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Comparison of Cardiovascular Risk Factors Between Subjects With and Without Diabetes Mellitus: An Analytical Study

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Abstract

Background: Cardiovascular Disease (CVD) is developing treacherously along industrialization and development of urbanization

Objectives: The aim of this study was to compare cardiovascular risk factors between subjects with and without diabetes mellitus in the Minoodar district of Qazvin.

Patients and Methods: This analytical study was conducted on 100 subjects with diabetes and 140 subjects without diabetes in Qazvin from September 2010 to April 2011. Standardized measurements were available for waist circumference (WC), blood pressure (BP), fasting serum cholesterol, high-density lipoprotein cholesterol (HDL), and triglycerides (TGs). Cardiovascular risk factors were defined according to the diagnostic criteria proposed by the national cholesterol education program. Data were analyzed using the t-test, Mann-Whitney U test, and Chi-square test.

Results: Overall, 12% of subjects with diabetes and 17.9% of subjects without diabetes were smokers (P = 0.277). The WC, TGs, systolic and diastolic BP were significantly higher in subjects with diabetes compared to subjects without diabetes. The prevalence of high WC, high BP, low HDL, and high TGs were significantly higher in subjects with diabetes compared to subjects without diabetes.

Conclusions: Cardiovascular risk factors were higher in subjects with diabetes compared to subjects without diabetes. Lifestyle intervention programs should be focused on community education about reduction of CVD risk factors in patients with diabetes.

Keywords: Risk Factor, Coronary Heart Disease, Diabetes Mellitus

1. Background

Cardiovascular disease (CVD) is a chronic disease (1) that develops treacherously during lifetime and usually has symptoms in advanced stage. Prevalence of coronary heart disease (CHD) and other related diseases have increased with industrialization and development of urbanization since these two features can result in sedentary life style (2). Diabetes is a growing medical problem that can be seen in a large part of the population and causes a huge cost to the society (3). Patients with diabetes mellitus are at high risk for coronary heart disease (4). Previously, it has been shown that the risk of CVD is two to three folds higher in patients with diabetes compared to subjects without diabetes (5). Micro vascular and macro vascular complications have been seen in people with long-term hyperglycemia, both in type 1 and type 2 diabetes (6). Much of the research into CHD risk in diabetes has focused on type 2 diabetes and insulin resistance. Thus, control of CHD risk factors is an important priority that must be considered in diabetes health programs (2). Dyslipidemia is one of the important risk factors for cardiovascular disease CVD. Dyslipidemia, beside other metabolic disorders such as obesity, hypertension, and glucose intolerance, increases the risk of type 2 diabetes as well as CVD (7). High fasting blood glucose is another risk factor for mortality due to CVD (8, 9). This hypothesis that cigarette smoke exposure increases oxidative stress as a potential mechanism for initiating cardiovascular dysfunction was approved in recent experimental studies (10). According to another research, blood pressure (BP) is a major risk factor that acts on the arterial wall and is responsible in part for various CVD, such as cerebra-vascular accidents and ischemic heart disease (11). Chapman et al. (12) showed that plasma cholesterol and triglycerides are independent risk factors for CHD morbidity and mortality in subjects with diabetes. Iran, like many countries, is in rapid changing demographic and economic conditions; and is facing problems of noncontagious diseases, particularly cardiovascular disease. According to the results of mentioned studies, prevention and reduction of CHD risk factors is an important priority in diabetes program. Prevalence of cardiovascular risk factors among the Iranian urban population is high (13). Study of CVD risk factors would help to find valuable strategy for life style modification and other risk factors for reduction of cardiovascular disease.

2. Objectives

The aim of this study was to compare cardiovascular risk factors between subjects with and without diabetes mellitus in the Minoodar district of Qazvin.

3. Patients and Methods

This analytical study was conducted on 240 subjects (100 with diabetes and 140 as the control group) identified by the Qazvin metabolic diseases study (QMDS), Iran. The study protocol was approved by the ethics committee of Qazvin University of Medical Sciences. All subjects provided a written informed consent. The QMDS was a cross sectional population based a study performed on a representative sample of residents of Minoodar district of Qazvin from September 2010 to April 2011. All households of this district had profiles at the Minoodar health center. The household was considered as the sampling unit. Subjects were invited by telephone to attend the health center, and after full explanation of the study protocol, they could choose to participate. Overall, 1107 individuals, aged ≥ 20 years old, were selected by multistage cluster random sampling methods. Social and demographic information was recorded in a self-reported questionnaire. Two practitioners recorded past medical history, smoking status, family history, drug history, and physical examination for all subjects. Anthropometric indices including waist circumference (WC), hip circumference, weight, height, waist to hip ratio (WHR), and body mass index (BMI) were measured after 12 - 14 hours of overnight fasting. blood pressure (BP) was measured three times in the seated position by a mercury sphygmomanometer and after a 15-minute rest on a single occasion. After 12 - 14 hours of overnight fasting, blood levels of glucose, triglycerides (TGs), total cholesterol, high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were measured for all subjects in the same laboratory. Oral glucose tolerance test (OGTT) by 75 g of glucose was performed on subjects without previous history of diabetes. Details of the sampling method and data collection of the QMDS have been published previously (14). According to the American diabetes association, diabetes mellitus was defined as fasting blood sugar (FBS) ≥ 126 mg/dL or two-hour post load glucose ≥ 200 mg/dL during OGTT or previous diagnosis of diabetes. Given this information, presence or absence of diabetes mellitus was known for all study subjects and 124 (11.5%) of the participants had diabetes mellitus. In total, 100 subjects with diabetes were selected and 140 subjects without diabetes (with normal glucose metabolism) were matched for age and gender, as the control group. Subjects with impaired fasting glucose and impaired glucose tolerance were excluded from the study. Cardiovascular risk factors were defined according to the diagnostic criteria proposed by the national cholesterol education program as follow: WC ≥ 102 cm in males and ≥ 88 cm in females, TGs ≥ 150 mg/dL, Cholesterol ≥ 200 mg/dL; HDL < 40 mg/dL in males and < 50 mg/dL in females, systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 85 mmHg (15). Variables were described as mean ± standard deviation (SD) or numbers (percentages). Quantitative variables were compared using the t-test or Mann-Whitney U test, where appropriate. The chi-square test was used to compare categorical variables. $P \leq 0.05$ were considered significant.

4. Results

Overall, 100 subjects with diabetes and 140 subjects without diabetes (with normal glucose metabolism) were evaluated. Mean age was 46.25 ± 1.54 years in subjects with diabetes and 45.71 ± 1.01 in subjects without diabetes. Overall, 12% of subjects with diabetes and 17.9% of subjects without diabetes were smokers (P = 0.277). Family history of myocardial infarction and cerebrovascular accident was not significantly different between the two groups. Clinical and laboratory characteristics of the study subjects are shown in (Table 1). Mean WC, WHR, BMI, TGs, systolic blood pressure and diastolic blood pressure were significantly higher in subjects with diabetes compared to subjects without diabetes. Cardiovascular risk factors were compared between subjects with and without diabetes, according to the diagnostic criteria proposed by the National Cholesterol Education Program (Table 2). The prevalence of high WC, high BP, low HDL, and high TGs were significantly higher in subjects with diabetes compared to subjects without diabetes.

Table 1. Clinical and Laboratory Characteristics of the Study Subjects[a]

Variable	Subjects With Diabetes (n = 100)	Subjects Without Diabetes (n = 140)	P Value
Waist circumference, cm	95.62 ± 1.82	92.03 ± 1.53	0.003
Waist to hip ratio	0.891 ± 0.01	0.866 ± 0.01	0.006
Body mass index, kg/m^2	27.80 ± 0.88	26.69 ± 0.67	0.046
Triglycerides, mg/dL	184.20 ± 16.82	148.89 ± 15.27	< 0.001
Total cholesterol, mg/dL	192 ± 7.95	195.03 ± 7.04	0.576
HDL-C, mg/dL	40.06 ± 2.06	42.09 ± 1.54	0.113
LDL-C, mg/dL	113.131 ± 5.13	112.30 ± 4.19	0.804
Systolic blood pressure, mmHg	117.40 ± 3.79	112.47 ± 2.69	0.050
Diastolic blood pressure, mmHg	74.50 ± 2.44	71.14 ± 1.87	0.015

[a]Data are presented as mean± SD.

Table 2. Comparison of Cardiovascular Risk Factors Between Subjects With and Without Diabetes[a]

Variable	Subjects Without Diabetes (n = 140)	Subjects With Diabetes (n = 100)	P Value
WC ≥ 102 cm in males or ≥ 88 cm in Females	50 (35.7)	56 (56)	0.002
BMI > 25, kg/m^2	92 (65.7)	72 (72)	0.327
SBP ≥ 130 mmHg or DBP ≥ 85 mmHg	28 (20)	35 (35)	0.011
Cholesterol ≥ 200, mg/dL	56 (40)	38 (38)	0.790
HDL-C < 40 mg/dL in Males or < 50 mg/dL in Females	86 (61.4)	75 (75)	0.036
TGs ≥ 150, mg/dL	51 (36.4)	57 (57)	0.002

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; HDL-C, high density lipoprotein cholesterol; SBP, systolic blood pressure; TGs, Triglycerides; WC, waist circumference.
[a]Data are expressed as number (percent).

5. Discussion

The results of our study indicated that not only mean WC, WHR, BMI, TGs and blood pressure were significantly higher in subjects with diabetes but also, the prevalence of high WC, high BP, low HDL, and high TGs, according to the diagnostic criteria proposed by the National Cholesterol Education Program, were significantly higher in subjects with diabetes compared to subjects without diabetes. There are countless arguments about higher frequency of cardiovascular disease in patients with diabetes. Many epidemiological prospective studies have been performed in this field. About 11 million Americans with diabetes have CVD, and it is estimated that two-thirds will die from CHD (5). Reports presented that there is an association between type 2 diabetes disease and CVD (16, 17). Results of the present study on patients with and without diabetes confirmed the above-mentioned results. Comparison between the two groups showed that mean value of TGs and BP are more in subjects with diabetes compared to subjects without diabetes. On the other hand, several studies showed that control of modifiable risk factors for cardiovascular disease reduces rate of heart disease. The matter is more essential in patients with diabetes; since they are more prone to coronary heart disease. Tuomilehto has demonstrated that diet and exercise can reduce diabetes by nearly 60% in the Finish population in 2003. Also this study indicated that statin and fibrate therapy can reduce LDL-cholesterol level and consequently will result to reduce the risk of cardiovascular disease in type 2 diabetes (4). Also a study indicated that there is a major relationship between physical activity and insulin resistance (18). Therefore, strategies for modification of risk factors might have great impact on reducing number of heart failure cases in the population (19). Intervention in lifestyle can change dietary habits and consumption of fiber, increase physical activity, decrease WC, and control blood glucose and lipid concentrations. Therefore, it can be effective in the reduction of cumulative incidence of diabetes in the intervention group (20). Based on the recommendation of the national cholesterol education program and the Joint European societies, reduction of cholesterol, body weight, increase in consumed fiber, and physical exercise are cornerstones for cutback of CHD risk level (15). Programs for reduction of morbidity and mortality from heart disease in patients with diabetes should emphasize on primary and secondary prevention for the rise of blood glucose and CHD risk factors (4). Tuomilehto et al. (8) studied the consequence of changes in lifestyle on prevention of type 2 diabetes mellitus. They reached to similar result in this subject. They showed that lifestyle change is the best strategy for prevention and reduction of CHD risk patients with diabetes (13, 21). In the present study, central obesity, high BP, high TGs, and Low HDL-C in subjects with diabetes were more prevalent than subjects without diabetes. Changes in lifestyle, fulfilled intervention to reduce level of CHD risk factors and especially prevention of progression to diabetes in individuals with impaired glucose tolerance are recommended. The lifestyle intervention program used in the Diabetes Prevention Study (DPS) is effective and can be done in primary health care facilities (20). Thus, there are evidences that the control of risk factors or lifestyle intervention can help with the reduction of CHD risk level in high-risk populations, for example diabetic patients (4). These are the best ways for the reduction of the burden of cardiovascular disease in patients with diabetes. Indeed this will be achieved by ongoing surveillance, checkup, control of all risk factors associated with cardiovascular disease, and improvement of metabolic profile. Lifestyle intervention programs should be focused on increase in physical activity, dietary measures to increase HDL-C cholesterol and reduce LDL-C cholesterol, TG, fasting blood glucose, community education about smoking cessation, control of high blood pressure, reduction of body mass index in obese population, and so on. The strength of the present study was the selection of the study subjects from a population-based design. However, there were some limitations including the number of study subjects. The duration of diabetes

was not considered and the authors grouped previously and newly diagnosed participants with diabetes into the same category. Results of the current study are imperative for healthcare professionals and authorities. They help us recognize CHD risk factors in patients with diabetes and develop preventive plans in the future. The findings can be applied in planning for primary and secondary prevention in Iranians with diabetes. Moreover, the results will serve as a baseline for assessment of future trends, medium-term and long-term planning.

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Footnote

Authors' Contribution: Study concept and design: Mousavi, Ghorbani, Esmailzadehha; analysis and interpretation of data: Asefzadeh, Ghorbani; drafting of the manuscript: Mousavi; critical revision of the manuscript for important intellectual content: Ziaee, Ghorbani, Esmailzadehha; acquisition of data: Mousavi, Esmailzadehha; statistical analysis: Asefzadeh, Mousavi; administrative, technical, and material support: Asefzadeh, Ziaee; study supervision: Ziaee.

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