High prevalence of the cardiovascular risk factors in Al-Ain, United Arab Emirates

An emerging health care priority

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ABSTRACT

الأهداف : تعتبر أمراض القلب والأوعية الدموية في دولة الإمارات العربية المتحدة هي المسبب الرئيسي للوفيات. مع هذا هنالك شح في المعلومات المتعلقة بعوامل الخطورة لهذه الأمراض.

الطريقة : أُجريت دراسة ميدانية في المجتمع لتحديد عوامل الخطورة الأساسية لأمراض القلب والأوعية الدموية في مدينة العين – دولة الإمارات العربية المتحدة، خلال الفترة مابين فبراير 2004م وحتى فبراير 2005م. تمت مقابله المشاركين وقيس لهم ضغط الدم، الوزن، الطول، ومستوى السكر في الدم «صائم»، ونسبة الدهون. اُستخدام مقياس مستوى خطورة فرامنجهام لتقييم مستوى الخطورة للتعرض لأمراض القلب والأوعية الدموية.

النتائج : أكمل البحث 817 شخص (403 – ذكر و 414 – أُنثى)، في 28.4% منهم بلغ مقياس فرمنجهام للخطورة أكثر من 20%، وفي 23.3% مرض السكري، 20.8% ارتفاعا في ضغط الدم، 37.3% بدانة، 22.7% الملازمة الأيضيّة، وكان 19.6% من الذكور مدخنين. سجل مرض شرايين القلب التاجيّة في 2.4% من المشاركين. كانت نسبة الدهون غير طبيعية في 64% من الذكور و 53.9% من الإناث، وكانت من نوع انخفاض HDL ، أو ارتفاع الدهون الثلاثية.

خاتمة : الصورة العامة لعوامل الخطورة لأمراض القلب والأوعية الدموية في المجتمع تستدعي التدخل الفوري لمكافحتها والوقاية منها.

Objective: In the United Arab Emirates (UAE) cardiovascular mortality is a leading cause of death. Yet, there is a dearth of data on its risk factors.

Method: A cross-sectional community based study on established cardiovascular risk factors carried out between February 2004 - February 2005 in Al-Ain City, UAE. Subjects were interviewed, blood pressure, weight, height, fasting blood sugar, and lipid profile measured. Framingham risk scores were used for risk assessment.

Results: Eight hundred seventeen subjects (403 males and 414 females) completed the survey, of these 28.4% had a Framingham risk assessment score of more than 20%, 23.3% had diabetes mellitus, 20.8% hypertension, 37.3% obesity, 22.7% metabolic syndrome, and 19.6% of male smoked. Coronary heart disease was reported in 2.4%. Lipid profiles were abnormal in 64% of the males, and in 53.9% of the females, mostly due to low high-density lipoproteins or high triglycerides levels.

Conclusion: The overall cardiovascular risk assessment of the population screened calls for targeted interventions.

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Cardiovascular disease (CVD) is a major cause of morbidity, and mortality in many parts of the world. In Al-Ain, in the United Arab Emirates (UAE) it accounts for a fourth of total mortality.[1] As many of its risk factors are amenable to intervention, much of this burden of disease and death is preventable. Different areas of the world have different cardiovascular risk-factor profiles, and identical profiles may have a different impact on mortality in different settings.[2] While some of the heterogeneity in risk may be ethnicity dependent, much of it appears to be associated with lifestyle, the more "Western" the lifestyle, with lack of physical exercise, high energy, fat intake, and smoking, the higher the risk.[3-5] The UAE experienced a rapid transition to a wealthy Western lifestyle during recent decades, and its citizens are now among the richest in the world.[6] Despite the country's developing health-care system, only limited systematic data is available on the epidemiology of CVD. Most of these data suggest a high cardiovascular risk profile,[7-11] similar to neighboring Arab countries[12-16] however, the magnitude of risk still needs to be assessed.

We therefore, undertook a community-based survey in the adult population of Al-Ain, the third largest city in the UAE, of the established cardiovascular risk factors, body mass index (BMI), waist circumference, impaired glucose tolerance, (high) blood pressure, (BP) blood lipid profiles, smoking, and family history of coronary heart disease (CHD) in first degree relatives. We restricted our survey to Emirati nationals since they seem to have higher risk profiles than the expatriate workforce.

Methods. A cross-sectional, community based prevalence study conducted, in Al-Ain, UAE, between March 2004 and February 2005. Subjects were randomly drawn from lists of UAE citizens in possession of a health card. This is obtained through registration with one of the 10 primary health care centers in Al-Ain, and gives access to comprehensive free health care. As a result, the private sector is rarely used by UAE citizens. It can thus be reliably assumed that registration among adults is almost universal. We selected 4 out of the 10 eligible primary care centers, stratified by geography. Where several health centers were available in an area we chose the busiest one. Thus, the 4 selected health centers (Mezyad, South Al Khabisi Center, Al Masoudi North-East, and Al Yahar West) together account for 56% of all primary health care consultations in Al-Ain. Lists (namely, our sampling frame) of all individuals registered at the health center were compiled, and a random sample stratified by gender were selected and invited to participate by telephone. Inclusion criteria were residence in Al-Ain, age over 19 years, and UAE nationality. Exclusion criteria were secondary dyslipidemias or being non-UAE nationals or below 19 years of age. In each center, a doctor and a nurse participated in the study. The nurse's role was to call subjects for enrollment, receive, and recall subjects for follow-up. The doctor's role was to review results and advise patients on subsequent management. Both doctors and nurses received specific training on operating procedures. Subjects were contacted by telephone and invited to participate. Upon giving consent, they were given an appointment at the health center and instructed to fast for at least 10 hours prior to their appointment. Individuals who missed their appointment were reminded up to 3 times. At the initial visit the nurse recorded demographic and administrative data, and took a history of the surveyed cardiovascular risk factors. After resting for 5 minutes, subject's BP was recorded to the nearest 2 mm Hg at the fifth Korotkoff sound, measured in a sitting position, using a mercury sphygmomanometer. Weight, height, and waist circumference were measured, and blood drawn for determination of fasting blood sugar (FBS), total cholesterol, high density lipoprotein (HDL) and triglyceride. Blood samples were transported to the primary health care main laboratory on the same day. The FBS was determined using Glucose Oxidase, the enzymatic colorimetric method, total cholesterol was determined using the enzymatic endpoint method, HDL was determined using HDL cholesterol precipitant, and triglycerides using the Gpo-PAP method. For each patient, the Framingham Risk Assessment Score (FRAS) adapted by Adult Treatment Panel III[17] was calculated.[18] On the basis of their results, subjects were recalled for counseling and management, or repeat measurements of abnormal BP or FBS, or both. The diagnosis of hypertension was made using Joint National Committee (JNC VII) criteria,[19] namely, systolic and diastolic blood pressure >140/90 mm Hg on both visits. Diabetes and impaired glucose tolerance were diagnosed following American Diabetic Association (ADA) 2005 criteria,[20] namely, FBS >125 mg/dl, patient using diabetic medications or self-reported diabetes, and impaired fasting glucose (IFG) diagnosed when 100 FBS ≤125 mg/dl. Metabolic syndrome (MS) was diagnosed according to ATP III criteria[17] as >=3 of the following risk-factors; central obesity, high triglyceride level, low HDL level, high BP, or IFG. Non-response was studied in 2 ways. First, age and gender of responders were compared to non-responders. Second, a more detailed non-response study was carried out in one of the health centers (Khabisi), where the medical files of 99 non-responders were reviewed, and age, gender, blood pressure, lipid profiles, diabetes, hypertension history, current smoking status were recorded, at the time of the study. Stratified sampling was used to recruit 400 subjects of each gender, to yield a precision (standard error) of 0.02 (2%) for gender specific prevalence of

20%. Data were analyzed using SPSS version 12.0 and statistical significance was defined as *p*-value <0.05. Boxplots, histograms, and scatterplot were used for graphical display of data. Analysis of variance (ANOVA) was used to compare group means. Logistic regression was used to compare participants to non-participants. The study was approved by the Al-Ain Human Ethics Committee

Results. Calls to 2863 subjects were made, 861 were unreachable due to inaccuracies in the available contact numbers, or for reasons such as death, or traveling. Out of the 2002 subjects who were informed 817 subjects (40.8%) completed the survey. Non-responders were slightly younger, 49.3% were male (mean age = 39.9, range 20-80) and responders 48.2% were male (mean age = 44.1, range 25-68). This was supported by logistic regression of the factors influencing participation among patients from Khabisi clinic, where we carried out our non-response study. This showed that only age was significantly related to non-participation with responders (mean 44.3 years) being on average 4.3 years older than non-responders (mean 40 years). Apparently, participation was not influenced by the conditions, such as a history of diabetes, and risk factors studied. The 4 health centers contributed similar numbers of participants, Khabisi (229), Masoudi (187), Mezyad, (209), and Al-Yahar (192). Of the 817 subjects who completed the survey, 403 were males and 414 were females, no difference in gender distribution was found among health centers. A significant difference in age (p=0.032, analysis of variance) was found among health centers, with Masoudi and Mezyad having lower ages. The prevalence of cardiovascular risk factors is shown in **Table 1**. The prevalence of self-reported diabetes was 19.5%, and a further 3.8% were detected by FBS, giving a total prevalence of 23.3%. The prevalence was particularly high in the older age groups, and it was already prevalent at younger ages, as was IFG, which reached 20% as early as age 20-24 years in males and 35-39 years in females (**Table 1**). Hypertension was reported by 162 (20.0%). A further 8 patients were detected during the survey yielding a total prevalence of 20.8% (**Table 1**). No significant difference was found between males and females. Prehypertension[17] (BP ≥120/80 mm Hg on more than 2 occasions) was detected in 59 individuals (7.3 % of the population). The overall prevalence of obesity (BMI ≥30) was significantly greater among females (46.5%) than males (28.3%) (p<0.01), as shown in (**Table 1**). Notably, younger males tended to have a higher BMI than older ones. Also, men tended to accumulate central fat at younger ages than women. Smoking was common in males (19.6%), and rare in females (1.2%). The prevalence of smoking decreased with age (**Table 1**). Only 34 % of the screened population had normal lipids levels. Although one-thirds of the screened population had elevated triglyceride levels, only 1.7% of females, and 5.5 % of males had levels over 300 (**Table 2**). About half of all males had HDL levels less than recommended, while only a third of females fell short of this level (p<0.01). No significant gender difference was observed for low-density lipoproteins

Table 1 - Prevalence (%) of the different risk factors in the population screened distributed by age and gender.

Gender/age	No. of patients	Diabetes millitus	Hypertension	DM/ HTN	Obesity (BMI=30)	Central Obesity	Known CHD	Smoking	Family history CHD	Metabolic syndrome
Male										
20-29	59	5.1	5.1	1.7	30.5	2 4	0	40.7	8.5	11.9
30-39	81	11.1	11.1	2.5	45.7	46.4	0	25.9	19.8	17.3
40-49	88	29.5	17.0	8.0	22.7	37.8	3.4	18.2	14.8	21.6
50-59	107	35.5	33.6	14.0	22.4	36.2	4.7	12.1	5.7	31.8
60+	68	55.9	36.8	23.5	22.1	38.5	7.4	7.4	4.4	17.6
Total %	**403**	**28.3**	**21.8**	**10.4**	**28.3**	**37.2**	**3.2**	**19.6**	**10.7**	**21.3**
Female										
20-29	59	1.7	1.7	0.0	35.6	32.5	0.0	0.0	13.6	3.4
30-39	114	5.3	7.0	0.9	41.2	50.0	0.0	1.8	15.0	14.9
40-49	126	26.2	23.0	8.7	53.2	68.0	0.8	0.8	10.3	31.7
50-59	85	27.1	38.8	18.8	56.0	71.0	4.7	2.4	14.1	38.8
60+	30	43.3	36.7	26.7	33.3	72.0	6.7	0.0	13.3	26.7
Total %	**414**	**18.4**	**19.8**	**8.7**	**46.5**	**59.9**	**1.7**	**1.2**	**13.1**	**24.2**
Total population	**817**	**23.3**	**20.8**	**9.5**	**37.3**	**39.0**	**2.4**	**10.3**	**11.9**	**22.7**

N - number, DM - diabetes millitus, HTN - hypertension, CHD - coronary heart disease, MS - metabolic syndrome, BMI - body mass index

Table 2 - Distribution of the Triglyceride, LDL and HDL values by age and gender. n (%).

Gender / Lipid levels (mg/dl)	Age groups (years)						
	20-29	30-39	40-49	50-59	>= 60	Total	% in All
Male: LDL							
<100	17 (28.8)	18 (22.2)	24 (27.3)	23 (21.5)	15 (22.1)	97	24.1
100-159	33 (55.9)	43 (53.1)	49 (55.7)	56 (52.3)	37 (54.4)	218	54.1
≥160	9 (15.3)	20 (24.7)	15 (17)	28 (26.2)	16 (23.5)	88	21.8
Female: LDL							
<100	24 (40.7)	40 (35.1)	31 (24.6)	25 (29.4)	5 (16.7)	125	30.2
100-159	27 (45.8)	62 (54.4)	78 (61.9)	43 (50.6)	17 (56.7)	227	54.8
≥160	8 (13.6)	12 (10.5)	17 (13.5)	17 (20.0)	8 (26.7)	62	15
Male: HDL							
<40	29 (49.2)	44 (54.3)	48 (54.5)	57 (53.3)	31 (45.6)	209	51.9
40-59	29 (49.2)	31 (38.3)	36 (41.0)	47 (43.9)	29 (42.6)	172	42.7
≥60	10 (1.6)	6 (7.4)	4 (4.5)	3 (2.8)	8 (11.8)	22	5.5
Female: HDL							
<40	14 (23.7)	30 (26.3)	53 (42.1)	20 (23.5)	7 (23.3)	124	30.8
40-59	32 (54.2)	64 (56.1)	59 (46.8)	56 (65.9)	15 (50.0)	226	54.6
≥60	13 (22.0)	20 (17.5)	14 (11.1)	9 (10.6)	8 (26.7)	64	15.5
Male: Triglycerides							
<150	40 (67.8)	57 (70.4)	46 (52.3)	67 (62.6)	48 (70.6)	258	64
150-299	17 (28.8)	18 (22.2)	37 (42.0)	35 (32.7)	16 (23.5)	123	30.5
≥300	2 (3.4)	6 (7.4)	5 (5.7)	5 (4.7)	4 (5.9)	22	5.5
Female: Triglycerides							
<150	48 (81.4)	86 (75.4)	77 (61.1)	59 (69.4)	22 (73.3)	292	70.5
150-299	11 (18.6)	24 (21.1)	48 (38.1)	25 (29.4)	7 (23.3)	115	27.8
≥300	0 (0)	4 (3.5)	1 (0.8)	1 (1.2)	1 (3.3)	7	1.7
Male: Total Cholesterol							
<200	38 (64.4)	42(51.9)	45 (51.1)	53 (49.5)	37 (54.4)	215	53.3
≥200	21 (35.6)	39(48.1)	43 (48.9)	54 (50.5)	31 (45.6)	188	46.7
Female: Total Cholesterol							
<200	42 (71.2)	78 (68.4)	81 (64.3)	47 (55.3)	11 (36.7)	259	62.6
≥200	17 (28.8)	36 (31.6)	45 (35.7)	38 (44.7)	19 (63.3)	155	37.4
Male							
Normal*	20 (33.9)	20 (26.7)	16 (21.9)	23 (26.1)	20 (32.3)	99	(36.0)
Dyslipidemia*	39 (66.1)	55 (73.3)	57 (78.1)	65 (73.9)	42 (67.7)	258	(64.0)
Female							
Normal*	30 (50.8)	51 (45.9)	36 (32.1)	23 (34.8)	8 (34.8)	148	(46.1)
Dyslipidemia*	29 (49.2)	60 (54.1)	76 (67.9)	43 (65.2)	15 (65.2)	223	(53.9)
Male							
Not on LLM	59 (100)	75 (92.6)	73 (83.0)	88 (82.2)	62 (91.2)	357	(88.6)
On LLM	0	6 (7.4)	15 (17.0)	19 (17.8)	6 (8.8)	46	(11.4)
Female							
Not on LLM	59 (100)	111 (97.4)	112 (88.9)	66 (77.6)	23 (76.7)	371	(89.6)
On LLM	0 (0)	3 (2.6)	14 (11.1)	19 (22.4)	7 (23.3)	43	(10.4)

LDL - low density lipoproteins, HDL - high densiy lipoproteins, LLM - lipid lowering medication

(LDL). About 25% of the population had an LDL level of less than 100 and 18.4% had an LDL level exceeding the recommended 160. **Table 2** shows the lipids levels by age-group. Generally, lipids profiles tended to be worst between age 40 and 60, and better at older age. The overall percentages of males and females on lipid lowering medications were similar. A history of CHD was found in 2.4% of subjects. A family history of premature CHD in a first degree relative[17] was reported by 11.9%. Older males reported fewer CHD events in relatives than either females or younger males as seen in (**Table1**). The prevalence of MS was 22.7%. It increased with age in both genders and peaked in the age group 50-59 years. After 60 years of age it decreased from 31.8-17.6% in males and from 38.8-26.7% in females. **Figure 1** shows the mean number risk factors by age and gender. Only 10.7 % of the population had no risk factors (excluding age, gender), while 60.4% had 2 or more risk factors. It is clear that younger males had a higher number of risk factors than females or older

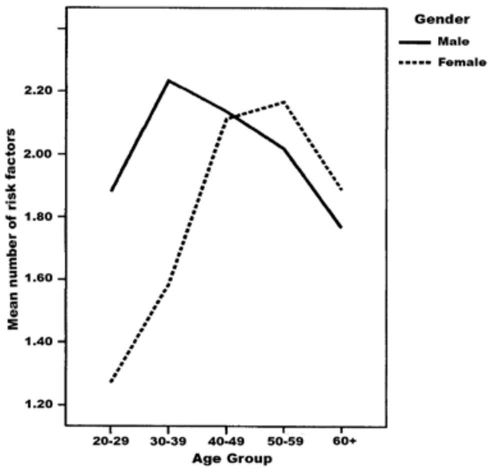

Figure 1 - Number of risk factors by age group (all serviced risk factors except age and gender).

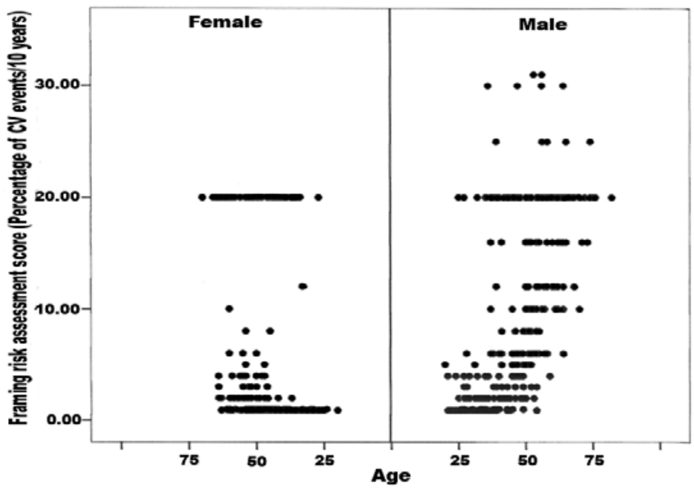

Figure 2 - Framingham cardiovascular (CV) risk assessment comparing males and females distributed by age and gender, (diabetics and other coronary disease equivalent as defined by ATP III guideline are given a score of 20% as advised by the same guideline).[17] y - years

males. **Figure 2** shows the Framingham Risk Assessment Score,[17] estimating the 10-year cardiovascular events rate for each subject. Risk increased with age and was higher among males. Overall, 23.8% had a risk of 20% or higher, however, this included subjects considered to have CHD equivalent conditions for example diabetes, who are given a risk score of $\geq$20%.[17] Even if those with CHD equivalent conditions were excluded 19.7% of males had a risk of $\geq$10% compared to 0.9% of the females, in 4.6% of the males the risk was $\geq$20%.

Discussion. The age-specific prevalence of DM in this community is among the highest in the world, and high prevalences are found already in young adulthood. This finding is consistent with another recent study that reported a prevalence of 25% among UAE citizens, [10,21,22] similar to that in Saudi Arabia[13] (23.7%). Comparison with previous studies in the UAE suggests a steady increase in prevalence,[10,21,22] as in many Western countries.[13,23-27] This high and increasing prevalence is probably the result of interacting genetic, environmental, and behavioral factors, notably diet, and lack-of-exercise. Regrettably, no information on either was elicited in our survey. However, all available information suggest that the level of physical activity in this population is low.[28] Information on trends in cardiovascular risk factors in the UAE is limited. In a study in 1996 among university female students 41.4 % of the students were overweight or obese,[8] close to current findings. Smoking appears to be on the increase in young adult males, as a study in 1993[9] had reported a prevalence of 19% in older secondary school students, as compared to 40.7% in the youngest age group in our study. Unlike Western countries, where smoking rates in females have overtaken those in males, female smoking in this community is rare and socially not accepted. Cardiovascular risk factors (other than obesity and diabetes) in many Western countries are declining,[29-32] however, the UAE appears to be moving in the opposite direction. A recent analysis of mortality, using the IMPACT CHD model, suggested that the observed reduction in CV mortality in countries such as the United States and Finland, could largely be attributed to a reduction in smoking and cholesterol levels.[33-36] These stresses the importance of health education and lifestyle modification in the Al Ain community. It seems to focus intervention on younger generations who appear to have higher risks than their parents. This could be due to survival of healthier elderly, but more likely reflects the impact of the new affluent "Western" life style experienced by the younger generations whose parents grew up in less affluent, and more physically demanding times. The high Framingham risk assessment score in this population is a cause for concern. Provided it is valid for this population it has not yet been evaluated in any Arabic country, it would predict a further deterioration of the current CVD morbidity and mortality situation. This study is the first to target the screening of most of the conventional risk factors in a population in the UAE through a community base survey with determination of risk assessment score. Nevertheless, the limitation of the study is mainly the response rate, although lower than we hoped for, is comparable to another population based recent study,[23] which enrolled subjects through home visits to randomly selected households, instead of telephone calls. Reassuringly, however, we found no association between any condition or CVD risk factor and participation in the study, except for age. While participants were on average 2.5 years older than the target population as a whole, we felt that the overestimation in prevalence rates that this would cause would be insufficient to substantially affect our conclusions. We therefore, also felt that re-weighting the sample to increase the average age was not required.

In the second part of this study, where associations between different cardiovascular risk factors were studied and among them ethnicity, patient were asked on where were they born and origin. These UAE nationals were mainly born in Al-Ain, or immigrated from near gulf countries mostly from Oman or Yemen. As well Al-Ain is among the large cities in the UAE, and therefore, lifestyle, urbanization, and invasion of western life style, is in other areas in the UAE. Therefore, generalizability of the results can be accepted since this population was not affected by any different immigration or social or environmental factors than other gulf regions.

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