Prevalence and 10-year secular trend of obesity in Oman

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ABSTRACT

Objective: To determine the prevalence of overweight and obesity by age, gender and region and to assess the difference between rural and urban populations and determine the trends of the past decade.

Methods: Analysis of nationally represented samples from 2 cross-sectional surveys conducted in 1991 and 2000, containing 5,086 and 6,400 Omani citizens aged ≥20 years. Body mass index (BMI) (weight in kg) divided by height (in meters squared) was calculated using measured height and weight data. Overweight was defined as BMI 25-29.9 kg/m^2 and obesity as BMI ≥ 30 kg/m^2.

Results: In the year 2000, the age adjusted prevalence of obesity reached 16.7% in men, compared to 10.5% in 1991 (p<0.001). In women, the prevalence was 23.8% in 2000, compared to 25.1% in 1991 (p=0.231). Similarly, the prevalence of overweight increased among men, from 28.8-32.1% (p=0.011) and decreased among women, from 29.5-27.3% (p=0.053). When obesity and overweight were combined, there was a significant increase in men (9.5%; p for the change <0.001) and decrease in women (3.5%; p for the change <0.003). Obesity and overweight combined was markedly more common in the Southern part of Oman (70%) compared to Northern areas (32-57%). People living in urban areas were more obese (21.1%) than those living in the rural communities (13.1%) (p<0.001).

Conclusion: The prevalence of obesity is high in Oman and has increased predominantly among men. Primary prevention programs are needed to counteract this condition and its cardiovascular and metabolic complications.

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The problem of weight gain has reached an epidemic proportion globally. The prevalence of obesity in adults is estimated to be between 10-25% in most countries in Western Europe, 20-25% in some countries in America, and even higher rates (40-70%) have been reported in some parts of the world.[1] Obesity was ranked among the top 10 causes of morbidity and mortality measured both by deaths and disability adjusted life years (DALYs) lost for the whole human population.[2] The hazards of this public health problem to the health of individuals and populations were also highlighted in the recent World Health Organization (WHO) reports.[3,4]

Not only obesity has increased in developed countries but an increasing number of developing countries report alarmingly high rates of overweight and obesity. Several epidemiological studies have demonstrated high rates of overweight and obesity in countries of the Eastern Mediterranean Region of WHO.[5-10] In Oman, 2 nationwide cross-sectional surveys were conducted 10 years apart. First, the National Diabetes Survey,[11] conducted in 1991, was followed by a comparable National Health Survey in 2000 to estimate the non-communicable disease risk factors including obesity.[12]

In this analysis, we report on the prevalence of obesity in relation to age, gender, region and in rural

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Table 1 - Mean body mass index and standard deviation by gender and age group, Oman 1991 and 2000.

Age Group	1991			2000		
	n	Mean	SD	n	Mean	SD
Males						
20-29	684	23.0	3.9	1247	24.1	4.9
30-39	488	25.3	4.1	579	26.2	4.7
40-49	455	25.6	4.5	415	27.0	5.2
50-59	281	24.6	4.6	361	26.3	5.6
60-69	153	23.6	4.3	269	25.1	5.6
70-79	56	21.9	4.0	138	23.7	4.6
80+	11	21.3	2.8	60	22.2	4.6
All	2128	24.3	4.4	3069	25.2	5.1
Females						
20-29	1010	24.8	5.8	1343	24.5	6.0
30-39	817	27.3	6.0	756	27.0	6.4
40-49	555	27.6	5.9	337	28.2	6.3
50-59	348	27.2	6.2	544	26.4	6.0
60-69	171	25.6	5.6	200	26.7	6.3
70-79	51	23.8	4.3	102	23.5	4.9
80+	6	25.6	4.3	49	22.8	4.9
All	2958	26.3	6.0	3331	25.8	6.2
Total	**5086**	**25.5**	**5.5**	**6400**	**25.5**	**5.7**

n - number of individuals, SD - standard deviation

and urban settings in Oman. Furthermore, we compare results of the 2000 survey with that of the 1991 survey using WHO cut points for overweight and obesity.

Methods. ***Sampling and data collection.*** The 1991 survey was conducted to estimate the prevalence of diabetes mellitus and other cardiovascular risk factors among the Omani population. Households from typical residential areas in each administrative region were selected to participate in the survey with additional areas selected from regions which lacked population homogeneity and had more population density. The National Health Survey in 2000, aimed at estimating non-communicable diseases related risk factors. It employed multi stage stratified probability sampling method in which 49 census enumeration areas (CEA's) were randomly selected according to proportional allocation of the population in each region and to give an urban rural ratio similar to that of the 1993 National Census (2:1). A census of all households living within the selected CEA's was conducted to obtain a sampling frame. Subsequently, households were selected from this frame using systematic random sampling technique and all eligible subjects within a household were included in the survey. Both study protocols were seen and approved by the central research and ethics committee and informed consent was given by study subjects.

The target population in both surveys was Omanis aged ≥20 years in the 10 administrative regions of Oman. There were 5,086 subjects (2,128 males and 2,958 females) in the 1991 survey and 6,400 subjects (3,069 males and 3,331 females) in the 2000 survey. The response rates in 1991 survey was 92% and 91% in the 2000 survey.

Anthropometric measurements. In 1991, all selected subjects were asked to come to the nearest health center for clinical and anthropometric measurements. Following a brief interview, height and weight were measured in standing position and without footwear using a fixed metal scale and a beam balance. In the year 2000, households were visited by trained survey teams to interview subjects and obtain various anthropometric measurements. Height of eligible subjects within each household was measured without footwear using a wooden vertical ruler fixed to the wall. The weight was recorded using portable bathroom scales which were checked regularly against standard weights. The body mass index (BMI) was used as a measure of overweight and obesity and was calculated as weight in kilograms divided by the square of height in meters. Overweight was defined as BMI 25-29.9 kg/m^2 and obesity as BMI ≥30 kg/m^2. These definitions are consistent with those of WHO and the National Heart, Lung and Blood institute of North America.[4,13]

Statistical methods. Data were entered in EPI INFO software (Center for Disease Control and Prevention, Atlanta, Georgia, United States of America (USA)) and exported to Intercooled Stata software package version 7 (Stata Corporation, Collage Station, Texas, USA) to calculate prevalence rates, 2 sided *p* values and 95% confidence intervals for the difference in prevalence of overweight and obesity in both genders using 2 sample t-test of proportions. To facilitate comparisons with other published rates, the prevalence of overweight and obesity were age-adjusted by direct method[14] (see annex to reference 14) within 10-year bands using the World Standard Population.[15] Subjects with missing data on age, gender height and weight as well as women with pregnancy were excluded from this analysis.

Results. The mean BMI increased from 24.3 kg/m^2 in 1991 to 25.2 kg/m^2 in 2000 among males (*p* value for the difference <0.001), but decreased from 26.3 kg/m^2 to 25.8 kg/m^2 among females (*p* value for the difference <0.001) (**Table 1**). The mean BMI increased with increasing age and peaked in the age group (40-49) in both genders and over both periods. The prevalence of overweight and obesity by gender and age group is shown in **Table 2**. In 1991, 28.8% of men aged ≥20 years were overweight and a further 10.5% were obese. In the

Table 2 - Age-adjusted and age-specific prevalence of overweight and obesity by gender among Omanis, in 1991 and 2000.

Age Group	Overweight		Obesity		Overweight and obesity combined		Percentage change between 1991 and 2000 (95% CI)			
	1991	2000	1991	2000	1991	2000	Over-weight	95% CI	Obesity	95% CI
Males										
20-29	18.9	24.6	6.6	11.0	25.5	35.6	5.7	1.9, 9.4	4.4	1.8, 6.9
30-39	37.9	37.0	12.5	19.7	50.4	56.7	-0.9	-6.0, 4.9	7.2	2.8, 11.6
40-49	36.3	41.0	16.5	23.1	52.8	64.1	4.7	-1.7, 11.2	6.6	1.3, 11.9
50-59	32.4	34.6	12.6	19.9	45.0	54.5	2.2	-5.1, 9.5	7.3	1.6, 12.9
60-69	26.8	29.7	8.5	16.4	35.3	46.1	2.9	-6, 11.8	7.9	1.6, 14.1
70-79	19.6	29.7	1.8	8.0	21.4	37.7	10.1	-2.7, 22.9	6.2	0.4, 11.9
80+	0.0	15.0	0.0	5.0	0.0	20.0	15.0	5.9, 24.0	5.0	-0.5, 10.5
All	28.8	32.1	10.5	16.7	39.3	48.8	3.3	0.7, 5.8	6.2	4.3, 8.0
Females										
20-29	23.7	23.0	18.1	15.9	41.8	38.9	- 0.7	-4.0, 2.7	-2.2	-5.2, 0.8
30-39	31.9	30.3	31.2	28.3	63.1	58.6	- 1.6	-6.2, 2.9	-2.9	-7.4, 1.6
40-49	30.4	30.9	32.1	35.3	62.5	66.2	0.5	-5.7, 6.7	3.2	-3.2, 9.6
50-59	31.6	31.6	29.9	23.7	61.5	55.3	0.0	-6.2, 6.2	-6.2	-12.2, -0.2
60-69	27.5	29.0	25.1	26.0	52.6	55.0	1.5	-7.7, 10.7	0.9	-7.9, 9.7
70-79	33.3	27.4	5.9	8.8	39.2	36.2	-5.9	-21.4, 9.7	2.9	-5.6, 11.4
80+	66.7	20.4	0.0	8.2	66.7	28.6	-46.3	-85.6, -6.9	8.2	0.5, 15.9
All	29.5	27.3	25.1	23.8	54.6	51.1	-2.2	-4.4, 0.0	-1.3	-3.4, 0.8
Total	**28.9**	**30.4**	**19.0**	**20.5**	**47.9**	**50.9**	**1.5**	**- 0.2, 3.1**	**1.5**	**0.03, 2.9**

CI - confidence interval

year 2000, the prevalence were 32.1% for overweight and 16.7% for obese, indicating a 3.3% increase in overweight and twice as much in obesity. In comparison, Omani women had a decreasing trend in overweight (from 29.5-27.3%) and obesity (from 25.1-23.8%). When obesity and overweight were combined, there was a 9.5% increase in men (p value for the difference <0.001) and a 3.5% decrease in women (p value for the difference =0.003). Among men, all age-specific changes in overweight and obesity showed an increasing trend except for those aged 30-39. Changes among women were less consistent among different age groups.

For men, the distribution of BMI between the year 1991 and 2000 has shifted to the right (**Figure 1a**), with a greater shift noted at the upper percentiles leading to more skewed distribution. On the other hand, the females distribution curve was more broad-based with a slight shift to the left mainly at the upper percentiles of the distribution (**Figure 1b**).

The regional distributions of overweight and obesity combined in 2000 were similar to those of observed in 1991. The prevalence of overweight and obesity in the 10 administrative regions of Oman in the year 2000 ranged from 20-33% for overweight and 10-40% for obese. The highest combined prevalence of overweight and obesity was observed in the most southern region of Oman in Dhofar followed by South Sharqiyah, Al-Wusta, the capital Muscat and Adh-Dhahirah regions (**Figure 2**). In comparison, the lowest observed prevalence was seen in the most northern tip of Oman in the Musandum peninsula (32%). The year 2000 survey also collected data by rural and urban residence. Overweight did not differ by area of residence (29.4% in urban versus 27.8% in rural, p=0.210), while obesity was found to be significantly higher among urban (21.1%) compared to rural (13.1%) population (p<0.001).

Discussion. Both overweight and obesity has markedly increased among Omani men during the past decade, while a declining trend was seen among Omani women. The increase in the prevalence of obesity among men was approximately the same size as reported among US males aged 20-74 years between 1988-2000.[16] The increase among men may be attributed partly to rapid urbanization in Oman. Due to the oil boom in the early 80's, an increasing number of Omanis have been leaving rural agricultural areas and labor intense traditional jobs, to join more sedentary jobs as civil servants in the capitol Muscat. On the other hand, the decreasing trend among women may be attributed to several factors such as increasing educational levels among females, declining fertility rates in Oman, and improved awareness of "self-image".

During the early 1970's gender disparities in school enrollment in Oman has been in a continuous decline. In 1989 for example, 82% of Omani

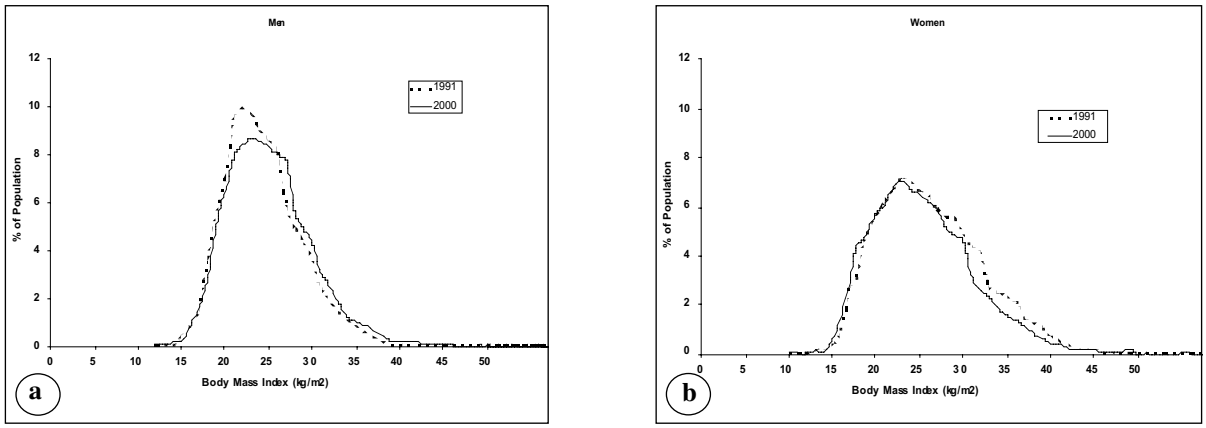

Figure 1 - **a)** Distribution of body mass index among Omani men in 1991 and 2000, **b)** Distribution of body mass index among Omani women in 1991 and 2000.

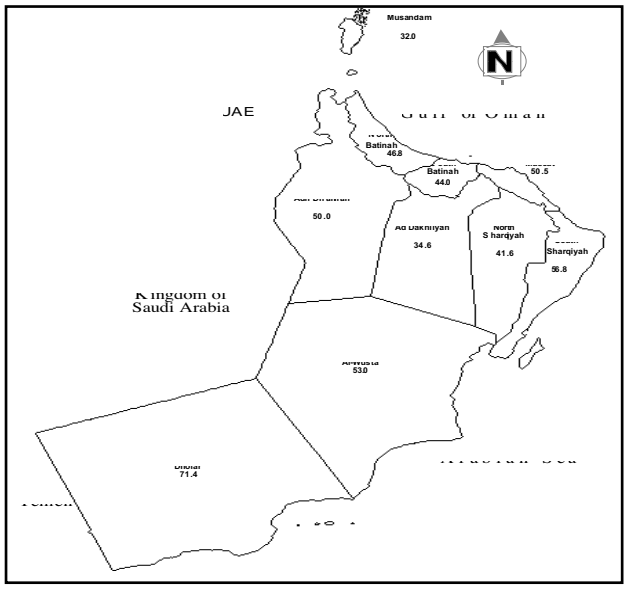

Figure 2 - Prevalence (%) of combined overweight and obesity by region among 6400 subjects (3069 men and 3331 women), in the National Health Survey, Oman, 2000.

females were estimated to be illiterate or did not complete primary education. In 1995, the corresponding figure was 60.8%.[17,18] Moreover, the decline in illiteracy was at a sharper rate among females (21.2% decline) compared to males (15.8% decline) over the same period of time. The number of women in higher education in Oman has also been on rise. In the academic year 1988/1989, 43% of university enrolled students were females while in 1993/1994 females comprised 55% of the total enrolled students.[17] Decreased fertility is also associated with reduced rates of obesity and overweight among women. The total fertility rate of Omani women has decline by almost half, from 7.8% in 1988-1989 to 4.2% in 2001.[17,19]

Over the past 3 decades, starting with the discovery and exportation of crude oil, Oman has witnessed rapid socio economic developments which were nonetheless, accompanied by a shift from traditional to more "westernized" lifestyles including dietary changes, physical inactivity and increased rates of smoking. Consumption of high fat caloric-dense food, refined sugar and salt has increased and in the same period, physical activity has decreased.[20,21] Due to economic development and advances in technology, relatively fewer people are physically active during their daily work. Rapid increase in car ownership (from only few cars in Oman in the 1970 to current ratio of 1 car : 4 people) has lead to further decrease in physical

activity.[22] Even though the prevalence of obesity increased among men and decreased among women between 1991 and 2000, both surveys show obesity to be more prevalent among women. Cultural and social restrictions in Oman often imply requirements for men and women separateness especially in regions other than the capitol Muscat. As a result women-only exercise facilities tend to be rare and expensive, and even where mixed facilities exist, training and coaching is mostly provided by men, making it less favorable for women to exercise.[23] In addition, current cultural norms in Oman, make it less acceptable for women to be seen walking or exercising alone without the company of a close family member. Also confinement of most women as "housewives" assisted by expatriate housemaids and hot weather during most parts of the year have been contemplated as putative risk factor for obesity among Arab Muslim women in addition to high dietary food intake.[24]

High prevalence rates of overweight and obesity have also been noted among many developing populations of the Middle East. Nearly 70% of Kuwaitis, 30% of Saudis, 25-30% of Iranians, aged 20 years and over, were reported to have overweight using the WHO cut-points.[6,8,25] Even higher rate of obesity than observed in Oman have been reported in neighboring countries (36% in Kuwait and 22% in Saudi Arabia). In comparison less than 1% of people in Ghana and Mali have obesity.[26] Using the same cut points, the following obesity prevalence rates have been reported worldwide, 1.7-2.7% in Japan, 9% in Canada and 31% in United States.[4,16,27] Both surveys have shown a consistent regional trend for overweight and obesity in 1991 and 2000. Higher prevalence rates of overweight and obesity combined were found in the southern part of Oman (70%) compared to the northern parts (32-50%). A United Nations Children Fund survey conducted in early 1990's among 907 women found also the highest prevalence of combined overweight and obesity in the southern region (82.5%) compared to north (35-62%) using same WHO cut points.[28] A food habit survey among women comparing the northern part (Muscat) with the southern region (Dhofar) showed women in the south consumed food rich in saturated fat significantly more than women in the north.[20] In addition, adiposity is believed to be "a sign of good health and prosperity" in the south region of Oman resulting in obesity being accepted and even desirable. Further, women in the south of Oman are culturally and socially more restricted and segregated from men as compared to women in the northern parts of Oman. Such disparities may explain the high rates of obesity in the southern region of Oman.

Our analysis has also shown that urbanized areas of the country had higher prevalence of obesity as compared to more remote and rural areas. This finding is consistent with results reported from nearby countries, such as Bahrain and Pakistan, indicating that rural living is still associated with physical activity, healthy food consumption, and even limited food availability.[29,30]

In conclusion, this report highlights the problem of overweight and obesity in Oman and alarms that the burden of obesity related diseases can only be expected to rise in a nation which already suffers from relatively high prevalence of diabetes and hypertension. Primary prevention programs with lifestyle modifications are needed for weight control and prevention of obesity in Oman and in similar rapidly developing countries.

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