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# Obesity in Saudi Arabia

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## ABSTRACT

**Objectives:** Obesity and overweight are well known risk factors for coronary artery disease (CAD), and are expected to be increasing in the Kingdom of Saudi Arabia (KSA) particularly among females. Therefore, we designed this study with the objective to determine the prevalence of obesity and overweight among Saudis of both genders between the ages of 30-70 years in rural as well as in urban communities. This work is part of a major national project called Coronary Artery Disease in Saudis Study (CADISS) that is designed to look at CAD and its risk factors in Saudi population.

**Methods:** This study is a community-based national epidemiological health survey, conducted by examining Saudi subjects in the age group of 30-70 years of selected households over a 5-year period between 1995 and 2000 in KSA. Data were obtained from body mass index (BMI) and were analyzed to classify individuals with overweight ( $BMI = 25-29.9 \text{ kg/m}^2$ ), obesity ( $BMI \geq 30 \text{ kg/m}^2$ ) and severe (gross) obesity ( $BMI \geq 40 \text{ kg/m}^2$ ) to provide the prevalence of overweight and obesity in KSA.

**Results:** Data were obtained by examining 17,232 Saudi subjects from selected households who participated in the study. The prevalence of overweight was 36.9%. Overweight is significantly more prevalent in males (42.4%) compared to 31.8% of females ( $p < 0.0001$ ). The age-adjusted prevalence of obesity was 35.5% in KSA with an overall prevalence of 35.6% [95% CI: 34.9-36.3], while severe (gross) obesity was 3.2%. Females are significantly more obese with a prevalence of 44% than males 26.4% ( $p < 0.0001$ ).

**Conclusions:** Obesity and overweight are increasing in KSA with an overall obesity prevalence of 35.5%. Reduction in overweight and obesity are of considerable importance to public health. Therefore, we recommend a national obesity prevention program at community level to be implemented sooner to promote leaner and consequently healthier community.

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It is ironic that as people continue to suffer from malnourishment and starvation in some poor parts of the world, others are gone to the other extreme of being overweight or obese particularly in developed as well as developing countries. A large number of individuals in our society perceive overweight or obesity as being healthy in contrast to

the western world, where growing numbers of people recognize that being overweight or obese is associated with major health problems such as diabetes mellitus (DM), coronary artery disease (CAD) and stroke. At the same time, most overweight or obese people do not know which foods best meet their nutritional and weight loss

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needs. A person's weight is determined by the net result of the balance between energy intake and energy expenditure. Obesity is a risk factor for CAD, hypertension and DM; however, not everyone with these conditions is obese, and not all obese people have these conditions. Nonetheless, the Office of the US Surgeon General reports that overweight or obesity may cause as much disease and death as cigarette smoking.<sup>1</sup> Morbidity and mortality as a result of obesity has been demonstrated by several studies to affect men and women in different societies.<sup>2-9</sup> Fortunately, the health hazards related to obesity and overweight are reversible upon reducing weight back to normal.<sup>10-12</sup> Over the past 2 decades, the prevalence of obesity has increased markedly worldwide, and as more people are adopting sedentary life, the prevalence is likely to continue to increase. In the United States, data from national population surveys obtained since 1960 until 1994 have demonstrated that the prevalence of obesity has more than doubled from 12.8-27%, and nearly 61% of adults are overweight or obese.<sup>13</sup> Similar results have been noted in the United Kingdom as the percentage of prevalence of obesity increased between 1986 and 1993 from 6-13% in men and from 8-16% in women.<sup>14</sup> These data and those from other countries are indicative of a major global epidemic. Previous studies from Kingdom of Saudi Arabia (KSA), conducted from 1990 to 1993, have shown an overall prevalence of obesity of 22.1% and approximately 53% of Saudi adults are either overweight or obese.<sup>15</sup> Therefore, it is of national public health interest to know the magnitude of the obesity epidemic in the Saudi community. In this article, we report the results of overweight and obesity prevalence in adults in KSA as observed from the data obtained from the Coronary Artery Disease in Saudis Study (CADISS).

**Methods.** Kingdom of Saudi Arabia, encompasses with four-fifth of the Arabian Peninsula, has inhabitants of 20.8 million people with 15.6 million of local population (Saudis).<sup>23</sup> A 5-year National Epidemiological Health Survey to study CAD and its risk factors was conducted between 1995 and 2000. Male and female Saudi subjects aged 30-70 years, in rural and urban areas of the Kingdom formed the target population for this study. For the purpose of the study, a Saudi is identified as a person holding (or a dependent of a holder) of a Saudi Nationality Identification Card. Most previous studies on overweight and obesity from other parts of the world focused on similar population that allows for inter-countries comparison.

A sample size of 20,000 participants was the target of the study to ensure a high reliability of our estimates of the prevalence of overweight and

obesity. The subjects were selected using a 2-stage stratified cluster sampling procedure, urban and rural being the strata. For practical and logistic reasons, the study population was drawn from the local primary health care centers' catchment's areas. The catchment's population of each primary care center was taken as a cluster. The KSA is subdivided into 14 administrative regions and samples were selected from each region. The first stage-sampling units were 1,623 primary health centers (PHCs) uniformly distributed in the Kingdom. Since the establishment of PHCs was dictated by the population in each region, the allocation of the required number of PHCs were made proportional to be the number of PHCs in each region. Then, each region was stratified into urban and rural communities and a simple random sample of PHCs was selected. The number of PHCs to be selected from each community was based on the total number of PHCs in each rural and urban community. A total of 66 PHCs were selected from urban and 58 from rural areas. The selected PHCs were taken as catchments areas, then block were randomly selected from the catchments areas of each selected PHCs and used as cluster. One hundred households from urban PHCs and 50 households from rural PHCs were selected from these blocks.

All subjects of age group of 30-70 years of selected households were interviewed at their house and examined at PHCs. The questionnaire was developed, pre-tested, and validated in a pilot study. The questionnaire included basic demographic and socio-economic data. A clinical examination was conducted, included height, weight, blood pressure, followed by obtaining urine and blood samples as well as performing an electrocardiogram (ECG). Well-trained primary care physicians conducted a clinical examination including measurement of blood pressure. Weight was measured with ordinary scales (non-electronic portable balance) with indoor clothing on without shoes on to the nearest 0.1 kg. Height measurement was carried out in the standing position, without footwear, to the nearest mm by using measuring tape that is part of the weighing scale. Weight and height were measured using standardized techniques and equipment (to be precise, healthcare workers were trained, for the purpose of this study, to use the same technique of weight and height measurements for all subjects of the study population, using the same type of equipments such as blood pressure apparatus, weighing scale and ECG machine).

Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. The following definitions are based on the recommendations of the United States of America National Heart, Lung, and Blood Institute as well as the World Health Organization.<sup>11,12</sup> For adults,

overweight was defined as a BMI of 25-29.9 kg/m<sup>2</sup>, obesity as a BMI of 30 kg/m<sup>2</sup> or higher, and severe (gross) obesity as a BMI of 40 kg/m<sup>2</sup> or higher.

The data were analyzed using the Statistical Package for Social Sciences (Version 10.0) on PC. The estimated overweight and obesity prevalence rate was calculated for the total sample, and sub-groups of gender, area of residence and age groups.

**Results.** Data were obtained from 17,232 Saudi subjects from selected households who participated in the study over a 5-year period between 1995 and 2000. Overweight has an overall prevalence of 36.9% in Saudis [95% confidence interval (CI) = 36.2-37.6], and the age adjusted prevalence of overweight is 36.6%. Males are significantly more overweight compared to females with an overweight prevalence of 42.4% and 31.8% ( $p<0.0001$ ) (Table 1). Six thousands one hundred and thirty-five subjects were found to be obese (BMI  $\geq 30$  kg/m<sup>2</sup>); thus, the overall prevalence of obesity in KSA as obtained from this study is 35.6% [95% (CI) 34.9-36.3], while age adjusted prevalence of obesity is 35.5% (Table 1). Obesity is observed to be substantially higher among females with a prevalence of 44% [95% CI 43.0-45.0], compared to males with obesity prevalence of 26.4% and this difference was statistically significant ( $p<0.0001$ ) (Table 1).

Table 2 shows that nearly one fourth (24.2%) of Saudi females are of normal or underweight, while 31.1% of Saudi males are having normal or underweight based on BMI  $\leq 25$  kg/m<sup>2</sup>. Moreover, the prevalence of overweight is proportionally increasing with age, whereas the obesity prevalence reaches a peak of 41.4% at age group 40-49 years and starts to decline, as Saudis get older. Males at the age group 40-49 years have the highest prevalence for overweight (44%) and obesity (30.3%) compared to other age groups of males ( $p<0.0001$ ) (Table 2). While females showed peak prevalence of overweight (34%) at age group 60-70 years and peak prevalence of obesity (50.2%) at age group 40-49 years ( $p<0.0001$ ). Urban Saudis are more likely to have statistically significant obesity compared to Saudis living in rural areas with an obesity prevalence of 39.7% and 27% ( $p<0.0001$ ) (Table 2). However, there was no difference in the prevalence of overweight observed between Saudis living in urban or rural areas (36.9% for both). The prevalence of obesity is highest among Saudis living in the Eastern region of KSA (42.2%), while the lowest rate was observed in the Southern region (29.9%) and this was statistically significant ( $p<0.0001$ ) (Table 2).

Table 3 shows the comparison of obesity prevalence reported from several studies conducted in KSA and some of the Arabian Gulf countries.

**Discussion.** The data obtained from this survey reports an overall obesity prevalence of 35.6%. The prevalence of overweight is 36.9%, that makes 72.5% of Saudis are either overweight or obese. Considering the health hazards associated with overweight and obesity, our society is facing real health problems that may be avoided if we just maintain normal body weight. Moreover, our data revealed that females are likely to be more obese than males with a prevalence of 44% and 26.4%, and this was statistically significant. The figures reported from earlier studies in KSA on obesity were significantly lower than the current figures. One study conducted from 1990 to 1993 with a sample size of 10,651 subjects (age  $>20$  years), reported an overall prevalence of obesity of 22.1%, with females obesity prevalence of 26.6% compared to the obesity prevalence in males of 17.8%.<sup>15</sup> Clearly, females are substantially more obese than males as consistent finding is also shown by our study. This may be attributed to many factors, mostly related to females in KSA are less physically active in comparison to males. Earlier data from KSA, conducted between 1989 and 1994 on adult population aged 18 years and older, revealed an overall obesity prevalence of 20.5%.<sup>16</sup> Another study conducted in KSA with a population sample of 14000 subjects (age  $\geq 14$  years) in the year 2000, established a prevalence of obesity of 20.3% in females, which is significantly higher than males with 13.1%.<sup>17</sup> For overweight, our results are showing that males are more likely to be overweight than females with prevalence of 42.4% compared to 31.8%. However, a large number of females in our study (4.8%) were extremely obese compared to 1.5% of males. It has been shown that obese men and women are generally at higher risk for adverse health events than those who are considered overweight.<sup>18</sup>

The observed increased prevalence in obesity and overweight as shown from our study reflects a true increase in the incidence of obesity as urbanization is spreading in our society. This is clearly demonstrated in our data as urban Saudis have significantly higher prevalence of obesity compared to Saudis living in rural areas. The difference in overweight prevalence between urban and rural Saudis is not significant. However, the effect of urbanization is more evident when comparing the prevalence of extreme obesity as it is doubled at 3.8% for urban versus 1.9% for rural Saudis. It is obvious that sedentary life, unhealthy eating habits such as fast foods, excessive dining as well as lack of physical activities are the hallmark factors when living in an urban area in contrast to rural areas, consequently, leading to a true increase in overweight and obesity. The observed lowest rate of obesity prevalence in the Southern region of at a rate of 29.9% is likely to be attributed to more

**Table 1** - Prevalence of overweight and obesity categorized by gender.

Factors	Male %	Female %	Total %	p-value
<b>Overweight (BMI=25.1- 29.9 kg/m<sup>2</sup>)</b>				
Crude prevalence	42.4	31.8	<b>36.9</b>	<0.0001
95% CI	(41.3 - 43.5)	(30.8 - 32.8)	(36.2 - 37.6)	
Adjusted by age groups*	42.3	31.8	<b>36.6</b>	
<b>Obese (BMI ≥30 kg/m<sup>2</sup>)</b>				
Crude Prevalence	26.4	44.0	<b>35.6</b>	<0.0001
95% CI	(25.5 - 27.3)	(43.0 - 45.0)	(34.9 - 36.3)	
Adjusted by age group*	26.3	43.6	<b>35.5</b>	
<b>Mean body mass index (BMI)</b>	<b>27.49 ± 5.01</b>	<b>29.64 ± 6.23</b>	<b>28.61 ± 5.78</b>	<0.0001

\*The population of respective age groups of census report of year 2000 was used for age adjustment. CI - confidence interval

**Table 2** - Prevalence of normal weight, overweight and obesity for demographic factors of gender, age, residence and regions.

Factors	N	Not overweight nor obese ≤25 kg/m <sup>2</sup>	Overweight 25.1 - 29.9 kg/m <sup>2</sup>	Obese ≥ 30 kg/m <sup>2</sup>	p-value
<b>Gender/age (years)</b>					
<i>Male</i>					<0.0001
30 - 39	2136	33.2	41.6	25.2	
40 - 49	2170	25.7	44.0	30.3	
50 - 59	1962	29.7	42.5	27.8	
60 - 70	1947	36.3	41.6	22.1	
<b>Total</b>	<b>8215</b>	<b>31.1</b>	<b>42.4</b>	<b>26.4</b>	
<i>Female</i>					<0.0001
30 - 39	3775	28.1	31.7	40.2	
40 - 49	2717	18.7	31.1	50.2	
50 - 59	1522	22.3	31.8	45.9	
60 - 70	994	27.0	34.0	39.0	
<b>Total</b>	<b>9008</b>	<b>24.2</b>	<b>31.8</b>	<b>44.0</b>	
<b>Residence</b>					<0.0001
Urban	11723	23.4	36.9	39.7	
Rural	5500	36.1	36.9	27.0	
<b>Region</b>					<0.0001
Central	3995	23.6	36.4	40.0	
Northern	1536	26.2	36.8	37.0	
Southern	3590	31.8	38.3	29.9	
Western	5462	30.6	36.7	32.7	
Eastern	2640	21.9	35.9	42.2	
<b>Total</b>	<b>17223</b>	<b>27.5</b>	<b>36.9</b>	<b>35.6</b>	

**Table 3** - Obesity prevalence in Arabian Gulf countries

Authors	Country	Year published	Age group (years)	Sample size	Prevalence of obesity %
Osman and Al-Nozha <sup>16</sup>	Saudi Arabia	2000	≥18	6,253	20.5
El-Hazmi and Warsy <sup>17</sup>	Saudi Arabia	2000	≥14	14,000	20.3
Masjedi and Al-Mannai <sup>24</sup>	Bahrain	2001	30-79	514	34.9
Carter et al <sup>22</sup>	United Arab Emirates	2004	≥18	535†	35
Sorkhou et al <sup>23</sup>	Kuwait	2004	≥40	250	46
Al-Nozha et al*	Saudi Arabia	2004	30-70	17,232	35.6

\*present study, †all female

physical activity as well as healthier eating habits as more individuals are maintaining rural lifestyle in the southern region. Moreover, the increase in obesity and overweight prevalence is likely to be augmented by selecting older population in our study between ages 30-70 years in comparison to the younger age groups selected in the other 2 studies, nonetheless, our selected age range are the most vulnerable to health hazards related to obesity, particularly associated with CAD. The Nutrition Committee of the American Heart Association has identified obesity as an independent risk factor for CAD.<sup>19,20</sup> Furthermore, obesity has been classified as a category II risk factor, that is, a risk factor for which intervention may lower the incidence of CAD events.<sup>21</sup> The observed increase in obesity prevalence is noted by other investigators to affect other populations as well. The reported figures from nearby gulf countries showed the prevalence of obesity is 35% in United Arab Emirates, 46% in Kuwait, and 34.9% in Bahrain.<sup>22-24</sup> Another study from Kuwait showed that the rate of temporal changes in BMI and obesity were higher than other countries.<sup>25</sup>

We further looked at the prevalence of obesity according to age groups, our data showed nonlinear relationship as the prevalence of obesity and extreme obesity reached a peak in the age group of 40-49 years; whereas, the prevalence declines in the other groups. However, it was linear relationship with overweight as shown by overweight prevalence of 35.3% at age 30-39 years that persistently increased reaching 39% at age group 60-70 years. Recent study from Spain reported a high rate of obesity among elderly adult Spanish population 60 years and older as the prevalence was 31.5% in men compared to 40.8% in women.<sup>26</sup> It is obvious from the data presented here that overweight and obesity are current and active problems in the Saudi community. Therefore, we have an obligation, as health care providers, to address and provide practical solution to this problem, such as promoting healthier eating habits as well as weight reduction to maintain BMI <25 kg/m<sup>2</sup>, particularly previous data have shown evidence that medical complications of obesity are reversible.<sup>27-29</sup>

In summary, the prevalence of overweight and obesity is increasing in KSA. The current data demonstrate that approximately three fourth of females and nearly two third of males in KSA are either overweight or obese. Therefore, the large portion of the Saudi community falls either in the overweight or the obesity range that are well known risk factors to variety of medical disorders. Adopting modern lifestyle with less physical activity and unhealthy eating habits are the most likely causes of increasing the prevalence of obesity. We therefore, recommend aggressive campaign against obesity that promotes exercise and

healthier eating habits starting at younger age groups to prevent an inevitable obesity epidemic.

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