Healthcare in Low-resource Settings

eISSN: 2281-7824

https://www.pagepressjournals.org/index.php/hls/index

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Healthc Low-resour S 2023 [Online ahead of print]

To cite this Article:

Murad NS, Miro SS, Ismael VAH, Abdulah DM. **Modifiable risk factors for cardiovascular disease in Iraqi Kurdistan population: a large epidemiological study.** *Healthc Low-resour S* doi: 10.4081/hls.2023.12087

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Modifiable risk factors for cardiovascular disease in Iraqi Kurdistan population: a large epidemiological study

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Key words: risk factor; modification; prevention; cardiovascular disease.

Conflict of interest: The authors declare no potential conflict of interest, and all authors confirm accuracy.

Ethics approval: the Ethics Committee of Duhok General Directorate of Health approved this study (registered as 08032023-2-24 on 8 March 2023). The study is conformed with the Helsinki Declaration of 1964, as revised in 2013, concerning human and animal rights.

Informed consent: The written consent forms were not applicable in this study because we collected the data of this study from the medical records of the patients.

Patient consent for publication: Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

Availability of data and materials: all data generated or analyzed during this study are included in this published article (the raw data file was sent to the publisher). The raw data is available through the following link as well:

https://drive.google.com/file/d/1UYSfP3g6JfzuFAm-nf58GkvWZSUHKga0/view?usp=sharing

Abstract

Cardiovascular diseases (CVDs) are considered the leading factor of morbidity and mortality across the world. This study aimed to identify the modifiable risk factors of CVDs in the Kurdistan Region. In this retrospective cross-sectional study, the patients who visited and were diagnosed with any type of CVDs and treated in a main private cardiac center in Duhok governorate in Kurdistan Region were included between the years 2018 and 2023. The study found a similar percentage of male and female patients. The percentage of old patients was significantly increased from 18-19 to ≥70. The most preventable modifiable risk factors among cardiac patients were hypertension (86.17%), physical inactivity (60.59%), diabetes (40.15%), and dyslipidemia (56.31%). The less preventable modifiable risk factors were alcohol (4.01%) and cigarette smoking (14.43%). Males had a higher prevalence of cigarette smoking (24.63% vs. 4.38%; P<0.0001) and female patients had a higher prevalence of hypertension (91.25% vs. 81.02%; P<0.000), diabetes (44.43% vs. 35.80 %; P=0.0007) and dyslipidemia (59.15% vs. 53.43%; P=0.0257). In terms of family history of heart disease, the middle age group had a higher prevalence compared to younger and older age groups.

Diabetes and cigarette smoking was more prevalent among older age groups, while dyslipidemia was more prevalent among younger and older age groups. Alcohol, physical inactivity, and hypertension were similar among age groups. Hypertension, diabetes, dyslipidemia, and physical inactivity were the most prevalent risk factors for CVDs in this region. The older patients had significantly higher rates of some of these risk factors.

Introduction

Cardiovascular diseases (CVDs), including conditions such as coronary heart disease and stroke, are widely recognized as the primary cause of illness and death worldwide.[1] Over the past 30 years, there has been a significant increase in the number of cases of CVDs, with the total rising from 271 million in 1990 to 523 million in 2019. Similarly, mortality associated with CVDs has also increased, with the number of deaths rising from 12.1 million to 18.6 million during the same period. This trend is expected to continue due to the aging population, resulting in an increased burden of CVD-related deaths.[2] It is projected that 55 million deaths occurred in the workplace in 2017, and 17.7 million of these deaths were due to CVD.[3]

It is crucial to collect and record information about the modifiable risk factors associated with CVDs on a global and country-specific level. This data serves as a foundation for creating strategies for prevention that are tailored to the global and local contexts. Currently, there is limited data on modifiable risk factors in low and middle-income countries. The most comprehensive global estimates of the relationship between risk factors, adult deaths, and CVDs are provided by the Global Burden of Disease (GBD) study. Keeping this data up-to-date is vital for understanding the impact of risk factors on CVDs and developing effective preventive measures.[1,4] The available cross-sectional studies conducted in this region reported that hypertension (55.3%), followed by dyslipidemia (42.7%), type 2 diabetes mellitus (T2DM, 29%), smoking (11%), and ex-smoking (9.3%) are the most prevalent risk factors for coronary artery disease.[5,6] These studies have a small size and did not focus on risk factors specifically. Therefore, we need large and more robust studies to identify the

modifiable risk factors of CVDs in this region for preventive purposes. In this regard, we aim to explore the modifiable risk factors of CVDs in a large study in Iraqi Kurdistan.

Materials and Methods

Study design and sampling

In this retrospective cross-sectional study, the patients who visited and were diagnosed with any type of CVDs and treated in a main private cardiac center were included. In this regard, we recruited the medical records of the CVDs patients who were documented in the center between the years 2018 and 2023. The mentioned cardiac clinic is located inside the Shilan Private Hospital in Duhok City. The ethical approval of this study was obtained from the local health ethic committee registered as 08032023-2-24 on 8 March 2023.

Sampling

Between 5000 and 5500 patients have visited the cardiac center since 2018. The center has the papers of the medical records of the patients in some cabinets. The medical records have not been documented in a computer data system yet. To obtain a representative and the most practical and suitable sample of the target population, we selected one medical record of fifth papers saved in the cabinets. We selected the sixth paper in the case of having too much missing information in the fifth medical record. This process was continued until all medical records were completed. Finally, we included 1497 patients in this study.

Setting of the study

The Kurdistan Region of Iraq is comprised of four governorates, which are officially recognized as Erbil, Sulaymaniyah, Halabja, and Duhok (Figure 1). The study was conducted among cardiac patients in the Duhok governorate. The Duhok governorate is in the North part of the Kurdistan Region and has a border with Turkey, Syria, and Iraq. Based on the latest statistics of the Kurdistan Regional Statistics Office Duhok governorate has 1,557,020 persons.[7]

Inclusion and exclusion criteria

We included patients of both genders without applying any restriction of age and other socio-demographic aspects such as religion, residency, etc. The patients who lived in the Duhok governorate and visited the center were eligible for this study. However, we excluded the patients with too much missing information and pregnant women to avoid possible bias.

Measurements

The flowing modifiable risk factors were drawn from the medical records of the clinic. The factors were alcohol, hypertension, diabetes, dyslipidemia, cigarette smoking, and physical inactivity. In addition, we included the following non-modifiable risk factors from the medical records of the patients; included past cardiac vascular history and family history of heart disease. We included gender and age groups to explore the risk factors by gender and age groups. We could not include more risk factors since only these factors have been documented in the medical records of the patients. The data were entered into a pre-designed Excel sheet between 25 June 2022 and 21 February 2023.

Statistical methods

Descriptive statistics were used for determining the prevalence of modifiable risk factors among CVD patients. The risk factors by gender and age groups were examined in Pearson chi-squared test. The statistical calculations are performed in JMP Pro 14.3.0.

Results

The study found a similar percentage of male (49.63%) and female (50.37%) patients. The most prevalent modifiable risk factors among cardiac patients were hypertension (86.17%), physical inactivity (60.59%), dyslipidemia (56.31%), diabetes (40.15%), and the less prevalent modifiable risk factors were alcohol (4.01%) and cigarette smoking (14.43%). The non-modifiable risk factors were past cardiac vascular history (63.73%) and family history of heart disease (6.15%). The study showed that male and female patients did not have a

statistically significant difference in the prevalence of alcohol, family history of heart disease, and physical inactivity. However, male patients had a significantly higher prevalence of cigarette smoking (24.63% vs. 4.38%; P<0.0001). Female patients had a significantly higher prevalence of hypertension (91.25% vs. 81.02%; P<0.000), diabetes (44.43% vs. 35.80%; P=0.0007, and dyslipidemia (59.15% vs. 53.43%; P=0.0257). In terms of non-modifiable risk factors, the study showed that male patients had a significantly higher prevalence of past cardiac vascular history (74.16% vs. 53.45%; P<0.0001). Most of the patients had multiple modifiable risk factors (82.43%) followed by mono risk factors (14.56%). We found that a small percentage of patients had only non-modifiable risk factors (3.01%). Both male and female patients mostly had multiple risk factors, but the males had significantly higher rates of mono risk factor (16.96%) compared to females (12.20%; P=0.0029; see Table 1 and Figure 1).

The study also found that patients with cardiac disease were more likely to be elderly. The prevalence of alcohol, cigarette smoking, and physical inactivity was not statistically significant among age groups. The modifiable risk factors of diabetes and cigarette smoking were more prevalent among older age groups, while dyslipidemia was more prevalent among younger and older age groups. Alcohol, physical inactivity, and hypertension were similar among age groups. The multiple risk factors were increased with increasing age groups in contrast with mono risk factor (P<0.0001). In terms of non-modifiable risk factors, the study found that prevalence of past cardiac vascular history was higher among younger age groups, decreased by 40-49 years old, and increased from 40-49 years to ≥70 years old. In terms of family history of heart disease, the middle age group had a higher prevalence compared to younger and older age groups. (Table 2; Figure 2). Additionally, the study found that the most commonly occurring types of cardiovascular diseases were ischemic heart ailments, hypertension, myocardial infarction, cerebrovascular accidents, heart failure, and angina (as depicted in Figure 3).

Discussion

In this study, we found that the most prevalent modifiable risk factors among cardiac patients were hypertension, diabetes, Dyslipidemia, and physical inactivity.

Hypertension

According to the local health system, hypotension is diagnosed when systolic blood pressure (SBP) is equal to or greater than 130 mmHg, or diastolic blood pressure (DBP) is equal to or greater than 80 mmHg. Hypertension, characterized by elevated blood pressure, has been strongly linked to the development of CVD with robust evidence found globally.[8,9] The Global Burden of Disease (GBD) study conducted a comprehensive and comparative assessment of the burden of CVDs attributable to hypertension from 1990 to 2019. The study reported that the number of deaths and years lived with disability (YLD) caused by CVDs related to hypertension in young adults were 640,239 and 2,717,474, respectively. These numbers represented a significant increase of 43.0% in deaths and 86.6% in YLDs compared to 1990. Interestingly, middle-income countries had the highest burden of hypertension-related CVDs, while high-income countries had the lowest burden.[8,9] Our study found that hypertension was prevalent in both genders, but the prevalence was higher in females (91.25% vs. 81.02%), and the rate of hypertension increased with age. However, in the GBD review, men had higher mortality rates from hypertension-related CVDs compared to women. Ischemic heart disease (IHD) and stroke were the leading causes of death and years lived with YLD burden, respectively, in the GBD review, which is consistent with our findings where IHD was also one of the most common types of CVDs. Another study on pre-hypertensive patients with 30,258 participants showed that for every 10 mmHg increase in systolic blood pressure, there was a 12% increase in mortality associated with CVDs.[10] A prospective study conducted among 10,558 persons aged ≥30 years showed that living with blood pressure ≥180/105 mmHg increases the risk of CVD mortality by 37% among men and 18% among women compared to those persons with blood pressure <120/80 mmHg.[11]

Controlling hypertension is the most effective way to prevent CVDs development.[8,12] A prospective study conducted on 13,383 participants aged 60-80 years who were free from CVD at baseline and had SBP within the range of 110 to <150 mm Hg, followed them up for a median of 13.01 years. The study observed 1,727 cases of CVD and 3,742 deaths. The analysis revealed that normalized SBP was associated with a decreased risk of CVD, with a hazard ratio (HR) of 0.81 (95% confidence interval [CI], 0.76-0.87), as well as a decreased risk of all-cause mortality, with an HR of 0.89 (95% CI, 0.85-0.93).[13]

Dyslipidemia

According to an updated systematic review, the overall prevalence of hypercholesterolemia, defined as total cholesterol (TC) levels ≥5.1 mmol/L (200 mg/dL), was found to be between 17% to 54.9% in males and 9% to 53.2% in females during the period from 1990 to 2014.[14] Dyslipidemia is one of the main risk factors for developing CVD worldwide.[15] The higher prevalence of dyslipidemia has been shown to associate with the Western diet. The Western diet is characterized by high consumption of red and processed meat, high-fat milk and dairy products, fried and salty foods, refined grain products, and sugar-laden desserts and soft drinks.[16,17]

Various dietary patterns have been linked to decreased rates of dyslipidemia and CVDs. Examples of such eating patterns include vegetarian and near-vegetarian diets, Mediterranean-style diets, the Dietary Approaches to Stop Hypertension (DASH) diet, and the Prudent Heart Healthy Diet recommended by the American Heart Association (AHA), the Adult Treatment Panel III (ATP III), and the US Departments of Agriculture and Health and Human Services (DHHS) in their Guidelines for Americans 2005. These dietary patterns emphasize whole, plant-based foods and healthy fats, while limiting or avoiding animal products, added sugars, sodium, and saturated fats. Along with other healthy lifestyle choices, such as regular physical activity, maintaining a healthy weight, avoiding smoking, and managing stress, these dietary patterns can contribute to a lower risk of dyslipidemia and CVDs.[18]

Physical inactivity

The World Health Organization advises individuals to participate in regular physical activity, which can include moderate-intensity activity for a minimum of 150 minutes per week or vigorous-intensity activity for at least 75 minutes per week. This recommendation promotes the importance of incorporating physical activity into one's lifestyle for maintaining overall health and well-being.[19] Physical activity has been shown to associate with a reduction in CVDs morbidity and mortality.[20]

In a retrospective national study carried out in Korea involving 131,558 adults, it was observed that an increase of 500 metabolic equivalent task-minutes per week in physical activity was associated with a 14% decrease in the risk of mortality due to CVDs. This finding highlights the potential benefits of regular physical activity in reducing the risk of CVD-related mortality.[21] A multicentered, randomized, controlled community intervention involving 364 patients in four primary care centers was aimed to evaluate the short and medium-term effects of 9 months of a supervised physical activity program. The study reported that there was a significant difference in physical activity in the intervention community compared to the control community. They reported a significant decline in the SBP, total cholesterol, and LDL-cholesterol even after adjustments for the confounders. The incidence of adverse cardiovascular events was substantially lower (2.5% vs. 10.5%) compared to the control community, respectively.[22] Habitual physical activity has been reported to associate with a lower predicted risk of CVD.[23] We suggest that the Kurdistan Region encourages individuals for physical activity through suitable health promotion programs. A healthy city is an active city.[24]

Smoking

Cigarette smoking is a global public health issue. The age and gender-adjusted proportion of smoking is 31.2% ([95% CI: 30.9 31.6%] in the Middle East countries with a higher rate among men compared to women (48.0% vs. 13.8%).[25]

The Global Youth Tobacco Survey conducted in Kurdistan Region revealed that the overall prevalence of current cigarette smoking among adolescents was 15.3%. Specifically, the prevalence was 25.1% among boys and 2.7% among girls. Several factors were found to be associated with smoking among adolescents, including parents' smoking, smoking among closest friends, male gender, having pocket money, and perceptions that boys or girls who smoked were attractive. These findings shed light on the factors that contribute to smoking behavior among adolescents in the Kurdistan Region.[26] Smoking is the second main modifiable risk factor for CVD worldwide.[27] A prospective study performed on 19,782 men and 21,500 women (40-59 years) showed that current smokers have a significantly higher risk of coronary heart disease incidence: 185% in men and 207% in women, compared to non-smokers. In addition, the study showed that smoking cessation was associated with a rapid

risk reduction of coronary heart disease within 2 years.[28] There is strong evidence that a range of pharmacologic and behavioral interventions, both individually and in combination are effective in rising smoking cessation in non-pregnant adults.[29]

Diabetes mellitus

The pooled prevalence rate of T2DM is about 14.6% (95% CI: 11.6–17.5) which varied from 2.6% (95% CI: 2.5–2.6) to 21.9 (95% CI: 16.8–17.5) amongst countries. It is estimated that a total of 46 million individuals are now suffering from diabetes in the Middle East.[30] Diabetes is the main significant risk factor for the development of CVD.[31] A Korean study induced 76,434 from the Health Screening and Promotion Center and showed that diabetes is associated with risks of total CVD by 70%, coronary heart disease by 67%, and stroke by 58%.[32] It is crucial to focus on cardiovascular threat factors to decrease the illness's lasting cardiovascular complications.

Strengths and limitations

The main strong point of this study is that we tried to include as much as possible the medical records in this study. But the study was not exempt from the limitations. Firstly, the study was performed retrospectively, therefore, we could not include obesity and diet factors in this study. In addition, the data repository of other private clinics was not accessible to the researchers.

Conclusions

This study showed that hypertension, physical inactivity, dyslipidemia, and diabetes were the most prevalent risk factors for CVDs in this region. The older patients had significantly higher rates of some of these risk factors.

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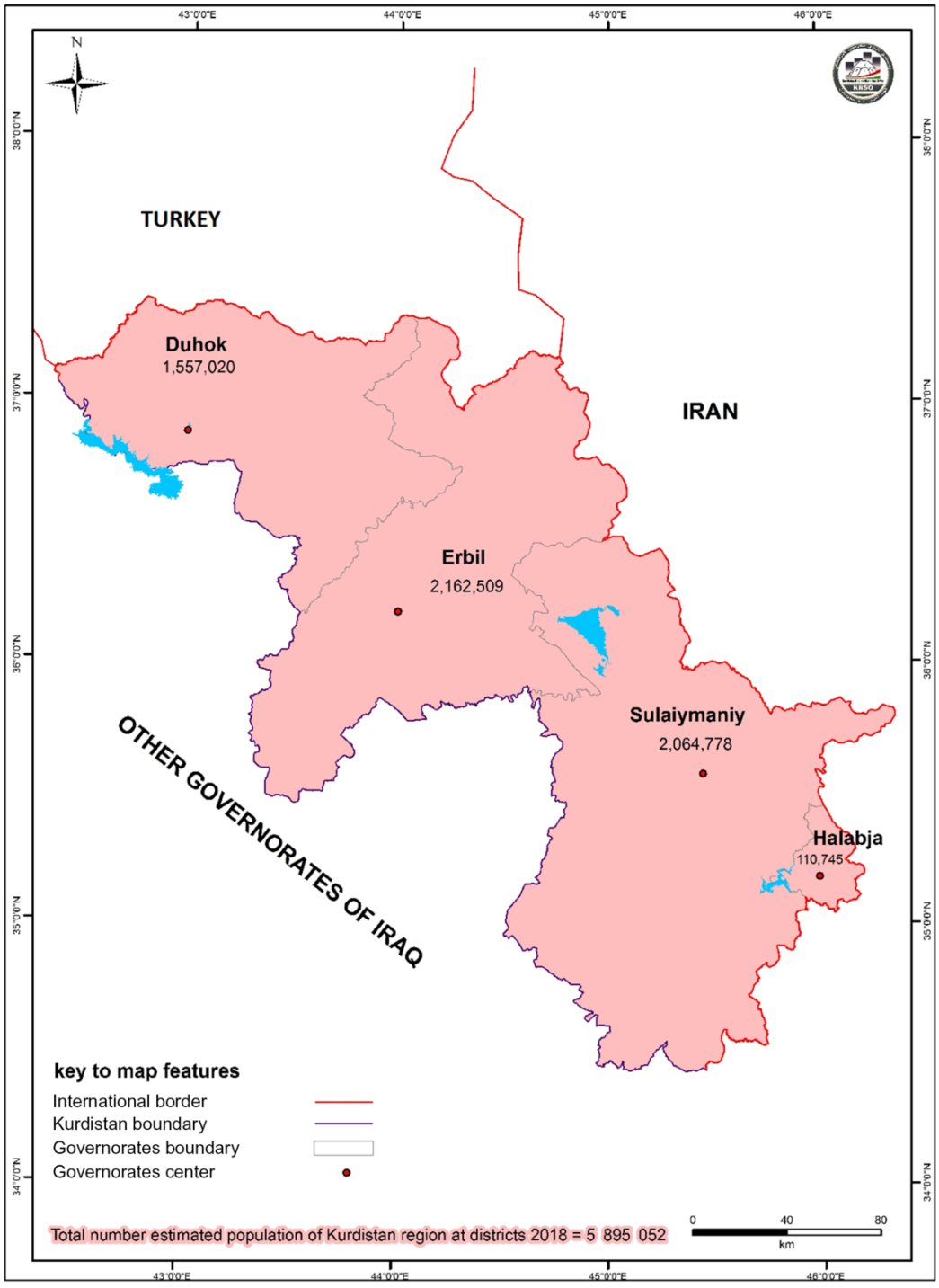

Figure 1. Map of Kurdistan region.[7]

Table 1. Prevalence of modifiable risk factors among all patients and by gender.

Risk factors (N=1497)	All patients	Gender no (%)		
		Male (743, 49.63%)	**Female (**754, 50.37%)	**P (two-sided)**
Modifiable risk factors				
Hypertension				**<0.0001**
No	207 (13.83)	141 (18.98)	66 (8.75)	
Yes	1290 (86.17)	602 (81.02)	688 (91.25)	
Physical inactivity				
No	590 (39.41)	308 (41.45)	282 (37.40)	0.1086
Yes	907 (60.59)	435 (58.55)	472 (62.60)	
Dyslipidemia				
No	654 (43.69)	346 (46.57)	308 (40.85)	**0.0257**
Yes	843 (56.31)	397 (53.43)	446 (59.15)	
Diabetes				
No	896 (59.85)	477 (64.20)	419 (55.57)	**0.0007**
Yes	601 (40.15)	266 (35.80)	335 (44.43)	
Cigarette smoking				
No	1281 (85.57)	560 (75.37)	721 (95.62)	**<0.0001**
Yes	216 (14.43)	183 (24.63)	33 (4.38)	
Alcohol				
No	1437 (95.99)	710 (95.56)	727 (96.42)	0.3960
Yes	60 (4.01)	33 (4.44)	27 (3.58)	
Risk factors				
Mono risk factor	218 (14.56)	126 (16.96)	92 (12.20)	**0.0029**
Multiple risk factors	1234 (82.43)	588 (79.14)	646 (85.68)	
Non modifiable risk factors	45 (3.01)	29 (3.90)	16 (2.12)	
Non-modifiable risk factors				
Past cardiac vascular history				**<0.0001**
No	543 (36.27)	192 (25.84)	351 (46.55)	
Yes	954 (63.73)	551 (74.16)	403 (53.45)	
Family history of heart disease				
No	1405 (93.85)	696 (93.67)	709 (94.03)	0.7734
Yes	92 (6.15)	47 (6.33)	45 (5.97)	

Pearson chi-squared tests were performed for statistical analyses. The bold numbers show the significant differences between male and female CVD patients.

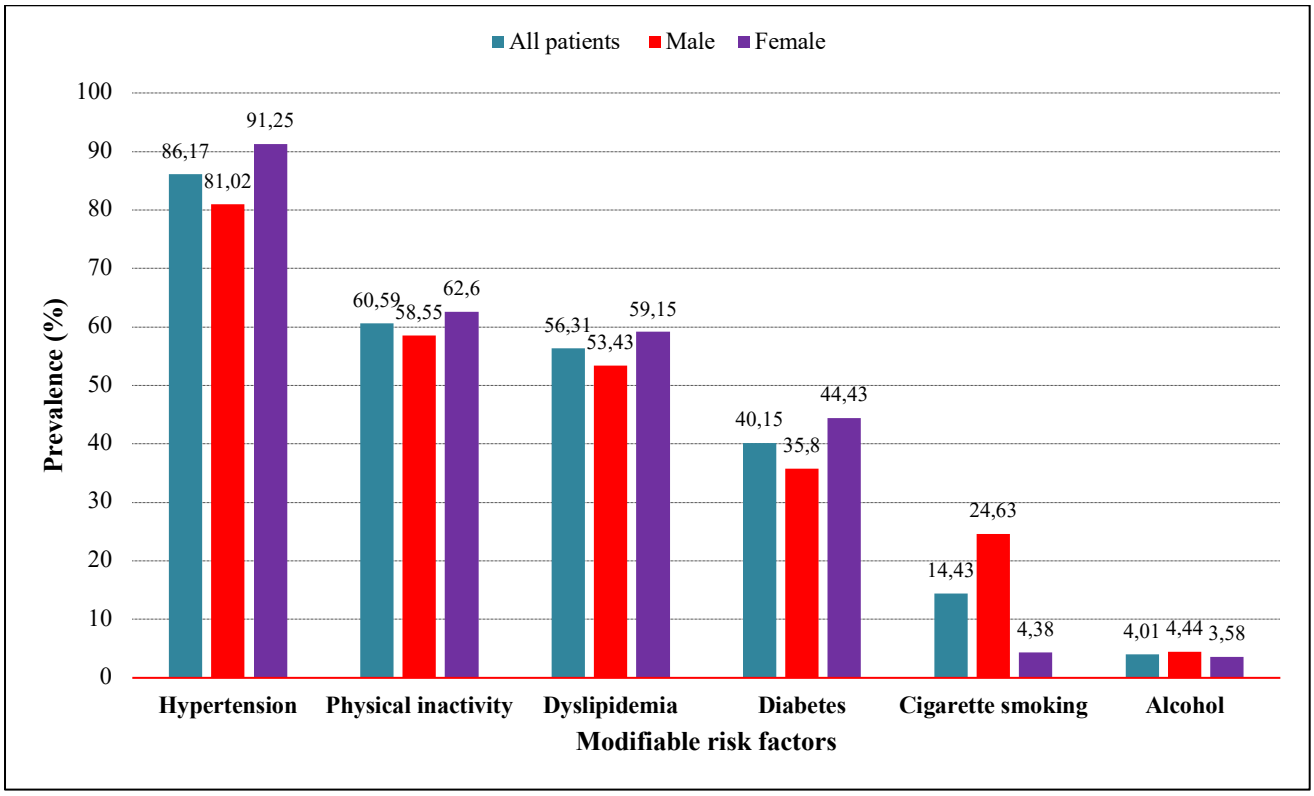

Figure 2. Overall and between gender modifiable risk factors among patients with CVDs.

Table 2. Prevalence of modifiable risk factors by gender among cardiac patients

Risk factors (n= 1497)	Age groups no (%)							
	18-19 (5, 0.33%)	20-29 (57, 3.81%)	30-39 (91, 6.08%)	40-49 (247, 16.5%)	50-59 (385, 25.72%)	60-69 (398, 26.59%)	≥70 (314, 20.98%)	P
Modifiable risk factors								
Hypertension								**0.0239**
No	0 (0.00)	11 (19.30)	15 (16.48)	35 (14.17)	67 (17.40)	36 (9.05)	43 (13.69)	
Yes	5 (100)	46 (80.70)	76 (83.52)	212 (85.83)	318 (82.60)	362 (90.95)	271 (86.31)	
Physical inactivity								
No	2 (40.00)	17 (31.48)	37 (41.57)	86 (35.68)	144 (37.89)	168 (43.19)	124 (39.87)	0.3682
Yes	3 (60.00)	37 (68.52)	52 (58.43)	155 (64.32)	236 (62.11)	221 (56.81)	187 (60.13)	
Dyslipidemia								
No	3 (60.00)	31 (54.39)	67 (73.63)	149 (60.32)	173 (44.94)	112 (28.14)	119 (37.90)	**<0.0001**
Yes	2 (40.00)	26 (45.61)	24 (26.37)	98 (39.68)	212 (55.06)	286 (71.86)	195 (62.10)	
Diabetes								
No	4 (80.00)	37 (64.91)	64 (70.33)	174 (70.45)	223 (57.92)	199 (50.00)	195 (62.10)	**<0.0001**
Yes	1 (20.00)	20 (35.09)	27 (29.67)	73 (29.55)	162 (42.08)	199 (50.00)	119 (37.90)	
Cigarette smoking								
No	5 (100)	54 (94.74)	84 (92.31)	205 (83.00)	323 (83.90)	340 (85.43)	270 (85.99)	0.1119
Yes	0 (0.00)	3 (5.26)	7 (7.69)	42 (17.00)	62 (16.10)	58 (14.57)	44 (14.01)	
Alcohol								
No	5 (100)	55 (96.49)	88 (96.70)	240 (97.17)	366 (95.06)	384 (96.48)	299 (95.22)	0.8284
Yes	0 (0.00)	2 (3.51)	3 (3.30)	7 (2.83)	19 (4.94)	14 (3.52)	15 (4.78)	
Risk factor categories								
Mono risk factor	0 (0.00)	18 (31.58)	23 (25.27)	49 (19.84)	52 (13.51)	26 (6.53)	50 (15.92)	**<0.0001**
Multiple risk factors	5 (100)	37 (64.91)	64 (70.33)	192 (77.73)	315 (81.82)	364 (91.46)	257 (81.85)	
Non-modifiable risk factors	0 (0.00)	2 (3.51)	4 (4.40)	6 (2.43)	18 (4.68)	8 (2.01)	7 (2.23)	
Non-modifiable								
Past cardiac vascular								**<0.0001**
No	1 (20.00)	25 (43.86)	45 (49.45)	123 (49.80)	141 (36.62)	135 (33.92)	73 (23.25)	
Yes	4 (80.00)	32 (56.14)	46 (50.55)	124 (50.20)	244 (63.38)	263 (66.08)	241 (76.75)	
History of heart disease								
No	5 (100)	53 (92.98)	81 (89.01)	215 (87.04)	368 (95.58)	377 (94.72)	306 (97.45)	**<0.0001**
Yes	0 (0.00)	4 (7.02)	10 (10.99)	32 (12.96)	17 (4.42)	21 (5.28)	8 (2.55)	

Pearson chi-squared tests were performed for statistical analyses. The bold numbers show the significant difference among different age groups.

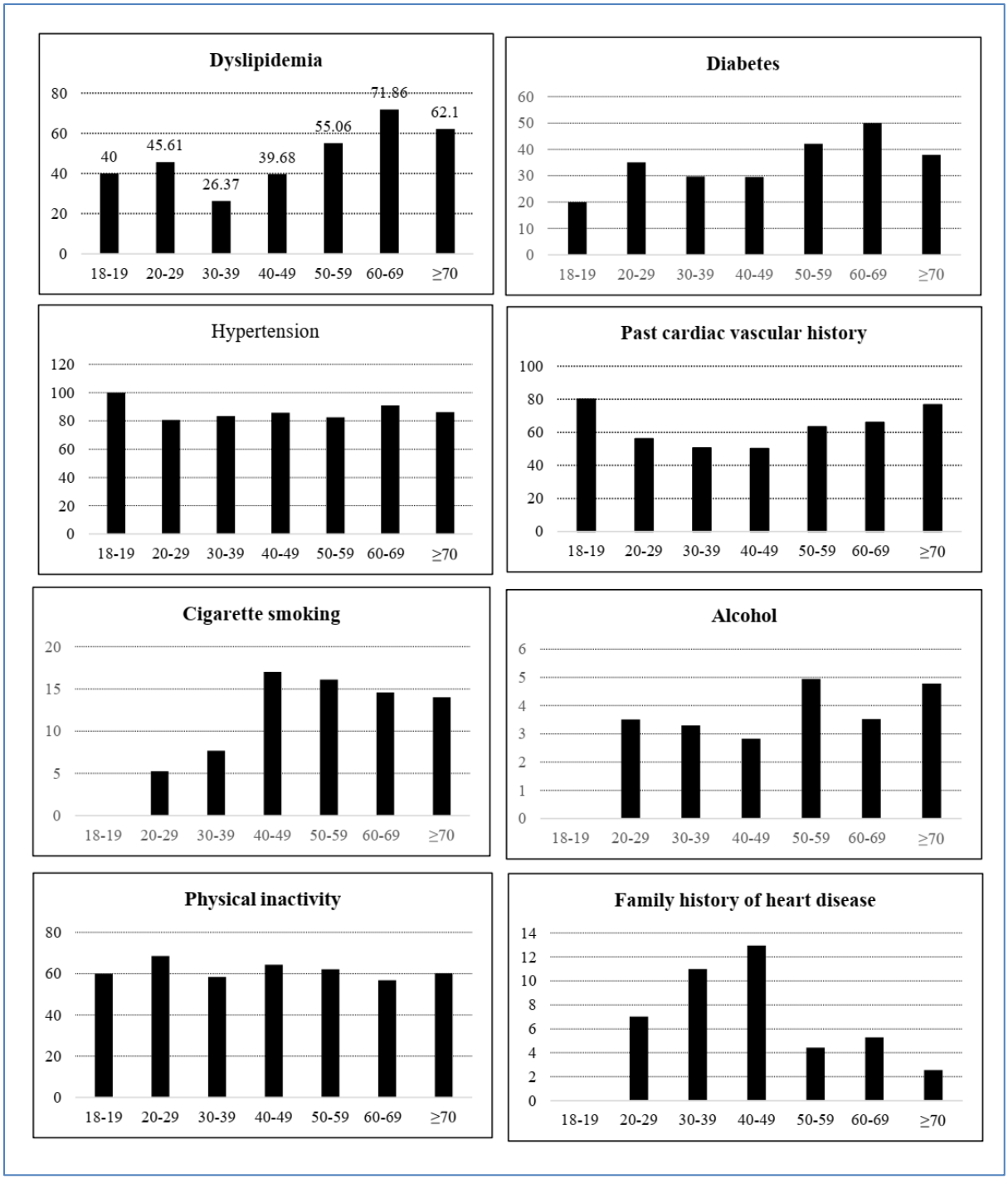

Figure 3. Modifiable risk factors of CVDs among patients with different age groups.

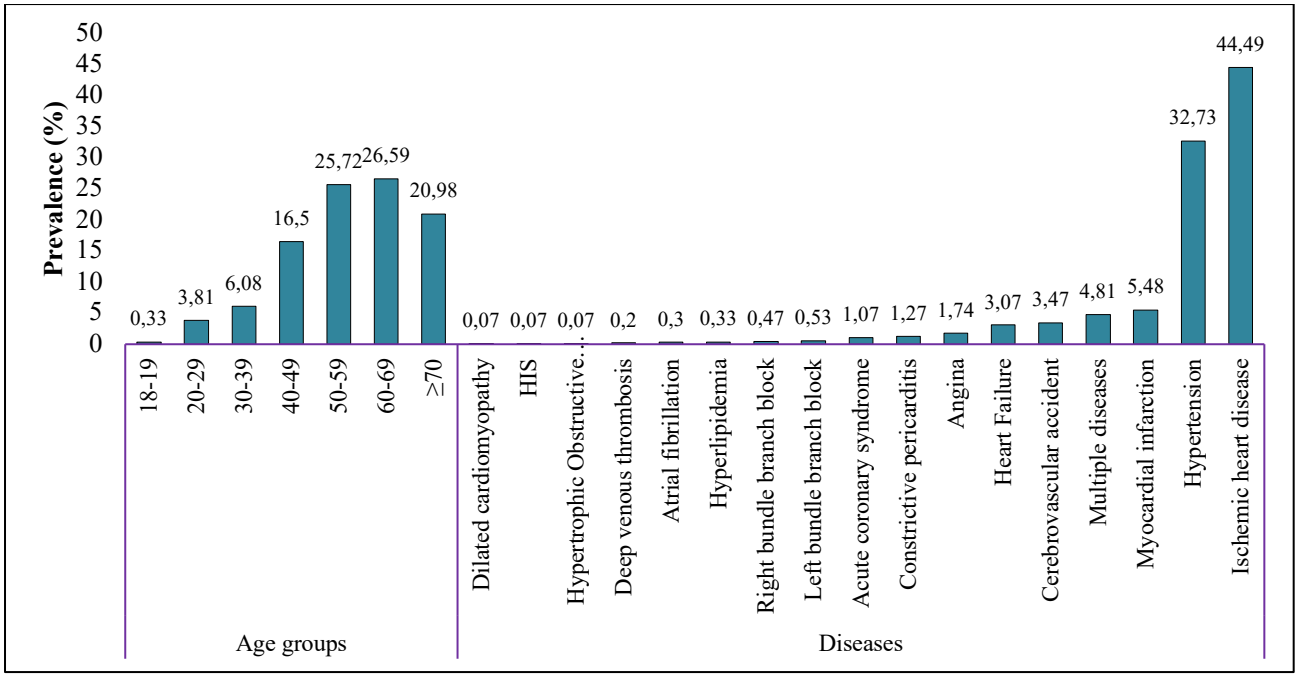

Figure 4. Age groups and current diagnoses of patients with CVD.

Submitted: 14 November 2023

Accepted: 27 November 2023

Early access: 19 December 2023