Prevalence of Traditional Coronary Artery Disease Risk Factors in Yazd Urban Population: Yazd Healthy Heart Project

M. Rafiei MD, S. M. Sadr MD, Z. Ansari MD, S. M. Namayandeh MD and M. H. Sadr MD

Abstract

Background- Coronary artery disease (CAD) risk factors are increasing in developing counties. Previous studies have shown a high prevalence of CAD risk factors in Iran but geographical prevalence is not uniform. We performed this study to determine the prevalence of these risk factors in Yazd province, central Iran.

Method- In this cross-sectional study, a total of 2000 participants, 1000 men and 1000 women among Yazd citizens, were surveyed and data was recorded in a 500-item questionnaire.

Results- About 85% of Yazd citizens had at least one and 61.1% had at least two coronary artery disease risk factors. The present study showed that 16.38% of Yazd citizens were obese (9.2% in men and 24.2% in women), and 43.3% of men and 62.05% of women had excess weight. Prevalence of hypercholesterolemia was 12.1% (10.6% in men and 13.8% in women, respectively), dyslipidemia 58.5% (59% and 57.6%, respectively), high blood pressure (HTN) 25.6% (27.5% and 23.5%, respectively), diabetes mellitus (DM) 11% (10.48% and 11.5%, respectively), impaired glucose tolerance 8.5% (7.9% and 9.1%, respectively) and cigarette smoking 13.12% (24.45% and 0.5%, respectively). The prevalence of hypercholesterolemia, dyslipidemia, DM, HTN, and abdominal obesity increased significantly with age ($p < 0.005$). The prevalence of obesity, abdominal obesity, hypercholesterolemia and DM was significantly higher in women.

Conclusion- Excess weight, dyslipidemia and HTN were the most prevalent risk factors in Yazd. Although Yazd did not have the highest levels of risk factors in Iran, but the findings showed that Yazd is one of the "at risk" cities with regard to prevalence of risk factors. Preventive and therapeutic programs should thus be considered as a major health priority in Yazd ***(Iranian Heart Journal 2009; 10 (4):28-36).***

Key words: coronary artery disease ■ risk factor ■ prevalence ■ Yazd, Iran

Coronary artery disease (CAD) is the leading cause of cardiovascular mortality in Iran and other developing countries.[1,2] Also coronary artery risk factors are increasing in most populations and the trend is particularly worrisome 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, etc.

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Dr. M. Rafiei Cardiologist, Associated Professor, Cardiovascular Research Center, Dr. S.M. Sadr Cardiologist, Professor, Cardiovascular Research Center

Dr. Z. Ansari Medical Doctor, Researcher, Cardiovascular Research Center , Dr. S.M. Namayandeh Medical Doctor, Researcher, Cardiovascular Research Center, Dr. M.H. Sadr Medical Doctor, Researcher, Cardiovascular Research Center

Yazd Medical University, Cardiovasculr Research Center. Tel: 0351-5231421 Fax: 0351-5253335 Yazd cardiovascular research center, Afshar hospital, jomhoori BLV, Yazd,IRAN Corresponding Author Email: nedansari@yahoo.com mnamayandeh@yahoo.com

That need more investigations.[3] Although fixed risk factors are not modifiable, but by controlling major modifiable risk factors not only can we decrease the risk of atherosclerosis but we also can eliminate the synergistic effects of modifiable risk factors on the fixed risk factors. Of course the control of CAD risk factors - which is one of the major goals in health programs - requires reliable data about their exact prevalence. The aim of this study was to estimate the prevalence of traditional CAD risk factors in citizens of Yazd, central Iran. With regarding to the results of this study, health care projects can be designed and performed in order to decrease the incidence of CAD.

Population Study

In this cross-sectional study, a total of 2000 subjects, 1000 male and 1000 female, of Yazd citizens were surveyed by cluster sampling. The subjects were 20 – 74 years old and they had been living in Yazd at least for one year. They were divided into 5 age groups: 20-34, 35-44, 45-54, 55-64, and 65-74 years old.

Data Collection

Demographic, clinical and paraclinical data were recorded in a 500-item questionnaire that was completed by trained healthcare providers. The questionnaire was used to obtain information on demographic and socioeconomic aspects, family health history, personal medical history and lifestyle factors such as smoking. In the same visit, anthropometric and blood pressure (BP) measurements were performed. BP was measured twice at 5-minute intervals on each visit (2 visits) by a mercury sphygmomanometer. First and fifth phase Korotkoff sounds were recorded as systolic and diastolic blood pressures, respectively. The average of these four measurements was used for defining the BP. Individuals were then referred to the district health center to perform biochemical tests and anthropometric measurements.

Biochemical tests were taken after at least 12 hours of fasting and consisted of blood glucose, total cholesterol, triglyceride, LDL and HDL levels. Body mass index was calculated as weight (kg) divided by height squared (m^2). Waist circumference was measured 2-3 cm above the umbilicus (or waist circumference at the middle of nipple and top of thigh) and hip circumference was defined as the greatest diameter between the waist and knee.[4]

Criteria for diagnosis:

The definition of risk factors was as follows:

- Obesity: BMI > 30
- Overweight: 25<BMI<30
- Abdominal obesity: Waist to hip ratio (w/h) > 1 in males and w/h >0.8 in females.
- Dyslipidemia: triglycerides > 150 and/or cholesterol >200 and/or low density lipoprotein (LDL) > 160 and/or high density lipoprotein HDL < 40 for males and < 50 for females and/or history of taking anti-hyperlipidemic drugs.
- Hypertension: Currently taking anti-hypertensive medications and/or systolic blood pressure (SBP) >140 and/or diastolic BP >90, 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: 10 cigarettes per day at least for 3 months

Statistical methods

Statistical analysis was done with SPSS 12. Differences in various quantitative data were tested by student's T test and Fisher's exact test. The prevalence rate is given in percent and numerical variables as mean plus or minus 1 standard deviation (mean ± SD). P value < 0.05 was considered as significant.

Results

The present study revealed that the most prevalent coronary artery risk factors in Yazd are dyslipidemia, HTN and excess weight, respectively (Figs. 1, 2). About 85.8% of subjects (85.7% of men and 85.9% of women) had at least one and 61.1% (51.2% of men and 64.9% of women) had at least two risk factors. The prevalence of overweight and obesity were 36.05% and 16.54%, respectively in Yazd. Overall, nearly 43.3% of men and 62.05% of women had excess weight. Obesity was significantly higher in females (24.29% vs. 9.13%, *p*= 0.000). The highest prevalence of obesity was in the 55-64 year age group. (Table I)

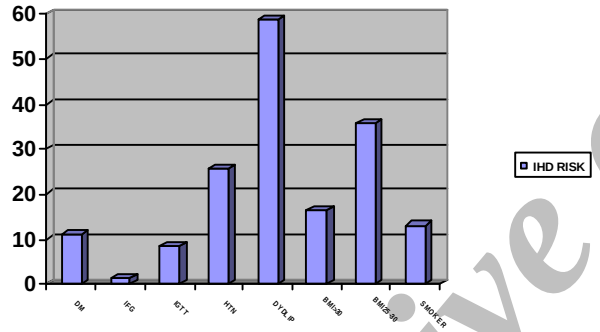

Fig. 1. Age adjusted prevalence of traditional IHD risk factors in 20-74 year olds in Yazd urban population.

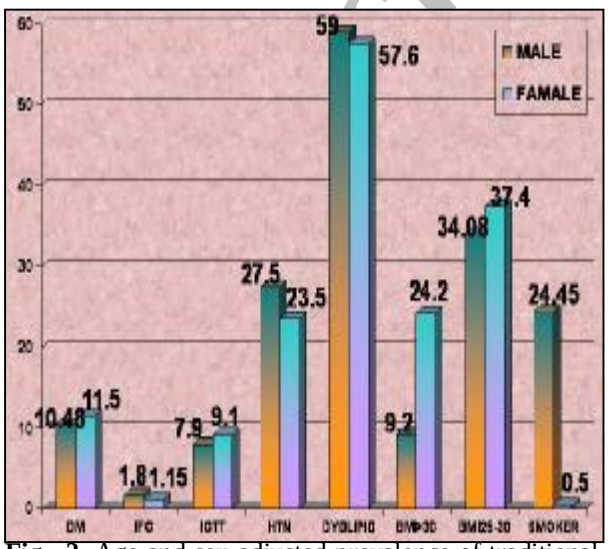

Fig. 2. Age and sex-adjusted prevalence of traditional IHD risk factors in 20-74 year olds in Yazd urban population.

The prevalence of abdominal obesity, which is strongly associated with CAD, was 21.97%, and was more prevalent in females (35.82% vs. 8%, *p*= 0.000) and increased with age significantly in both genders (*p*= 0.000, *p*= 0.000); especially in females it increased from 18% in the 20-34 year old group to 74.1% in the 65-74 year old group (Table I).

The present survey showed that about 25.2% of males and 20.9% of females with normal BMI had abdominal obesity. According to the findings, the total prevalence of high blood pressure (HTN) was 25.6% (27.5% in men and 23.5% in women). Again the prevalence of HTN increased with age in both genders (*p*= 0.000, *p*= 0.000), 10% in the 20-34 vs. 70.1% in the 65-74 year old subjects (Table I).

Almost 12.16% of people had cholesterol levels more than 240 mg/dl; 10.65% of males and 13.83% of females. By considering cholesterol >200 mg/dl as an abnormal level, 35.42% had hypercholesterolemia. The prevalence of hypercholesterolemia increased with age significantly (*p*= 0.000) in men, but not in women (Table I).

The prevalence of lipid profile disturbances was 58.5% (59% in men and 57.6% in women) in Yazd. Dyslipidemia also increased with age in both genders (*p*= 0.000, *p*= 0.000, Table I). The prevalence of lipid profile disturbances was as follows: 24.21% abnormal HDL levels, 5.73% LDL level>160 (26.7% had LDL level > 130 - the target for LDL level according to new texts), 35.42% had cholesterol level >200 (Table II).

The present investigation revealed that about 11% of the 20-74 years old population of Yazd are diabetic, 10.48% in men and 11.5% in women (*p*=0.014). Aging had an increasing influence on the prevalence of diabetes (*p* = 0.000). DM increased from 2.2% in the 20-34 year old group to 32.4% in the 65-74 year old subjects.

The prevalence of impaired glucose tolerance test and impaired fasting glucose were 8.5% and 1.5%, respectively (7.9% and 1.8% in men versus 9.1% and 1.15% in women). Both

IGT and IFG increased significantly with age (p=0.000, p=0.035). Approximately 13.12% of subjects were cigarette smokers. The prevalence of smoking was significantly higher in men (24.45% vs. 0.5%, p= 0.000). The highest prevalence of smoking was in the 45-54 year old men (34.8, Table I).

Table I. Prevalence of coronary artery risk factors in Yazd

Age group / Risk Factors	Prevalence of risk factor (%)						
	20-34	35-44	45-54	55-64	65-74	Total	*p*
Diabetes Mellitus							
male	2	11	20.8	24.2	27.6	10.48	0.000
female	2.5	7.5	22.7	36.5	37.2	11.5	0.000
total	2.2	9.2	21.7	30.4	32.4	11	0.001
Hypertension *							
male	13.1	31	40.6	62.6	67.3	27.5	0.000
female	7	23	39.9	66.5	72.9	23.5	0.000
total	10	27	40.2	64.5	70.1	25.6	0.000
Impaired glucose tolerance test							
male	5.5	12	14.4	17.7	18.1	7.9	0.02
female	5.5	12.5	20.7	17	23.6	9.1	0.000
total	5.5	12.2	17.5	17.3	20.8	8.5	0.001
Impaired fasting glucose							
male	0	4.5	2.5	7.1	3.5	1.8	0.05
female	0.5	2.5	3	3	3	1.15	0.60
total	0.2	3.5	2.7	5	3.2	1.5	0.001
Obesity *							
male	7.1	11.2	9.5	16.4	8.2	9.2	0.02
female	18	27.8	36.6	33.3	21.4	24.29	0.000
total	12.6	19.5	23.1	25	14.9	16.3	0.001
Abdominal Obesity *							
male	2.6	8.6	13	22.2	24.7	8	0.000
female	18	42	58.1	71.9	74.1	35.8	0.000
Total	10.4	25.4	35.7	47.1	49.4	21.9	0.000
Smoking **							
male	18.7	32.3	34.8	26.3	21	24.4	0.001
female	0.5	0	1	0.5	1.5	0.5	0.43
total	9.5	16.1	17.9	13.3	11.2	13.1	0.004
Dyslipidemia							
male	45.2	74.9	72.6	77.8	71.3	59	0.000
female	43	62.8	78.3	86.4	86.2	57.6	0.000
total	44.9	68.9	75.5	82.1	78.8	58.5	0.000
Cholesterol>240 *							
male	8.6	12.6	14.4	12.6	8.2	10.6	0.2
female	6	12.6	27.1	30.7	35.4	13.8	0.000
total	7.3	12.6	20.8	21.7	21.8	12.1	0.000

*: Total prevalence of obesity, abdominal obesity, hypertension and cholesterol>240 in females were significantly higher than males ($p < 0.05$). **: Total prevalence of smoking was significantly higher in males than females ($p< 0.05$)

Table II. Prevalence of lipid profile disturbances in different age groups

Age / Lipids	20-34	35-44	45-54	55-64	65-74	Total	PV
Low HDL-c level	24.2% (96)	24.2% (96)	24.3% (98)	25.2% (100)	23.8% (93)	24.21% (438)	0.958
High LDL-c (LDL > 160)	3.3% (13)	6.5% (25)	8 % (31)	12.6% (49)	11% (42)	5.73% (160)	0.000
High TC (Chol >200)	44.1% (96)	68.8% (157)	75.5% (214)	82.1% (223)	78.8% (211)	58.41% (901)	0.000
High TG (TG >150)	26.2% (104)	52.3% (208)	56.2% (227)	56.4% (224)	52.3% (204)	39.56% (967)	0.000

HDL-c, high-density lipoprotein cholesterol; LDL-c; low-density lipoprotein cholesterol;
TC, total cholesterol; TG, triglyceride

Discussion

The present study demonstrated that about 85.8% of subjects (85.7% of males and 85.9% of females) had at least one, and 61.1% (51.2% of males and 64.9% of females) had at lest two CAD risk factors. In Bushehr healthy heart study,[5] 96.6% of males and 98.6% of females had at least one, and 57.2% of subjects had at least two risk factors. While the findings in the Bushehr study were close to ours, in the Isfahan healthy heart study,[6] 34.3% of males and 32.2% of females had at least one, and 19.3% of cases had at least two risk factors (methods and definitions in these two studies were the same as in ours). Differences in food habits, environmental and socioeconomic factors can explain this wide range of differences.

In our study, the overall prevalences of overweight and obesity were 36.05% and 16.3%, respectively. In other words about 43.3% of males and 62.05% of females had excess weight. Both overweight and obesity were significantly more prevalent in women (p=0.000). Hence, regarding the high prevalence of obesity and overweight, both genders need close control but this control should be considered more seriously in women. Low physical activity and eating habits may be relevant factors that explain the difference between males and females. As in one study in Yazd, it was shown about 68.5% of Yazd citizens have a sedentary life style.[7]

Other studies in Isfahan[6,8] and Bushehr[9] also showed a high prevalence of overweight and obesity. In another study in Tehran,[10] more than 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 an increased risk of CAD. 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 a is major risk factor for HTN.[9,13] According to INTERSALT[14] study, each 10kg excess weight increased systolic and diastolic blood pressure about 3mmHg and 2.2mmHg, respectively. Also, increasing the BMI 10 kg/m^2 elevated LDL levels about 10 mg/dl.[13,15] The highest prevalence of overweight and obesity in Yazd were in the young and middle ages. Because early obesity is a strong predictor of later cardiovascular disease, it is necessary to have a close control program for obesity especially in younger ages in preventive care and of course in the older population because of association with other CAD risk factors.[16]

However in our study the prevalence of over weight, obesity and abdominal obesity were higher in women, similar to other studies conducted in Iran.[6,9,10] This can be due to differences in eating habits, physical activity and sexual hormones that effect fat distribution.[10,11] The 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. The present investigation showed a higher prevalence of HTN in Yazd compared with the Tehran[10] and Isfahan[17] surveys (25.6% vs. 22.9% and 21%). The prevalence of HTN had a wide range in different countries, from 28.5% and 23.5% in males and females respectively in South America[18], to 51.3% and 51.3% in males and females in Punjabi Bhatia community.[19] The prevalences 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 in water can affect these variations.[9,13] We found a rapid increase in HTN prevalence with age, from 10% in the 20-34 year old group to 70.1% in the 65-75 year old group (p = 0.000). The same trend was found in Argentina and some other studies.[13,20]

The 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 a trend. The increasing rate of diabetes with age (28.7% in subjects older than 45 years vs. 11% in the 20-74 year old subjects) is closely associated with high blood pressure also.[13,21] Every 10mmHg increase in BP was associated with a two-fold increase in CHD incidence,[9] so prevention and treatment of HTN is a major health priority that should be attended.

The total prevalence of hypercholesterolemia was close to 12.16% (10.65% in men and 13.83% in women) in Yazd and it was less than findings in Isfahan, Tehran and Bushehr[9] (19.1%, 19.3% and 21% in males and 23.6%, 26.7% and 26.7% in females, respectively).

The prevalence of dyslipidemia was 58.5% in Yazd, 59% in men and 57.6% in women, while in Argentina[13] about one third of population had HLP (HLP was defined as cholesterol ≥240 mg/dl and/or triglycerides ≥ 200 mg/dl). Dyslipidemia is caused by the interaction of genetic and environmental factors.[22] Environmental factors such as dietary constituents,[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 up to the 44-54 year old group (menopausal age for females), 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,[27] thus explaining the above results. A number of studies have elucidated that serum lipid levels are closely related with age,[28] as we have found as well. The exact effects of aging on lipid profiles are not known, 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 a documented positive correlation with the prevalence of hyperlipidemia.[22] The prevalences of diabetes mellitus, impaired glucose (IGTT) tolerance test and impaired (IFG) fasting glucose in our study were 11%, 8.5% and 1.5%, respectively. Previous studies have shown a wide range of DM prevalences in our country; from 5% in Zanjan to 14.5% in Yazd.[29] Other countries also had different diabetes prevalences, 6-8% in Argentina[14] and 10.2% in Spain.[30] Again differences in food habits, socioeconomic levels, physical activity and other environmental and also genetic factors can lead to these dissimilarities. Our findings showed a rapidly increasing rate of DM with age in both genders (p= 0.000, p = 0.000) and this increase was more significant in women. These findings are coherent with the data in the literature.[14,29,31] Overall as a consequence of increasing body mass index and decreasing physical activity, the rate of diabetes, predominantly type 2 diabetes, is on the rise[13] and it is clearly dominant in older ages, as the prevalence of DM in subjects older than 45 years was 28.7% in Yazd.

In the year 2000, about 14.5% to 22.5% of the population older than 30 had DM or IGTT in Iran, whereas it is estimated that about 25% of subjects with IGTT would develop DM in the future and more than 50% will remain with IGT, but the risk of CVD exists and threatens them for ever.[29] So not only we should screen and treat diabetic subjects but also screen and follow IGTT cases.

The prevalence of cigarette smoking was 13.12% in this survey and it was significantly more prevalent in males (24.45% vs. 0.5%, p =0.000). Peak smoking was in the middle ages (34.8%). During 2005, the prevalence of smoking in the United States ranged from 11.5-28.7%, with a peak in the young and middle ages, and was higher in men (22.1% vs. 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 the 25-34 year old group. In the MONICA survey in Tehran,[10] the prevalence

of current smoking was 23.5% in males and 1.8% in females. The negative influence of cigarette smoking on the 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 a few as one to four cigarettes daily increases the coronary artery disease risk. Exact changes of smoking prevalence in Yazd in the past years are unknown and needs to be more closely investigated.

Conclusion

According to this study, CAD risk factors are as prevalent in Yazd as in the other regions in Iran and regional countries. The contemporary increase in the prevalence and incidence of CAD makes the obligations to prevent and control the risk factors. CAD traditional risk factors are like a connected chain and each one can aggravate others.

So with regard to preventive goals, it is ideal to control all CAD risk factors as far as possible, while it may be difficult to manage. However, in the present time, a wide spectrum of preventive processes are on going in Yazd by the Heart Research Center in collaboration with the health authority of the university and we hope these attempts will be successful, though it will be inherently difficult.

Conflict of Interest

No conflicts of interest have been claimed by the authors.

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