The prevalence of the risk factors associated with cardiovascular diseases among Iranian adults: Findings of a cross-sectional study

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Abstract:

BACKGROUND: Cardiovascular diseases are among the leading causes of death worldwide. Lack of accurate estimation of the risk factors associated with these diseases can impair the designing of effective interventions in this field; the present study aimed to investigate the risk factors attributable to cardiovascular diseases in males and females visiting comprehensive health service centers in 2018.

MATERIAL AND METHOD: This cross-sectional study is part of the national health transformation plan shaped in response to the emerging epidemic of noncommunicable diseases. In the present study, 6,331 participants aged 30 years and older were randomly and census selected from comprehensive urban and rural health service centers in Naein County, in Isfahan, Iran, respectively. The data were collected using the electronic health record from the IraPEN program in two sections: demographic information and the prevalence of cardiovascular disease risk factors. They were then analyzed with Statistical Package for the Social Sciences (SPSS) 24 software using descriptive statistics, Chi-square test, one-way ANOVA, and logistic regression.

RESULTS: The participants' mean age was 55.09 ± 16.11 years. The main risk factor was insufficient consumption of fruits and vegetables while smoking was a negligible risk factor. Low physical activity, diabetes, hypertension, hypercholesterolemia, and high body mass index were more prevalent in females than in males, whereas smoking was more frequently reported in males ($P < 0.001$). Risk factors such as age, gender, education level, place of residence, and marital status, played a significant role in determining CVD risk factors.

DISCUSSION: More than half of Iranian adults had one or older cardiovascular disease-related risk factors, and the prevalence of such factors was higher in females than in males. Given the importance of gender differences in cardiovascular disease-related health habits, it is necessary to reduce the majority of these diseases in society, especially in women, by controlling modifiable risk factors.

Keywords:

Cardiovascular disease, gender, lifestyle

Key Messages:

More than half of Iranian adults had one to two cardiovascular disease-related risk factors. The prevalence of the risk factors increased with age. The prevalence of the risk factors is higher in females than in males.

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Introduction

Cardiovascular diseases (CVDs) are among the leading causes of death worldwide, accounting for about 17.9 million deaths annually.[1] It is forecasted that 30.5% of deaths will be due to CVDs by 2030.[2,3] They are the first causes of death[4] and disability, accounting for 40% of all deaths and 20%–23% of the disease-related burden in Iran.[3] CVDs lead to numerous economic

complications and human suffering; their costs are estimated to be $210 billion for the European Union (EU) economy, including direct healthcare and non-healthcare costs, such as informal care of people with CVDs and lower productivity.[5]

Most problems and deaths caused by CVDs occur due to modifiable behavioral factors.[6] A case-control study introduced CVD's most crucial behavioral risk factors: insufficient physical activity, unhealthy diet, diabetes mellitus, alcohol consumption and smoking, abdominal obesity, hypertension, and psychosocial stress.[7] The prevalence of CVD-associated risk factors is significantly related to their higher frequency;[8] for example, insufficient consumption of fruits and vegetables worldwide is associated with 2.8% of deaths, a significant number of which is due to CVDs, cancer, and stroke.[9] A review study by Abdi *et al*.[10] investigated Iranians' food baskets and consumption patterns from 2000 to 2014. They reported that the consumption of fruits and vegetables was 25% less than the recommended amount in Iran. Furthermore, insufficient physical activity accounts for 6%–10% of major noncommunicable diseases (NCDs).[11] A systematic review also reported that a higher level of physical activity according to the recommended level by the World Health Organization (WHO) (at least 150 min with moderate to severe intensity) decreased the risk of CVDs by 17% and CVD death by 23%.[12] Finally, a study reported that 90% of heart attacks could be controlled if the abovementioned nine risks were controlled.[7]

According to a previous study, suitable measures to control and decrease the risk factors are more effective than treatment in reducing CVDs.[13] Therefore, detecting CVD-related risk factors can help identify groups at risk and conduct effective programs for the target groups, and finally, reducing costs and increasing the effectiveness of these programs[14]; Screening the risk factors attributed to CVDs is known as a primary prevention strategy.[15] Over the recent years, the prevalence of NCDs, including CVDs, has increased significantly in the Middle East, including Iran, due to lifestyle changes followed by food and behavioral pattern alterations.[16]

Numerous studies have thoroughly examined the prevalence of these risk factors in Iran.[17,18] This crucial step in intervention planning involves determining the extent of their influence and modifying the elements accordingly.[19] Given the diverse ethnicities, cultures, lifestyles, environmental conditions, and socioeconomic statuses in Iran, it becomes evident that they play a significant role in the prevalence of various diseases. Therefore, it is essential to understand the geographical distribution patterns, educational levels, and age and gender groups when identifying risk factors for effective health promotion interventions, specifically targeting CVDs.[20] However, to our knowledge, none have investigated the association among sociodemographic variables, lifestyles, and other CVD-related risk factors. Hence, the present study aimed to address this knowledge gap by measuring the association between sociodemographic variables and other risk factors among the Iranian population. The obtained findings would help policymakers for future decisions.

Material and Method

Study design and setting
The present descriptive-analytical cross-sectional study examined 6,331 participants aged 30 and older in the urban and rural areas of Naein County, east of Isfahan province, Iran, in 2018. The research population comprised individuals who visited the centers and health homes covered by the Comprehensive Health Center of Naein to receive the Package of Essential Noncommunicable (PEN) disease, as the electronic health records indicated. This study employed census and simple random sampling methods to select participants from rural and urban areas. A total of 3,160 residents from rural regions and 3,171 residents from urban areas were chosen as samples. The selection process involved utilizing the electronic health records available at comprehensive health centers, ensuring a representative and diverse sample for the study. The study's inclusion criteria were being 30 and older and living in Naein County. The only exclusion criterion was incomplete demographic profiles and health records.

Data collection tool
Data were collected in two parts in this study; primarily, the participants' demographic characteristics were obtained, including age, gender, marital status (married and single), education level (illiterate, primary, secondary school, high school diploma, bachelor and higher), a history of smoking, diet, and physical activity. In addition, measurements were taken for their height, weight, body mass index (BMI), blood sugar levels, blood pressure, and blood cholesterol. The data mentioned above has been extracted from the information stored in the IraPEN program. IraPEN is part of the national health transformation plan shaped in response to the emerging epidemic of noncommunicable diseases, launched in 2014 by the Iranian Ministry of Health and Medical Education to provide universal health coverage, including access to noncommunicable disease prevention and care and mental health services.[21]

In this program, individuals with hypercholesterolemia, hypertension, and diabetes were defined as follows: According to the Adult Treatment Panel III (ATP III) guideline, people with total cholesterol ≥ 200 mg/dL were considered to have hypercholesterolemia[22]; according

to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) guideline, people with systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥ 90 mmHg were considered to have hypertension[23]; according to the standards of the WHO and the American Diabetes Association, people with fasting blood sugar ≥ 126 mg/dL were considered as diabetics.[24] Considering the BMI variable, people with BMI ≥ 30 kg/m² were considered with general obesity, and those with a BMI of 18.5–24.9 kg/m² were considered normal.

Statistical analysis

The collected data were inserted into Statistical Package for the Social Sciences (SPSS) 24 software. For data analysis, statistical indices, including the mean, standard deviation, frequency, and percentage of frequency, the Chi-square test, one-way ANOVA, and logistic regression, were utilized at a significance level of 0.05.

Ethical consideration

The ethical principles for conducting the present research included receiving the moral code (IR.RESEARCH. REC.1398.515), obtaining the necessary permits from the research deputy of the university, ensuring the confidentiality of the data, and not disclosing the samples' personal information.

Results

The present study investigated 6,331 individuals aged 30 years and older, with a mean age of 55.63 ± 16.03 years in females and 54.4 ± 16.19 years in males.

Table 1 presents the participants' demographic data, indicating that more females participated in the study than males. Most subjects were married, had primary education, and lived in urban areas, most of whom were housewives.

Table 2 presents the CVDs risk factors in females and males. Certain risk factors, such as insufficient physical activity, hypertension, diabetes, hypercholesterolemia, and a high BMI, were more common in females than in males. On the contrary, smoking was more prevalent in males ($P < 0.001$). In the present study, insufficient consumption of fruits and vegetables was not significantly different between males and females ($P = 0.3$).

Table 3 presents the association between sociodemographic variables and CVDs risk factors. The Chi-square test results indicated that above the age of 60, females, divorced subjects, those living in urban areas, and participants with primary education ($P < 0.001$)

Table 1: The samples' demographic data

Type of variable	Number (%)
Age	16.11±55.09
Gender	
Male	2,802 (44.3)
Female	3,529 (55.7)
Marital status	
Single	1,317 (20.8)
Married	5,014 (79.2)
Education level	
Primary	3,706 (58.5)
Secondary	840 (13.3)
High school diploma	1,172 (18.5)
College Education	613 (9.7)
Place of residence	
Rural	3,160 (49.9)
Urban	3,171 (50.1)

Table 2: Prevalence of CVD-related risk factors based on gender

Type of variable	Total (%)	Females (%)	Males (%)	*P* value
Smoking	3.8	0.2	8.4	<0.001
Insufficient physical activity	66	31.3	36.2	<0.001
Insufficient consumption of fruits and vegetables	99	98.9	99.2	0.3
Diabetes	12.2	14.2	9.6	<0.001
Hypertension	22.7	27.7	16.5	<0.001
Hypercholesterolemia	17.3	19.7	14.4	<0.001
BMI	15.8	20.5	9.9	<0.001
Individuals without any risk factors	33.5	29.1	39.1	<0.001
Individuals with one or two risk factors	57.6	59.8	57.6	<0.001
Individuals with three or more risk factors	8.9	11.1	6.1	<0.001

Table 3: The association between sociodemographic variables and CVD risk factors

Contextual variables	Without Risk Factor N (%)	With Risk Factor N (%)	*P* value
Age			
30–60 years	1,500 (37)	2,556 (63)	<0.001
Above 60 years	37 (27.4)	63 (72.6)	
Gender			
Female	1,027 (29.1)	2,502 (70.9)	<0.001
Male	1,096 (39.1)	1,706 (60.9)	
Place of residence			
Rural	1,015 (32.1)	2,145 (67.9)	0.017
Urban	1,108 (34.9)	2,063 (65.1)	
Marital status			
Single	166 (50.2)	165 (49.8)	<0.001
Married	1,957 (39.6)	4,043 (67.4)	
Education level			
Primary	1,074 (29)	2,632 (71)	<0.001
Secondary	319 (38)	521 (62)	
High school diploma	457 (39)	715 (61)	
College Education	273 (44.5)	340 (55.5)	

had significantly higher risk factors associated with CVD. Nonetheless, among males, single subjects, those living in rural areas, and those with bachelor's education reported fewer CVDs risk factors than the others ($P < 0.001$).

Logistic regression was used to calculate the odds ratio [Table 4] to assess the correlation between independent variables and the risk of CVD-related factors. Various risk factors associated with CVD, such as age, gender, education level, place of residence, and marital status, played a significant role in determining CVD risk factors. Specifically, individuals over 60 and those who were married had an increased likelihood of having these risk factors, whereas being male, residing in urban areas, and having higher education levels were associated with a decreased likelihood. For instance, being male and 60 years old or younger reduced the chances of having these risk factors by 31% and 30%, respectively.

Discussion

There are a few comprehensive studies on the risk factors attributed to CVDs on a large scale in Iran. Based on the results of the present study, several risk factors, namely, insufficient physical activity, diabetes, hypertension, hypercholesterolemia, and high BMI, were more prevalent in females than in males, whereas males more frequently reported smoking. Inadequate fruit and vegetable consumption was most commonly reported while smoking had the lowest frequency among the CVD risk factors. A previous paper also reported low fruit and vegetable consumption as the most common risk factor.[25]

The present findings revealed that more than half of the Iranian population over 30 had one CVD risk factor or more, which is on the constant increase with age such that almost 72.6% of the population had one risk factor or more in the age group of over 60. This ascending trend with age was also reported in other studies.[26,27] The elderly population of Iran is on a rising trend since the age pyramid is changing due to the increase in life

expectancy and decrease in fertility rate;[20] thus, the prevalence of CVDs is increasing. Given that age is a nonmodifiable risk factor,[28] necessary interventions should be designed and implemented to control other modifiable risk factors. Based on the present study's findings, the prevalence of risk factors was higher in females than in males. This higher prevalence in women might be due to the transition from the youth to the postmenopause stage and the lower estrogen levels;[28] for example, there was a significant relationship between abdominal obesity and higher postmenopause triglycerides.[29] Geographical distribution indicated that the risk factors were more observed in the urban population than the rural population; thus, different lifestyles could be the main reason for such differences. That said, urbanization inhibits physical activity while encouraging fast food consumption, leading to obesity and a higher incidence of CVDs. The obtained results herein were consistent with those of other studies.[8,25] In this work, married participants reported more risk factors than single subjects, probably because married people cared less about their healthy lifestyles because of family responsibilities and roles; also, married people had more risk factors probably because of their higher mean age. The findings were consistent with Jahangiry *et al*.'s[30] results on adults in Iran, reporting that married people had hypertension, diabetes, and higher abdominal obesity than others. According to this research, people with primary education levels had more risk factors. Jahangiry *et al*.[30] also reported that more than half of the samples with metabolic syndrome were illiterate, but such a trend decreased at higher education levels. Another study on French adults reported that relative socioeconomic status, especially educational inequalities, was closely related to the prevalence of hypertension[31] as a risk factor in females compared with males.[32]

The results of the present study confirmed a significant difference between gender and risk factors. Therefore, the mean risk factors were higher in females than in males. Even though some other papers have reported that the incidence of CVDs was lower in females than in males,[8,33] such difference might be because females were less likely to seek healthcare, thereby underreporting their CVDs.[8] On the other hand, evidence indicates that the mortality rate and worse prognosis after an acute cardiac event were higher in females.[33]

According to the present study, the prevalence of obesity was 15.8% in the research population, and the mean obesity was higher in females than in males. The majority of overweight and obesity was reported to be 19.9 in a study by Khanam *et al*.,[8] with their prevalence being higher in females, in line with our research. The lower physical activity[34] and higher subcutaneous fat in women in all age groups due to anatomical reasons

Table 4: CVD risk (odds ratio derived from logistic Regression) based on demographic characteristics of the study population

Contextual variables	Odds ratio (OR)	95% confidence interval		*P* value
		Lower bound	Upper bound	
Age (Above 60 years)	1.308	1.157	1.479	<0.001
Gender (Male)	0.697	0.625	0.776	<0.001
Place of residence (Urban)	0.811	0.725	0.907	<0.001
Marital status (Married)	1.576	1.252	1.984	<0.001
Education level	0.846	0.800	0.895	<0.001

indicate the higher prevalence of obesity in females.[35] Meanwhile, the majority of overweight was similar in males and females in a study by Mamani-Ortiz *et al*.[25] Obesity is also a significant risk factor for diabetes and hypertension, increasing the risk of CVDs.[36] However, proper weight as an indicator of a healthy lifestyle can finally prevent CVDs by preventing inactivity, hypertension, high blood fat, and diabetes.[2,37]

Despite the beneficial effects of physical activity on CVDs risk factors, more than two-thirds of the research population had physical activities below the recommended level. A sedentary lifestyle was found to be more common in females compared with males. In a study by Mamani-Ortiz *et al*.[25] on the Bolivian adult population, 64.77% of people had sedentary lifestyles, higher in females than in males. The females' sedentary lifestyles were probably due to family roles and responsibilities.[38] Since the present study indicated that six out of 10 adults in Nain County had insufficient physical activity, reducing sedentary lifestyles should be seriously considered. Evidence suggests that physical activity decreases heart failure, angina symptoms, and mortality after myocardial infarction, even in CVD patients.[39]

The prevalence of hypercholesterolemia was 17.3%, whose mean was higher in females than in males in this study. Our results were consistent with the findings of Jahangiry *et al*.[30] on the Turkish population in Iran and Jahromi *et al*.[18] However, low blood cholesterol in people without cardiac disorders will decrease the incidence of CVDs in the future.[40]

Diabetes and hypertension are believed to be the leading causes of CVDs.[41] A meta-analysis of approximately one million participants without a history of CVDs indicated that diabetes tripled the risk of CVD-caused mortality from ischemic heart disease or ischemic stroke in females while doubling it in males.[42] According to the results of the present study, the blood sugar and pressure levels were higher in females than in males, with 12.2% of the population having high fasting blood sugar and 22.7% having high blood pressure. Similar trends have been reported in other studies in Iran.[30,43] A survey of adults in Bangladesh said the prevalence of hypertension vs. diabetes (33.1% vs. 5.5%) is higher in females.[8] This gender difference was due to hormonal, genetic, and socioeconomic factors.[44,45]

Smoking was another significant risk factor that significantly increased the risk of CVDs.[46,47] According to the findings, smoking prevalence among males was higher than in females, consistent with other results.[25,48] In studies in Iran,[18,30] smoking prevalence was much lower in both sexes compared with other countries.[25,49]

The social disapproval of smoking in Iran was probably the reason behind such a difference.

Eating habits have significant effects on CVDs risk factors. In many randomized clinical trials, eating habits affect other intermediary risk factors.[50,51] Mamani-Ortiz *et al*.,[25] for instance, reported the prevalence of fruit and vegetable consumption to be low among females and males. Khatti-Dizabadi *et al*.[52] said that females in northern Iran consumed more fruits and vegetables on average than their male counterparts. Genetic factors and lifestyle were probably the reasons for such differences between geographical areas[53]; for example, most people consumed fatty and high-calorie foods in the central regions of Iran.[54] Given the women's roles in choosing household food baskets, future studies should use women as the influential group to adopt appropriate nutritional behaviors of other family members.

Strengths of the study

The strengths of the present study included an excellent population-based survey of both gender groups (female and male). Furthermore, a wide range of CVD-related demographic, social, and lifestyle factors was collected from the participants. Therefore, the findings can be generalized to other societies due to the large sample size and sampling method.

Limitations and recommendation

There were also several limitations in the present study. First, the data were collected through self-reports, which might cause measurement errors; however, we sought to minimize such mistakes by training and monitoring the quality of care provided by health service providers. Second, even though the tools related to anthropometric and blood pressure measurements were periodically calibrated and the health service providers had access to training instructions and participated in training and retraining courses, some measurement errors could occur. Ultimately, alcohol drinking was not measured due to the prohibition of alcoholic beverages in Iran.

Conclusion

The study findings indicate that most Iranian adults, accounting for over half, possess one or more risk factors associated with CVDs. These risk factors are more prevalent among females than males, and their occurrence increases with age. Moreover, individuals residing in rural areas and those with a basic level of education exhibit a higher susceptibility to these risk factors. Consequently, it is imperative to implement targeted interventions addressing the environmental, economic, and social factors linked to CVDs by planners and policymakers and to emphasize the design and promotion of lifestyle modification programs by Iranian

health behavior professionals. These initiatives aim to effectively manage the identified risk factors and ultimately alleviate the burden of CVDs within the community.

Conflicts of interest

There are no conflicts of interest.

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