Report

Obesity: an emerging problem in Saudi Arabia. Analysis of data from the National Nutrition Survey

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السمنة: إحدى المشكلات المستجدة في المملكة العربية السعودية. تحليل معطيات المسح الوطني للتغذية

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الخلاصة: اعتمد الباحثان على معطيات دراسة متعدِّدة القطاعات شملت نحو 19 598 فرداً من 2837 أسرة، بُغْيَة دراسة مدى انتشار السِّمنة في المملكة العربية السعودية. وتم قياس مَنْسَب كتلة الجسم، وثخانة ثنية الجلد، ومحيط منتصف الذراع، فوجد أن معدل انتشار السِّمنة يتراوح ما بين 33.9٪ في حائل إلى 11.7٪ في جيزان، وأن نسبة النسوة السِّمان (23.6٪) أعلى من نسبة الرجال (14.2٪). في حين كان معدل انتشار زيادة الوزن 30.7٪ بين الرجال بالمقارنة بنحو 28.4٪ بين النساء. كما لوحظ وجود السِّمنة في كل المجموعات العمرية. واتّضح من هذه الدراسة ضرورة تغيير نمط حياة السكان في المملكة بُغْيَة تقليص معدل انتشار السِّمنة.

ABSTRACT To document the prevalence of obesity in Saudi Arabia, we used data from a cross-sectional study on 19 598 individuals in 2837 households. Body mass index, skinfold thickness and mid-arm circumference were measured. Prevalence of obesity ranged from 33.9% in Ha'il to 11.7% in Jizan. More women than men were obese, 23.6% compared to 14.2%. Prevalence of overweight was 30.7% for males and 28.4% for females. Obesity was present in all age groups. It is clear that changes must be made to the lifestyle of the Saudi population in order to reduce the prevalence of obesity.

L'obésité : un problème émergent en Arabie saoudite. Analyse des données de l'Enquête nationale sur la Nutrition

RÉSUMÉ Afin d'évaluer la prévalence de l'obésité en Arabie saoudite, nous avons utilisé les données d'une étude transversale portant sur 19 598 individus appartenant à 2837 foyers. L'indice de masse corporelle, l'épaisseur du pli cutané et le périmètre brachial à mi-hauteur ont été mesurés. La prévalence de l'obésité oscillait entre 33,9 % à Ha'il et 11,7% à Jizan. L'obésité frappait davantage la population féminine, avec 23,6 % de femmes obèses contre 14,2 % d'hommes. La prévalence du surpoids était de 30,7 % chez les hommes et de 28,4 % chez les femmes. L'obésité était présente dans toutes les tranches d'âge. Il est évident que des modifications doivent être apportées au mode de vie de la population saoudienne si l'on veut réduire la prévalence de l'obésité.

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Introduction

Obesity is a term used to indicate excessive deposition of fat in the body. It is the most common nutritional disorder in developed countries and is becoming significant in the developing countries [*1*]. The etiology of obesity is very complex and has perplexed researchers since it was first described. It is affected generally by factors such as genetics and environment, in addition to social, physiological and psychological factors [*1*]. The rapid increase in obesity rates over recent years has, however, occurred in too short a time to result from significant genetic changes alone. This suggests that environmental and socioeconomic factors are probably the main causes of the rapid global rise in obesity.

The World Health Organization has stated that obesity has become a worldwide health problem which can lead to a variety of conditions such as diabetes, cardiovascular disease, hypertension and high blood cholesterol/lipids [*1*].

The population of Saudi Arabia is going through a nutrition transition where customary and traditional food is being replaced by fast food high in fat, sugar and salt. This is happening along with changes in lifestyle and reduced physical activity. The National Nutrition Survey, a nationwide cross-sectional study to determine the nutritional status of the population, revealed that eating non-nutritional and high calorie snacks is becoming common practice; fried foods and carbonated drinks are now common foods in the country [*2*]. These changes can lead to increases in the prevalence of obesity.

In a community-based national survey on 10 657 Saudi Arabians aged ≥ 20 years, multiple logistic regression analysis showed that age, residential area, region, income, sex, and education were statistically significant predictors of obesity [*3*]. The prevalence of obesity was higher in females than males, lower in those living in rural areas with traditional lifestyles than those in more urbanized environments, and increased with increasing age.

Besides, several previous studies conducted in Saudi Arabia have linked obesity with a number of health problems and diseases. Hamilton, Jaroudi and Sieck [*4*] quantified the prevalence of obesity in females in the infertility clinic at King Faisal Specialist Hospital in Riyadh: 80% of non-fertile females were either overweight or obese.

Al-Turki estimated the prevalence of overweight and obesity among hypertensive and diabetic adult patients in Riyadh: overweight and obesity were coexisting risk factors among hypertensive and diabetic adult patients, and were an important focus for the treatment and prevention of high blood pressure and diabetes [*5*].

El-Hazmi and Warsy conducted a study to determine the relationship between obesity, overweight and plasma lipids in Saudi Arabians [*6*]. The cholesterol and triglyceride levels were significantly higher in the overweight and obese groups compared to the normal weight groups, and since the prevalence of overweight and obesity was high, they concluded that it was essential to initiate control and prevention programmes in an attempt to reduce the prevalence of overweight and obesity and hence morbidity and mortality associated with hyperlipidaemic states.

In another study in Saudi Arabia, El-Hazmi and Warsy investigated the prevalence of obesity in people with type 2 diabetes mellitus [*7*]. Prevalence of obesity was 39.3% among women with diabetes compared to 18.5% among non-diabetic women.

The prevalence of obesity was lower among men than women. Men with diabetes had a higher prevalence than non-diabetic men (20.7% and 12.1% respectively).

Since the increased prevalence of obesity has been well documented in the last few years in Saudi Arabia, there is increasing concern among health professionals regarding the rise of obesity-related diseases in the Kingdom.

This analysis was done out to determine the prevalence of obesity in the population living in different regions of the country as part of the evaluation of the project to determine the nutritional status of the people of Saudi Arabia [*2*].

Survey methodology

This report is part of the evaluation of the National Nutrition Survey, a cross-sectional study to determine the nutritional status of the Saudi Arabian population, which was carried out over a period of 3 years starting in 1985 and reported in 1991 [*2*]. The participants were families (husband, wife, children and other dependants who were being supported by the head of the family) living in the community. All family members had to be living and consuming food regularly in the same residence at the time of the study.

For the National Nutrition Survey, a stratified random sample of houses in every region of the country was selected. Total sample size was 2556 families, 17 892 individuals. Demographic data (age, sex, weight, height, etc.) was collected by trained health personnel, i.e. physicians, nutritionists and social workers.

Common methods to evaluate obesity were used: skinfold thickness and mid-upper arm muscle/circumference. The body mass index (BMI) status of individuals investigated was categorized using the standard criteria suggested by Garrow [*8*]: underweight BMI < 20 25 kg/m^2, desirable range 20.0–24.9, overweight BMI 25–29.9, obesity BMI $\geq$ 30.

Data and analysis

The total number of households actually surveyed (i.e. for whom complete information was available) was 2837; the total number of individuals investigated was 17 892. Females constituted 51.5% of the sample. Infants (< 1 year old) constituted 3.4%, children and infants < 5 years constituted 18.4%, children < 10 years constituted 35.8%, those < 15 years constituted almost half of the total sample, 49.9%, and this reflects the population pyramid [*9*].

Weight according to height for the age group birth to < 18 years in the study sample (Table 1) falls below the physical growth of the National Centre for Health Statistics percentiles [*10*], but those aged 18–65 years showed higher values for weight to height ratio.

Males and females $\geq$ 18 years were grouped according to age and BMI was calculated (Table 2). The proportion of those with BMI $\geq$ 25 kg/m^2 in the age group 18–< 21 years was 23.1% in males and 30.4% in females. The group having the highest proportion with BMI $\geq$ 25 25 kg/m^2 was females aged 41–< 51 years, 71.6%. In all age groups, the proportion of females having BMI $\geq$ 25 was greater than males.

Comparing participants aged 18–< 61 years, 30.7% of men were overweight compared with 28.4% of women, but more women were obese than men, 23.6% compared to 14.2% of men.

Mid-arm circumference and triceps skinfold thickness were used to validate BMI (Table 3). Skinfold thickness is more

Table 1 **Height and weight for males and females according to age in Saudi Arabia**

Age (years)	Males			Females		
	No.	Height (cm) Mean (SD)	Weight (kg) Mean (SD)	No.	Height (cm) Mean (SD)	Weight (kg) Mean (SD)
< 1	249	63.8 (8.7)	6.65 (1.91)	286	62.9 (7.5)	6.59 (2.0)
1–< 2	270	76.3 (7.3)	9.90 (1.97)	305	76.2 (8.0)	9.46 (1.67)
2–< 3	286	84.7 (7.1)	12.20 (9.13)	283	84.8 (9.8)	11.63 (7.39)
3–< 4	284	91.5 (10.5)	13.23 (4.92)	307	92.4 (9.8)	14.12 (6.1)
4–< 5	284	99.1 (6.7)	14.71 (5.4)	318	98.8 (10.3)	14.18 (5.1)
5–< 6	307	105.8 (8.7)	18.18 (15.4)	309	105.0 (8.7)	16.52 (10.4)
6–< 7	296	111.3 (8.2)	18.29 (4.6)	277	109.9 (7.1)	19.30 (10.3)
7–< 8	259	116.7 (6.4)	20.17 (5.9)	276	115.5 (7.5)	19.70 (7.14)
8–< 9	272	122.1 (7.3)	22.96 (8.3)	309	121.0 (9.6)	22.98 (9.8)
9–< 10	232	126.5 (8.5)	25.85 (11.8)	245	126.9 (7.7)	26.21 (10.6)
10–< 11	254	130.9 (9.4)	27.83 (9.22)	284	130.6 (9.5)	28.42 (8.9)
11–< 12	214	134.1 (9.7)	30.72 (10.8)	205	136.7 (11.7)	33.38 (10.0)
12–< 13	227	138.9 (11.4)	35.14 (13.3)	235	140.7 (10.6)	36.21 (9.7)
13–< 14	207	144.4 (9.3)	39.85 (11.5)	201	145.3 (7.8)	41.98 (11.5)
14–< 15	162	149.4 (12.2)	44.98 (16.4)	202	148.1 (10.1)	46.83 (13.5)
15–< 16	166	154.6 (8.4)	48.01 (12.0)	191	149.2 (7.2)	47.92 (10.8)
16–< 17	121	158.6 (14.0)	53.46 (12.5)	194	151.9 (8.1)	51.20 (11.7)
17–< 18	136	163.0 (7.8)	57.30 (12.1)	178	150.4 (12.0)	51.0 (13.4)
18–< 19	107	162.4 (7.9)	58.27 (14.8)	181	151.8 (10.4)	54.15 (16.2)
19–< 25	425	163.8 (10.4)	62.42 (14.3)	864	151.5 (9.7)	55.80 (13.7)
25–< 35	680	163.1 (10.2)	67.78 (13.8)	1161	151.7 (9.1)	61.44 (16.5)
35–< 45	464	163.4 (11.0)	71.66 (13.9)	618	150.7 (11.3)	66.40 (17.7)
45–< 55	399	162.3 (8.7)	69.61 (13.7)	430	150.7 (8.8)	65.35 (15.4)
55–< 65	311	159.7 (9.8)	67.30 (14.1)	198	149.9 (11.1)	62.22 (15.2)
65–< 75	184	158.0 (11.9)	65.67 (15.8)	108	145.5 (15.3)	60.56 (24.0)

SD = standard deviation.

sensitive to the degree of fatness than BMI alone. In males in the age group, birth–18 years, the mid-arm circumference ranged from 13.2 cm to 25.7 cm, while in the age group 19–< 65 years it ranged from 26.4 cm to 27.9 cm and decreased to 27.0 cm in the age group 65–75 years (Table 3). For women it was 12.9–24.5 cm and 25.5–29.1cm respectively and decreased to 27.0 cm in the age group 65–75 years. The skinfold thickness in the young age group, 1–18 years, ranged from 7.3 mm to 13.4 mm, while in age group 19–< 65 years it ranged from 12.0 mm to 15.6 mm and decreased to 13.3 mm in age group 65–75 years. In the female population, the values for skinfold thickness

Table 2 **Prevalence of overweight and obesity [body mass index (BMI) ≥ 25 kg/m²] for males and females according to age in Saudi Arabia**

Age (years)	Males			Females		
	Total	BMI ≥ 25 kg/m²		Total	BMI ≥ 25 kg/m²	
		No.	%		No.	%
18–< 21	273	63	23.1	542	165	30.4
21–< 31	704	276	39.2	1401	662	47.3
31–< 41	590	334	56.6	785	522	66.5
41–< 51	399	218	54.6	468	335	71.6
51–< 61	352	207	58.8	233	159	68.2
61+	307	147	47.9	156	78	50.0

Overweight and obesity increased significantly with age in both sexes (P < 0.001).
Females had higher BMI than males in all age groups (P < 0.001).

were higher, 7.4 mm–16.7 mm and 17.3 mm–20.7 mm respectively and decreased to 17.0 mm for age group 65–75 years.

The prevalence of obesity (BMI ≥ 30 kg/m²) varied in different regions (Table 4). The highest obesity rate was in Ha'il (33.9%), followed by Al Sharqiya (27.7%) while the lowest was in Jizan (11.7%) and Al Medina (15.1%).

Discussion

Obesity is a major health problem in the industrialized countries and in the developing countries. The data of this report illustrate the high prevalence of overweight and obesity in all regions of Saudi Arabia, especially among females.

A high proportion of participants aged 18–65 years had BMI ≥ 25 kg/m²; this may be a reflection of the effects of food habits, lifestyle and climate. There is a high consumption of high calorie food; the lifestyle is quite sedentary, especially for females, and most of the time is spent indoors. Sports and other activities are undertaken by a very small proportion of the population and physical activities are limited [*11*]. Socializing is frequent and people gather for meals that are high in carbohydrates and fat, e.g. meals composed of rice with whole lamb [*11*]. The climate is generally hot in most regions and does not encourage individuals to indulge in many physical activities: vehicles are used for even short distance travel. These factors may be important in the etiology of obesity.

Comparing our results with studies done in some other countries (Table 5), the prevalence of overweight among men 18–60 years was 30.7%, lower than for all the other countries shown, while the prevalence of overweight among women in the same age group was 28.4%, higher than for the other countries [*3*]. Prevalence of obesity in the same age group was 14.2% in males and 23.6% in females in our study and these rates were higher than for all other countries. The overall obesity rate in Saudi Arabia was, however, much higher, especially among females. This indicates that health authorities need to address the

Table 3 **Mean mid-arm circumference (MAC) and triceps skinfold thickness (TSFT) for males and females according to age**

Age (years)	Males			Females		
	No.	MAC (cm) Mean (SD)	TSFT (mm) Mean (SD)	No.	MAC (cm) Mean (SD)	TSFT (mm) Mean (SD)
<1	248	13.2 (4.0)	7.3 (3.5)	277	12.9 (2.3)	7.4 (5.1)
1–< 2	273	14.4 (2.4)	7.8 (3.4)	306	14.1 (2.0)	8.4 (4.8)
2–< 3	284	14.7 (3.5)	8.6 (3.8)	287	14.6 (3.4)	8.2 (3.8)
3–< 4	284	14.9 (2.0)	8.6 (3.9)	304	15.1 (2.4)	8.6 (3.8)
4–< 5	281	15.4 (2.5)	8.5 (3.8)	320	15.1 (1.7)	8.5 (3.9)
5–< 6	304	15.8 (2.6)	8.1 (3.7)	303	15.7 (2.2)	8.7 (4.0)
6–< 7	290	16.3 (2.8)	8.8 (4.2)	278	16.1 (2.1)	8.9 (4.5)
7–< 8	256	16.3 (2.4)	8.2 (3.9)	276	16.3 (2.2)	9.6 (4.9)
8–< 9	270	17.3 (2.6)	9.1 (4.7)	301	17.3 (3.4)	10.1 (4.8)
9–< 10	231	17.9 (2.6)	10.0 (7.5)	244	18.2 (3.2)	10.7 (6.2)
10–< 11	245	18.4 (2.8)	9.9 (5.2)	279	19.1 (3.7)	11.7 (6.1)
11–< 12	212	19.2 (3.3)	11.5 (7.5)	202	19.9 (4.1)	12.1 (7.0)
12–< 13	224	20.5 (4.6)	11.7 (8.2)	236	20.6 (3.4)	12.7 (6.8)
13–< 14	201	21.4 (3.6)	12.0 (7.0)	197	21.9 (4.0)	13.4 (6.8)
14–< 15	162	22.3 (4.6)	11.9 (7.4)	201	22.9 (3.7)	14.5 (7.3)
15–< 16	163	22.8 (3.9)	11.5 (6.0)	187	23.4 (3.6)	15.1 (7.8)
16–< 17	118	24.2 (3.3)	11.9 (7.1)	192	24.0 (3.6)	16.7 (8.7)
17–< 18	132	24.7 (3.4)	12.6 (7.1)	178	23.8 (4.2)	15.1 (7.6)
18–< 19	106	25.7 (4.6)	13.4 (8.8)	178	24.5 (3.5)	16.6 (7.8)
19–< 25	414	26.4 (4.1)	12.0 (7.5)	846	25.5 (4.4)	17.3 (9.0)
25–< 35	665	27.5 (3.7)	14.3 (7.7)	1153	27.3 (5.0)	19.8 (9.8)
35–< 45	459	28.7 (4.0)	15.6 (8.4)	611	28.9 (5.3)	20.7 (9.4)
45–< 55	395	28.4 (3.8)	14.8 (8.2)	424	29.1 (5.0)	20.6 (9.7)
55–< 65	304	27.9 (4.2)	13.6 (7.8)	193	28.6 (5.2)	19.5 (10.4)
65–75	179	27.0 (3.7)	13.3 (8.0)	109	27.0 (5.1)	17.0 (8.2)

SD = standard deviation.

problem, e.g. with a campaign for nutrition education and physical activity for the whole population.

The lowest obesity rate was in the south-western province of Jizan. This may be a result of several factors: most people in this region are involved in agricultural work and fishing and lead a fairly active life. Genetic factors may contribute to some extent. The type of food eaten in this region is low in calories, as is clear from the National Nutrition Survey [*2*]. The highest obesity rate was found in the northern and eastern provinces (Ha'il, Al Sharqiya, Al Qasim

Table 4 **Prevalence of obesity (body mass index ≥ 30 kg/m²) according to region**

Region	Obesity (%)
Ha'il	33.9
Al Sharqiya	27.7
Al Qasim	26.5
Tabuk	25.2
Al Ta'if	23.9
Riyadh	21.7
Mecca	19.3
Jeddah	16.4
Asir	16.2
Farason	15.7
Medina	15.1
Jizan	11.7

and Tabuk). This was probably a result of sedentary lifestyle and the nature of the diet as it is high in fat [*2*].

It is clear that changes need to be made to the lifestyle of the Saudi population in order to reduce the prevalence of obesity. There is a great need to establish applied programmes in education and treatment. These could help decrease the prevalence of chronic diseases related to obesity such as heart diseases, diabetes and some types of cancer as indicated by the World Health Organization [*12*].

Large prospective studies show a significant association with obesity for several cancers, and evidence of a causal link with cancers of the colon, female breast (postmenopausal), endometrium, kidney (renal cell), and oesophagus (adenocarcinoma) has been established [*12*]. These data, and the rising worldwide trend in obesity, suggest that overeating may be the largest avoidable cause of cancer in non-smokers. Calle and Thun estimated that overweight and obesity now account for 1 in 7 cancer deaths in men and 1 in 5 in women in the United States of America [*13*].

It is recommended that health and nutrition programmes be developed and updated using modern facilities such as computers, mass media, the Internet and distance learning to target all members of the community as the problem of obesity occurs among all age groups. Future research and methods of evaluating obesity must use ≥ 1 method, for example, combine BMI and skinfold thickness in measuring body fat, and hence evaluate obesity more accurately.

Table 5 **Comparison of prevalence of overweight (body mass index 25–< 30) and obesity (body mass index ≥ 30 kg/m²) in Saudi Arabia and 4 other countries [*2*]**

Country	Age range (years)	Overweight (%)		Obesity (%)	
		Males	Females	Males	Females
Saudi Arabia	18–60	30.7	28.4	14.2	23.6
Sweden	16–84	35	24	7	8
USA	20–74	34	24	12	12
Italy	15–90	39	25	7	6
Australia	25–64	34	24	7	7

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