)	135	73.0	19.8 (19.5–20.1)	15	8.1	26.6 (26.1–27.2)	3	1.6	30.8 (26.8–34.8)
17–17.9	212	33	15.6	16.3 (16.1–16.5)	157	74.1	20.2 (19.9–20.5)	18	8.5	27.1 (26.3–27.8)	4	1.9	34.1 (24.8–43.4)
18–18.9	162	34	21.0	16.5 (16.2–16.8)	113	69.8	20.4 (19.9–20.8)	13	8.0	27.5 (26.9–28.2)	2	1.2	31.0 (28.5–33.5)
Total	752	122	16.2	16.0 (15.8–16.2)	554	73.7	19.8 (19.7–20.0)	65	8.6	26.5 (26.1–26.8)	11	1.5	32.0 (29.5–34.4)

[a]BMI < 5th percentile.
[b]BMI ≥ 5th ≤ 85th percentile.
[c]BMI > 85th < 95th percentile.
[d]BMI ≥ 95th percentile.
BMI = body mass index; CI = confidence interval.

Table 2 Prevalence of overweight and obesity in high-school girls in Sistan va Baluchistan province according to NHANES I [19] and IOTF [18] cut-offs

Age (years)	Total no.	Overweight per NHANES I[a]			Obesity per NHANES I[b]			Overweight per IOTF[c]			Obesity per IOTF[d]		
		No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)
14–14.9	37	4	10.8	25.2 (24.7–25.7)	0	0.0	0	4	10.8	25.2 (24.7–25.7)	0	0.0	0
15–15.9	156	11	7.1	25.5 (24.9–26.0)	2	1.3	30.4 (25.7–35.2)	12	7.7	25.4 (24.8–25.9)	2	1.3	30.4 (25.7–35.1)
16–16.9	185	15	8.1	26.6 (26.1–27.2)	3	1.6	30.8 (26.8–34.8)	15	8.1	26.6 (26.1–27.2)	3	1.6	30.8 (26.8–34.8)
17–17.9	212	17	8.0	27.2 (26.4–27.9)	4	1.9	34.1 (24.8–43.3)	18	8.5	27.1 (26.3–27.7)	4	1.9	34.1 (24.8–43.4)
18–18.9	162	16	9.9	27.2 (26.5–27.8)	2	1.2	31.0 (28.5–33.5)	17	10.5	27.1 (26.4–27.7)	2	1.2	31.0 (28.5–33.5)
Total	752	63	8.4	26.6 (26.3–26.9)	11	1.5	32.0 (29.5–32.4)	66	8.8	26.5 (26.2–26.9)	11	1.5	32.0 (29.5–34.4)

[a]BMI 85th < 95th percentile.
[b]BMI ≤ 95th percentile.
[c]BMI ≥ 23.66–28.87 kg/m²; ≥ 24.17–< 29.29 kg/m²; ≥ 24.54–< 29.56 kg/m²; ≥ 24.85–< 29.84 kg/m²; and ≥ 25–30 kg/m² respectively.
[d]BMI ≥ 28.87 kg/m²; ≥ 29.29 kg/m²; ≥ 29.56 kg/m²; ≥ 29.84 kg/m²; and ≥ 30 kg/m² respectively.
BMI = body mass index; CI = confidence interval; NHANES I = First National Health and Nutrition Examination Survey; IOTF = International Obesity Task Force.

at risk of overweight and obese respectively (Table 3).

Discussion

This study showed that, based on CDC standards, 16.2%, 8.6% and 1.5% of female high-school students in Sistan va Baluchistan were underweight, overweight and obese respectively. The prevalences of overweight and obese were similar according to WHO BMI-for-age criteria (8.4% and 1.5% respectively) and NHANES I standards (8.4% and 1.5% respectively). However, WHO criteria led to fewer students being classified as underweight (10.1%) while using NHANES I cut-offs the prevalence of underweight was much higher (23.8%).

We can compare these results with other studies in Asia. Öner et al. reported that in Turkish adolescent girls the prevalences of underweight, overweight and obesity were 11.1%, 10.6% and 2.1% respectively [21]. In a similar study in Qatari adolescent girls the rates were 5.8%, 18.9% and 4.7% respectively [22]. Ko and Tang reported that in Hong Kong Chinese aged < 30 years, the prevalence of underweight was high, with 35.9% of women aged 15–20 and 27.8% aged 20–30 years having BMI < 18.5 kg/m^2. [23]. Wiwanitkit and Sodsri reported a high prevalence of underweight children in a rural primary school near the Thai–Cambodian border [24].

Comparison of our results with similar studies shows that the prevalence of overweight and obesity in Sistan va Baluchistan province high-school girls was lower than in other part of the Islamic Republic of Iran. Only 1.5% of the subjects were obese and the prevalence of overweight was less than 9%. In Iranian high-school girls in Tabriz (a city in north-west of the Islamic Republic of Iran) according to NHANES I and IOTF standards, the prevalences of overweight

Table 3 Prevalence of underweight, normal, overweight and obesity in high-school girls in Sistan va Baluchistan province according to World Health Organization BMI-for-age criteria [20]

Age (years)	Total no.	Underweight[a]			Normal[b]			Overweight[c]			Obesity[d]		
		No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)	No.	%	BMI (kg/m²) Mean (95% CI)
14–14.9	37	6	16.2	14.3 (13.2–15.4)	27	73.0	19.5 (18.6–20.3)	4	10.8	25.2 (24.7–25.7)	0	0.0	0
15–15.9	156	12	7.7	15.1 (14.7–15.5)	131	84.0	19.3 (18.9–19.6)	11	7.1	25.5 (24.9–26.0)	2	1.3	30.4 (25.7–35.2)
16–16.9	185	22	11.9	15.4 (15.1–15.8)	145	78.4	19.6 (19.2–19.9)	15	8.1	26.6 (26.1–27.2)	3	1.6	30.8 (26.8–34.8)
17–17.9	212	20	9.4	15.9 (15.6–16.2)	171	80.7	20.0 (19.7–20.3)	17	8.0	27.2 (26.4–27.9)	4	1.9	34.1 (24.8–43.3)
18–18.9	162	16	9.9	15.8 (15.4–16.1)	128	79.0	19.8 (19.4–20.2)	16	9.9	27.2 (26.5–27.8)	2	1.2	31.0 (28.5–33.5)
Total	752	76	10.1	15.5 (15.3–15.7)	602	80.1	19.7 (19.5–19.8)	63	8.4	26.6 (26.3–26.9)	11	1.5	32.0 (29.5–34.4)

[a]BMI < 5th percentile.
[b]BMI ≥ 5th ≤ 85th percentile.
[c]BMI > 85th < 95th percentile.
[d]BMI ≥ 95th percentile.
BMI = body mass index; CI = confidence interval.

were 10.1% and 11.1% and of obesity were 3.6% and 3.9% respectively [*25*]. In another study in Tehran, the prevalences of overweight and obesity were 21.1% and 7.8% respectively [*26*]. The Islamic Republic of Iran experienced a rapid nutrition transition during the 1990s, with decreases in physical activity and increases in energy and fat intake in the population [*27*]. Rates of obesity in Sistan va Baluchistan were also lower than most other countries in the region such as Turkey and Saudi Arabia and other developed countries [*28–31*].

Our results indicate therefore that obesity is not a major problem in the survey population, and the percentage of underweight subjects was higher than those who were overweight or obese. In a study in high-school girls aged 14–21 years in Kerman (another south-east province of the Islamic Republic of Iran), the results showed only 4.6% were overweight/obese, while 54.6% were underweight and 1.6% were very underweight [*9,11*]. Data from the 1995 national food consumption survey of energy and fat intakes for Sistan va Baluchistan and Kerman found them be relatively deprived provinces [*3*]. It shows that, despite the rising trend of obesity worldwide, problems of malnutrition and micronutrient deficiencies still dominate the public health nutrition agenda in our area. Underweight and protein–energy malnutrition are frequently a symptom of disease and should be assessed medically. Distinct geographical patterns are seen in the prevalence of underweight children, which could be linked to agricultural and climate factors, population density and economic problems [*32*]. Both underweight and obesity, particularly higher levels of obesity, are associated with increased mortality [*33*]. In most developing economies, the prevalences of overweight in young women residing in both urban and rural areas are higher than those in underweight women, especially in countries with higher levels of socioeconomic development [*34*].

In conclusion, our results show that the prevalence of underweight is high in high-school girls in this area of the Islamic Republic of Iran. The Demographic and Health Survey in this province showed that the mean family household size is 5.7 [*35*]. The socioeconomic status in this province is low and more than half the females are illiterate. Therefore social factors may play an important role. As our only measure was BMI, evaluation of nutritional status and associated risk factors in this province is highly recommended.

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References

1. Hooshyar Rad AM et al. Using body mass index for determination of obesity, overweight and underweight in Iranian groups. In: *Iranian 6th Nutritional Congress Executive Committee*, 1st ed. Ahwaz, Islamic Republic of Iran, Mehr Publications, 2001:62.

2. *Global strategy on diet, physical activity and health*. Geneva, World Health Organization, 2004 (WHA57.17).

3. Ghassemi H, Harrison G, Mohammad K. An accelerated nutrition transition in Iran.

Public health nutrition, 2002, 5(1A):149–55.

4. Infancy, childhood and adolescent. In: Garrow J, James WPT, eds. *Human nutrition and dietetics*, 10th ed. London, Churchill Livingstone, 2000:460–1.

5. Omidvar NE et al. [Body image and its association with body mass index and eating attitudes in young adolescents in Tehran]. *Pejouhesh*, 2002–03, 26(4):257–64 [in Farsi].

6. Dietz WH. Critical periods in childhood for the development of obesity. *American journal of clinical nutrition*, 1994, 59(5):955–9.

7. Harlan WRH et al. Secondary sex characteristics of girls 12 to 17 years of age: the US Health Examination Survey. *Journal of pediatrics*, 1980, 96:1074–8.

8. Laquatra J. Nutrition for weight management. In: Mahan LK, Escott-Stump S, eds. *Krause's food, nutrition, and diet therapy*, 10th ed. Philadelphia, WB Saunders, 2000:485–515.

9. Janghorbani MP, Parvin F. Prevalence of overweight and thinness in high-school girls in Kerman, Iran. *International journal of obesity and related metabolic disorders*, 1998, 22(7):629–33.

10. Sotoudeh G et al. High prevalence of overweight and obesity inwomen of Islamshahr, Iran. *Asia Pacific journal of clinical nutrition*, 2005, 14(2):169–72.

11. Rashidi A et al. Prevalence of obesity in Iran. *Obesity reviews*, 2005, 6(3):191–2.

12. Azizi F, Esmaillzadeh A, Mirmiran P. Obesity and cardiovascular disease risk factors in Tehran adults: a population-based study. *Eastern Mediterranean health journal*, 2004, 10:887–97.

13. *Nutritional status of children in the province of Iran: anthropometrics nutritional indicators survey (ANIS).* Tehran, Islamic Republic of Iran, Ministry of Health and Medical Education and the United Nations Children's Fund, 1998.

14. *2000 CDC growth charts: United States.* National Center for Health Statistics Centers for Disease Control (http://www.cdc.gov/growthcharts/, accessed 11 December 2008).

15. *Obesity, preventing and managing the global epidemic. Report of a WHO consultation*. Geneva, World Health Organization, 1998 (Technical Report Series, No. 894).

16. Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht2) and triceps skinfold thickness. *American journal of clinical nutrition*, 1991, 53:839–46.

17. Swallen KC et al. Overweight, obesity, and health-related quality of life among adolescents: the National Longitudinal Study of Adolescent Health. *Pediatrics*, 2005, 115(2):340–7.

18. Cole TJ et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British medical journal*, 2000, 320:1240–3.

19. Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht2) and triceps skinfold thickness. *American journal of clinical nutrition*, 1991, 53:839–46.

20. *Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1995 (WHO Technical Report Series, No. 854).

21. Öner N et al. Prevalence of underweight, overweight and obesity in Turkish adolescents. *Swiss medical weekly*, 2004, 134(35–36):529–33.

22. Bener A. Prevalence of obesity, overweight, and underweight in Qatari adolescents. *Food and nutrition bulletin*, 2006, 27(1):39–45.

23. Ko G, Tang JS. Prevalence of obesity, overweight and underweight in a Hong Kong community: the United Christian Nethersole Community Health Service (UCNCHS) primary health care program 1996–1997. *Asia Pacific journal of clinical nutrition*, 2006, 15(2):236–41.

24. Wiwanitkit V, Sodsri P. Underweight schoolchildren in a rural school near the Thai–Cambodian border. *Southeast Asian journal of tropical medicine and public health*, 2003, 34(2):458–61.

25. Gargari BP et al. Prevalence of overweight and obesity among high-school girls in Tabriz, Iran, in 2001. *Food and nutrition bulletin*, 2004, 25(3):288–91.

26. Mohammadpour-Ahranjani B et al. Prevalence of overweight and obesity in adolescent Tehrani students, 2000–2001: an epidemic health problem. *Public health nutrition*, 2004, 7(5):645–8.

27. Dorosty AR, Siassi F, Reilly JJ. Obesity in Iranian children. *Archives of disease in childhood*, 2002, 87(5):388–91.

28. Sur HK et al. Biochemical and behavioral indices related to BMI in schoolchildren in urban Turkey. *Preventive medicine*, 2005, 41(2):614–21.

29. Warsy AS, El-Hazmi MAF. Diabetes mellitus, hypertension and obesity-common multifactorial disorders in Saudis. *Eastern Mediterranean health journals*, 1999, 5(6):1236–42.

30. Al-Nuaim AR, Al-Rubeaan K, Al-Mazrouy Y. High prevalence of overweight and obesity in Saudi Arabia. *International journal of obesity and related metabolic disorders*, 1996, 20(6):547–52.

31. Magarey AM, Daniels LA, Boulton TJ. Prevalence of overweight and obesity in Australian children and adolescents: reassessment of 1985 and 1995 data against new standard international definitions. *Medical journal of Australia*, 2001, 174:561–4.

32. Nubé M, Sonneveld B. The geographical distribution of underweight children in Africa. *Bulletin of the World Health Organization*, 2005, 83(10):764–70.

33. Flegal KM et al. Excess deaths associated with underweight, overweight, and obesity. *Journal of the American Medical Association*, 2005, 293(15):1861–7.

34. Mendez MA, Monteiro CA, Popkin BM. Overweight exceeds underweight among women in most developing countries. *American journal of clinical nutrition*, 2005, 81(3):714–21.

35. *Population and health in the Islamic Republic of Iran: demographic and health survey (DHS).* Tehran, Islamic Republic of Iran, Ministry of Health and Medical Education and the United Nations Children's Fund, 2000.