FREQUENCY OF RISK FACTORS FOR CORONARY HEART DISEASE AMONG DIABETIC PATIENTS IN AL-RABWAH PHC CENTER IN RIYADH

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هدف الدراسة: داء السكري من الأمراض الشائعة في المملكة العربية السعودية ويرتبط بنسبة انتشار وحدوث عالية لمرض القلب التاجي. وهذه الدراسة تهدف إلى تحديد نسبة عوامل الخطورة المتغيرة لمرض القلب التاجي بين مرضى السكري المسجلين بمركز صحي الربوة بالرياض.

طريقة الدراسة: تمت مراجعة ملفات جميع مرضى السكري المسجلين بمركز صحي الربوة خلال أبريل ومايو عام 2001م حيث بلغ عددهم 495 مريضاً 292 رجال و203 نساء. حيث تم جمع المعلومات عن مؤشر كتلة الجسم للسمنة وضغط الدم المرتفع ونسبة الكوليستيرول الكلي والترايجلسيريدات وذلك بأخذ متوسط آخر ثلاثة قراءات منهم. وعادة التدخين لديهم. وكذلك مدة مرض السكري ونسبة سكر الصيام في الدم.

النتائج: بلغت نسبة انتشار زيادة الوزن بين مرضى السكري 43.2% بين الرجال مقابل 22% بين النساء وكانت ظاهرة بين الرجال. ونسبة السمنة 27.9% بين الرجال مقابل 64.1% بين النساء وهي ظاهرة بين النساء.
أما نسبة الكوليستيرول (≤5.2ممول/ل)49.5% بين الرجال, و68.5% بين النساء. والترايجلسريدات (≤1.7ممول/ل) تبلغ 50% في كلا الجنسين. ونسبة ارتفاع ضغط الدم 13.4% بين الرجال مقابل 44.3% في النساء بنسبة واضحة بينهن. وتبلغ نسبة التدخين 19.5% بين الرجال فقط. وعند مقارنة المرضى الذين يعانون من السكري لمدة أكثر من عشر سنوات تبين أنهم أكثر في نسبة الوزن الطبيعي وأقل في نسبة المدخنين بينهم مقارنة بمرضى السكري لمدة أقل من عشر سنوات. والمرضى الذين لديهم ارتفاع في نسبة سكر الصيام في الدم أكثر من 8.3ممول/ل ترتفع بينهم نسبة السمنة والكوليستيرول المرتفع والترايجليسريدات المرتفعة وكذلك نسبة المدخنين مقارنة باللذين تبلغ نسبة سكر الصيام لديهم أقل من 8.3ممول/ل.

الخلاصة: تشير النتائج إلى ارتفاع نسبة انتشار عوامل الخطورة المتغيرة لمرض القلب التاجي بين مرضى السكري وبنسبة أكثر بين النساء. وهذا يحتاج إلى فحص دوري وتدخل مبكر لهذه العوامل لتقليل نسبة حدوث مرض القلب التاجي بين مرضى السكري أو تأخيره على الأقل.

الكلمات المرجعية: عوامل الخطورة، مرض نقص التروية القلبي، داء السكري، مركز الرعاية الصحية الأولية.

Background: *Diabetes mellitus associated with high prevalence and incidence of CHD is a common problem in Saudi Arabia.*

Objectives: *To assess the percentage of major modifiable risk factors for CHD among diabetic patients.*

Methods: *This is a retrospective study conducted on 495 diabetic patients (292 males and 203 females) attending the Miniclinic at Al-Rabwah PHC center in Riyadh. Their records for the months of April and May 2001 were reviewed. Data collected from the patient's files included body mass index (BMI), blood pressure, total cholesterol, triglyceride, and smoking status. In addition, information on the duration of diabetes was obtained and fasting blood sugar was done.*

Results: *The percentage of overweight males was 43.2% as against 22% females, the figure for males being highly significant ($p<0.0001$). Obesity which was 27.9% in males and 64.1% in females, was highly significant in females ($p<0.0001$). For cholesterol ($\geq$5.2 mmol/l) was 49.5% in males versus 68.5% in females ($p=0.0036$). High triglyceride ($\geq$1.7%) was 50% in both genders. 13.4% of males were hypertensive as against 44.3% female hypertensives which was highly significant in females ($p<0.0001$). 19.5% of the males smoked. There was no significant difference between risk factors for CHD and duration of diabetes except that there were more smokers among those who had had diabetes for less than 10 years. Most of the diabetics with poor glycemic control (FBS> 8.3mmol/l) tended to be smokers, were more obese, had high triglyceride and high total cholesterol.*

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Conclusion: *The findings indicated that diabetic patients have high percentage of risk factors for CHD and more females than males are at risk. Therefore, early intervention is required if the incidence of CHD among diabetic patients is to be reduced.*

Key Words: *Risk factor, Coronary heart disease, Diabetes Mellitus, Primary Health Care Center.*

INTRODUCTION

Diabetes is a common, complex, serious, and costly disease. It can affect nearly every organ of the body. Microvascular and macrovascular complications are common and can be devastating. In 1996, diabetes was the seventh leading cause of death in the United States.[1] In 2000, diabetes became the sixth leading cause of death,[2] so its incidence is increasing. Coronary artery disease is a major cause of morbidity and mortality in patients with diabetes who also have a high incidence of silent myocardial ischemia.[3]

Atherosclerosis accounts for approximately 80% of all diabetic mortality, and about 75% of this is a consequence of coronary artery disease; the remaining 25% results from accelerated cerebrovascular and peripheral vascular disease.[4] Patients with Type 2 diabetes mellitus have a two to three-fold increased incidence of disease related to atheroma.[5] The prevalence of diabetes mellitus among adults in Saudi Arabia is 11.8% and 12.8% among males and females respectively,[6] and is expected to rise in the near future.

In Saudi Arabia, diabetes has become a major cause of morbidity in the last two decades, apparently due to the sudden changes in lifestyle as a result of economic development, urbanization and competitive life.[7] The reported percentage of risk factors for CHD among Saudi diabetic patients are as follows: high total cholesterol was 30%,[8-10] high triglyceride ranged from 14%-30% which could be due to the variations in the cut off point used,[8-10] overweight ranged from 33%-40,[9,11,12] and obesity from 30%-46%,[9,11,12] and hypertension was 22.1%.[13]

In Al-Rabwah primary health care center, where a mini-clinic for chronic diseases including diabetes mellitus has been run since 1998, the present study was designed to estimate the percentage of risk factors for coronary heart disease (CHD) among diabetic patients. Because of the seriousness of coronary heart disease among diabetic patients and its association with modifiable risk factors, it is important to take steps to reduce these risk factors. In addition, studies in this field are few in Saudi Arabia.

The objective of this study was to assess the percentage of major modifiable risk factors for CHD among diabetic patients attending the mini-clinic at Al-Rabwah PHC center.

METHODOLOGY

This retrospective study was conducted in Al-Rabwah training PHC center in Riyadh. The data was obtained from the mini clinics started in 1998 for chronic disease (e.g. DM, hypertension...). So far 495 diabetic patients have been registered (292 males and 203 females). On the first visit, to the clinic every registered patient had the history, physical examination and required investigations done in accordance with the manual of quality assurance in primary health care.[14] Two nurses, a male and female were trained and assigned to the clinic; the male nurse to the male section and the female nurse to the female section. The same nurse used the same instruments to measure weight, height, body mass index (BMI) and blood pressure.

All registered diabetic patients at this center, both men and women were included in this study. The researcher reviewed patients' files for the months of April and May 2001. The following data were recorded: history of hypertension, BMI, smoking and laboratory tests including total cholesterol and triglycerides. In addition, age, duration of DM, and fasting blood sugar were also recorded. A hypertensive is defined either as a patient who is a known hypertensive on treatment, or as one who persistently has three or more successive readings of either systolic blood pressure 140 mmHg or above, or diastolic blood pressure 90 mmHg or above.[15] Total cholesterol and triglyceride investigations were done on instruction to fast for at least 12 hours. In this study, the average of the last three readings was taken for total cholesterol and triglycerides and patients were classified according to NCEP (ATP III). [(16)] This means that patients were classified as follows: for total cholesterol (5.2-6.2 mmol/L) as a borderline and equal or above 6.2mmol/L as a high level. For triglyceride (1.7-2.25mmoI/l) as a borderline and equal or above 2.26mmol/L as a high level. Obesity and overweight were defined using the average of the last three

measurements of BMI and they were grouped according to the following WHO classification;[17] BMI 25 -29.9kg/m^2 for overweight, BMI 30kg/m^2 for obese: Class I obese: BMI 30-34.9kg/m^2, Class II obese: BMI 35-39.9kg/m^2, Class III obese: BMI ≥ 40kg/m^2. Using the American Diabetic Association's goal of glycemic control cut-off point for FBS as 8.3mmol/L,[18] the average of the last three readings of FBS was taken.

Statistical Analysis

Data were entered in a PC using SPSS statistical package. Descriptive statistics (i.e., mean and standard deviation) were performed to describe the variables. The percentages of the various CHD risk factors in the studied sample were calculated. The level of significance was set at <0.05 throughout the analysis.

RESULTS

A total of 495 diabetic patients' files, 292 (59%) males and 203 (41%) females were studied. Table 1 shows some baseline characteristics of the male and female patients, their similarities in mean age, mean duration of DM and mean fasting blood sugar. Female diabetics had significantly higher mean total cholesterol (5.9mmol/l) with high significant statistical difference (p<0.0001), a higher mean body mass index (32 kg/m^2) with high significant statistical difference (p<0.0001) and a higher mean HbAlc (10.6%) with high significant difference (p<0.0001). Male diabetics, however, had a higher mean triglyceride (2.2 mmol/l) with high significant statistical difference (p=0.018).

Table 1: *Baseline characteristics in 495 diabetic patients in Al-Rabwah PHC in Riyadh, 2001 (Means ± standard deviation)*

Characteristics	Male (292)	Female (203)	p-value
Age	53 ± 14	52 ± 11	0.395
TC (mmol/l)	5.3 ± 1	5.9 ± 1.2	0.000
TG (mmol/l)	2.2 ± 1.6	1.9 ± 1	0.018
BMI (kg/m^2)	27 ± 5	32 ± 6	0.000
FBS (mmol/l)	9.2 ± 3	9.7 ± 3	0.068
HbA1C	9.4 ± 2.7	10.6 ± 3	0.000
Duration (year)	8.7 ± 7	8 ± 7	0.274

TC=Total cholesterol, TG = Triglycerides
BMI = Body mass index, FBS = Fasting blood sugar

The number and percentage of each risk factor for CHD for the entire sample is shown in Table 2. Four fifth (78%) of the diabetics had high body mass index (BMI>25 kg/m^2). High level of total cholesterol (≥5.2mmol/l) was 60.6%.

Table 2*: The percentage of each risk factor for CHD among diabetic patients in Al-Rabwah PHC in Riyadh, 2001*

Risk Factors	No. (%)
BMI (N=473)	
Normal (<25 kg/m^2)	104 (22.0)
Overweight (25-29.9 kg/m^2)	164 (34.7)
Obesity Class I (30-34.9 kg/m^2)	124 (26.2)
Class II (35-39.9 kg/m^2)	54 (11.4)
Class III (≥ 40 kg/m^2)	27 (5.7)
Total cholesterol (N=386)	
Normal (<5.2 mmol/l)	152 (39.4)
Borderline (5.2-6.2 mmol/l)	123 (31.8)
High (≥ 6.2 mmol/l)	111 (28.8)
Triglycerides (N=379_)	
Normal (<1.7 mmol/l)	187 (49.3)
Borderline (1.7-2.25 mmol/l)	80 (21.1)
High (≥ 2.26 mmol/l)	112 (29.6)
Hypertension (N=495)	129 (26.0)
Smoking (N=292 males)	57 (19.5)

N=total number of patients in each variable

Table 3: *Percentage of risk factors of CHD among diabetic patients by sex in Al-Rabwah PHC in Riyadh, 2001*

Risk factor	Male (292) No. (%)	Female (203) No. (%)	p-value
Hypertension	39 (13.4)	90 (44.3)	0.000
Smoking	57 (19.5)	0	0.000001
Total cholesterol:	N=211	N=175	
Borderline (5.2-6.2 mmol/l)	71 (33.6)	52 (29.7)	0.47
High (≥ 6.2 mmol/l)	43 (20.4)	68 (38.9)	0.0001
Triglycerides:	N=205	N=174	
Borderline (1.7-2.25 mmol/l)	34 (16.6)	46 (26.4)	0.026
High (≥ 2.25 mmol/l)	68 (33.2)	44 (25.3)	0.118
BMI:	N=274	N=199	
Overweight (25-29.9)	120 (43.8)	44 (22.1)	0.0000019
Obese class I (30-34.9)	60 (21.9)	64 (32.1)	0.016
Obese class II (35-39.9)	12 (4.4)	42 (21.1)	0.000001
Obese class III (≥ 40)	5 (1.8)	22 (11.1)	0.000046

N= Total number of patients for each variable which was recorded in their files and it also includes the normal values

Approximately half of the patients (50.7%) had high level of triglyceride (≥1.7mmol/l). Of the diabetic patients, hypertensives represented 26%, 19.5% male diabetic patients smoked but none of the females did.

***Table 4**: Distribution of percentage of risk factors of CHD among diabetic patients with regard to the duration of 10 years of DM in Al-Rabwah PHC in Riyadh, 2001*

Risk factor	≤10 yrs (360) No. (%)	> 10 yrs (135) No. (%)	p-value
Hypertension	95 (26.4)	34 (25.2)	0.875
Smoking (male)*	45 (22.4)	9 (10)	0.011
BMI:	N=348	N=125	
Overweight (25-29.9)	125 (36.0)	39 (31.2)	0.40
Obese Class I (30-34.9)	94 (27.0)	30 (24.0)	0.59
Obese Class II (35-35.9)	41 (11.7)	13 (10.4)	0.80
Obese Class III (≥40)	26 (7.5)	1 (0.8)	0.011
Total cholesterol:	N=288	N=98	
Borderline (5.2-6.2 mmol/l)	92 (31.9)	31 (31.6)	0.945
High (≥ 6.2 mmol/l)	82 (28.5)	29 (21.5)	0.934
Triglyceride:	N=284	N=95	
Borderline (1.7-2.25 mmol/L)	60 (21.0)	20 (21.0)	0.896
High (≥2.26 mmol/L)	82 (28.9)	30 (31.6)	0.711

N= total number of patients for each variable which was recorded in their files and it also includes the normal values.
*number of male diabetic patients who have the disease for less than 10 yrs was 201 and those for more than 10 years were 91.

***Table 5**: Distribution of percentage of risk factors for CHD among diabetic patients with respect to fasting blood sugar (FBS) as 8.3 mmol/l is cut-off point between controlled and uncontrolled group in Al-Rabwah PHC in Riyadh, 2001*

Risk factor	FBS ≤8.3 mmol/l (238) No. (%)	FBS > 8.3 mmol/l (257) No. (%)	p-value
Hypertension	52 (21.8)	62 (24.0)	0.54
Smoking (male)*	19 (12.0)	29 (21.5)	0.215
BMI:	N=222	N=251	
Overweight (25-29.9)	89 (40.0)	75 (29.9)	0.0256
Obese class I (30-34.9)	45 (20.3)	79 (31.5)	0.0078
Obese class II (35-39.9)	21 (9.5)	33 (13.1)	0.265
Obese class III (≥40)	12 (5.4)	15 (6.0)	0.945
Total cholesterol:	N=179	N=207	
Borderline (5.2-6.2 mmol/l)	46 (25.7)	77 (37.2)	0.021
High (≥6.2 mmol/l)	40 (22.3)	71 (34.3)	0.013
Triglyceride:	N=175	N=202	
Borderline (1.7-2.25 mmol/L)	38 (21.7)	42 (20.6)	0.887
High(≥2.26 mmol/L)	38 (21.7)	72 (36.3)	0.0028

N=Total number of patient for each variable which was recorded in their files and it also includes the normal values.
*the number of male diabetic patients who had FBS (≤ 8.3 mmol/l) was 157 and those who had FBS (>8.3 mmol/l) were 135

Table 3 shows the number of patients and the result of statistical comparison between male and female patients for each risk factor sub-categories. There was a high percentage with significant statistical difference of high total cholesterol ($p=0.0001$), obesity ($p<0.0001$), borderline triglyceride ($p=0.026$), and hypertension ($p<0.0001$), among female diabetic patients. However, there was a high percentage of overweight patients with significant statistical difference ($p<0.0001$), and of smokers ($p<0.0001$), among male diabetic patients. There was no significant statistical difference for borderline cholesterol and high triglyceride.

The patients were divided into two groups based on the duration of diabetes (Table 4). One group was for those who had had diabetes for more than ten years and the other for ten years or less. A comparison of the risk factors for CHD among diabetic patients with regard to the duration of diabetes, more smokers ($p=0.011$) were found in the group who had had it for less than 10 years. There was also a high percentage of morbid obesity ($p=0.011$), with significant statistical difference. Other risk factors for CHD did not seem to have a clear relation with the duration of diabetes.

Table 5 shows the division of patients into two groups based on the value of FBS, as a good control (FBS≤8.3mmol/l) or poor control (FBS>8.3mmol/l). There was a high percentage with significant difference of borderline cholesterol ($p=0.02$), high cholesterol ($p=0.013$), high triglyceride ($p<0.003$), and obesity Class I ($p<0.008$), among diabetic patients with poor glycemic control. However, there was also a high percentage of overweight with significant statistical difference ($p<0.026$) in the group with good glycemic control. There was no significant statistical difference between the two groups for other risk factors.

DISCUSSION

This study revealed a high percentage of obesity and overweight among diabetic patients. The overall percentage of overweight was 35%, the rate being higher among men than women and the obesity rate was 43.3% and was higher among women than men. This was quite comparable to the results of other studies,[9,11,12] in which overweight ranged from 33-40% and obesity from 30- 46%. The explanation of this may be that females had a more sedentary life with little exercise. In general, the bulk of high body mass index in diabetic patients could explain its role as a predisposing factor of DM Type II and as a risk factor for CHD in diabetic patients. Also high body

mass index could lead to bad glycemic control and increased insulin resistance.[20]

The percentage of hypercholesterolemia in diabetic patients with the cut off point at 6.2 mmol/l was about 29%, affecting more females than males. Moreover, with a lower cut-off point of 5.2 mmol/l, the percentage of hypercholesterolemia doubled. These results were quite comparable to the results of other researches done here in Saudi Arabia,[8,9] and similar to that reported from diabetes surveillance (1999) in the United States, as abnormalities in lipids and lipoproteins were found in almost 30% of persons with diabetes.[1] However, it was different from the Framingham study, which revealed that female but not male diabetic subjects had a higher serum cholesterol level than their nondiabetic peers.[19]

The overall prevalence of hypertriglyceridemia among diabetic patients was about 30%. This result was similar to the result of the Al-Nuaim study,[8] but higher than the result of the Khalid and Rumana study[9] because of the level of cut-off point. This research and that of Khalid and Rumana[9] showed that the rate of hypertriglyceridemia was higher among diabetic men than women, in contrast to Al-Nuaim study,[8] where women had a higher rate of hypertriglyceridemia. However, these differences were not of statistical significance. Also in the Framingham study, triglyceride was higher in diabetic subjects but was only statistically significant in diabetic females compared to nondiabetic peers.[19] However, when the cut-off point of the high triglyceride was reduced to 1.7mmol/l in accordance to (NCEP ATP III),[16] the overall percentage of hypertriglyceridemia in diabetic patients reached 50%. Therefore, hyperlipidemia is an important cause for atherosclerosis. Atherosclerosis accounts for a considerable percentage of all diabetic mortality, the majority of which is the consequence of CHD.

The percentage of hypertension in diabetic patients was found to be 26%, the rate being higher among women (OR 5.17) than men. This result is much higher than that reported in the Al-Zubair study (21.9%),[13] but less than that reported in the Three-City Study (47.2%).[21] Also both latter studies showed a higher rate of hypertension among diabetic patients, especially in females. The high percentage of hypertension in diabetic females can be explained by the high prevalence of obesity and the little physical activity among females. When hypertension coexists with overt diabetes, the risk for CHD, stroke, and nephropathy is doubly increased.

The prevalence of smoking in this study was 19.5% in males. This is similar to the results of National chronic metabolic disease survey (21%) of the general population.[6] Cigarette smoking is a leading risk factor of cardiovascular disease. Patients with diabetes who are smokers are doubly at risk. The percentage of risk factors of CHD among diabetic patients in respect to the duration of diabetes mellitus is worth discussing. Smoking was less in patients who had had the disease for more than 10 years and the reason may be that with time, diabetics are more concerned about their health. However, there was no statistical difference with the duration of DM with regard to high body mass index, high total cholesterol, high triglyceride, and hypertension. This suggests that the risk factors of CHD in diabetes may be present even during the asymptomatic hyperglycemic phase. This necessitates the need to ascertain the point at which the risk factors of CHD come into play in the evolution from elevated blood glucose or insulin resistance.

When FBS was used as a measure of the control of diabetes, there was a high prevalence of obesity and hyperlipidemia in the group with high FBS, possibly related to diet control and the major role it plays in the control of diabetes and its complications. Smoking was also more among the patients with high FBS. This may explain the indirect role of stress in the rate of smoking and hyperglycemia. In general, this could explain the role of hyperglycemia in the risk factors of CHD or even its association. Achieving acceptable levels of glycemic control may be important for secondary as well as primary prevention of CHD in diabetics.

CONCLUSION AND RECOMMENDATION

The clustering of risk factors of coronary heart disease is much higher among diabetic patients. The impact of these risk factors except for smoking which applies only to males is greater in females than males. This could explain the high rate of CHD events and mortality in individuals with diabetes mellitus. Because of these findings, an aggressive approach is needed and strategies have to be developed for the identification of the risk factors so that targeted preventive intervention measures could be undertaken through health education and healthy lifestyle. CHD and diabetes awareness programs, periodic screening, and early therapy for those risk factors by general physicians are strongly recommended. Finally, a more extensive study is needed to confirm these finding in relation to the duration and control of diabetes.

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