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Original Article

Prevalence of Multiple Coronary Artery Disease Risk Factors in Kerman: A Population-Based Study in Southeast Iran

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Abstract

Background: The risk of disease with 1 risk factor is increased by the presence of additional risk factors. The goal of this study was to assess the prevalence of multiple coronary artery disease (CAD) risk factors among adults in Kerman, Iran, to identify the population groups most at risk.

Methods: The present study included 5900 adults aged between 15 and 75 years in 2011 in Kerman, Iran. They were selected by 1-stage cluster sampling. Blood pressure, fasting blood glucose, lipids, and 6 CAD risk factors were assessed in the study population. Standardized prevalence rates were compared between the genders and age groups using the χ^2 test. A $P<0.05$ was considered statistically significant. All the analyses were performed using Stata, version 14.1.

Results: Overall 93.1%, 57.8%, and 26.2% of the patients had at least 1, 2, and 3 risk factors, respectively. The most frequent combinations of risk factors were dyslipidemia plus low physical activity (37.9%), metabolic syndrome (27.7%), dyslipidemia plus abdominal obesity (14.1%), dyslipidemia plus hypertension (HTN) (10%), dyslipidemia plus smoking (8.6%), and HTN plus abdominal obesity (6.3%). The rate of diabetes mellitus plus HTN plus dyslipidemia was 2.8%. Both prevalence and multiplicity of the risk factors increased by age, and they were mostly higher in the women.

Conclusion: Almost 60% of the patients had at least 2 CAD risk factors and only 7% were risk-factor-free. Given that the population is ageing, community health authorities should seek to lessen the burden of these risk factors, almost all of which are preventable.

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Keywords ● Coronary artery disease ● Risk Factors ● Prevalence ● Iran

What's Known

- Risk of coronary artery disease with 1 risk factor (RF) is increased by the presence of additional RFs.

What's New

- Almost 60% of the studied patients were exposed to at least 2 CAD RFs and only 7% were RF-free.
- Most combined RFs were dyslipidemia plus low physical activity (37.9%), metabolic syndrome (27.7%), and dyslipidemia plus abdominal obesity (14.1%).

Introduction

Cardiovascular disease (CVD) and cerebral apoplexy are the main causes of death in the world.[1] Identification of people susceptible to CVD is an important step in controlling these problems. Case-control studies of acute cerebral apoplexies in 52 countries have shown that 90% of potentially modifiable risk factors associated with myocardial infarction are attributed to smoking, insufficient physical activity, poor nutrition, alcohol consumption, hypertension (HTN), abnormal blood lipids,

overweight, type II diabetes mellitus (DM), and psychophysical factors.[2]

The Kerman Coronary Artery Diseases Risk Factors (KERCADR) study was a population-based epidemiological research carried out on 5900 citizens aged between 15 and 75 years old in Kerman.[3] The KERCADR study aimed to investigat, Iran the prevalence of CAD risk factors such as DM, HTN, overweight/obesity, dyslipidemia, low physical activity, smoking, opium addiction, metabolic syndrome, anxiety, and depression in conjunction with their sex distribution. The results demonstrated that the prevalence of HTN, a well-known cause of heart attack and stroke, was 18.4%, of which 10.5% had already been diagnosed and 7.9% had gone undetected.[4]

There is no doubt that obesity and weight gain may lead to diseases such as type II DM, CVD, HTN, metabolic syndrome, and cancer. In Kerman's population, the prevalence rates of overweight/obesity and abdominal obesity were 43% and 15%, respectively.[5] Anxiety, insufficient physical activity, cigarette smoking, and opium consumption can be associated with obesity.

The prevalence of smoking in men was significantly more than that in women among Kerman's population. About 18.5% of the city's men were smokers,[6] while one-third of women and one quarter of men were passive smokers (i.e., exposed to smoke). Although the number of smoker women was relatively low, they were more exposed to smoke.

It seems that the chronic use of opium increases the risk of cardiovascular disorders[7] and metabolic syndrome.[8] It was shown that about 11% of Kerman's adult population consumed opium and 5.6% of them were opium addicts.[9] Depression, insufficient physical activity, and obesity are 3 CVD risk factors which have a significant relationship with opium addiction.

The prevalence of DM in Kerman was about 9%,[10] which is higher than what was reported by the International Diabetes Federation in 2011.

Although only 1 risk factor is sufficient to increase the risk of a disease, these factors are interrelated in such a way that the risk of becoming susceptible to a certain disease with 1 risk factor is augmented when another risk factor is added. Lowe et al.[11] showed that the combination of different risk factors was able to increase the risk of CVD and all-cause death.[11] Likewise, an Australian study demonstrated that people who had more risk factors were also more likely to report a heart attack, stroke, angina, or atherosclerosis, independent of age and sex.[12]

Some risk factors are in clusters. Most studies have considered high cholesterol, HTN, and tobacco consumption as the main factors since they are more prevalent and have the potential to be controlled and prevented.[12] Interventions in lifestyle such as increasing physical activity, correcting eating habits, and overcoming addiction are useful for the management of metabolic syndrome, which is a multiplex risk factor.

Considering that individual risk factors have high prevalence rates in Kerman's population and that a combination of risk factors in a cluster augments the risk more than the sum of the individual risks, determining the prevalence rates of combinations of risk factors in a population and their relationships with demographic variables can provide a better picture of the risks in that population. Thus, the purpose of the present study was to investigate multiple CAD risk factors among adults in Kerman in order to identify population groups most at risk. The results should help health policy makers to devise programs aimed at lessening the burden of CVD in the community.

Participants and Methods

Study Population and Sampling

The current study was performed in conformity with the national guidelines for conducting human studies and was approved by the Ethics Committee (Permission No. 88/110KA) of Kerman University of Medical Sciences, Kerman, Iran.

Totally, 5 900 subjects of both sexes aged between 15 and 75 years with at least a 1-year period of residency in Kerman participated in the study in 2011. Individuals <15 years old or >75 years old and those who were not Iranian or had resided for less than 1 year in the city were excluded from the study. The sampling method; demographic, clinical, and anthropometric characteristics; laboratory measurements; and validity of the data have been mentioned elsewhere.[3] In brief, after taking the patients' blood pressure and reviewing their medical history, a physician clinically examined the participants. Trained interviewers completed a structural questionnaire comprising demographic information and data on cigarette smoking, opium consumption, and level of physical activity based on metabolic equivalents. Fasting plasma glucose, total cholesterol, triglyceride (TGs), and high-density lipoprotein (HDL) were measured using traditional laboratory kits. Low-density lipoprotein (LDL) was calculated based on the Friedewald formula: (LDL=total chol.–[HDL+TGs/5]).

All the collected data were entered into an Epi-data 3.1 database over a 3-day period from the interview with a specific control with several cross-check points. Any inconsistency was reported to the data-collection team for further investigation and correction even by recalling the study population.[3]

Definition of Coronary Artery Disease Risk Factors

Any individual who was previously diagnosed with DM and/or was taking insulin or non-insulin drugs and/or had fasting plasma glucose ≥126 mg/dL at the time of recruitment was considered diabetic.[10] Dyslipidemia was defined as total cholesterol >200 mg/dL and/or LDL>130 mg/kg, and/or HDL<30 mg/kg in men or HDL<45 mg/kg in women. Hypertriglyceridemia was defined as TGs>200 mg/dL. Physical activity was measured using the Global Physical Activity Questionnaire, and metabolic equivalents were used to express the intensity of physical activity.[13]

HTN was defined as a systolic blood pressure ≥140 mm Hg and/or a diastolic blood pressure ≥90 mm Hg and/or taking any antihypertensive drug.[4]

Overweight[5] was defined as a body mass index (BMI) between 25 and 29.9 kg/m^2 and obesity as a BMI≥30 kg/m^2.

Opium addiction was defined according to the DSM-IV criteria. Addicts were defined as those who regularly consumed opium.[9] Smokers were defined as those who smoked at least 1 cigarette per day.[6]

The diagnosis of metabolic syndrome was based on the NCEP: ATPIII criteria: the presence of at least 3 of the following: waist circumference >102 cm in men and >88 cm in women, TGs>150 mg/dL or receiving treatment for hypertriglyceridemia, HDL<40 mg/dL in men and <50 mg/dL in women or receiving treatment for low HDL, fasting blood sugar >100 mg/dL or previous diagnosis of type II DM, and a blood pressure >130/80 mm Hg or receiving treatment for HTN.[8]

Statistical Analysis

The prevalence rates of the multiple risk factors were standardized based on Kerman's population in 2006. The prevalence rates were presented as percent frequencies and 95% confidence intervals (CIs) based on gender and age groups and were compared using the χ^2 test. All the data analyses were performed under a survey data analysis by Stata, version 14.2. Households were considered primary sampling units. A P<0.05 was considered statistically significant.

Results

Out of the 5900 participants, 2 662 (45.1%) were male and 54.9% were female. The mean±SD of their age was 44.4±16.2 years. Moreover, 829 (14.1%) were illiterate and 1 110 (18.8%) had academic educations. Regarding job status, 3 483 (59.1%) of the participants had no job, while 1 859 (32%) had different jobs (table 1).

As is illustrated in table 2, both dyslipidemia and low physical activity were detected in 37.8% of the people living in Kerman. The other important risk-factor combinations were HTN plus dyslipidemia, HTN plus obesity, HTN plus abdominal obesity, dyslipidemia plus obesity, dyslipidemia plus abdominal obesity, dyslipidemia plus smoking, dyslipidemia plus DM, low physical activity plus obesity, DM plus low physical activity, DM plus HTN plus dyslipidemia, DM plus HTN plus abdominal obesity, and DM plus dyslipidemia plus obesity. In addition, the prevalence rate of metabolic syndrome as a special combination of 3 factors was 27.7%.

The prevalence rates of DM plus obesity, DM plus abdominal obesity, DM plus dyslipidemia, HTN plus abdominal obesity, and HTN plus dyslipidemia were significantly higher in the women than in the men (P values<0.001). In addition, the combinations of obesity and abdominal obesity with other risk factors such as dyslipidemia (P<0.001), low physical activity (P<0.001), DM plus HTN (P<0.001), and DM plus dyslipidemia (P<0.001) were also more common among the women (P values <0.001). That was the case for metabolic syndrome as well as dyslipidemia plus low physical activity and DM plus HTN (P values <0.001). The prevalence rates of smoking along with other risk factors such as HTN, dyslipidemia, DM, dyslipidemia plus abdominal obesity, and DM plus HTN were significantly more common in the men than in women (table 2). Similarly, the combinations of opium addiction with other risk factors such as DM, DM plus obesity, and DM plus low physical activity were more prevalent among the men. No difference was observed in the combinations of HTN plus dyslipidemia (P=0.4), DM plus low physical activity (P=0.1), and DM plus low physical activity plus obesity (P=0.08) between the genders (table 3).

As is illustrated in table 4, the prevalence rates of all the multiple risk factors investigated in the current study were increased significantly by age. The highest prevalence rates of DM plus abdominal obesity, DM plus obesity, HTN plus dyslipidemia, HTN plus abdominal obesity, DM plus low physical activity, dyslipidemia plus low

Table 1: Demographic characteristics of the study population

Demographic Factors	N (%)
Sex	
Male	2662 (45.12)
Female	3238 (54.88)
Education	
Illiterate	829 (14.06)
Under diploma	3.957 (67.11)
Academic education	1.110 (18.83)
Job	
Housewife/jobless	3.483 (59.06)
Clerk	526 (8.92)
Nongovernmental	1.359 (23.05)
Student/soldier	485 (8.22)
Other	44 (0.75)
Age	
Mean±SD	44.43±16.25

Table 2: Standard prevalence of multiple risk factors among Kerman's residents

Risk Factors	No	Yes
	N (%)	N (%)
DM/abdominal obesity	5494 (97.1)	359 (2.9)
DM/obesity	5627 (98.2)	226 (1.8)
HTN/smoking	5744 (99)	109 (1)
HTN/DL	4615 (90)	1238 (10)
HTN/obesity	5448 (96.6)	405 (3.4)
HTN/abdominal obesity	2536 (97.3)	442 (6.3)
DL/abdominal obesity	4566 (85.9)	1287 (14.1)
DL/obesity	4853 (87.7)	1000 (12.3)
DL/smoking	5282 (91.4)	571 (8.6)
DM/DL	5061 (92.9)	792 (7.1)
DL/smoking	5793 (99.3)	60 (0.7)
DM/HTN/abdominal obesity	5636 (98.5)	217 (1.5)
DM/HTN/DL	5443 (97.2)	410 (2.8)
DM/HTN/smoking	5816 (99.8)	37 (0.2)
DM/smoking	5759 (99)	94 (1)
DM/LPA	5460 (96.6)	393 (3.4)
DM/addiction	5694 (98.6)	159 (1.4)
LPA/obesity	5334 (93.6)	519 (6.4)
LPA/DL	3473 (62.2)	2380 (37.8)
DM/LPA/obesity	5738 (99.1)	115 (0.9)
DM/addiction/obesity	5820 (99.8)	33 (0.2)
DM/DL/obesity	5631 (98.2)	222 (1.8)
DM/addiction/LPA	5766 (99.3)	87 (0.7)
Metabolic syndrome	4232 (72.3)	1621 (27.7)

DM: Diabetes mellitus; DL: Dyslipidemia; HTN: Hypertension; LPA: Low physical activity

physical activity, DM plus HTN plus abdominal obesity, DM plus HTN plus dyslipidemia, DM plus low physical activity plus obesity, DM plus obesity plus dyslipidemia, and DM plus opium addiction plus low physical activity were observed after 65 years. However, no significant differences were observed between the prevalence rates in the last 3 age groups in most of these complexes. Dyslipidemia plus abdominal obesity, DM plus dyslipidemia, HTN plus obesity, HTN plus smoking, DM plus opium addiction, DM plus HTN plus smoking, and also metabolic syndrome were more common among those aged between 55 and 64. Additionally, dyslipidemia plus obesity, dyslipidemia plus smoking, low physical activity plus obesity, and dyslipidemia plus smoking plus abdominal obesity were more prevalent among the participants aged between 45 and 54 years.

The total estimation showed that 6.9% of Kerman's population had none of the abovementioned risk factors. The prevalence rates of those who had at least 1, 2, and 3 risk factors were 93.1%, 57.8%, and 26.2%, respectively. In addition, 13.1% of the study population had at least half of the aforementioned risk factors (table 5).

Discussion

Our study, the first cohort for CVD risk factors in southeast Iran, showed that in most cases, an individual had multiple CVD risk factors. The effects of multiple risk factors are more than their accumulated effects. In fact, the total effects can be multiplicatively increased.[14] The main finding was that more than 90% of the people living in the urban area of Kerman had at least 1 of the CAD risk factors. Only 6.9% of the people did not show any risk factors. Two or more risk factors were observed in 57.8% of them.

The combination of dyslipidemia plus low physical activity, followed by metabolic syndrome, was the most common multiple risk factor involving more than 37% and 27% of our study population, correspondingly. In a study conducted in Australia, 53% of the participants had at least 2 or 3 risk factors and only 6% of the males and 10% of the females had no risk factors.[12] Thus, the prevalence rates of the risk factors in Kerman are comparable to those in western societies. One advantage of our study over the Australian one is that we obtained our data via questionnaires and clinical experiments, while the Australian study was based on answers gained from questionnaires. A study in China investigated the 4 risk factors of HTN, dyslipidemia, overweight, and DM and showed that 31.1% of the participants had no diagnosed risk factors while 36.2 of them had multiple risk factors.[15] A study in Oman reported that 96.6% of the patients suffering from CAD had 2 to 6 risk factors and that smoking and dyslipidemia

Table 3: Multiple CAD risk factors among Kerman's residents based on gender

Risk Factors	Sex	Number	Prevalence	P value
DM/abdominal obesity	Female	288	4.5	<0.001
	Male	71	1.3	
DM/obesity	Female	164	2.4	<0.001
	Male	62	1.2	
HTN/smoking	Female	25	0.3	<0.001
	Male	84	1.6	
HTN/DL	Female	731	10.2	0.4
	Male	507	9.7	
HTN/obesity	Female	299	4.4	0.001
	Male	106	2.5	
HTN/abdominal obesity	Female	442	6.3	<0.001
	Male	117	2.7	
DL/abdominal obesity	Female	1046	21.3	<0.001
	Male	241	7.1	
DL/obesity	Female	749	16	<0.001
	Male	251	8.7	
DL/smoking	Female	52	1.1	<0.001
	Male	519	15.8	
DM/DL	Female	477	8.3	<0.001
	Male	315	6	
DL/smoking/Abdominal obesity	Female	25	0.5	0.04
	Male	35	1	
DM/HTN/abdominal obesity	Female	170	2.3	<0.001
	Male	47	0.7	
DM/HTN/DL	Female	253	3.4	<0.001
	Male	157	2.2	
DM/HTN/smoking	Female	9	0.1	<0.001
	Male	28	0.4	
DM/smoking	Female	13	0.2	<0.001
	Male	81	1.7	
DM/LPA	Female	244	3.8	0.1
	Male	149	3.1	
DM/addiction	Female	39	0.5	<0.001
	Male	120	2.2	
LPA/obesity	Female	391	8.1	0.0001
	Male	128	4.8	
LPA/DL	Female	1430	42.5	<0.001
	Male	950	33.2	
DM/LPA/obesity	Female	85	1.1	0.08
	Male	30	0.7	
DM/addiction/obesity	Female	12	0.1	0.03
	Male	21	0.3	
DM/DL/obesity	Female	163	2.4	<0.001
	Male	59	1.2	
DM/addiction/LPA	Female	24	0.3	<0.001
	Male	63	1.2	
Metabolic syndrome	Female	1013	31.3	<0.001
	Male	617	23.2	

CAD: Coronary artery disease; DM: Diabetes mellitus; DL: Dyslipidemia; HTN: Hypertension; LPA: Low physical activity

were the 2 most common risk factors among the males, with the remainder mostly found among the females.[16] The measures gained from our investigation are higher than those in the Chinese study and lower than the ones in the Omani one. The reason might be that the Chinese study was conducted on rural and urban residents >18 years of age and the Omani

Table 4: Standardized prevalence of multiple CAD risk factors among Kerman's residents based on different age groups

Risk Factors	Standard Prevalence No (%) 95% CI						P value
	15–24	25–34	35–44	45–54	55–64	>65	
DM/abdominal obesity	1 (0.1) 0-0.5	7 (0.5) 0.2-1.1	33 (3.4) 2.3-5	112 (8.3) 6.8-10.1	122 (11.3) 9.3-13.6	84 (11.9) 9.5-14.8	<0.001
DM/obesity	2 (0.2) 0-0.7	5 (0.4) 0.1-0.9	22 (2.1) 1.3-3.4	72 (5) 3.9-6.4	73 (6.9) 5.3-8.8	52 (7.6) 5.6-10.1	<0.001
HTN/smoking	1 (0.1) 0.5-0.1	3 (0.3) 0.1-1.1	9 (0.7) 0.3-1.5	32 (3.2) 2.1-4.7	41 (3.7) 2.7-5.2	23 (3) 1.9-4.6	<0.001
HTN/DL	8 (1.2) 0.6-2.5	23 (2.5) 1.5-3.9	87 (8.6) 6.8-10.9	280 (23.2) 20.5-26	451 (43.7) 40.3-47.2	389 (54.3) 50-58.4	<0.001
HTN/obesity	2 (0.2) 0-0.7	13 (1.5) 0.8-2.7	29 (2.8) 1.8-4.2	126 (9.8) 8.1-11.8	149 (14.7) 12.3-17.4	86 (12.9) 10.3-16	<0.001
HTN/abdominal obesity	2 (0.2) 0-0.7	13 (1.7) 0.9-3.1	36 (3.6) 2.5-5.2	152 (11.8) 10-13.9	212 (19.7) 17.2-22.4	144 (21.1) 17.9-24.6	<0.001
DL/abdominal obesity	32 (3.6) 2.4-5.4	117 (11.9) 9.7-14.5	220 (19.9) 17.4-22.8	385 (28.9) 26.3-31.6	338 (31.2) 28.4-34.2	195 (28.4) 25-32.1	<0.001
DL/obesity	41 (5.4) 3.8-7.5	110 (10.7) 7-13	194 (17.7) 15.2-20.5	316 (22.9) 20.5-25.4	229 (21.6) 19-24.4	110 (16) 13.2-19.2	<0.001
DL/smoking	17 (2.1) 1.2-3.7	83 (9.7) 7.8-12	119 (13.3) 11.1-15.8	173 (18) 15.6-20.7	130 (13.5) 11.4-16	49 (6.4) 4.7-8.6	<0.001
DM/DL	10 (1) 0.5-2	24 (2.7) 1.7-4.2	74 (8.3) 6.4-10.6	222 (17.9) 15.6-20.5	273 (26) 23.1-29.2	189 (25.7) 22.2-29.5	<0.001
DM/HTN/ Abdominal obesity	0 0	1 (0.1) 0-1	9 (0.80) 4-1.7	54 (4.1) 3.1-5.5	87 (8.3) 6.6-10.4	66 (9.2) 7.1-11.8	<0.001
DL/smoking/ Abdominal obesity	0 0	6 (0.9) 0.4-2.1	6 (0.7) 0.3-1.7	26 (2.2) 1.4-3.5	17 (1.7) 1-2.8	5 (0.6) 0.2-1.7	<0.001
DM/HTN/DL	0	1 (0.1) 0-1	15 (1.5) 0.8-2.6	86 (6.7) 5.3-8.4	170 (16.5) 14.1-19.3	138 (18.7) 15.7-22.2	<0.001
DM/HTN/smoking	0	0	0	9 (0.8) 0.4-1.6	19 (1.8) 1.1-3.1	9 (1) 0.5-2	<0.001
DM/smoking	0	4 (0.6) 0.2-1.6	10 (1.2) 0.6-2.5	29 (2.8) 1.9-4.2	34 (3.7) 2.5-5.2	17 (2) 1.2-3.4	<0.001
DM/LPA	4 (0.4) 0.1-1.2	11 (1.1) 0.6-2.2	38 (4.3) 2.9-6.1	102 (8) 6.5-10	131 (12) 9.9-14.4	107 (16.1) 13.2-19.5	<0.001
DM/addiction	0	2 (0.3) 0.1-1.1	11 (1.2) 0.6-2.4	46 (4.3) 3.1-5.9	61 (5.9) 4.5-7.8	39 (5.3) 37-7.5	<0.001
LPA/obesity	15 (2.1) 1.2-3.7	63 (6.7) 5.1-8.8	105 (9.6) 7.7-11.9	157 (11.3) 9.5-13.3	115 (10.7) 8.7-13.1	64 (9.4) 7.2-12.2	<0.001
LPA/DL	259 (30.8) 27.3-34.6	445 (41.7) 38.3-45.2	442 (42.5) 39.1-46.1	497 (41) 37.8-44.3	412 (39.3) 35.9-42.7	325 (47.1) 43-51.3	<0.001
DM/LPA/obesity	0	4 (0.3) 0.1-0.8	13 (1.2) 0.6-2.3	31 (2.1) 1.4-3.1	35 (3.1) 2.2-4.5	32 (4.9) 3.4-7.1	<0.001
DM/addiction/ obesity	0	0	3 (0.2) 0.1-0.9	9 (0.6) 0.3-1.3	12 (1.2) 0.6-2.3	9 (1.3) 0.6-2.8	<0.001
DM/DL/obesity	2 (0.2) 0-0.7	5 (0.4) 0.1-0.9	21 (2) 1.2-3.3	72 (5) 3.9-6.4	73 (6.9) 5.3-8.8	49 (7.1) 5.2-9.5	<0.001
DM/addiction/ LPA	0	1 (0.2) 0-1.2	7 (0.9) 0.4-2	23 (2) 1.3-3.2	32 (3.1) 2.1-4.6	24 (3.4) 2.2-5.3	<0.001
Metabolic syndrome	41 (5.2) 3.6-7.3	144 (14.1) 11.8-16.8	291 (28.1) 25.1-31.4	570 (46.4) 43.2-49.7	611 (58.3) 54.8-61.7	416 (57.9) 53.8-61.9	<0.001

CAD: Coronary artery disease; DM: Diabetes mellitus; DL: Dyslipidemia; HTN, Hypertension; LPA: Low physical activity

study focused on CAD patients and not on the general population. Since urban populations live in a more industrialized environment than their rural counterparts do, the prevalence in Kerman is higher than that in China.

A few Iranian studies have also considered multiple risk factors in other areas. For example, Azizi et al.[17] showed that 78% of the males and 80% of the females over 30 years of age in their investigation in Tehran had at least 2 CVD risk factors. In another study undertaken in Isfahan, it was shown that in a population aged between 11 and 18 years (both sexes), 79.1% had 1 CVD risk factor and 24.6% had 2 CVD risk factors.[18]

Table 5: Distribution of the study population according to the prevalence of CAD risk factors

Number of Risk Factors	No (%)	95% CI
No risk factor	235 (6.9)	5.9-8.2
At least 1 risk factor	5618 (93.1)	91.8-94.1
At least 2 risk factors	4097 (57.8)	56-59.6
At least 3 risk factors	2340 (26.2)	25-27.5
At least half of the risk factors	1256 (13.1)	12.2-14.1

CAD: Coronary artery disease

The point is that the abovementioned studies have failed to specify the prevalence of multiple risk factors. In contrast, the present study, which focused on the general population, took into account combinations of risk factors and their frequencies in detail. In the present study, it was proved that individuals with low physical activity suffer more from obesity-independent dyslipidemia. It has been previously shown that clustering of risk factors is related to physical activity; therefore, the number of risk factors in individuals with low physical activity tends to increase.[15] Although it is not accurately understood how low physical activity affects dyslipidemia, some findings suggest that increase in physical activity reduces plasma lipid profiles in both sexes, regardless of age and body weight.[19] Other studies have shown that physical activity controls body fat, fights obesity, and ultimately regulates blood lipids.[20] Given that the prevalence of low physical activity and dyslipidemia in Kerman's population was 37.8%, it seems that physical activity acts on lipids independently from weight reduction.

In Kerman's population, the prevalence rates of overweight/obesity and abdominal obesity were 43% and 15%, respectively.[5] The prevalence of dyslipidemia was 81.4%, with a significant relationship with age and obesity.[21] In Japan, Ito et al.[22] showed that the risk of dyslipidemia was significantly higher in those whose waist circumferences were in the upper third of the percentile. Another study carried out in Isfahan showed that dyslipidemia was higher in obese people.[23] In Kerman's population, the combination of dyslipidemia plus abdominal obesity was the third most frequent one at a prevalence rate of 14%, followed by dyslipidemia plus obesity. In vitro, empirical and epidemiological data have shown that dyslipidemia is the most important CAD risk factor.[14] Based on the estimations of the World Health Organization, dyslipidemia accompanies half of ischemic diseases and is considered the cause of more than 4 million deaths each year.[24] Studies in Iran and other countries have shown that dyslipidemia is affected by factors like sex, lipid profile, obesity and socioeconomic status. The distribution of regional lipid significantly influences cardiovascular and metabolic risk factors. In individuals with high abdominal fat, resistance to insulin is allied to dyslipidemia. Findings suggest that hypertensive individuals have higher dyslipidemia than normotensive individuals. Moreover, diabetic patients have a higher chance of HTN than normal people.[25] Framingham's study revealed that HTN was the sole CAD risk factor only in 20% of the hypertensive individuals;[26] that's while 30% of the males and 32% of the females had at least 3 more risk factors besides HTN. In our study, the dyslipidemia plus HTN combination amounted to 10%. Our results also showed that obesity, especially abdominal obesity, and DM were accompanied by HTN. Therefore, the 2 principal CAD risk factors, namely DM and HTN, are both intensified by low physical activity and obesity, both of which had high prevalence rates in our study population, especially in the females.

Most of these multiple risk factors were related to gender. Apart from smoking and opium consumption as common behaviors among men, the prevalence rates of the other combined risk factors were higher among the women.[9] Although younger females have less CVD risk factor prevalence due to their sex hormones, reports from the United States and other parts of the world have shown that the difference in CVD-caused mortality among older males/females and younger males/females wanes. In other words, while generally the number of risk factors has increased in all age groups over recent years, the rate of the increase is more rapid in younger people. This warns that people's lifestyles and behaviors have worsened. Most studies such as that carried out by Sarrafzadegan et al.[27] in Iran have shown that CVD risk factors are more frequent in women; this finding is different from most studies done on the world population. The reason may be that females in Iran do less exercise and are less physically active[13] due to sociocultural restrictions. In China, the general prevalence of clustering was higher in males, while after 60 years it became more prevalent in females. The reason is that in females, the psychological stress may increase the risk of metabolic syndrome, type II DM, and CVD.[28] Our previous report on Kerman's population revealed that depression and anxiety were more prevalent among females.[29] Dyslipidemia, obesity, and the combination of the 2 were also more common in females. It seems that most obesity-based risk factors are more prevalent in females. The higher effect of obesity on females' susceptibility to CAD can be due to the presence of other risk

factors such as depression, anxiety,[29,30] and low physical activity,[13] all of which are more common among women. The good news is that smoking and addiction to opium, which are 2 other CAD risk factors, were less prevalent in the female population of Kerman.[6,9] Framingham's study showed that obesity increased CAD risk up to 64% in females and 46% in males.[31]

As is shown in the results, all the multiple risk factors were significantly increased with age. In addition, most of them were more common among individuals over 50 years of age. An Australian study demonstrated that the prevalence of at least 5 risk factors increased until the individual reached 74 years old.[12] Physical activity decreases with aging, and 47.7% of the people in Kerman had low physical activity.[13] This can increase the risk of DM, dyslipidemia, HTN, and obesity, all of which are also age-dependent.

We acknowledge the limitation of our study as a cross-sectional survey failing to show the changing trend of the risk factors over time. Nonetheless, the current study benefited from a relatively large sample size, random sampling, and high response rate and included new risk factors such as mental health conditions and opium consumption. For further studies, we recommend monitoring the multiple risk-factor profile by a longitudinal prospective cohort study.

Conclusion

Almost 60% of the people living in the urban area of Kerman had at least 2 CAD risk factors, and these were more frequent among the women and older people. As almost all CAD risk factors are preventable and Iran's mostly young population are approaching middle ages, appropriate and immediate strategies such as changing lifestyles (increase in physical activity and consuming healthy foods) should be taken into consideration by health policymakers to reduce the prevalence of these risk factors and the burden of CAD diseases in the community.

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