Blood lipids and body fat in Bahraini women

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ABSTRACT

Objectives: The aim of this study was to examine some biomedical parameters of a representative sample from the population of overweight and obese, and average weight Bahraini women visiting 2 health centers in Bahrain.

Methods: This study was conducted over a period of 4 months in 2 health centers in the urban city of Muharraq in Bahrain, namely Muharraq Health Center and Shaikh Salman Health Center. The association was examined between body mass index, and the distribution of body fat determined by the waist hip ratio. Serum triglycerides, total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, as well as glucose levels were measured.

Results: The 2 groups of pre-menopausal women selected for this study were of similar age (mean of 30.4 and 30.7 years) but differed significantly in their body mass index values; however, their mean waist hip ratio was similar (0.80 and 0.82). The type of obesity shown by these Bahraini women was not associated with an elevation of serum glucose concentrations, or with significant differences in either serum cholesterol or triglyceride concentrations. There was however, a statistically significant difference between the 2 groups with respect to the level of high-density lipoprotein cholesterol, which was lower in the obese group, compared with the lean counterparts. Furthermore, the ratio of high-density lipoprotein to low-density lipoprotein cholesterol was significantly lower in the obese subjects, compared with the controls.

Conclusion: Obesity in a group of Bahraini women was associated with indices predisposing to coronary heart disease, and this has public health implications.

Keywords: Pre-menopausal, serum cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol.

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The rapid change in socioeconomic status of the Bahraini population due to oil revenues during the past 30 years has led to great changes in food habits and lifestyle. The most commonly occurring chronic diseases that are influenced by over-consumption of animal foods, fat and sugar are cardiovascular diseases (atherosclerosis, arterial thrombosis and hypertension) and diabetes mellitus (DM).[1,2] Coronary heart disease (CHD) is the principal disease frequently associated with obesity in the public's mind and is considered to be the leading cause of death in Great Britain (GB), the United States of America (USA) and other western countries.[2] Similarly, heart diseases are the first cause of death in Bahrain, accounting for 36% of total deaths in 1999, and have retained this position since 1991.[3] The relationship of obesity to CHD is at present not clear and there is some debate as to whether obesity is a direct etiological factor. For instance, Keys[4] disputed whether obesity was important in explaining cross-cultural differences in CHD. Nevertheless, if account is taken of long-term follow-up, for example over 5 years, the role of

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obesity in CHD is claimed to become more evident.[5] An association between obesity and CHD was found in the very obese, namely those with a body mass index (BMI) above the 80-90 percentile, in an American Cancer Society study, and this occurred in both young men and young women.[4] It is possible that the risk factors for CHD, hyperlipidemia, hypertension and low plasma concentrations of high density lipoproteins (HDL) are more prevalent in individuals who are obese than in those of normal body weight.[6] Upper body obesity, caused by an intake of dietary energy in excess of requirements, increases cardiovascular risk factors, probably as a result of hyperinsulinemia.[7,8] Obesity is closely related to Type 2 DM as well as to premature cardiovascular disease.[9] Indeed, the link between this type of diabetes and obesity is sufficiently strong so that weight reduction in the obese diabetic patient could be used as a treatment for the disease.[10] Type 2 DM is the main type of the disease in Bahrain and has been estimated to account for about 4% of total deaths in 1991,[11] however this value has increased within the last 10 years and now it accounts for approximately 18%.[12] Musaiger[13] reported that in hospitalized patients examined in 1982 approximately 30% of the diabetics were from Muharraq city, and the same percentage were from Manama city (the capital) while the prevalence in rural areas was very low; 2% from the western region, 3% from Sitra and 3% from the northern region. The rational of the present study was based on the findings previously reported[14] that 30% of women in Bahrain were overweight and about the same proportion were obese.

Methods. The women selected for the study, 19 average weight, and 21 overweight or obese, had formed part of the population included in our study of obesity in Bahraini adults.[14] The subjects were informed about the objectives of the study and they agreed to participate and to complete a questionnaire about the family background of disease disorders. The subjects also agreed to provide a sample of blood for analysis. Fasting blood samples were collected by venepuncture. The blood samples were allowed to clot and the serum separated by centrifugation. The serum samples were frozen at -20^{0}C and stored at that temperature until analyzed. The women were divided into 2 groups according to their BMI (calculated as body weight in Kg/height in meters squared). Using Garrow classification for obesity,[15] those of average or ideal body weight had a BMI in the range 20-24.9, whilst those who were obese had a BMI in the range 30-45. The body measurements of the women-weights, heights, and waist and hip circumferences and the calculated waist/hip ratios (WHR), were included in those reported in our previous paper.[14] Information on the disease patterns in the subjects and those of their first degree relatives was collected by questionnaire. The laboratory analysis was performed as described in the Stanbio Laboratory Techniques Manual, San Antonio, Texas, 1995. The Oxstat statistical program, and Microsoft Excel, were used to undertake the statistics in this study. The Students' unpaired t-test was used to analyze the differences between the 2 groups chosen for this study.

Results. Table 1 shows that there was no significant difference in the mean age or mean WHR between the 2 groups of women with significantly different BMIs, 23±1.9 for average weight group and 35±4.8 for the obese (P<0.0001). Blood glucose concentrations were within the normal range levels in the whole sample with no distinction between average weight (mean=4.07 mmol/L) and obese subjects (mean=4.18 mmol/L). Higher than normal blood glucose are apparent, the most likely explanation for this is that although the subjects were asked to fast overnight, the occasional one forgot to do so, and failed to mention this. The mean serum concentration of the 3 lipid components, cholesterol, triglycerides and low-density lipoprotein (LDL)

Table 1 - Age, BMI, WHR, and blood glucose and lipid indices of Bahraini women with average and elevated BMI values. Values given in this table are mean +/- standard deviation ranges.

Biochemical parameter	Group A (BMI 20-25) (n = 19) Mean +/- SD and range	Group B (BMI >30) (n = 21) Mean +/- SD and range	P-value
Age (years)	30.7 +/- 4.2 (23-37)	30.4 +/- 4.5 (23-40)	(0.85)
Body Mass Index (BMI)	22.8 +/- 1.68 (20-25)	34.6 +/- 4.8 (30-45)	(0.000)***
Waist/Hip Ratio (WHR)	0.80 +/- 0.07 (0.7-0.96)	0.82 +/- 0.05 (0.74-0.94)	(0.35)
Glucose (mmol/L)	4.07 +/- 0.66 (3.08-5.5)	4.18 +/- 0.77 (3.1-6.71)	(0.52)
Cholesterol (mmol/L)	4.43 +/- 0.85 (2.69-6.03)	4.74 +/- 0.83 (3.52-6.22)	(0.261)
Triglyceride (mmol/L)	1.02 +/- 0.35 (0.46-1.56	1.36 +/-0.7 (0.69-3.8)	(0.056)
HDL (mmol/L)	1.24 +/-0.26 (0.78-1.61)	1.1 +/- 0.23 (0.65-1.48)	(0.025)*
LDL (mmol/L)	2.62 +/- 0.83 (1.37-4.38)	3.03 +/- 0.71 (1.81-4.3)	(0.079)
HDL/LDL Ratio	0.47 +/- 0.3 (0.57-0.37)	0.36 +/- 0.32 (0.36-0.34)	(0.008)**

Where * = P<0.05; ** = P <0.01; *** = P < 0.001
HDL - high-density lipoprotein; LDL - low-density lipoprotein

Table 2 - The occurrence of different diseases in obese and average weight Bahraini women and their first-degree relatives.

Incidence of disease	Group A- Average weight group and their relatives (BMI - 20-35)				Group B - Obese group and their relatives (BMI > 30)			
	Average weight n = 19	Their Mothers n = 19	Their Fathers n = 19	Their Siblings n = 106	Obese group n = 21	Their Mothers n = 21	Their Fathers n = 21	Their Siblings n = 121
Diabetes	2*	3	3	2	1*	2	5	-
Hypertension	1*	2	-	-	2*	2	2	1
High Cholesterol level	-	1	1	1	3	-	1	1
Cardiovascular Diseases	-	-	-	-	-	-	3	-
Backache	3	-	-	-	14	-	-	-
Arthritis	-	-	-	-	2	1	1	-
Thyroid Dysfunction	-	-	-	-	2	-	-	-
Kidney Stone	-	-	-	-	1	-	-	-
Anemia	3	-	-	-	2	2	-	-
TOTAL	**9**	**6**	**4**	**3**	**27**	**7**	**12**	**2**

* Indicates that these diseases occurred during pregnancy only. Obese group Siblings n = 121 (sisters = 68, brothers = 63). Overweight group Siblings n = 106 (sisters = 49, brothers = 57).

cholesterol, tended to be higher in the overweight/obese women relative to those of normal body weight. However, the ranges of individual values showed considerable overlap and the mean values for each component were significantly different between the 2 groups. Though there was some overlap in the ranges of the concentration of HDL cholesterol between the 2 groups, the mean concentration of HDL cholesterol in the overweight/obese was significantly lower ($P<0.05$) than that in the women of normal body weight. The difference between the 2 groups with respect to HDL cholesterol is emphasized by the more significant difference ($P=0.008$) in the HDL/LDL ratio. The normal average range for this ratio in our laboratory is 0.46-0.49 and the range of individual values in the overweight/obese women shows that all the values were below the normal range. The number of subjects who had serum values above and below the normal range was investigated. In the normal weight group, 9 (47%), 3 (16%) and 2 (11%) subjects had below the normal range values for glucose, cholesterol and LDL-cholesterol, with no values above the normal range. In comparison, in the obese group, 6 (29%), 4 (19%) and 2 (10%) subjects had below the normal range values for glucose, cholesterol and HDL-cholesterol, with one (5%) high glucose and 5 (24%) high triglyceride values. On studying the family history disease of these subjects, it was observed that 33% of mothers and 57% of the fathers of these obese subjects had obesity-related diseases such as diabetes, hypertension, arthritis, hyper-cholesterolemia and cardiovascular diseases, while 32% of the mothersand 21% of the women of average weight suffered from an obesity-related disease (Table 2). It was also found that a small percentage of the other first-degree relatives namely, brothers and sisters, were identified as having diseases related to obesity, specifically hypercholestolemia, hypertension, and diabetes. This observation was valid for both groups of women (Table 2).

Discussion. Obesity has been found to be more prevalent in Bahraini women than Bahraini men.[11] A similar finding was obtained earlier in Saudi diabetic patients,[16] where obesity was encountered more frequently in females (83%) than in males (41%). Children of obese Bahraini women consume more food as measured by their energy intake.[17] Therefore, obese women may influence the occurrence of obesity in their children because they are the food providers in these families. In the present study, the 2 groups of women were of similar age but differed in their degree of fattness, as indicated by their BMIs. Their WHR was however, found to be similar. The differences in fat content in the obese women was due to greater fat deposition in the upper part of the body, namely on the arms and shoulders.[14] As this type of fat is not included in any waist measurements (it is above the line of measurement), this explains the finding that the subjects who were obese have similar waist/hip measurements but different BMI values to the normal weight subjects. Indeed, this

kind of obesity was not associated with elevated serum glucose concentrations. Additionally, it was not associated with elevated concentrations of either total cholesterol or triglycerides. However, it was associated with a lower concentration of HDL cholesterol and particularly with a lower HDL/LDL ratio. These findings agree with those of Glueck and colleagues[18] who also reported that HDL cholesterol concentrations and HDL/LDL ratio were reduced in obese persons. It is these changes in HDL concentration, which could increase the likelihood of development of atherosclerosis and CHDs in later life.

It is now generally accepted that higher values of HDL/LDL ratios are favorable factors in reducing the risk of CHD. One possible mechanism for the protective action of HDL cholesterol is that these lipoproteins are usually low in cholesterol and rich in phospholipids and facilitate clearance of cholesterol from the athrematous plaque and its transport to the liver, where it may be degraded rather than reutilized in the further synthesis of LDL.[19] The distribution of body fat as indicated by WHR has been considered to be a more important predictor of metabolic health risks than total body fat.[20] For females, a ratio of >0.8 is considered an overt degree of abdominal adiposity.[21] Excess body fat in women tends to be deposited in the femoral or gluteal region, giving the body a pear shape.[22] However, this is not so in Bahraini women for they deposit more fat than US women in the subscapular region,[14] Gray 1989, determined that the risk of developing coronary disease is greater for those with a higher subscapular skinfold thickness at any level of BMI.[23] In the overweight/obese women in the present study, the mean WHR was similar to that in women of average body weight. It therefore remains to be established whether the WHR in Bahraini women has any predictive value for proneness to either DM or CHD. In a Danish population,[24] it was shown that in men variations in blood lipids could be explained by the overall obesity rather than by abdominal obesity; however in women the reverse was true. As to the serum concentration of HDL cholesterol, it is of interest that in elderly patients, this has been increased by an ascorbic acid supplement.[25] Thus the main finding of this study is that the level of HDL cholesterol was reduced in women who were obese but who did not have a high WHR, as usually reported in western women. The public health implications of this finding with respect to heart disease and diabetes merits further investigation.

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