Some Risk Factors for Coronary Heart Disease among Omani Males

A matched case-control study

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بعض عوامل الاختطار لِمرض القلب التاجي عند الذكور العمانيين :
دِراسَة حالاتٍ وشَواهِد توافقية

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الملخص: الهدف: تقييم بعض عوامل الاختطار لمرض القلب التاجي عند الذكور في عمان . الطريقة: أجرينا دراسـة الحالات والشـواهد التوافقية للمرضى المصابين بمرض القلب التاجي والراقدين في كل من مستشـفى جامعة السـلطان قابوس والمستشـفى السـلطاني . قمنا بعمل توافق بين عدد المرضى والعينة الضابطة من حيث العمر والمستشـفى . أخذت المعلومات من المرضى وأقرانهم في العينة الضابطة بواسـطة مقابلة المعنيين ومراجعة السـجلات الطبية . قدرت نسـبة الأرجحية بواسطة كلا من أحادي ومتعدد المتغيرات وذلك باستخدام برنامج الانحدار اللوجستي الثنائي المتعدد الشـرطي . النتائج: بين التحليل أن 74% من الحالات كانت تعاني من الذبحة الصدرية . وأن عمر المرضى في أغلب الحالات (96%) كان فوق الأربعين و كان انتشـار نمط الحياة الخالي من الحركة كبيرا (88%). كانت عوامل الاختطار المتسـببة بمرض القلب التاجي بصورة معتدة إحصائيا هي ارتفاع ضغط الدم وداء السكر ووجود حالات مرض القلب التاجي في الأسرة وطبيعة العمل الخالي من الحركة . كانت القيم المقدرة المصححة لنسب الاختطار هي: (9.98, 2.74, 28.19 , 3.00) (p<0.05). الخلاصة: يعتبر الأشـخاص المصابون بارتفاع ضغط الدم وداء السـكر . والتي توجد في أسرهم حالات مرض القلب التاجي . والذين يزاولون أعمالا تتميز بالركود وقلة الحركة أكثر اختطارا للإصابة بمرض القلب التاجي . من الأمور الضرورية القيام بالتثقيف الصحي لمثل هؤلاء الأشخاص وكذلك عمل مراقبة دقيقة لظهور أعراض وعلامات مرض القلب التاجي لديهم .

مفتاح الكلمات: مرض القلب التاجي . عوامل الاختطار . دراسة حالات وشواهد . عمان.

ABSTRACT *Objectives:* Evaluation of some of the leading risk factors for coronary heart disease (CHD) among males in Oman. *Methods:* We conducted a hospital-based pair-wise matched case-control study among Omani CHD patients admitted in the Sultan Qaboos University Hospital and the Royal Hospital located in Muscat, Oman. The cases were matched with an equal number of controls in respect of age and hospital. The information was collected from the cases and controls based on an interview and review of the medical records of the admitted CHD patients. The odds ratios (ORs) were estimated under univariate as well as multivariate situations using conditional multiple binary logistic regression model. *Results:* The analysis revealed that 74 percent of the cases were of angina pectoris. The majority of the cases (96%) were above 40 years of age. The prevalence of sedentary life style was predominant (88.0%). Hypertension, diabetes, family history of CHD and a sedentary occupation were the most significant risk factors for the development of the disease. The estimated values of the adjusted ORs were found to be 9.98, 2.74, 28.19 and 3.00 respectively ($p < 0.05$). *Conclusion:* Individuals with hypertension, diabetes mellitus, a family history of CHD and with sedentary occupations are to be considered at high risk of developing CHD. Such individuals should be provided with appropriate health education along with close monitoring for symptoms and signs of CHD.

Key words: Coronary heart disease; Risk factors; Males; Case-control study; Oman.

Advances in Knowledge

- *The findings of the article have important implications in the primary prevention of CHD.*
- *The study indicated major risk factors for CHD among males in Oman.*
- *The hypertension, diabetes mellitus, family history of CHD and sedentary type of occupation were found to be the most contributing factors in the causation of CHD.*

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Applications to Patient Care
• *Data could be used for appropriate health education to patients as well as the community in Oman.*

AN ESTIMATED 16.7 MILLION OR 29.2% OF total global deaths result from the various forms of cardiovascular disease, many of which are preventable. Out of the 16.7 million deaths, 7.2 million are due to coronary heart disease (CHD). Moreover, 56% of these deaths occur before the age of 75 years.[1] At least twenty million people survive heart attacks and strokes every year, their treatment requiring costly clinical care and so placing a huge financial burden on the individual as well as on the nation.[1] Heart disease has no geographic, gender or socio economic boundaries.[1, 2] The World Health Organization (WHO) has drawn attention to the fact that (CHD) is a modern epidemic. In the Eastern Mediterranean region, cardiovascular diseases (CVD) and stroke account for 31% of mortality.[3]

In Oman, chronic non-communicable diseases related to lifestyle, namely coronary heart diseases, hypertension, diabetes mellitus and cancer, are now emerging as new health challenges for the country.[4]

The CHD made up nearly 10.5% of all deaths for adults aged 45–60 years and 31.5% for these above 60 years. In various studies carried out in the Omani population, hypertension, diabetes, dyslipidaemia, sedentary occupations and smoking have been reported to be the major cardiovascular risk factors.[5, 6] Moreover, consanguinity is quite common with 34 percent of women married to first cousins and 20% married to other relations.[7] This cultural practice may have resulted in an increased prevalence of hypertension and diabetes.[8, 9] Although there are many risk factors related to CHD in our population, we focused on some of the leading risk factors, namely hypertension, diabetes mellitus, sedentary occupations, lack of physical exercise and a family history of CHD and diabetes. As the prevalence of CHD risk factors in the Omani population is high, so the present study aimed to quantify the degree and extent of association between CHD and such risk factors in terms of ORs under univariate and multivariate situations.

METHODS

A hospital-based pair-wise matched case control study was carried out among the Omani male CHD patients admitted and treated in the Cardiac Care Units (CCU) of Sultan Qaboos University Hospital (SQUH) and the Royal Hospital, Muscat. Patients were identified from the CCU register and information was extracted from the medical records. An equal number of controls (i.e. either noncoronary patients or any asymptomatic individual) were matched in respect of the confounding variables namely, age (± 2yrs) and hospital.

Following the method as described by Schlesselman,[10] a total of 100 case-control pairs constituted an adequate sample size for carrying out the study. A questionnaire was developed and pilot testing was conducted with 20 subjects. After the pre-testing, the relevant information on the risk factors of interest (including level of physical activity) in 200 subjects was recorded based on interviews. The study subjects gave informed consent before participation in the study. The study was conducted based on the necessary permission from the concerned authorities of both hospitals.

The various levels/degrees of CHD risk factors used in this study were as follows:

HYPERTENSION
The standard definition of hypertension was considered as systolic blood pressure ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mm Hg or current use of any hypertensive medicines.[11]

DIABETES MELLITUS
Individuals who were on anti diabetic drugs or having fasting blood glucose level ≥ 7.0 mmol/L were considered havings diabetes.[12]

FAMILY HISTORY OF CHD
Individuals who responded to a history of angina on exertion, myocardial infarction, diagnosis of CHD or sudden death among first degree relatives were considered to have a positive family history of CHD.

SEDENTARY OCCUPATION
The individuals who were working in an office at a job without much movement were classified as sedentary.

FAMILY HISTORY OF DIABETES
Individuals who responded to a history of diagnosis of diabetes among first degree relatives were considered

Table 1: *Summary of variables used in the analysis of Coronary Heart Disease data*

Variable		Definition
Disease Status (D)	0	Noncoronary patient/asymptomatic individual
	1	A case of CHD
Hypertension (X_1)	0	<140mm Hg systolic and < 90mm diastolic
	1	≥ 140mm Hg systolic and/or ≥90mm Hg diastolic
Diabetes mellitus (X_2)	0	< 7.0 mmol/L
	1	≥ 7.0 mmol/L
Family history of CHD (X_3)	0	Absence of family history
	1	Presence of family history
Type of occupation (X_4)	0	Active
	1	Sedentary
Family history of diabetes (X_5)	0	Absence of family history
	1	Presence of family history
Physical exercise (X_6)	0	At least 90 minutes vigorous exercise weekly
	1	Less than the above
Smoking (X_7)	0	Nonsmoker
	1	Smoker

to have a positive family history of diabetes.

LACK OF PHYSICAL EXERCISE

This was classified as individuals who were not doing at least 150 minutes of moderate intensity aerobic physical activities or at least 90 minutes of vigorous exercise per week.

SMOKING

The matched pairs were classified into ever smoker and non-smoker groups. The ever smokers were individuals who were irregular or regular were considered at risk.

STATISTICAL ANALYSIS

The percentages were calculated to summarize the various socio-demographic characteristics of the patients. The data on all the risk factors included in the study were coded "1" if the respondent was found to be in the exposure category and "0' if the individual was not in the exposure category. The McNemar chi-square test[13] was used for testing the significance of association under univariate analysis. The data were entered and the univariate analysis was carried out using the Statistical Package for the Social Sciences (SPSS) software version 10.0. To estimate the ORs for each of the risk factors, a 2x2 table was formed representing the results of matched case-control study designed to assess the relationship between a single dichotomous risk factor and CHD. Denoting an exposed individual by (+) and an unexposed individual by (-), we obtained the discordant pairs of observations in the resulting cells of the table corresponding to (+ -) and (- +). Considering b and c as the discordant pairs, the estimated values of the ORs were obtained by the relation OR= b/c and their 95% confidence limits were obtained by:

$$OR \times \exp[\pm 1.96 \times \sqrt{\{(1/b)+(1/c)\}}]$$

THE CONDITIONAL LOGISTIC REGRESSION METHOD

Consider X= (X_1,......., X_7) a vector of risk factor variables for an individual under study. Each of the variables entering in the conditional logistic regression analysis is defined in Table 1. The parameters β_j (j = 1...,7) and their asymptotic standard errors were estimated using conditional likelihood procedure.[14, 15]

Table 2: *Distribution of 100 cases according to the socio-demographic characteristics and type of coronary heart disease diagnosed*

Characteristics	n	%
Age range		
< 40	4	4.0
40 – 49	21	21.0
50 – 59	32	32.0
≥ 60	43	43.0
Education		
Illiterate	61	61.0
Koran	28	28.0
Elementary & above	11	11.0
Marital Status		
Single	2	2.0
Married	73	73.0
Divorced	3	3.0
Widowed	22	22.0
Type of occupation		
Active	12	12.0
Sedentary	88	88.0
Category of CHD		
Acute	15	15.0
Chronic	11	11.0
Angina Pectoris	74	74.0

The ORs for each of the risk factors were estimated by $\Psi_j = \exp(\beta_j)$, j=1,... ,7. The asymptotic variances of the estimated ORs were obtained by the use of delta method [16] and is given by

$$v(\Psi_j) = [\Psi_j]^2 \, v[\beta_j], \; j = 1, ..., 7$$

The tests of significance of the parameters involved in the model were carried out using the Wald test. The conditional multiple logistic regression model was fitted using EGRET, version 2.0.31 software. The level of $p < 0.05$ was considered as cut-off value of statistical significance.

RESULTS

Table 2 shows that the mean age was 56.24 years (± 10.37) with 96 percent above 40 years of age. The literacy rate was 39 percent. The majority (73%) was married. The prevalence of a sedentary life style was very high (88.0%). The break-up of the 100 cases according to the type of CHD diagnosed revealed that the largest number of cases were of angina pectoris (74%) followed by acute myocardial infarction (15%) and chronic CHD (11%).

UNIVARIATE ANALYSIS

The results from univariate analysis for each risk factor are shown in Table 3. It is evident that an individual with a history of hypertension has 7 times more chance of developing CHD as compared to a person without hypertension ($p< 0.01$). The risk of developing CHD was 3 times higher for a diabetic patient as compared to a nondiabetic person ($p<0.05$). A family history of CHD was found more frequent among the cases as compared to controls with an OR of 5.0, but this was not statistically significant ($p>0.05$). The ORs of suffering from CHD for a person with a sedentary type of occupation as compared to an individual with a non-sedentary occupation was found to be 3.14 ($p<0.01$). A family history of diabetes, lack of physical exercise and the smoking habits of the individual also contributed to the incidence of the disease, with ORs of 1.71, 1.43 and 1.15 respectively, but these were not statistically significant ($p>0.05$).

MULTIVARIATE ANALYSIS

The pair-wise matched case-control data set, for which the univariate analysis was carried out, was also considered for multivariate analysis. For this, conditional logistic regression analysis was used. All seven risk factors, which were entered in the analysis, provided the estimated values of ORs controlled for other variables included in the model. The maximum likelihood estimates of the parameters, the standard errors of the estimates and the estimated values of ORs with their standard errors under the model, are shown in Table 4.

It is observed that, out of the seven risk factors, hypertension status, diabetes mellitus, a family history of CHD and sedentary type of occupation of the individual are the main modifiable factors in the development of CHD in this community ($p<0.05$). The estimated odds of developing CHD for an individual with hypertension, after adjusting the effect of other risk factors, was about 10 times higher as compared to a normal person. The adjusted OR for CHD due to diabetes mellitus was found to be 2.74. The odds of suffering from the disease for an individual with the presence of family history of CHD after adjusting the effect of other factors, was found to be very high as compared to an individual who did not have a family history ($p<0.05$).

Moreover, the analysis also revealed that an indi-

Table 3: *The estimated values of odds ratios and their 95 percent confidence limits for the various risk factors*

Sl. No.	Risk factor	No. of discordant pairs		Odds ratio	95% Confidence limits	p
		(+ -)	(- +)			
1	Hypertension	44	6	7.33	3.12, 17.20	0.008
2	Diabetes mellitus	23	7	3.29	1.34, 8.40	0.010
3	Family history of CHD	5	1	5.00	0.58, 42.79	0.230
4	Sedentary occupation	22	7	3.14	1.50, 6.58	0.006
5	Family history of diabetes	12	7	1.71	0.67, 4.34	0.359
6	Lack of physical exercise	10	7	1.43	0.54, 3.78	0.630
7	Smoking habit	15	13	1.15	0.55, 2.52	0.850

vidual with a sedentary occupation had 3 times the risk of developing CHD as compared to a person with an occupation involving physical activity ($p<0.05$). The chance of developing CHD among the individuals with the family history of diabetes was found to be about 2.7 times more as compared to the individuals without family history of diabetes mellitus but this was not statistically significant ($p>0.05$). In the case of the other two risk factors, namely lack of physical exercise and smoking, the risk of developing the disease were found to be approximately the same as found under the univariate analysis.

DISCUSSION

By the end of twentieth century, most developing countries, including Oman, experienced a major surge in life expectancy due to a decline in various mortality indicators and an improvement in overall socio-economic development. The demographic shift has increased the number of older adults thus providing longer exposure to risk factors of CHD. The medical and socioeconomic consequences of an increase in the burden of CHD will be disastrous for most of the countries as costly interventions and drugs may not be affordable.[17] Strategies to prevent the acquisition or augmentation of CHD risk factors will be a combination of primordial prevention and primary preventive action to reverse and reduce the elevation of risk factors.

Most researchers suggest that overweight/obesity

increased serum total cholesterol, low density lipoprotein cholesterol and decreased high density lipoprotein cholesterol are well established risk factors for coronary heart diseases.[18, 19] In our study, we excluded these factors since they have been well uninvesigated in this part of the world.

Our study has reported that the average age of the patients was 56.2 ±10.4 years ranging from 36 years to 80 years. Al Adsani et al[20], in their study carried out in Kuwait on a similar population to ours, found that the average age of male patients of CHD was 52.4 ± 10.4.

The results from both univariate and multivariate analyses indicate that hypertension, diabetes mellitus and sedentary occupations contributed significantly to the development of CHD ($p<$ 005). Yusuf et al[21] in their INTERHEART study in 52 countries reported the strength of association between hypertension and acute myocardial infarction in men and women after adjustment for age, sex, and geographical region with an OR of 2.95 (95% CI 2.59, 3.39). In the present study, it was found that hypertension was present in 61% of the cases against 23% in the control ($p<0.001$). A family history of CVD reflects genetic, environmental and behavioural elements and interactions between them. The relative risk ranges from 2.0 to 9.0 among persons who report a family history of CVD, depending on the type and number of relatives considered.[22] In this study, the family history of CHD is associated with the development of the disease ($p<0.05$).

Ganguly et al[23] in their study reported that smok-

Table 4: *The estimated values of odd ratios for the risk factors under conditional logistic regression model*

Variable X_j	Estimate of the parameter β_j	Standard error $SE(\beta_j)$	Odds ratio (adjusted) $\Psi_j = \exp(\beta_j)$	Standard error $SE(\Psi_j)$
Hypertension, β_1	2.301	0.519	9.98**	5.17
Diabetes, β_2	1.010	0.530	2.74**	1.45
Family history of coronary heart disease, β_3	3.39	0.615	28.19*	17.33
Sedentary occupation, β_4	1.100	0.553	3.00*	1.65
Family history of diabetes, β_5	0.978	0.691	2.66	1.83
Lack of physical exercise, β_6	0.548	0.655	1.73	1.13
Smoking, β_7	0.295	0.505	1.34	0.67

**$p<0.01$, *$p < 0.05$

ing increases by threefold the chances of developing CHD as compared to nonsmokers ($p<0.001$). In this study, no significant association between smoking history and development of disease was found ($p>0.05$). This may be due to reluctance to provide a correct history of smoking habits because of religious and cultural taboos.

It can be observed that the ORs computed using univariate analysis and multivariate analysis differ. In univariate analysis, we estimate the ORs for each factor independently, whereas, under the conditional logistic regression model, the estimation of ORs depends upon the regression coefficients, which in turn were estimated by simultaneously considering all the factors included in the model. Thus we can always expect differences in conclusions based on the two procedures.

CONCLUSION

From the above study, it can be concluded that individuals above 40 years of age with hypertension, diabetes mellitus, a family history of CHD and a sedentary life style should be considered at high risk for developing CHD. They should be provided with intensive health education along with close monitoring to detect the emergence of the symptoms and signs of CHD.

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