

Assessment of some cardiovascular risk factors during the pre-Haj medical examinations in Oman

Firdosi R. Mehta,¹ Ali Jaffer Mohammed Suleiman,² Adrian Lambourne³ and Suleiman Al Auffy⁴

تقييم بعض عوامل الخطر القلبية الوعائية في الفحوص الطبية التي تجرى قبل الحج في سلطنة عُمان
فردوسي رستم ميتا ، وعلي بن جعفر بن محمد بن سليمان ، وإدريان لمبورن ، وسليمان العوفي

تبيّن معطيات المستشفيات العُمانية أن أمراض نقص التروية القلبية والأمراض المخية الوعائية تسبب وحدها 30٪ من وفيات المستشفيات في الفئة العمرية ١٥ سنة وما فوقها . ولا يُتاح إلا قدر ضئيل من المعطيات المرتكزة على المجتمع ، حول هذا الموضوع . من أجل ذلك أُجريت دراسة متعددة المراكز لتحمي الأمراض القلبية الوعائية أثناء الفحوص الطبية التي تجرى قبل الحج في أيار/ مايو ١٩٩١ ، حيث تم فحص ١٧٤٩ مواطنا . وتم تسجيل وتحليل المعالم السريرية لمستويات ضغط الدم ومنسب كتلة الجسم وكوليسترول المصل وسكر الدم . وتشير نتائج هذه الدراسة إلى أن عوامل الخطر الرئيسية للأمراض القلبية الوعائية منتشرة في المجتمع . ولذلك ينبغي إجراء المزيد من الدراسات الوبائية ووضع استراتيجيات للوقاية من الأمراض القلبية الوعائية ومكافحتها قبل أن تصبح مشكلة للصحة العمومية في عُمان .

Hospital-based data in Oman reveal that ischaemic heart disease and cerebrovascular diseases alone account for 30% of hospital deaths in the age group 15 years and above. Very few community-based data are available on the subject, hence a multicentre cardiovascular screening study was undertaken during the pre-Haj medical examination in May 1991, in which 1749 Omanis were screened. Blood pressure levels, body-mass index, serum cholesterol and sugar were recorded and analysed. The results of this study indicate that major risk factors for cardiovascular diseases are prevalent in the community, hence further epidemiological studies should be undertaken, and strategies formulated for the prevention and control of cardiovascular diseases before they emerge as a public health problem in Oman.

Evaluation de certains facteurs de risque cardio-vasculaire à Oman lors des examens médicaux antérieurs au pèlerinage

Selon des données hospitalières recueillies à Oman, les cardiopathies ischémiques et les accidents vasculaires cérébraux uniquement comptent pour 30% des décès hospitaliers du groupe d'âge 15 ans et plus. Etant donné que très peu de données communautaires sont disponibles dans ce domaine, une étude multicentres sur le dépistage des maladies cardio-vasculaires a été réalisée en mai 1991 lors des examens médicaux antérieurs au pèlerinage. Au cours de cette étude, le dépistage a été effectué auprès de 1749 Omanais. La pression artérielle, l'indice de masse corporelle, le niveau de cholestérol et de glycémie sériques ont été enregistrés et analysés. Les résultats de cette étude montrent qu'il existe des facteurs de risque majeurs pour les maladies cardio-vasculaires dans la collectivité. Il faudrait donc réaliser d'autres études épidémiologiques et formuler des stratégies de prévention des maladies cardio-vasculaires et de lutte contre ces maladies avant qu'elles ne deviennent un problème de santé publique à Oman.

¹ Head of Disease Surveillance; ² Director-General of Health Affairs; ³ Head of Health Information, Directorate General of Planning; ⁴ Director of Central Public Health Laboratory; Ministry of Health, Oman.

Introduction

Cardiovascular diseases rank first as a cause of premature death in industrialized countries, occurring in age groups in which productivity is highest and social and family responsibilities are most demanding. Developing countries like Oman are likely to be exposed to a similar experience as they proceed with their socioeconomic development. The prevailing epidemic of heart disease in industrialized countries is not, however, an unavoidable consequence of economic development. It can, and should, be obviated by appropriate, timely, preventive action that will enhance, rather than hinder, economic and technological advancement.

At present, only some hospital-based mortality data are available for Oman, as it does not yet have a national death registration system. This reveals that ischaemic heart diseases and cerebrovascular diseases alone account for 30% of hospital deaths in the age group 15 years and above [1]. Very little community-based data are available on the subject. However, the national diabetes survey conducted in 1991 in Oman attempted to estimate the prevalence of risk factors such as hypertension, triglycerides and cholesterol, and their relationship with diabetes mellitus.

In view of the fact that no systematic surveys have been carried out to assess the prevalence or incidence of risk factors for cardiovascular diseases in the general population, a multicentre cardiovascular screening study was undertaken during the pre-Haj medical examination in May 1991.

Study population

The period of pre-Haj medical examination was chosen to conduct the study for the following reasons:

- large samples would be covered in a short period of time in different regions simultaneously;
- a more cost-effective approach could be employed from the start;
- the population involved tends to gain weight after the age of 40.

A total of 1749 Omani nationals were selected by a systematic sampling method at four centres when they attended a pre-Haj medical examination. The age and sex distribution is shown in Table 1. Some 83.5% of the subjects examined were above 40 years of age. Four centres were chosen as study sites: Muscat, Seeb, Sohar and Nizwa. The study was conducted in May and June 1991.

Methodology

The clinical parameters of blood pressure levels, body-mass index, serum, cholesterol and sugar were recorded and analysed. The following standard procedures were adopted throughout.

Table 1 Distribution of study population by age and sex

Age group (years)	Sex		Total	%
	Female	Male		
0-9	6	15	21	1.2
10-19	14	39	53	3.0
20-29	19	46	65	3.7
30-39	64	85	149	8.5
40-39	178	243	421	24.1
50-59	203	402	605	34.6
60-69	90	299	389	22.2
70 and above	6	40	46	2.7
TOTAL	580	1169	1749	100.0
	[33.2%]	[66.8%]		

Blood pressure

Blood pressure was measured with a digital blood pressure monitor equipped with a capacitive pressure sensor. The instrument was rigorously and repeatedly tested against standard methods. A standard cuff width of 12.5 centimetres was used. Measurements were made on individuals using the left arm and in a sitting position at a comfortable temperature.

The definition of hypertension was followed according to WHO guidelines [2] (systolic > 160 or diastolic > 95). Individuals found to have high blood pressure levels and other risk factors (e.g. raised blood cholesterol or sugar levels) were referred to the nearest regional hospital for further investigation and follow-up.

Blood cholesterol and sugar

Blood cholesterol and random sugar were measured using a Reflotron machine at each study site. Specific reagent carrier strips were used for the tests, and the instrument was calibrated and standardized according to the recommendations of the manufacturers.

Three categories in relation to diabetes were considered measuring random blood sugar: "likely" (≥ 200 mg/dl) "uncertain" (80–199 mg/dl) and "unlikely" (≤ 79 mg/dl) as per WHO guidelines [3]. For total blood cholesterol, three levels were designated based on the recommendations of the US Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol [4]: normal (< 200 mg/dl), borderline (200–239 mg/dl) and high (≥ 240 mg/dl).

Height and weight

Height and weight were measured using a lever-type weighing machine fitted with a height scale. The measure of obesity taken in this study is the body-mass index (BMI). This index is defined as the body weight in

kilograms divided by the squared height in metres (kg/m^2). Significant risks to health are not usually evident unless BMI is above 30 [5]. Hence the cut-off point used for obesity in this study was $\text{BMI} \geq 29 \text{ kg}/\text{m}^2$.

Results

Random blood sugar levels were recorded for 1695 persons in the study population (results for 54 persons were not available). The study population were placed into the categories in relation to diabetes based on random sugar assessment [3]. As shown in Table 2, it was observed that 4.7% were likely to be diabetic (with blood glucose levels ≥ 200 mg/dl), 81.4% in the uncertain group (blood glucose 80–199 mg/dl) and 13.9% unlikely (blood glucose ≤ 79 mg/dl). It was found that 5.1% of the females were in the "likely" diabetic category as against 4.5% of males. On further analysis of the "uncertain" diabetic category group (80–199 mg/dl), it was observed that 72.4% were in the range of 80–109 mg/dl and only 27.6% were in the range of 110–199 mg/dl. The distribution of the mean and median blood glucose levels recorded at different study sites is shown in Table 3. Analysis indicates that the varia-

Table 2 Distribution of study population by diabetic category, based on random glucose values

Diabetic category	Number	%
Likely (Blood glucose ≥ 200 mg/dl)	80	4.7
Uncertain (Blood glucose 80–199 mg/dl)	1380	81.4
Unlikely (Blood glucose ≤ 79 mg/dl)	235	13.9
Total	1695	100.0

Note: Results for 54 persons were not available

tion observed between the different regions was statistically significant (ANOVA, $F = 4.387$; $p < 0.001$).

Distribution of total blood cholesterol levels of the study population is given in Table 4. Three cholesterol levels were designated: normal, borderline and high [4]. It was observed that 26.3% of the study population had high cholesterol levels (i.e. ≥ 240 mg/dl). It was also observed that 31.2% of females had high cholesterol levels compared to 24.0% of males. On analysis of the "borderline" group of cholesterol levels (200–239 mg/dl), it was found that the num-

ber of persons was uniformly distributed among these levels.

The mean and median cholesterol levels at the different study sites are shown in Table 5. The difference observed between the different sites was found to be statistically significant (ANOVA, $F = 5.987$; $p < 0.001$).

The distribution of blood pressure levels recorded in the study population is given in Table 6. The blood pressure records of 16 persons were not available.

From the study population, 13.4% had raised blood pressure levels (i.e. > 160 sys-

Table 3 Distribution of mean and median blood glucose levels recorded at different study sites

Site	Number of observations	Mean	SD	Median
Muscat	508	112.8	49.3	99.0
Seeb	210	106.9	50.9	91.0
Nizwa	477	106.9	39.7	97.0
Sohar	500	102.4	46.5	93.5
TOTAL	1695			

ANOVA: $F = 4.387$; $p < 0.001$

Table 4 Distribution of total cholesterol levels

Total cholesterol level	Number	%
Normal (< 200 mg/dl)	699	41.3
Borderline (200–239 mg/dl)	549	32.4
High (> 240 mg/dl)	446	26.3
TOTAL	1694	100.0

Note: Results for 55 persons were not available

Table 5 Distribution of mean and median total cholesterol levels recorded at different study sites

Site	Number of observations	Mean	SD	Median
Muscat	507	216.2	51.3	211.0
Seeb	210	217.2	46.5	210.0
Nizwa	477	216.5	47.3	217.0
Sohar	500	203.4	56.3	200.0

ANOVA: $F = 5.987$; $p < 0.001$

Table 6 Distribution of blood pressure levels recorded in study population

Blood pressure risk category	Number	%
BP levels systolic ≤ 160 and/or diastolic ≤ 95 mm Hg)	1501	86.6
BP levels systolic > 160 and/or diastolic > 95 mm Hg)	232	13.4
TOTAL	1733	100.0

Note: Results for 16 persons were not available

Table 7 Distribution of body-mass index of study population above 19 years of age

Site	BMI \geq 29 kg/m ²		Total
	No	Yes	
Muscat	361	112 (23.7%)	473
Soob	103	60 (20.6%)	243
Nizwa	423	54 (11.3%)	477
Sohar	435	47 (9.8%)	482
TOTAL	1412 (84.3%)	263 (15.7%)	1675

tolic or $>$ 95 diastolic). Persons found to have raised blood pressure were referred to the nearest regional hospital for further investigation and follow-up. The prevalence of hypertension was found to be 15.2% among females and 12.5% among males.

The body-mass index of the study population above 19 years of age was analysed (Table 7). Thus of 1675 persons, 15.7% were found to have an BMI \geq 29 kg/m²

Discussion

Data on the magnitude of cardiovascular disease as a public health problem in the Eastern Mediterranean Region are generally scarce. The extent of the problem has not been adequately examined in most Member States. However, data reported to WHO/EMRO over the past five years indicate that cardiovascular diseases are the leading identifiable cause of death in the Region [6].

Hypertension

Several studies have examined blood pressure levels in the Eastern Mediterranean Region populations. Using the WHO criteria of 160/95, the prevalence rates for hypertension have been reported to range between 10% to over 17% of the adult popu-

lation [7,8,9]. A prevalence rate of 12% was found in an Iraqi community [8]. Its prevalence in Kuwait is about 16.1% in women and 22.6% in men [5]. In comparison, the approximate adult population prevalence for hypertension in the United States is 31% [5]. In the present study, 13.4% were found to be hypertensive, with 15.2% in females and 12.5% in males. These figures are comparable to those of Kuwait with regard to females, but are much lower among males. The overall prevalence is comparable to the findings in the Iraqi study [8].

A similar study conducted in 1989 in Oman [10], in which 1966 Omanis were examined during a pre-Hajj medical examination, found that 9.8% of the study population had hypertension. The present study thus indicates that the prevalence of hypertension in a comparable population using the same criteria may have increased. In a national diabetes survey [11] in Oman (1991) the prevalence of hypertension using similar cut-off points was found to be 9.7% in females and 12.6% in males. Compared to the present study, these results are comparable for males but are much lower for females.

Obesity

The association between obesity and diabetes, hypertension, cardiovascular disease and a reduced life expectancy is generally accepted: for these reasons the prevalence of obesity in the general population is an indicator of the health status of the adult population. Most of the recent investigations into the risks of obesity use BMI as the measure. Mortality rates begin to rise with BMI above 25kg/m², although significant risks to health are not usually evident unless the BMI is above 30 kg/m² [5]. The current cultural preference in some countries of the Region is for heavier women, which is not the case in most other countries of the world.

A survey conducted in Egypt in 1981 found 14% of males and 63% of females obese, where the indicator of obesity used was BMI > 25 [5]. The present study has revealed an overall rate of obesity of 15.7% according to the criterion of BMI \geq 29. This rate also appears to be lower than that found in the US [5] in 1987; using BMI > 25 kg/m² as the criterion, the prevalence was 26.7% for women and 24.4% for men.

Diabetes

Data on the epidemiology and clinical characteristics of diabetes have been reported from several countries of the Eastern Mediterranean Region. Using varying diagnostic criteria, non-insulin dependent diabetes (NID) has been detected in 5%, 4.8% and 4.3% of Saudi Arabian, Iraqi and Egyptian population samples respectively [12,13,14].

The present study found that 4.7% of the study population (5.1% females and 4.1% males) were likely to be diabetics with blood glucose levels > 200 mg/dl. This was determined by random blood glucose estimation. These levels appear to be comparable to the above-mentioned studies, but lower than the national diabetes survey results, as the study population was not subjected to a glucose load test [11]. In that survey, the prevalence of diabetes was 10.3% among adult females and 11.0% among adult males, using the two-hour glucose tolerance test with a cut-off level of > 11.1 mmol/dl (> 200 mg/dl).

The mean levels of blood glucose were found to be significantly higher in the capital area compared to other regions.

Cholesterol levels

Here 26.3% of the study population had total cholesterol levels > 240 mg/dl, i.e. 6.12 mmol/dl (31.2% among females and 24.0% among males). A significant proportion

(32.4%) were at the borderline level (i.e. 200–239 mg/dl). A small study (150 people) on cholesterol levels in Kuwait showed that 20% of those aged between 40 and 59 had elevated cholesterol levels (the cut-off point used was not mentioned) [5]. A national diabetes survey in Oman [11] found 11.9% of females and 12.9% of males with elevated cholesterol levels (using the criteria of > 6.8 mmol/dl; i.e. 265.2 mg/dl). Thus the present study indicates that elevated cholesterol levels appear to be a risk factor of importance, with more females affected than males.

The mean levels of blood cholesterol were found to be significantly lower in the Sohar Region as compared to the other three regions.

Conclusions

Some 13.4% of the study population were found to have hypertension. This observation is of significance, especially since a study carried out on a similar population in 1989, using the same criteria, showed a level of 9.8%. This may indicate an increasing trend of hypertension.

The rate of obesity observed with a factor of BMI \geq 29, appears to be lower when compared to other studies conducted in the Region, and compared to the rates found in developed countries.

Hypercholesterolaemia appears to be a significant risk factor (26.3%), with a large proportion of individuals (32.4%) falling in the borderline category: they need dietary advice and follow-up.

The lower level of diabetes observed is probably due to determination of only random sugar levels. This demonstrates that "random blood sugar" is not a sound epidemiological method to apply in detecting diabetes.

The mean levels of blood glucose and cholesterol were found to be significantly higher in the capital area compared to other regions, indicating that urban lifestyle probably has an effect on the mean levels of these two risk factors.

The results of this study indicate that major risk factors for cardiovascular diseases are prevalent in the community; hence specific epidemiological studies should be undertaken and strategies should be formu-

lated for the prevention and control of cardiovascular diseases before they become a public health problem in Oman.

Acknowledgements

The authors acknowledge the support provided by the World Health Organization for the purchase of filter strips for use in laboratory analysis, and also the support provided by the Director of Health Affairs in the Regions and staff at the various screening centres in the collection of data.

References

1. *Annual Statistical Report, 1985, 1986 and 1987*. Ministry of Health, Oman.
2. *Arterial hypertension: report of a WHO expert committee*. WHO Technical Report Series No. 628, 1978.
3. *Diabetes mellitus: report of a WHO study group*. WHO Technical Report Series No. 727, 1985.
4. Samantray SK. Lipoproteins: laboratory work up. *Medical Newsletter*, 1989, 6(2):10-11.
5. *Clinical disorders arising from dietary affluence in countries of the Eastern Mediterranean Region*. Alexandria, Egypt, WHO Regional Office for the Eastern Mediterranean Technical Publication No. 14, 1989.
6. Alwan AAS. Diseases of modern lifestyles: the need for action. *Health Services Journal of the Eastern Mediterranean Region*, 1993, 7(1):24-34.
7. *Multicentre study of risk factors for coronary heart diseases*. Pakistan Medical Research Council, Monograph No. 3., 1980.
8. Alwan AAS. et al. Studies on the prevalence of hypertension in Iraqi rural and urban communities. *Iraqi Med Jour*, 1982, 28.
9. Faruqi AMA. Heart disease in South Asia: experiences in Pakistan. In: Hurst JW, ed. *Clinical essays on the heart*, vol 1. McGraw-Hill Book Co., 1983.
10. Mehta FR. Observations from pre-Haj medical examination. *Medical Newsletter*, 1989, 6(2):27-30.
11. *National diabetes survey*. Sultanate of Oman, 1991.
12. Fatani H et al. Prevalence of diabetes mellitus in rural Saudi Arabia. *Diabetes Care*, 1987, 10(2):180-3.
13. Al-Kasab FM et al. Prevalence of diabetes mellitus in a rural community in Iraq. *Int J Epidemiol*, 1979, 8(1).
14. Arab M. Diabetes mellitus in Egypt. *Int Diabetes Digest*, 1992, 3:86-8.