

## Prevalences and Correlates of Diabetes, Obesity, and Hyperlipidemia in the United Arab Emirates (UAE)

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Associated with the rapid socioeconomic development during the last three decades, coronary heart disease (CHD) has emerged as a major cause of mortality in the UAE. Yet the prevalences and correlates of CHD risk factors including diabetes, obesity, and hyperlipidemia have not been studied in depth in any UAE population. We examined 358 apparently healthy office-based male employees of the Abu Dhabi oil industry for these three conditions. These men, aged 35-49 years, belonged to one of six ethnic groups: South Asian, Peninsular Arab, Shawam, Egyptian, Afro-Arab and European. Of all studied men, 10% had diabetes and 18% had glucose intolerance, 51% of the men were grade 1 overweight (body mass index (BMI): 25.00-29.99) and 18% were grade 2 (BMI:30.00-39.99) or grade 3 (BMI > 40.00) overweight. 31% of the men had a waist-hip ratio of 1:0. Borderline high levels (200-239 mg/dL) and high level (>240 mg/dL) of total blood cholesterol were detected in 35% and 39% of the men, respectively. The prevalences of the three studied CHD risk factors were associated with selected sociodemographic (age, ethnicity, level of education, and professional status) and lifestyle (current cigarette smoking and leisure-time physical activity) variables. The high prevalences of diabetes, obesity, and hyperlipidemia in this group of apparently healthy men emphasise the urgent need for effective interventions and further in depth research in this population and other comparable populations in the UAE.

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Associated with the rapid socioeconomic development and lifestyle changes during the past three decades, cardiovascular disease (CVD) has emerged as a leading cause of mortality in the United Arab Emirates (UAE)<sup>1</sup>. Therefore the need for CVD risk reduction in the UAE cannot be over-emphasised. The epidemiologic features of CVD risk factors have been studied extensively in the United States and Western Europe. Unfortunately, findings of these studies of CVD risk factors may not be directly applicable to the populations of other areas including the UAE<sup>2</sup>.

Therefore, before plans and programmes for CVD risk reduction in the UAE can be formulated and implemented, the epidemiology of CVD risk factors will have to be studied well. Currently, little is known about the prevalences and correlates of the major CVD risk factors in any population group in the UAE. This study was an attempt to fill partly this major knowledge gap.

The aims of this study were to estimate the prevalences of selected CVD risk factors (diabetes mellitus, impaired glucose tolerance (IGT), obesity defined by body mass index (BMI) and by waist-to-hip circumference ratio (WHR), and elevated blood cholesterol) and to examine the associations of these prevalences with selected sociodemographic and lifestyle characteristics in a group of apparently healthy adult males in the UAE. Of all sociodemographic

characteristics studied, we were particularly interested in ethnicity because of the multiethnic composition of the UAE population.

### METHODS

#### Study subject selection

Our study subjects, aged 35-49 years, were office-based male employees in a group of petroleum companies in Abu Dhabi, the capital of the UAE. We studied an occupational group rather than a community-based sample because of resource and logistic constraints. During May 1995 through January 1996, altogether 575 men were invited individually in writing through their departmental heads to attend a CVD risk factor screening centre set up for this study. Although only apparently healthy men without known diabetes, hypertension, hyperlipidemia, and prior episodes of myocardial ischemia were eligible for inclusion in our study, all volunteers responding to the invitation were screened and then counselled and referred as appropriate.

#### Data collection

Each participant was advised to attend the CVD risk factor screening centre on a prescheduled day between 8 am and 9.30 am after an overnight 12 hour fast. Sociodemographic and lifestyle data were collected using questionnaires, some of which were self-administered and other interviewer-

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administered. Height, weight, waist circumference and hip circumference of each subject were measured by a single well-trained individual using standard equipment and procedures according to detailed protocols<sup>3</sup>.

A fasting venous blood sample was taken from all subjects.

Then, to test for oral glucose tolerance, a drink composed of 75g anhydrous glucose in 120 ml of 'Fortical' (Cow & Gate, Trowbridge, UK) was given to subjects without known or newly detected diabetes. From these individuals, a second venous blood sample was taken two hours after the glucose drink. Blood samples were separated within 20 minutes and stored at 4°C for glucose level measurement within 6 hours by the glucose oxidase method in an Astra 8 analyser (Beckman, USA) using Beckman reagents. Parts of the fasting samples were also stored at 70°C for total cholesterol level measurement within 24 hours by cholesterol oxidase (Boehringer) automated enzymatic colorimetry.

### Definitions

We classified each subject into one of six ethnic groups based on his country of birth and parental origin. These six groups showing the predominant nationalities in parentheses were: Peninsular Arab (Emirati, Omani), South Asian (Indian, Pakistani), Afro-Arab (Sudanese, Somali), Egyptian, Shawan (Palestinian) and European (British). Subjects with fasting blood glucose level > 7.8 mmol/l or 2 hour blood glucose level > 11.1 mmol/l were classified as diabetics. Those with fasting blood glucose level < 7.8 mmol/l and 2 hour blood glucose level 7.8-11.1 mmol/l were classified as having IGT. Elevated blood cholesterol was defined as a fasting value

of > 200 mg/dl. An individual was considered obese if his BMI was > 24.99 Kg/m<sup>2</sup> and his WHR was >1.0. Because of the small numbers involved, for some analyses, we combined diabetes and IGT into a single group labelled 'abnormal glucose tolerance'.

### Data analysis

Associations of diabetes, IGT, obesity defined by BMI and by WHR, and elevated blood cholesterol with the studied sociodemographic and lifestyle factors were examined univariately by cross-tabulations and multivariately by logistic regression analysis. Adjusted odds ratio (OR) point estimates, their 95% confidence intervals (CIs), and associated two-sided p-values were obtained through the multivariate logistic regression analyses. A p-value was considered significant if it was < 0.05. The Stata Statistical Software (Stata Corp, College Station, Texas, USA) was used for data analysis.

### RESULTS AND DISCUSSION

Based on the employee health clinical data, of all 575 invited subjects, an estimated 458 were considered eligible for enrollment in this study. Of all eligible subjects, 361 (78.8%) actually volunteered to participate in the study. In the analyses for this paper, we included 358 subjects as the remaining 3 did not belong to any of the six main ethnic groups considered.

Overall, of our study subjects, 10% had diabetes, 18% had IGT, 68% had obesity defined by BMI, 31% had obesity defined by WHR, and 74% had elevated blood cholesterol.

Table 1. Prevalences of diabetes, impaired glucose tolerance (IGT), obesity defined by body mass index (BMI) and by waist-to-hip circumference ratio (WHR), and elevated blood cholesterol among the 358 study subjects, by sociodemographic and lifestyle characteristics, Abu Dhabi, UAE, 1995-96

Characteristics	Abnormal glucose tolerance (%)			Obesity (%)			Elevated Cholesterol %
	No	IGT	Diabetes	Total	BMI	WHR	
<b>Age (years)</b>							
35-39	115	16	6	22	64	26	66
40-44	115	17	15	32	74	32	70
45-49	128	21	9	30	67	33	84
<b>Ethnicity</b>							
South Asian	126	24	12	36	52	29	74
Peninsular Arab	67	22	16	38	78	39	72
Shawam	82	20	9	19	83	40	66
Egyptian	29	17	0	17	86	35	78
Afro-Arab	27	19	7	26	56	7	85
European	28	7	4	11	71	7	86
<b>Education level</b>							
Pre-university	32	19	22	41	50	31	72
University	326	18	9	127	70	30	74
<b>Occupation</b>							
Manager	164	17	7	24	76	32	75
Other	194	20	12	32	61	29	73
<b>Current smoker</b>							
No	270	20	9	29	68	32	73
Yes	88	14	14	28	68	26	77
<b>Leisure-time physical activity</b>							
None	119	19	14	33	71	35	73
Light	127	23	10	33	66	39	72
Medium	71	13	7	20	70	20	77
Heavy	41	12	5	17	61	12	76

The details of the socioeconomic and lifestyle characteristics of the 358 study subjects and the univariate associations of these characteristics with the prevalences of abnormal glucose tolerance, obesity defined by BMI and by WHR, and elevated blood cholesterol are presented in Table 1.

The highest prevalence of abnormal glucose tolerance (IGT + Diabetes) was among Peninsular Arab (38%) followed by South Asians (36%). Obesity measured by BMI was the highest among Egyptians (86%) and lowest among South Asians (52%). Elevated cholesterol ranged from 66% among Shawan to 86% among Europeans. In general, university education men had a lower proportion of diabetes, but a higher proportion of obesity (based on BMI) than pre-university men. Similar trends were observed in Manager compared to other occupations. With the exception of obesity based on WHR, there was no difference between current smokers and non-smokers in proportion of abnormal glucose balance, obesity (based on BMI) and elevated cholesterol. The men who practised heavy physical activity had a lower proportion of diabetes and obesity, than those who practised light and medium and those who did not practise physical activity.

The prevalence of IGT among Peninsular Arab in this study (16%) was higher than that reported for adult men in Saudi Arabia (10%)<sup>4</sup>. Diabetes measured by blood sugar was relatively higher in our sample compared to those reported in other Gulf countries for native population. However, the prevalence of diabetes among Emirati men of Bedouin origin was significantly lower than our findings for Peninsular Arab (5.8% vs 16%)<sup>5</sup>. Several factors contributed to the differences in proportion of diabetes in the Arab Gulf

**Table 2: Multivariate logistic regression analysis of the associations between abnormal glucose tolerance and selected characteristics of the study subjects, Abu Dhabi, UAE, 1995-96**

Characteristic	aOR	95% CI	P
Age (Ref: 35-39)			
40-44	1.86	0.99-3.49	<u>0.054</u>
45-49	1.84	0.99-3.43	<u>0.055</u>
Ethnicity (Ref: South Asian)			
Peninsular Arab	1.15	0.57-2.34	0.694
Shawam	0.37	0.17-0.78	<u>0.009</u>
Egyptian	0.31	0.10-0.96	<u>0.042</u>
Afro-Arab	0.62	0.23-1.66	0.343
European	0.26	0.07-1.01	<u>0.052</u>
Education (Ref: Pre-University)			
University	0.75	0.33-1.70	0.494
Profession (Ref: Manager)			
Other	1.15	0.64-2.05	0.644
Current smoker (Ref: None)			
Yes	1.05	0.58-1.88	0.882
Physical activity (Ref: None)			
Light	0.90	0.51-1.60	0.729
Medium	0.49	0.23-1.02	0.057
Heavy	0.61	0.23-1.59	0.308
Overweight			
BMI (Ref: <25)	1.42	0.80-2.50	0.229
WHR (Ref: <1.0)	1.36	0.79-2.34	0.269

Notes: aOR = adjusted odds ratio, CI = confidence interval, Significant p-values are shown in underscored bold

population such as age, ethnicity, exercise, overweight and food habits.

Multivariate logistic regression analysis of the association between abnormal glucose tolerance and selected characteristics of men studied is shown in Table 2. A significant association was found between abnormal glucose tolerance and age and ethnicity. Those who practise medium physical activity had a significant lower risk to have an abnormal glucose tolerance than those who did not practice any physical activity.

**Table 3: Multivariate logistic regression analysis of the associations between obesity defined as body mass index (BMI) >24.99 Kg/m<sup>2</sup> and selected characteristics of the study subjects, Abu Dhabi, UAE, 1995-96**

Characteristic	*OR	**95% CI	P
Age (Ref: 35-39)			
40-44	1.43	0.76-2.67	0.267
45-49	1.05	0.58-1.91	0.877
Ethnicity (Ref: South Asian)			
Peninsular Arab	3.06	1.44-6.54	<u>0.004</u>
Shawam	4.14	1.96-8.75	<u>0.000</u>
Egyptian	4.62	1.40-15.21	<u>0.012</u>
Afro-Arab	1.41	0.58-3.41	0.447
European	2.83	1.00-7.99	<u>0.050</u>
Education (Ref: Pre-University)			
University	1.93	0.83-4.50	0.127
Profession (Ref: Manager)			
Other	0.93	0.51-1.69	0.810
Current smoker (Ref: None)			
Yes	0.91	0.50-1.63	0.741
Physical activity (Ref: None)			
Light	0.82	0.44-1.50	0.512
Medium	1.07	0.52-2.18	0.853
Heavy	0.68	0.29-1.57	0.365
Overweight			
WHR (Ref: <1.0)	3.31	1.77-6.18	<u>0.000</u>

Notes: \*OR = adjusted odds ratio, \*\*CI = confidence interval, Significant p-values are shown in underscored bold

Ethnicity and overweight using WHR were found to be significantly associated with obesity defined by BMI > 24.9, using multivariate logistic regression. The risk to be overweight was lower among those who practise light and heavy physical activity (Table 3). However, when WHR was used as indicator for overweight, only medium and heavy physical activity had a significant association with WHR, as well as overweight measured by BMI. Afro-Arab and European had a significant association with overweight defined as WHR > 1.00. Although the risk for overweight (WHR > 1.00) was lower among university education and current smokers, the association was not statistically significant (Table 4).

Obesity, either measured by BMI or WHR is known as a risk factor for several chronic non-communicable diseases. The prevalence of overweight and obesity in Arab Gulf countries was high. Among men it ranged from 50%-60% using BMI > 24.9 as a cut-off<sup>6</sup>. This means that programmes to prevent and control overweight among both men and women are urgently needed. The programme should include school children and adolescents, as overweight and obesity usually occurs in early life.

Table 4: Multivariate logistic regression analysis of the associations between obesity defined as waist-to-hip circumference ratio (WHR) >1.00 and selected characteristics of the study subjects, Abu Dhabi, UAE, 1995-96

Characteristic	aOR	95% CI	P
Age (Ref: 35-39)			
40-44	1.19	0.63-2.25	0.599
45-49	1.44	0.77-2.70	0.253
Ethnicity (Ref: South Asian)			
Peninsular Arab	1.13	0.54-2.35	0.751
Shawam	1.18	0.59-2.36	0.637
Egyptian	0.83	0.31-2.19	0.702
Afro-Arab	0.14	0.03-0.64	<u>0.012</u>
European	0.15	0.03-0.72	<u>0.018</u>
Education (Ref: Pre-University)			
University	0.82	0.33-2.03	0.672
Profession (Ref: Manager)			
Other	0.78	0.44-1.38	0.391
Current smoker (Ref: None)			
Yes	0.64	0.35-1.16	0.139
Physical activity (Ref: None)			
Light	1.19	0.67-2.11	0.564
Medium	0.40	0.19-0.83	<u>0.015</u>
Heavy	0.27	0.09-0.80	<u>0.018</u>
Overweight			
BMI (Ref: <25)	3.57	1.89-6.73	<u>0.000</u>

Notes: aOR = adjusted odds ratio, CI = confidence interval, Significant p-values are shown in underscored bold

Elevated blood cholesterol was only significant among older men (45-49 years), using multivariate logistic regression analysis. The risk to have elevated blood cholesterol level was higher among Afro-Arab and European (Table 5).

Studies on elevated blood cholesterol in the Arab Gulf countries are scarce. A national survey on the prevalence of some risk factors for heart disease in Saudi Arabia showed that the prevalence of hypercholesterolemia (> 5.2 mmol/L) among adult men was 17.5%<sup>4</sup>. This percentage is significantly lower than our findings for all ethnic origin men, which may indicate that our sample is not representative for adult men for each ethnic group.

## CONCLUSION

**In conclusion, in this group of apparently healthy male office-based employees aged 35-49 years, diabetes, IGT, obesity defined by BMI and by WHR, and elevated blood cholesterol were found to be widespread. If these findings are applicable to other similar population groups in the UAE, then we have a major and massive public health problem to address. Therefore, community-based surveys of CVD risk factors are urgently needed in the UAE. The similarities and differences among different ethnic**

Table 5: Multivariate logistic regression analysis of the associations between elevated blood cholesterol and selected characteristics of the study subjects, Abu Dhabi, UAE, 1995-96

Characteristic	aOR	95% CI	P
Age (Ref: 35-39)			
40-44	1.23	0.69-2.22	0.482
45-49	2.80	1.47-5.32	<u>0.002</u>
Ethnicity (Ref: South Asian)			
Peninsular Arab	0.91	0.43-1.95	0.812
Shawam	0.61	0.31-1.23	0.169
Egyptian	1.08	0.36-3.21	0.893
Afro-Arab	2.15	0.67-6.93	0.201
European	2.03	0.57-7.17	0.274
Education (Ref: Pre-University)			
University	1.19	0.49-2.87	0.697
Profession (Ref: Manager)			
Other	1.07	0.59-1.95	0.816
Current smoker (Ref: None)			
Yes	1.56	0.86-2.85	0.146
Physical activity (Ref: None)			
Light	0.94	0.52-1.70	0.828
Medium	1.18	0.57-2.45	0.647
Heavy	1.33	0.55-3.22	0.523
Overweight			
BMI (Ref: <25)	1.19	0.68-2.10	0.540
WHR (Ref: <1.0)	1.19	0.67-2.11	0.555

Notes: aOR = adjusted odds ratio, CI = confidence interval, Significant p-values are shown in underscored bold

**groups as to the prevalences of the studied CVD risk factors need to be investigated in depth. Findings of such studies should guide the planning of appropriate and effective interventions.**

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## مجلة البحرين الطبية التعريف والأهداف

مجلة البحرين الطبية هي دورية علمية هدفها تطوير وتقديم العلوم الطبية البيولوجية والأكلينيكية والصحية وتقوم بإصدارها هيئة تحرير مستقلة وتطبع في وزارة الأعلام ، دولة البحرين . تنشر المجلة مقالات باللغتين العربية والإنجليزية.

تشمل مجالات النشر بالمجلة مقالات البحوث الأصلية ، المراجعات ، تقارير الحالات ، المقتطفات القصيرة ، رسائل للمحرر ، الأختبارات الطبية ، الأفتتاحيات ، الآراء والأخبار، مراجعات الكتب والدوريات ، التقارير العامة ، أخبار المؤتمرات والاجتماعات ، مقالات التعليم الطبي ، تقارير صحية ، تاريخ الطب والآراء الشخصية.

تخضع جميع الأعمال المقدمة للنشر في مجلة البحرين الطبية إلى المراجعة من قبل المحررين ومن محكمين مختصين ، يرسل إشعار إستلام الأعمال المقدمة إلى المؤلف الرئيسي . تكون هذه المقالات من ممتلكات المجلة في حالة الموافقة على نشرها . يقوم محرر المجلة بقراءة المقالات المعدة للطبع . تخضع جميع الأعمال المقدمة للنشر بما في ذلك الإعلانات إلى القواعد الأخلاقية للمهنة .

يقرر المحررون و المحكمون قبول أية مقال إلى أي من مجالات النشر بمجلة البحرين الطبية ويبلغ المؤلفين بهذا القرار قبيل النشر .

ينظر في الأعمال المقدمة للنشر في مجلة البحرين الطبية على أساس أنها مقدمة للمجلة فقط والأ تكون قد نشرت أو قيد النشر في مجلة أخرى و ألا تكون قد نشرت من قبل . وأن تكون المواد المقدمة للنشر متفق عليها من جميع المؤلفين ، لا يعتبر التخليص المنشور مسبقاً للمقالات الكاملة المقدمة للمجلة نشرًا مزدوجًا .

تشجع مجلة البحرين الطبية الأبحاث العلمية عن طريق تنظيم دورات وورش عمل عن أساليب البحث و ما يمت لها بصلة مثل طرق الكتابة و أعمال التحرير و للمجلة هيئة استشارية للبحوث لمساعدة الباحثين في أبحاثهم . كما و تواصل المجلة دورها الاجتماعي عن طريق إقامة المحاضرات الدورية للمواضيع التي تهم الرأي العام .

المجلد ٢٠ العدد ٣ سبتمبر (أيلول) ١٩٩٨

# مجلة البحرين الطبية

## هيئة التحرير

**المحررون**  
د. فائق الحلبي  
د. علي عبدالله الخليفة  
د. فضيلة المحروس  
د. فيصل الموسوي  
د. قاسم عرداتي  
د. محمد عبدالله الخليفة

**رئيس التحرير**  
د. أكبر محسن محمد

**نائب رئيس التحرير**  
د. جعفر محمد البريق  
د. نجيب صالح جمشير

تصدر مجلة البحرين الطبية كل ثلاثة شهور في مارس ، يونيو ، سبتمبر و ديسمبر. وهي مدرجة في الفهرس الطبي لمنظمة الصحة العالمية لمنطقة شرق المتوسط، اكستر امد في المملكة المتحدة و أنظمة الايداع العالمية بفرنسا.

تحتفظ المجلة بحقوق الطبع و لايجوز إعادة طباعة أو ترجمة المواد المنشورة بها بأي شكل وبأية وسيلة دون ما الحصول على إذن كتابي من رئيس التحرير. الآراء والمعلومات المنشورة في المجلة تعبر عن رأي أصحابها و هي لا تمثل وجهة نظر هئية تحرير مجلة البحرين الطبية.

الاشتراك في المجلة ثمانية دنانير بحرينية (٢٠ دولاراً أمريكياً) سنوياً. المجلة لا توفر اصدارات مجانية للمطبوعات المنشورة بها و يجوز طلب أعداد إضافية من المجلة.

يمكن الحصول على رسوم الاعلانات من مكتب تحرير المجلة. توزع المجلة لجميع مناطق العالم وبالأخص منطقة الخليج العربي والشرق الأوسط.

ترسل جميع المراسلات وطلبات الاشتراك و الاعلانات إلى :

مكتب التحرير :  
مجلة البحرين الطبية  
ص . ب : ٢٢١٥٩  
دولة البحرين

هاتف : ٢٦٥٢٥٨ (٩٧٣+)  
فاكس : ٢٧٧٠٢٦ (٩٧٣+)