A Cross-sectional Study of the Prevalence of Coronary Artery Disease Traditional Risk Factors in Yazd urban population, Yazd Healthy Heart Project

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Background: Coronary artery disease (CAD) risk factors are increasing in developing countries. Previous studies have shown a high prevalence of CAD risk factors in Iran but Geographical prevalence is not uniform. The present study was performed to determine the prevalence of CAD risk factors among Yazd urban population.
Method: This cross- sectional study performed in 2004, comprised a total 2000 Yazd citizens (1000 males), and the corresponding data were recorded in questionnaires carrying 500 items.
Results: About 85% of Yazd citizens had at least one and 61.1% had at least two coronary artery risk factors. The following data in brackets refer to the males and females respectively. The present study showed obesity in 16.38% of Yazd citizens (9.2 and 24.2%). The prevalence of hypercholesterolemia 12.1% (10.6 and 13.8%), dyslipidemia 58.5% (59% and 57.6%), high blood pressure 25.6% (27.5% and 23.5%), diabetes mellitus 11% (10.48% and 11.5%), impaired glucose tolerance test 8.5% (7.9% and 9.1%) and cigarette smoking 13.12% (24.45% and 0.5%). Also 43.3% of men and 62.05% of women had excess weight. The prevalence of hypercholesterolemia, dyslipidemia, diabetes mellitus (DM), hypertention (HTN), and abdominal obesity increased significantly with age (P< 0.005). The prevalence of obesity, abdominal obesity, hypercholesterolemia and DM were significantly higher in women.
Conclusion: Yazd did not carry the highest levels of risk factors in Iran, but the present study showed excess weight, dyslipidemia and HTN were the most prevalent risk factors found in this region. Thus it is recommended to consider the preventive and therapeutic measures as the major health priorities in this area.

Keywords: Coronary Artery Risk Factors, Prevalence, Coronary Artery Disease, Yazd

Introduction

Coronary artery disease (CAD) is the leading cause of cardiovascular mortality in Iran and other developing countries.[1,2] Coronary artery risk factors are also increasing in most populations and the trend is particularly worrying in developing countries. Atherosclerosis risk factors can be divided into three groups: fixed and non- modifiable factors such as age, sex and family history; major modifiable factors such as smoking and hypertension; and other risk factors such as diabetes, obesity and etc.[3] Although fixed risk factors are not modifiable but by controlling major modifiable risk factors not only we can decrease the risk of atherosclerosis but we can also eliminate the synergistic effects of modifiable risk factors on fixed risk factors. Indeed control of CAD risk factors, one of the major goals in health programs, needs reliable data about the exact prevalence of CAD risk factors. The aim of this study was to estimate the prevalence of CAD traditional risk factors in Yazd citizens. In regard to the results of this study, health care project can be designed and performed in order to decrease the incidence of CAD.

Patients and Methods
Population Study

This study was carried out in Yazd urban population aged from 20 to74 years. This was a part of the phase I of Yazd healthy heart project; a community based interventional study to prevent car-

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diovascular disease. Individuals were recruited by multistage sampling. We selected 100 clusters randomly in Yazd urban area according to health care provider devisions and then in each cluster we sampled 20 families based on systematic random sampling according to their identifying number in health care providers services. In each family one person was selected Participants were selected in equal sex and 5-year age groups: 20-34, 35-44, 45-54, 55-64 and 65-74. Results were reported after standardization based on sex and age distribution in 2006 census.
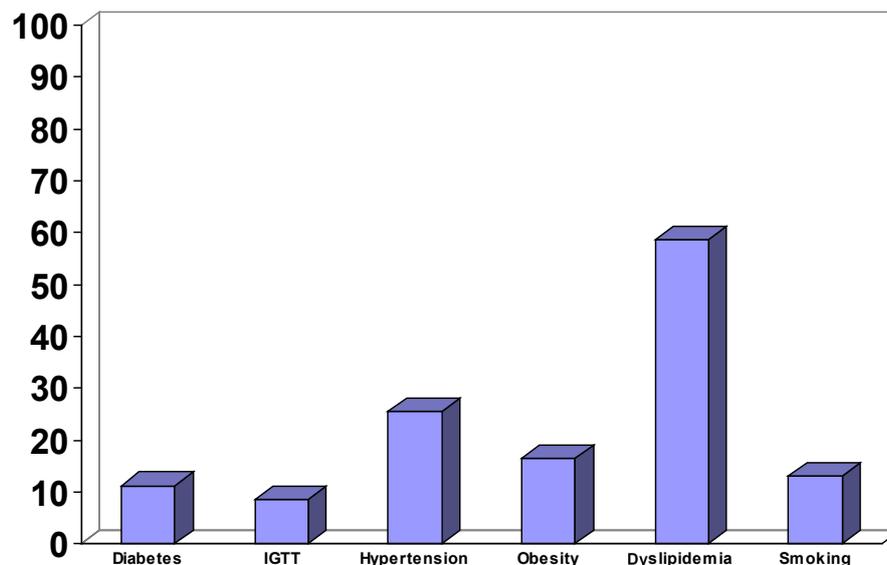
Data Collection

Demographic clinical and Para clinical data were recorded in a 500 items questionnaire that completed by trained health care providers.

The questionnaire was used to obtain information on demographic and socioeconomic aspects, family health history, past medical history and lifestyle factors such as smoking. During the same visit, anthropometric and blood pressure (BP) measurements were performed. BP was measured twice at 5 minute intervals in each of two visits using a mercury sphygmomanometer. Kortokoff first and fifth phase sounds were recorded as systolic and diastolic blood pressure respectively. BP was defined as the average of four measurements. The individuals were then referred to the district health center to perform biochemical tests and anthropometric measurements. Biochemical test were taken after at least 12 hours of fasting and consisted of blood glucose, total cholesterol, triglyceride, LDL and HDL. Body mass index was calculated as weight (kg) divided by height (m^2). Waist circumference measured at 2-3 cm obove the umbilicus, or waist circumference at the middle of nipple and top of thigh. Hip circumference was defined as the greatest diameter between the waist and knee.[4]

Traditional risk factors was defined as
- Obesity: body mass index(BMI) > 30
- Overweight: 25<BMI<30
- Abdominal obesity: Waist to hip ratio (w/h)>1 in male and >0.8 in female.
- Dyslipidemia: triglycerides>150 and / or cholesterol>200 and/ or low density lipoprotein (LDL)>160 and/ or high density lipoprotein (HDL)<40 for male and <50 for female and/or history of taking anti- hyperlipidemic drugs.
- Hypertension: Currently taking antihypertensive medications and/or systolic blood pressure (SBP) >140 and/or diastolic blood pressure (DBP)>90, by taking the average of 4 measurements.
- Diabetes mellitus: history of using hypoglycemic agents and/or fasting blood sugar (FBS)>126 and Glucose tolerance test (GTT) >200.
- Impaired GTT (IGTT): 140<GTT<200
- Impaired fasting glucose (IFG):GTT<140 and 110<FBS<126
- Smoking: consumption of 10 cigarettes per day at least for 3 months

Figure 1. Traditional CAD risk factors prevalence in 20-74 years-old of Yazd urban population

Table 1. The prevalence of traditional CAD risk factors in 20-74 years-old male and female population of Yazd.

CAD Risk factors	Diabetes mellitus	Hyper-tension	IGTT*	IFG**	Abdominal obesity	Obesity	Dyslip-idemia	Cholesterol >240 mg/dl
Male	10.8	27.59	7.92	1.89	8.06	9.13	59.43	10.63
Female	11.59	23.89	9.16	1.15	35.8	24.29	57.67	13.25
P value	0.001	<0.001	0.001	0.01	<0.001	<0.001	<0.001	<0.001

*: Impaired Glucose Tolerance Test; **: Impaired Fasting Glucose

Statistical Analysis

Statistical analysis was done with SPSS version 11.5. Differences in various qualitative data were tested by Chi-square test and Fisher's exact test. The prevalence rates are given in percent and numerical variables as (mean$\pm$SD). P value less than 0.05 was considered as significant.

Results

The participants aged from 20 to 74 years with mean age of 48.75$\pm$15 (48.8$\pm$15.3 in male and 48.6$\pm$15 in female, P=0.800). Based on 10-year age intervals of 20-34, 35-44, 45-54, 55-64, 65-74, the respective evaluations were 399(20%), 400 (20%), 405 (20.2%), 398 (19.9%), 398 (19.9%). The prevalence of CAD risk factors were standardized based on age and sex distribution of Yazd urban population. The present study revealed that the most prevalent coronary artery risk factors in Yazd were dyslipidemia, hypertension and overweight in decreasing order (Fig.1). About 85.9% of subjects (85.7% of men and 86.0% of women) had at least one and 61.2% (51.3% of men and 64.98% of women) two risk factors. Table 1 shows the prevalence of CAD risk factors based on both genders. The prevalence of overweight and obesity were 36.1% and 16.5% respectively and 43.3% of males and 62.1% of females were overweight. Obesity was significantly higher (P<0.001) in females (24.29%) than in males (9.1%). The highest prevalence of obesity was in 55-64 years-old subjects.

The prevalence of abdominal obesity, that is strongly associated with CAD, was 22.0%, it was more prevalent in females (35.8%) than males (8.06%) (P<0.001). It significantly increased with aging in both gender, especially in females that rose from 18.0% in 20-34 years-old group to 74.1% in those aged 65.7 years.

Present survey showed that about 25.2% of males and 20.9% of females with normal BMI had abdominal obesity. According to findings, total prevalence of high blood pressure (HTN) was 27.59% in men and 23.89% in women. Also the prevalence of HTN increased with aging in both gender (P<0.001), 10.0% in 20-34 and 70.1% in 65-74 years-old.

Almost 12.2% of people had serum cholesterol more than 240 mg/dl, 10.63% of males and 13.25% of females. By considering cholesterol>200 mg/dl as abnormal level, 35.4% had hypercholesterolemia. The Prevalence of hypercholesterolemia increased with aging significantly (P<0.001) in men, but not in women. The prevalence of dyslipidemia was 58.6% (59.4% in men and 57.67% in women) in Yazd. Dyslipidemia also significantly increased with aging in both gender (P<0.001). The prevalence of dyslipidemia was: 24.2% (low HDL level), 5.7% had LDL level more than160 (26.7% more than130), and 35.4% had cholesterol level more than200 (Table 2).

Table 3 shows the prevalence of CAD risk factors based on age groups. Present investigation revealed that about 11.0% of 20-74 years-old population of Yazd were diabetic, 10.8% males and 11.59% females (P=0.001). Also aging elevated the prevalence of diabetes (P<0.001). DM increased from 2.2% in 20-34 years-old to 32.4% in 65-74 years subjects.

The prevalence of IGTT and IFG were 8.5% and

Table 2. The prevalence of lipid profile disturbances in different age groups.

Lipids	Age					P Value
	20-34 No (%)	35-44 No (%)	45-54 No(%)	55-64 No (%)	65-74 No (%)	
Low HDL-c *	96 (24.2)	96 (24.2)	98 (24.3)	100 (25.2)	93 (23.9)	0.958
High LDL-c**	13 (3.3)	25 (6.6)	31 (8.1)	49 (12.6)	42 (11.2)	0.001
High TC***	96 (44.2)	157 (68.8)	214 (79.6)	223 (82.1)	211 (78.8)	0.001
High TG****	104 (26.2)	208 (52.3)	227 (56.6)	224 (56.4)	204 (52.3)	0.001

*HDL-c<40 for male and <50 for female; **LDL-c>160; ***TC>200; ****TG>150

Table 3. Standardized traditional CAD risk factors prevalence in 20-74 years-old urban population of Yazd in different age groups.

Risk Factors	Age						P value
	20-34	35-44	45-54	55-64	65-74	Total population	
Diabetes Mellitus	2.2	9.2	21.7	30.4	32.4	11.0	0.001
Hypertension	10	27	40.2	64.5	70.1	25.6	<0.001
IGTT	5.5	12.2	17.5	17.3	20.8	8.5	0.001
Impaired fasting glucose	0.2	3.5	2.7	5	3.2	1.5	0.001
Obesity	12.6	19.5	23.1	25	14.9	16.5	0.001
Abdominal Obesity	10.4	25.4	35.7	47.1	49.4	22.0	<0.001
Smoking	9.5	16.1	17.9	13.3	11.2	13.1	0.004
Dyslipidemia	44.9	68.9	75.5	82.1	78.8	58.6	<0.001
Cholesterol>240	7.3	12.6	20.8	21.7	21.8	12.1	<0.001

1.5% respectively and in regard to sex the respective values were 7.9% and 1.89% for males and 9.16% and 1.15% for females. Significant increases in IGT (P=0.001) and IFG (P=0.001) were found with aging. Approximately 13.1% of subjects were cigarette smoker. Prevalence of smoking was significantly higher (P<0.001) in males (24.5%) than in females (0.5%). The highest prevalence of smoking was found in 45-54 years- old men (34.8%).

Discussion

Present study demonstrated that about 85.85% of subjects had at least one, and 61.17% had at least two CAD risk factors. In Bushehr[5] healthy heart study 96.6% of males and 98.6% of females had at least one, and 57.2% of subjects had at least two risk factors. Whereas findings in Bushehr study were close to our study, in Isfahan[6] healthy heart study 34.3% of males and 32.2% of females had at least one, and 19.3% of cases had at least two risk factors. However, such discrepancy can due to different methods and definitions in these two studies. On the other hand differences in dietary pattern, environmental and socioeconomic factors can explain this wide range of differences.

In our study the overall prevalence of overweight and obesity were 36.1% and 16.54% respectively. In another word, about 43.31% of males and 62.01 of females were overweight. Both overweight and obesity were significantly more prevalent in women. Hence, according to high prevalence of obesity and overweight, both genders need control programs especially in women. Low physical activity and dietary habits may be relevant factors that explain the differences between males and females. As in one study in Yazd it was shown about 68.5% of Yazd citizens had sedentary life style.[7]

Other studies in Isfahan[6,8] and Bushehr[9] also showed high prevalence of overweight and obesity. In another study in Tehran[10] about 58.6% of males and 64% of females were overweight or obese. In the USA[11] a previous report by the Behavioral risk factor surveillance system (BRFSS) estimated that approximately 56.4% (65.5 of men and 47.6% of women) were overweight. Obesity is clearly associated with increased risk of CHD. However, much of this risk may be mediated by other CVD risk factors, such as hypertension, diabetes mellitus and lipid profile imbalances that are in association with obesity.[12] Also excess weight is major risk factor for HTN.[9,13] According to INTERSALT[14] study each 10 kg excess weight increased systolic and diastolic blood pressure about 3 mmHg and 2.2 mmHg respectively, Also increasing BMI to 10 kg/m2, elevated LDL levels about 10 mg/dl.[13,15] The highest prevalence of overweight and obesity in Yazd were in young and middle age individuals. Because obesity in younger age subjects is a strong predictor of subsequent cardiovascular disease, it is necessary to have a healthy life style especially in younger age persons and indeed in older population because of association with other CAD risk factors.[16]

However in our study the prevalence of overweight, obesity and abdominal obesity were higher in women, which were consistent with other studies conducted in Iran.[6,9,10] This can be due to differences in eating habits, physical activity and sexual hormones that affect fat distribution.[10,11] High prevalence of abdominal obesity in subjects with normal BMI (25.2% in men and 20.9% in women), shows that screening for abdominal obesity and controlling body fat distribution is as important as controlling body weight in CAD preventive programs. Present investigation showed higher prevalence

of HTN in Yazd compared with those of Tehran[10] and Isfahan[17] surveys (25.6%, 22.9% and 21.0% respectively). The prevalence of HTN had a wide range in different countries from 28.5% and 23.5% in males and female in South America,[18] to 51.3% and 51.3% in males and females in Punjabi Bhatia community.[19] While the prevalence were 27.5% in males and 23.5% in females in Yazd. Differences in life style such as dietary habits, socioeconomic and environmental factors even the salt content of water can contribute to these variations.[9,13] We found a rapid increase in the prevalence of HTN with aging which were 10.0% in 20-34 year-old group to 70.1% in those aged 65-75 years (P<0.001). The same trend was found in Argentina and reported by some other studies.[13,20]

High prevalence of other related risk factors as well as degenerative changes in vessels due to senility and decreased physical activity may be the major reason for such trend. Also every 10 mmHg increase in BP was associated with two-fold increase in CHD incidence.[9] Thus, prevention and treatment of HTN are the major priorities in preventive program that should be attended. The total prevalence of hypercholesterolemia was close to 12.1% and it was less than that of Isfahan (19.1%), Tehran and Bushehr (19.3%).

The prevalence of dyslipidemia was 58.6%, while in Argentina[13] about one-third of the population had HLP (cholesterol≥240 mgr/dl and/ or triglycerides≥200mg/dl). Dyslipidemia is caused by the interaction of genetic and environmental factors.[22] Environmental factors such as dietary constituent,[23,24] socioeconomic levels,[25] physical activity etc, as well as race and hereditary background[26] are involved in determining lipid profiles. The Prevalence of dyslipidemia and hypercholesterolemia were higher in males than females until the ages of 44 to 54 years, while after menopause both dyslipidemia and hypercholesterolemia became higher in females. It is commonly accepted that androgens induce changes in lipid concentrations that would predispose towards coronary heart disease, whereas estrogens are held to have opposite effects, which accounts for the above results.[27] Consistent with our results, a number of studies have shown that serum lipid levels are closely related with age.[28] The exact effects of aging on lipid profiles are not known, but it may be related to degenerative processes, changing in the metabolism or increase in the prevalence of other risk factors such as obesity that has documented positive correlation with the prevalence of hyperlipidemia.[22] The preva-

lence of diabetes mellitus (DM), IGTT and IFG in our study were 11.0%, 8.5% and 1.5% respectively. Previous studies have shown a wide range of DM prevalence in our country from 5.0% in Zanjan to 14.5% in Yazd.[29] Other countries also had different DM prevalence, 6-8% in Argentina[14] and 10.2% in Spain.[30] Again differences in dietary habits, socioeconomic levels, physical activity and other environmental and also genetic factors can contribute to these dissimilarities. Findings showed a rapidly increasing rate of DM with aging in both gender (P<0.001), which was more significant in women. These findings are coherent with the data of other studies.[14,29,31] On the whole, as a consequence of increasing body mass index and decreasing physical activity, rate of diabetes, the predominantly type 2 diabetes is on the rise,[13] and being clearly dominant in old age. In this connection, the prevalence in Yazd of DM in subjects older than 45 years was 28.8%.

In the year 2000 about 14.5% to 22.5% of Iranian population, older than 30 years, had DM or IGTT. However, it is estimated that about 25.0% of subjects with IGTT would develop DM and more than 50.0% will sustain IGT while threatened by the existing risk of CVD forever.[29] Therefore, not only we should screen and treat diabetic subject but also screen and follow IGTT cases.

The prevalence of cigarette smoking was 13.1% in this survey and it was significantly (P< 0.001) more prevalent in males (24.5%) than in females (0.5%). Smoking peaked in middle age (34.9%). During 2005 prevalence of smoking in United States ranged between 11.5% and 28.7% with a peak in young and middle age, and was higher in males (22.1%) than in females (19.2%).[32] One study in 2000 in Maybod located in Yazd province,[33] showed the prevalence of smoking was 14.85% with a peak in 25-34 years old cases.

In MONICA survey in Tehran[10] prevalence of current smoking was 23.5% in males and 1.8% in females. Negative influence of cigarette smoking on cardiovascular system has been proven.[34] Cigarette smoking has negative effects on blood pressure, sympathetic tone and myocardial oxygen supply. Smoking also accelerates atherosclerosis. Cigarette consumption remains the single most important modifiable risk factor for CAD. Even consumption of as few as one to four cigarettes per day can increase the coronary artery disease risk. The exact changes in smoking prevalence in Yazd in the past years are unknown and needs to be more closely investigated.

This study showed that the prevalence of CAD risk factors follow the same trend in several regions in Iran and other countries. Contemporary increase in the prevalence and incidence of CAD warrants obligations to prevent and control the risk factors. CAD traditional risk factors are interconnected, so that each one can aggravate others negative influence.

In regard to preventive measures, it is thus ideal to control all CAD risk factors as far as possible, although in absolute sense this may be difficult to implement. However, at present time wide spectrum of preventive processes are ongoing in Yazd by Heart Research Center in collaboration with health authority of Yazd University and despite inherent difficulties we hope such attempts will be successful.

Acknowledgement

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