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A Decade of Epidemiological Transition of Cardiovascular Risk Factors in South of Iran (Two Population-Based Cross-Sectional Studies)

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ABSTRACT

Background: The potential modifiable risk factors for Cardiovascular Diseases (CVDs) include lifestyle, overweight or obesity, hypertension, diabetes, and dyslipidemia.
Objective: This study aimed to evaluate a decade of transition (2008 and 2018) of cardiovascular risk factors in Fars province, south of Iran.
Methods: This repeated cross-sectional study was carried out in Fars province, Iran. The sample included 1000 and 1770 participants selected by cluster sampling in 2008 and 2018, respectively. The data about cardiovascular risk factors were collected using a pre-test. The participants' height, weight, lipid profile, and blood pressure were measured by standardized instruments. Then, the data were analyzed using the SPSS 16 software, and $P < 0.05$ was considered statistically significant.
Results: The results indicated that smoking was more prevalent in males than in females, ranging from 2.2% (n = 3) in the 15-24 age group to 39% (n = 38) in the 55-64 age group in 2008. In 2018, it increased from 5.72% (n = 7) in the 15-24 age group to 46.04% (n = 65) in the 55-64 age group, but the differences were not statistically significant ($P > 0.05$). During this period, the mean Body Mass Index (BMI) did not show any decrease among most of the age and gender groups, and increased significantly in some age and gender groups. For example, BMI increased from 23.5 to 25.4 kg/m^2 among males in the 25-35 age group ($P = 0.008$) and from 27.6 to 29.37 kg/m^2 among females in the 45 - 54 age group ($P = 0.009$). Considering blood pressure (systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg), hypertension became more prevalent during this period, but the difference was significant only for 15-24-year-old females ($P = 0.048$).
Conclusion: The present study findings revealed the high prevalence of CVD risk factors in Fars province in 2008 and 2018. In contrast to expectations, there was no significant reduction in the risk factors after a decade and, in many cases, an increase was detected in the prevalence of these risk factors.

1. Introduction

Low- and middle-income countries are responsible for 85% of Non-Communicable Diseases (NCDs) and approximately 78% of the resultant deaths (1). NCDs occur disproportionately during the most productive years of youth and middle ages (2, 3). Cardiovascular diseases (CVDs) are considered one of the most important NCDs with high mortality rates worldwide and a major health challenge in all countries' health systems. These diseases are the leading cause of death in the world, being responsible for 17.9 million deaths in 2016. This measure has been estimated to reach 23.6 million by 2030. Among the deaths associated with these diseases, 85% resulted from Myocardial Infarction (MI) and stroke (4-6). Not only cardiovascular events are common, but their mortality rate is also high in patients (4). Additionally, a previous research on 14786 males and females suffering from coronary artery disease indicated that the rate of this disease was three folds higher in males than in females. The associated mortality was also five times higher in males. Generally,

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aging is accompanied by an increase in the rate of coronary heart disease risk factors in both genders, with the risk being higher amongst females (7). Another study was conducted on 40102 patients with early signs of ischemic stroke, which revealed a higher prevalence of CVDs risk factors in males and the higher prevalence of the risk factors related to lifestyle among the youth. However, the prevalence of hypertension, diabetes, and coronary artery disease has sharply dropped in all people and that of atrial fibrillation has decreased among 70-80-year-old men (8). In the Netherlands, Cornelia et al. found that CVDs-induced mortality, especially heart failure and acute MI, were more common among males compared to females, while the risk factors were similar in both genders (9). Thus, the recent guidelines have proposed that all individuals should be encouraged to follow a healthy heart lifestyle. Additionally, the risk factors have to be identified so as to adjust the seriousness of preventive interventions for minimizing the incurred damages (9). Considering the recommendations of the World Health Organization (WHO) in this area, several studies have been conducted in all countries including Iran.

A previous study investigated the mortality rate in 29 provinces of Iran in 2004 and indicated that the proportion of CVDs-induced deaths was 39.3% and that of the years of life lost was 24%. In other words, about a quarter of all years of life were lost. Besides, the relative burden of CVDs was nearly 10% of the total burden of diseases, 80% of which resulted from ischemic heart and cerebrovascular diseases (10).

In a research performed in East Azerbaijan, the CVDs-induced hospitalization rate was higher in males than in females (56.6% vs. 43.4%). However, the mortality rate was higher among hospitalized females compared to males (11). In another study, the living style considering CVDs in the Iranian society was found to be extremely precarious, requiring strict control and constant planning (12). A research carried out on health and diseases demonstrated that 11.1% of males and 11.9% of females suffered from hypertension. In addition, the prevalence of obesity was 14.2% and 5.6% in females and males, respectively. The prevalence of tobacco consumption was also 1.7% in females and 23.9% in males (10). The American College of Cardiology/American Heart Association (ACC/AHA) 2019 Guidelines on Primary Prevention of CVDs recommended 40-75-year-old adults to be continuously evaluated for the prevention of CVDs (13).

Epidemiological transition of diseases has indicated a shift in mortality from infectious diseases to lifestyle-related diseases that many developing countries are going through. At the same time, the populations of these countries have experienced changes in diet and lifestyle as well as reduced physical activity, which have led to a higher prevalence of cardiovascular risk factors and CVDs and, eventually, death (14-16). In Iran, therefore, health policymakers have prepared programs to reduce these risk factors in the health system. Despite numerous community-based programs to reduce the risk factors, their risk rates have shown no changes during a 10-year period.

2. Objectives

The present study aims to identify the transition of cardiovascular risk factors among Fars province dwelling males and females after a decade as a foundation to develop the required preventive policies and to provide interventions for people exposed to CVDs risk.

3. Materials and Methods:

3.1. Study Design and Sample Size

This repeated cross-sectional study was conducted on the urban and rural populations of Fars province, south of Iran in 2008 and 2018 via a stepwise approach proposed by the WHO. The sample included 2770 participants selected by random cluster sampling from 15-64-year-old individuals living in urban and rural areas of Fars province in 2008 (n = 1000) and 2018 (n = 1770). Sampling was done using postal codes in urban areas and household lists in rural regions.

3.2. Data Gathering Tools and Forms

To compare the findings to those obtained in other studies in Iran and other countries, a standard questionnaire proposed by the WHO was used. Before administrating the questionnaire, it was translated into Persian and was implemented in a pilot study. The test reliability coefficient was acceptable (Cronbach's alpha = 0.80) (17).

3.3. Sampling and Procedure

Based on the NCDs' risk factors-related surveillance system project of the Islamic Republic of Iran, 50 clusters in 24 - 15, 34 - 25, 44 - 35, 54 - 45, and 65 - 55 age groups were selected.

Step 1: In the first step, the general demographic information was collected using a questionnaire and questions about smoking and physical activity were asked through an interview. It should be noted that the questions related to smoking were posed privately without the presence of others. The physical activity questions were focused on the duration of physical activity at different times (at work, while traveling, and during leisure times) and the results were divided into two categories as follows: 1) moderate intensity (at least 10-minute activities such as carrying light loads, resulting in a slight increase in heart and respiratory rates) and 2) high intensity (at least 10-minute activities like carrying heavy loads on a continuous basis, resulting in a drastic increase in heart and respiratory rates). Regarding fruits and vegetables intake, a list of fruits and vegetables were given to the participants and the responses were recorded according to the intake unit in the questionnaire.

Step 2: In the second step**,** the participants' height, weight, and blood pressure were measured by trained personnel using standard tools including a portable digital scale (electronic), portable graded bars, and Omron portable digital barometer with medium and large cuffs. In addition, Body Mass Index (BMI) was calculated by dividing weight in kilograms by height in meters squared. Accordingly, BMI > 30 kg/m^2 indicated obesity and BMI of 25 - 29.9 kg/m^2 represented overweight (18, 19). Hypertension was measured three times with five-minute intervals and the mean was recorded as the blood pressure level. According to the WHO's criteria, the individuals with systolic blood pressure > 140 mmHg or diastolic blood pressure > 90 mmHg were classified in the hypertensive group (19-21).

Step 3: In the third step, fasting plasma glucose, triglyceride, total cholesterol, High-Density Lipoprotein (HDL), and Low-Density Lipoprotein (LDL) levels were measured. Regarding the ethical considerations, the results were reported anonymously and publication of the results was authorized by the NCDs Management Center of the Ministry of Health. The quality control of the measurements was carried out through periodic reviews by the provincial supervisors.

3.4. Statistical Analysis

The data were entered into the SPSS 16 software (SPSS Inc., Chicago, USA), and continuous and discrete variables were presented as mean (95% CI) and percentage (%), respectively. The data were analyzed using chi-square test and independent sample t-test. $P < 0.05$ was considered statistically significant.

4. Results

The prevalence of tobacco abuse and low physical activity in different gender and age groups from 2008 to 2018 have been summarized in Table 1. Accordingly, the prevalence of tobacco abuse increased in both genders in all age groups from 2008 to 2018. Smoking was more common among males, ranging from 2.2% in the 15 - 24 age group to 39.0% in the 55-64 age group in 2008. In 2018, this measure increased from 5.72% in the 15 - 24 age group to 46.04% in the 55 - 64 age group, but the differences were not statistically significant ($P > 0.05$). Thus, the rate of tobacco abuse witnessed an increase in most age groups. Moreover, 35.0 - 72% of the people aged 15 - 24 and 55 - 64 years who were surveyed in 2008 had low physical activity. The percentage of females with low physical activity was higher compared to males in all age groups in the both 2008 and 2018. The low physical activity ranged from 40.19% in 2008 to 62.7% in 2018. Thus, incremental changes were observed in this respect over a decade. However, the differences were not significant ($P > 0.05$), except for 25-34-year-old males ($P = 0.049$).

In the 5-24 age group, the mean BMI was 23.0 kg/m^2 in males in 2008 (95% CI: 21.8 - 24.1), 23.47 kg/m^2 in males in 2018 (95% CI: 22.35 - 24.59), 22.2 kg/m^2 in females in 2008 (95% CI: 21.3 - 23.0), and 23.67 kg/m^2 in females in 2018 (95% CI: 22.35 - 24.59). The mean BMI was higher amongst females compared to males in all age groups, except for the 15 - 24 age group in 2008 (Table 2). The mean BMIs of other age groups have been presented in Table 2. Although there was no significant difference between the two study years ($P > 0.05$), the BMI increased in most age and gender groups.

In 2008, the means of systolic blood pressure of 15-24-year-old males and females were 114.3 mmHg (95% CI: 111.2 - 117.5) and 108.8 mmHg (95% CI: 105.7 - 111.5), respectively. In the 55 - 64 age group, this measure was obtained as 127.2 mmHg in males (95% CI: 121.9 – 132.6) and 126.4 mmHg in females (121.3 - 131.6). In 2018, the means of systolic blood pressure of 15-24-year-old males and females were 115.51 mmHg (95% CI: 113.18 - 117.85) and 109.7 mmHg (95% CI: 107.65 - 111.74), respectively. In the 55-64 age group, this measure was 127.2 mmHg in males (95% CI: 121.9 – 132.6) and 126.4 mmHg in females (95% CI: 121.3 - 131.6). The mean systolic blood pressure of other age groups has been summarized in Table 2. Overall, the systolic blood pressure increased with age, and was higher in males than in females.

In 2008, 5.4% of the male participants aged 15-24 years as well as 36.6% of those aged 55 - 64 years suffered from hypertension. These measures were respectively obtained as 2.77% and 42.25% in 2018. In most age groups, the percentage of the male participants with hypertension increased in 2018 compared to 2008, but the differences

Table 1. The Prevalence (%) of Tobacco Abuse and Low Physical Activity among the 15-65-Year-Old Population in Fars Province in 2008 and 2018

Risk Factors	Age	Gender	Prevalence (95% CI)		P-value[a]
			2008	2018	
Tobacco abuse	15 - 24	Male	2.2 (1.3 - 3.4)	5.72 (0.27 - 11.17)	0.289
		Female	----------	1.09 (0 - 3.22)	-
	25 - 34	Male	21 (19.3 - 22.8)	15.76 (10.63 - 20.89)	0.350
		Female	2 (1.4 - 2.9)	0	-
	35 - 44	Male	33 (32.9 - 36.6)	----------	-
		Female	1 (0.8 - 1.6)	----------	-
	45 - 54	Male	30 (28.5 - 30.5)	39.84 (31.44 - 48.23)	0.126
		Female	2 (1.9 - 2.8)	2.82 (0.38 - 5.26)	0.985
	55 – 64	Male	39 (38.1 – 39.4)	46.04 (36.51 – 55.56)	0.316
		Female	2 (2.1 – 2.5)	3.65 (0.51 – 6.8)	0.687
Low physical activity	15 – 24	Male	35 (31.3 – 38.3)	40.19 (27.79 – 52.59)	0.469
		Female	69 (65.1 – 72.6)	69.91 (60.05 – 79.77)	0.970
	25 – 34	Male	36 (33.2 – 38.9)	49.06 (40.9 – 57.21)	***0.049***
		Female	75 (72.7 – 77.2)	63.53 (57.37 – 69.69)	0.100
	35 – 44	Male	43 (41.1 – 44.9)	----------	-
		Female	59 (57.1 – 60.8)	----------	-
	45 – 54	Male	51 (49.9 – 52.1)	47.9 (38.04 – 57.77)	0.723
		Female	65 (63.6 – 66.4)	59.8 (52.38 – 67.21)	0.488
	55 – 64	Male	48 (42.3 – 48.7)	44.6 (34.62 – 54.59)	0.722
		Female	72 (71.3 – 72.6)	62.07 (43.5 – 60.64)	0.121

Some data contained missing values. a, chi-square test was used.

Table 2. Mean (95% CI) of the Risk Factors Related to Body Mass Index and Blood Pressure in the 15-64-Year-Old Population in Fars Province in 2008 and 2018

Risk Factors	Age	Gender	Mean (95% CI)		P-value[a]
			2008	2018	
Mean body mass index	15 - 24	Male	23 (21.8 - 24.1)	23.47 (22.35 - 24.59)	0.597
		Female	22.2 (21.3 - 23)	23.67 (22.35 - 24.59)	0.065
	25 - 34	Male	23.5 (22.8 - 24.1)	25.4 (24.76 - 26.04)	0.008
		Female	24.7 (23.7 - 25.6)	25.78 (25.2 - 26.36)	0.187
	35 - 44	Male	25.1 (24 - 26.1)	25.8 (24.2 – 26.5)	0.772
		Female	27 (26.3 - 27.8)	27.6 (26.6 – 28.0)	0.429
	45 - 54	Male	25.8 (25 - 26.6)	25.85 (25.12 - 26.57)	0.998
		Female	27.6 (26.6 - 28.6)	29.37 (28.59 - 30.15)	0.009
	55 - 64	Male	25 (24.2 - 26)	26.22 (25.52 - 26.91)	0.114
		Female	28.3 (27.3 - 29.2)	28.38 (27.46 - 29.31)	0.887
Mean systolic blood pressure	15 - 24	Male	114.3 (111.2 - 117.5)	115.51 (113.18 -117.85)	0.589
		Female	108.8 (105.7 -111.9)	109.7 (107.65 - 111.74)	0.601
	25 - 34	Male	117.9 (114 -121.8)	118.95 (117.18 - 120.72)	0.578
		Female	112.6 (109.9 - 115.4)	110.03 (108.67 - 111.39)	0.302
	35 - 44	Male	119.5 (113.2 - 120)	118.9 (117.1- 120.63)	0.591
		Female	116.6 (113.2 - 120)	117.4 (113.4 – 121)	0.514
	45 - 54	Male	127.1 ((123 - 131.2)	123.86 (121.33 - 126.39)	0.104
		Female	124.6 (120.5 - 129.4)	124.07 (120.88 - 127.26)	0.712
	55 - 64	Male	127.2 (121.9 - 132.6)	133.45 (129.96 - 136.94)	0.003
		Female	126.4 (121.3 - 131.6)	130.88 (127.8 - 133.98)	0.024
Mean diastolic blood pressure	15 - 24	Male	71 (68.8 - 73.4)	68.61 (66.8 - 70.42)	0.023
		Female	68.7 (66.7 - 70.6)	67.77 (66.13 - 69.4)	0.448
	25 - 34	Male	73 (71 - 74.2)	73.19 (71.8 - 74.58)	0.876
		Female	71.2 (69.5 - 72.8)	68.55 (67.48 - 69.61)	0.024
	35 - 44	Male	75 (72.8 - 77.3)	77.6 (75.4 – 78.3)	0.049
		Female	75.5 (72.5 - 78.6)	78 (76.8 – 80.9)	0.048
	45 - 54	Male	77.7 (75.6 - 79.8)	78.31 (76.23 - 80.4)	0.448
		Female	79 (76.6 - 81.5)	77.09 (75.64 - 78.49)	0.130
	55 - 64	Male	80.1 ((76.5 - 83.7)	80.42 (78.22 - 86.62)	0.876
		Female	76.7 (73.8 - 79.5)	77.8 (76.09 - 79.51)	0.448

Some data contained missing values. a, independent sample t-test was used.

were not statistically significant (Table 3). Among females also, the percentage of hypertensive participants increased from 2008 to 2018, and the difference was significant in the 15-24 age group (Table 3). However, male participants showed slightly higher blood pressure levels in comparison to females (Table 3).

The percentage of both males and females with blood cholesterol levels equal to or greater than 200 mg/dl increased with age, with the level being higher amongst females in all age groups, except for the 25 - 34 age group. However, the percentage of the individuals with blood triglyceride levels equal to or greater than 200 mg/dl was higher among males compared to females in all age groups. In addition, the level of blood triglyceride increased with age amongst females. Furthermore, the highest blood triglyceride level was observed in males in the 35 - 44 age group (Table 3). The percentage of the participants with blood sugar levels equal to or greater than 126 mg/dl witnessed a rise with increase in age in both males and females in all age groups, except for the 35-44 age group. Besides, the blood sugar level was higher among females in comparison to males in all the age groups, except for the 24 - 34 age group (Table 3). These results were the same in both study years; i.e., 2008 and 2018, and no significant change was detected in the trends.

5. Discussion

The present study aimed to assess the prevalence of CVDs risk factors in 15-64-year-old people in Fars province and to determine the proportion of these risk factors amongst males and females. The findings indicated that the CVDs risk factors were highly prevalent in Fars province in 2008 and 2018. In contrast to the expectations, no significant reduction was found in the prevalence of these risk factors after a decade, and even an increase was observed in the prevalence of the risk factors in many cases. This finding signifies that the health system has to move from a passive state towards developing some effective interventions in order to reduce the incidence, mortality, and morbidity of CVDs.

In many developing countries, obesity has become a health concern, but its predisposing factors follow different patterns in various populations (22-24). In the current study, the mean BMI, as a risk factor, was slightly high in both genders in all the age groups. No decrease was detected in the mean BMI until 2018, and the measure followed an ascending trend in most cases. According to the WHO's report in 2008, 25% of Iranians over 25 years of age (61% of males and 48.8% of females) had BMIs above 25 kg/m^2 (12, 23, 24). In the current research, the mean BMI was higher in females than in males in all age groups, except for the 15-24 age group. Additionally, the percentage of

Table 3. The Prevalence (%) of the Risk Factors Related to Lipid Profile among the 15-64-Year-Old Population in Fars Province in 2008 and 2018

Risk factors	Age	Gender	Prevalence (95% CI)		P-value[a]
			2008	2018	
Cholesterol level equal to or greater than 200 mg/dl	25 - 34	Male	31.4 (21.9 - 42.7)	25.93 (18.96 - 32.9)	0.341
		Female	25.9 (16 - 37.5)	25.27 (18.97 - 31.57)	0.992
	35 - 44	Male	43 (33.7 - 52.8)	44.5 (35.2 – 54.10)	0.875
		Female	40.7 (32.2 - 49.8)	41.2 (33.1- 50.2)	0.774
	45 - 54	Male	44.6 (35.4 - 54.2)	49.53 (40.03 - 59.03)	0.493
		Female	59 (49 - 67.9)	51.42 (43.33 - 59.51)	0.241
	55 - 64	Male	46.7 (34.8 - 58.9)	41.49 (30.83 - 52.14)	0.489
		Female	66.7 (56.7 - 75.4)	64.29 (54.99 - 73.6)	0.774
Triglyceride level equal to or greater than 200 mg/dl	25 - 34	Male	20.9 (14.3 - 29.7)	24.56 (17.57 - 31.55)	0.532
		Female	8.3 (3.7 - 17.6)	18.55 (13.23 - 23.87)	0.034
	35 - 44	Male	32.3 (23.9 - 41.9)	----------	-
		Female	17.4 (10.3 - 27.9)	----------	-
	45 - 54	Male	26.1 (17.7 - 36)	35.97 (26.71 - 45.26)	0.153
		Female	25.3 (17.3 – 35.3)	27.5 (19.79 - 35.2)	0.564
	55 - 64	Male	28.6 (20.3 - 38.6)	34.36 (34.09 - 44.62)	0.364
		Female	27.6 (19.1 - 38.1)	41.61 (32 - 51.21)	0.026
Blood glucose level equal to or greater than 126 mg/dl	25 - 34	Male	7 (3.2 - 14.7)	1.41 (0 - 3.35)	0.030
		Female	2.4 (0.6 - 8.9)	0	0.147
	35 - 44	Male	6.5 (3 - 13.8)	7.1 (3.3- 13.2)	0.432
		Female	8.1 (4.1 - 15.5)	7.8 (3.9 -14.5)	0.832
	45 - 54	Male	10.3 (5.5 - 20.1)	12.24 (6.23 - 18.25)	0.753
		Female	22.9 (16.6 - 30.8)	14.42 (7.54 - 21.29)	0.118
	55 - 64	Male	17.6 (11 - 27)	16.92 (8.53 - 15.3)	0.777
		Female	25 (17.9 - 33.8)	16.65 (9.71 - 23.59)	0.091
Percentage of individuals suffering from hypertension	15 - 24	Male	5.4 (3.7-7.8)	2.77 (0-6.54)	0.468
		Female	3.2 (2.1-4.9)	10.05 (0-3.95)	0.048
	25 - 34	Male	9.4 (8-11)	8.54 (4.54-12.55)	0.765
		Female	2.1 (1.5-3)	1.49 (0.01-2.97)	0.665
	35 - 44	Male	16.8 (15.3-18.5)	----------	-
		Female	14.6 (13.1-16.2)	----------	-
	45 - 54	Male	26.3 (25.1-27.6)	25.21 (17.44-32.97)	0.911
		Female	19.8 (18.8-20.7)	25.9 (19.45-32.35)	0.314
	55 - 64	Male	36.6 (35.9-37.2)	42.25 (32.78-51.72)	0.388
		Female	36.8 (36-37.6)	42.69 (34.42-50.95)	0.375

Some data contained missing values. a, chi-square test was used.

overweight females was constantly higher than that of males throughout the study. Physiologically speaking, Iranian men are usually fatter and taller compared to Iranian women. Besides, most rural men are more physically active due to occupational reasons, while most women living in these areas are homemakers. The abovementioned report by the WHO suggested that 21.6% of the Iranian population over 25 years old had BMIs over 30 kg/m^2 (13.6% of males and 29.5% of females). According to the results of a prior study on the burden of diseases in Iran, the prevalence of obesity was 14.2% in females and 5.6% in males (25).

Hypertension was the next risk factor assessed in the two studies conducted in 2008 and 2018. In this regard, the lowest percentage (1.49%) was related to 25-34-year-old females in 2018 and the highest percentage (42.69%) was related to 55-64-year-old females in the same year. The critical point in this analysis was that the percentage of hypertension followed an ascending trend during a decade, while huge costs have been incurred to control and prevent this risk factor comprehensively. A previous study demonstrated that the prevalence of hypertension in Iran was 17.4%, which increased with age in both genders and was more common in females aged above 35 years. Based on the results, 17.6% of males and 17.1% of females had blood pressure levels equal to or higher than 140/90 mmHg (26). According to another research carried out in Iran, after obesity and overweight, hypertension had the second rank (14.9%) of the total burden attributable to risk factors. In that study, 11.1% of males and 11.9% of females suffered from hypertension (27). In the report released by the WHO in 2008, 28.9% of the population over 25 years old had blood pressures equal to or greater than 140/90 mmHg. This measure was found to be 30.09% in males and 26.9% in females (12, 28). In the present study, blood pressure equal to or greater than 140/90mmHg was detected in 25.3% of males in 2008 and 18.76% in 2018. These values were respectively obtained as 18.2% and 15.11% among females. Thus, hypertension was more prevalent in males than in females. In general, women seem to care more about their health and follow some simple recommendations to control their blood pressure.

The prevalence of tobacco abuse increased from 2008

to 2018 in both genders in all age groups. Smoking was more prevalent among males, ranging from 2.2% in the 15-24 age group to 39.0% in the 55-64 age group in 2008. In 2018, it increased from 5.72% in the 15-24 age group to 46.04% in the 55-64 age group. Asgari et al. reported that 21.7% of males and 0.9% of females smoked on a daily basis in Iran (26). Another study indicated that 14% of the total population of the country used tobacco, with the proportion of cigarette smoking men being six times more than that of women (29). In the current research, an increase was observed in the percentage of males and females smoking cigarette, with men smoking more compared to women. However, a descending trend was detected in the percentage of smoking men (20.7% in 2008 and 18.18% in 2018) compared to women (0.7% in 2008 and 1.28 in 2018).

In the present study, the percentage of low physical activity was higher in females than in males in all age groups. Based on the results, 24.6% and 39.65% of males had low physical activity in 2008 and 2018, respectively, which had an increasing trend. In another research, 35.2% of the country's population had low physical activity. This measure was reported as 24.3% in males and 46.3% in females (26). Considering females in the present investigation, the lowest and highest prevalence of low physical activity in 2008 were related to the 35-44 and 55-64 age groups, respectively. This might be attributed to the fact that this age group is not able to function properly due to their older age and musculoskeletal problems. In males, on the other hand, the 45-54 age group was the most inactive, which might be associated with their employment and having less time for doing exercises. These results were almost the same in 2018, but the physical activity status seemed to have improved to some extent, which might result from more publicity in this area.

One of the strengths of this study was its procedure and the utilized questionnaire, which was consistent with the WHO's health plan steps.

5.1. Conclusion

The present study results demonstrated that the prevalence of the CVDs risk factors was mainly related to the individuals' lifestyles. The findings revealed the high prevalence of smoking, hypertension, dyslipidemia, and high blood sugar level, which was on the contrary to the results obtained in the total population of Iran (11) as well as in countries such as Finland (3) where the prevalence of risk factors was higher in females than in males and the Netherlands (5) where the prevalence of risk factors was the same in both genders. These findings indicate the need for developing some interventions and prevention measures in order to lower the incidence and mortality rate of CVDs, particularly in males. This study can be considered a proper foundation for future cohort studies.

5.1. Ethics Approval and Consent to Participate

The present study was in accordance with the Helsinki Declaration and was approved by the Research Ethics Committee of Shiraz University of Medical Sciences (ethical approval ID: IR.SUMS.REC.1400.421) .

5.2. Informed Consent

Written informed consent was obtained from all the participants.

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Authors' Contribution

SJ, FMA, and EH contributed substantially to the study design. SV and SJA contributed to data collection. SJ and FMA had roles in data interpretation. SJ wrote the initial draft and ML critically and substantially revised the final article. All authors reviewed the manuscript critically and approved it.

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Financial Disclosure

The authors declare no conflict of interests.

References

1. Yusuf S, Reddy S, Ôunpuu S, Anand S. Global burden of cardiovascular diseases: part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation*. 2001;**104**(22):2746-53.
2. Narayan KV, Ali MK, Koplan JP. Global noncommunicable diseases—where worlds meet. *New England Journal of Medicine*. 2010;**363**(13):1196-8.
3. Sayadi M, Zibaeenezhad M, Taghi Ayatollahi SM. Simple prediction of type 2 diabetes mellitus via decision tree modeling. *International Cardiovascular Research Journal*. 2017;**11**(2):71-6.
4. Organization WH. *Global status report on noncommunicable diseases 2014*. World Health Organization; 2014.
5. Joshi R, Jan S, Wu Y, MacMahon S. Global inequalities in access to cardiovascular health care: our greatest challenge. *Journal of the American College of Cardiology*. 2008;**52**(23):1817-25.
6. Blas E, Kurup AS. *Equity, social determinants and public health programmes*. World Health Organization; 2010.
7. Jousilahti P, Vartiainen E, Tuomilehto J, Puska P. Sex, age, cardiovascular risk factors, and coronary heart disease: a prospective follow-up study of 14 786 middle-aged men and women in Finland. *Circulation*. 1999;**99**(9):1165-72.
8. Andersen KK, Andersen ZJ, Olsen TS. Age-and gender-specific prevalence of cardiovascular risk factors in 40 102 patients with first-ever ischemic stroke: a Nationwide Danish Study. *Stroke*. 2010;**41**(12):2768-74.
9. van Jaarsveld CH, Ranchor AV, Kempen GI, Coyne JC, van Veldhuisen DJ, Ormel J*, et al.* Gender-specific risk factors for mortality associated with incident coronary heart disease—A prospective community-based study. *Preventive Medicine*. 2006;**43**(5):361-7.
10. Naghavi M, Abolhassani F, Pourmalek F, Lakeh MM, Jafari N, Vaseghi S*, et al.* The burden of disease and injury in Iran 2003. *Population health metrics*. 2009;**7**(1):1-21.
11. Alireza Yaghoubi M, Naser Safaie M, Rasoul Azarfarin M, Azin Alizadehasl M, Samad E. Evaluation of Cardiovascular Diseases and Their Risk Factors in Hospitalized Patients in East Azerbaijan Province, Northwest Iran: A Review of 18323 Cases.
12. Mirzaei M, Moayedallaie S, Jabbari L, Mohammadi M. Prevalence of hypertension in Iran 1980–2012: a systematic review. *The Journal of Tehran University Heart Center*. 2016;**11**(4):159.
13. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger

ZD, Hahn EJ, *et al.* 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Journal of the American College of Cardiology*. 2019;**74**(10):e177-e232.
14. Omram AR. The epidemiologic transition: a theory of the epidemiology of population change. *Bulletin of the World Health Organization*. 2001;**79**:161-70.
15. Block RC, Dozier AM, Hazel-Fernandez L, Guido JJ, Pearson TA. An epidemiologic transition of cardiovascular disease risk in Carriacou and Petite Martinique, Grenada: the Grenada Heart Project, 2005-2007. *Preventing chronic disease*. 2012;**9**.
16. Hastings KG, Boothroyd DB, Kapphahn K, Hu J, Rehkopf DH, Cullen MR, *et al.* Socioeconomic differences in the epidemiologic transition from heart disease to cancer as the leading cause of death in the United States, 2003 to 2015: an observational study. *Annals of internal medicine*. 2018;**169**(12):836-44.
17. Bonita R, De Courten M, Dwyer T, Jamrozik K, Winkelmann R. Surveillance of risk factors for noncommunicable diseases: the WHO STEPwise approach: summary. Noncommunicable Diseases and Mental Health, World Health Organization; 2001.
18. Prentice AM. The emerging epidemic of obesity in developing countries. *International journal of epidemiology*. 2006;**35**(1):93-9.
19. Khaodhiar L, Blackburn GL. Obesity assessment. *The American heart journal*. 2001;**142**(6):1095-101.
20. Kelishadi R, Alikhani S, Delavari A, Alaedini F, Safaie A, Hojatzadeh E. Obesity and associated lifestyle behaviours in Iran: findings from the first national non-communicable disease risk factor surveillance survey. *Public health nutrition*. 2008;**11**(3):246-51.
21. Attar A, Sayadi M, Jannati M. Effect of intensive blood pressure lowering on cardiovascular outcomes based on cardiovascular risk: a secondary analysis of the SPRINT trial. *European journal of preventive cardiology*. 2019;**26**(3):238-45.
22. Djalalinia S, Saeedi Moghaddam S, Sheidaei A, Rezaei N, Naghibi Iravani SS, Modirian M, *et al.* Patterns of obesity and overweight in the Iranian population: findings of STEPs 2016. *Frontiers in endocrinology*. 2020;**11**:42.
23. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, *et al.* Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The lancet*. 2014;**384**(9945):766-81.
24. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19· 2 million participants. 2016.
25. Nikbakht H-A, Sahraian S, Ghaem H, Javadi A, Janfada M, Hassanipour S, *et al.* Trends in mortality rates for gastrointestinal cancers in Fars province, Iran (2005–2015). *Journal of gastrointestinal cancer*. 2020;**51**(1):63-9.
26. Asgari F, Mirzazadeh A, Heidarian H. Iran non communicable disease risk factors surveillance data book for 2007, National NCD Risk Factors Surveillance Committee. *Iran NCD Risk Factors Steps Report*. 2007:12-5.
27. Sarrafzadegan N, Mohammmadifard N. Cardiovascular disease in Iran in the last 40 years: prevalence, mortality, morbidity, challenges and strategies for cardiovascular prevention. *Archives of Iranian medicine*. 2019;**22**(4):204-10.
28. HAGHDOUST A, Sadeghirad B, REZAZADEH KM. Epidemiology and heterogeneity of hypertension in Iran: a systematic review. 2008.
29. Moosazadeh M, Ziaaddini H, Mirzazadeh A, Ashrafi-Asgarabad A, Haghdoost AA. Meta-analysis of smoking prevalence in Iran. *Addiction & health*. 2013;**5**(3-4):140.