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Research Article

Analysis of the risk of developing cardiovascular diseases in the population served at a primary health unit in the midwestern region of Santa Catarina

Análise do risco de desenvolvimento de doenças cardiovasculares na população atendida em uma unidade básica de saúde do meio-oeste de Santa Catarina

Análisis del riesgo de desarrollo de enfermedades cardiovasculares en la atención de la población en una unidad básica de salud del medio oeste de Santa Catarina

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Abstract

Introduction: Cardiovascular diseases stand as the primary global causes of death, linked to modifiable factors like hypertension, diabetes, smoking, and dyslipidemia. **Objective:** This study aims to assess the prevalence of high cardiovascular risk among individuals aged 30 to 74 in a Health Basic Unit (*Unidade Básica de Saúde* – UBS) in Santa Catarina. **Methods:** Of the total number of medical records, those of 350 patients (235 women, 115 men) were selected for application of the Framingham Score. **Results:** The results revealed that 40% of men and 15% of women had a high cardiovascular risk. The main risk factors identified were Diabetes mellitus, use of medication for hypertension and age. Hypertension was present in 53.14% of patients, with 40.54% being smokers. Among diabetics, 70.96% of males and 50.8% of females displayed elevated cardiovascular risk. Total cholesterol had an impact on cardiovascular risk, being higher in females. **Conclusions:** It is concluded that several factors contribute to cardiovascular risk, including age, blood pressure, total cholesterol, HDL, antihypertensive medication, and smoking, all of which result from the interaction of multiple risk factors. Diabetes, antihypertensive medication, and age stand out as the most relevant factors. Increases in HDL indicate risk reduction, particularly among females. Conversely, the elevation of total cholesterol exerted a greater influence on cardiovascular risk in females, while smoking had greater significance in males.

Keywords: Cardiovascular diseases. Hypertension. Risk factors.

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Resumo

Introdução: Doenças cardiovasculares são as principais causas globais de morte, e são associadas a fatores modificáveis como hipertensão, diabetes, tabagismo e dislipidemia. **Objetivo:** Este estudo buscou analisar a prevalência de alto risco cardiovascular em indivíduos de 30 a 74 anos em uma Unidade Básica de Saúde (UBS) de Santa Catarina. **Métodos:** Do total de prontuários, foram selecionados os de 350 pacientes (235 mulheres, 115 homens) para a aplicação do Escore de Framingham. **Resultados:** Os resultados revelaram que 40% dos homens e 15% das mulheres apresentavam alto risco cardiovascular. Os principais fatores de risco identificados foram diabetes mellitus, uso de medicamento para hipertensão arterial sistêmica (HAS) e idade. A hipertensão esteve presente em 53,14% dos pacientes, enquanto 40,54% eram tabagistas. Entre os diabéticos, 70,96% dos homens e 50,8% das mulheres apresentaram alto risco cardiovascular. O colesterol total impactou o risco cardiovascular, sendo mais alto nas mulheres. **Conclusões:** Conclui-se que diversos fatores contribuem para o risco cardiovascular, incluindo idade, pressão arterial, colesterol total, lipoproteína de alta densidade (HDL), medicação anti-hipertensiva e tabagismo, sendo tal risco resultado da interação de múltiplos fatores de risco. Destacam-se como os mais relevantes diabetes, medicação anti-hipertensiva e idade. Aumentos no HDL indicam redução do risco, especialmente entre mulheres. Por outro lado, o aumento do colesterol total teve maior influência no risco cardiovascular no sexo feminino, enquanto o tabagismo foi mais significativo no sexo masculino.

Palavras-chave: Doenças cardiovasculares; Hipertensão; Fatores de risco.

Resumen

Introducción: Las enfermedades cardiovasculares son la principal causa global de muertes vinculadas a factores modificables como la hipertensión, diabetes, tabaquismo y dislipidemia. **Objetivo:** El estudio buscó analizar la prevalencia de alto riesgo cardiovascular en personas de 30 a 74 años en una UBS en Santa Catarina. **Métodos:** Del total de historias clínicas, se seleccionaron las de 350 pacientes (235 mujeres, 115 hombres) para la aplicación del Framingham Score. **Resultados:** Los resultados revelaron que el 40% de los hombres y el 15% de las mujeres presentaban un alto riesgo cardiovascular. Los principales factores de riesgo identificados fueron la diabetes mellitus, el uso de medicamentos para la hipertensión y la edad. La hipertensión se presentó en el 53,14% y 40,54% eran fumadores. En diabéticos, 70,96% de los hombres y 50,8% de las mujeres mostraron alto riesgo cardiovascular. El colesterol total impactó en el riesgo, siendo mayor en mujeres. **Conclusiones:** Varios factores contribuyen al riesgo cardiovascular, incluyendo edad, presión arterial, colesterol total, HDL, medicación antihipertensiva y tabaquismo, resultado de la interacción de múltiples factores. Diabetes, medicación antihipertensiva y edad son los más relevantes. La elevación del HDL reduce el riesgo, especialmente en mujeres. El aumento del colesterol total influyó más en el riesgo cardiovascular femenino, el tabaquismo fue significativo en hombres.

Palabras clave: Enfermedades cardiovasculares. Hipertensión. Factores de riesgo.

INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of death in Brazil.[1] According to the Brazilian Society of Cardiology (2022), more than 1,100 deaths occur daily due to CVD, representing a rate three times higher than that of respiratory diseases. Furthermore, heart diseases account for the highest costs related to hospitalization and treatment within the Brazilian Unified Health System (*Sistema Único de Saúde* – SUS).[1] The main risk factors for CVD, which are well established and modifiable within Primary Health Care Units (*Unidades Básicas de Saúde* – UBS), include hypertension, diabetes mellitus (DM), smoking, and dyslipidemia.[2] Atherosclerosis is directly and indirectly associated with the major CVDs, which can be categorized as ischemic heart disease, heart failure (HF), stroke, and peripheral arterial disease (PAD).[3] The signs and symptoms of these conditions commonly include chest pain, dyspnea, sweating, lower limb edema, tachycardia, weakness, and hypotension, among others.[4]

In light of the above, the control and appropriate management of risk factors are essential for the prevention of future diseases. To support this approach, the Framingham Heart Study (FHS), initiated in 1948, developed a risk score that estimates cardiovascular risk over a 10-year period. Within the FHS, cardiovascular risk is calculated based on parameters including the presence of DM, treatment for hypertension, and tobacco use, as well as age, gender, total cholesterol, high-density lipoprotein (HDL),

and systolic blood pressure (SBP). Furthermore, the study demonstrated the incidence of conditions of coronary origin, including myocardial infarction, coronary insufficiency, angina, ischemic and hemorrhagic stroke, transient ischemic attack (TIA), PAD, HF. These findings support the direct relationship between risk factors, longitudinal care, and patient survival.[4-7]

Therefore, it is essential to characterize the profile of patients treated at a UBS in the Midwest region of Santa Catarina, Brazil, with regard to modifiable risk factors, such as hypertension, DM, smoking, and dyslipidemia. This approach is justified by the potential to optimize disease prevention strategies within primary care in the target municipality through the correction of these factors, thereby improving patients' quality of life and, consequently, reducing public health expenditures. In this context, assessment using the Framingham score represents an important tool for minimizing adverse outcomes, particularly cardiovascular events, and for identifying patients who require more intensive care.

METHODS

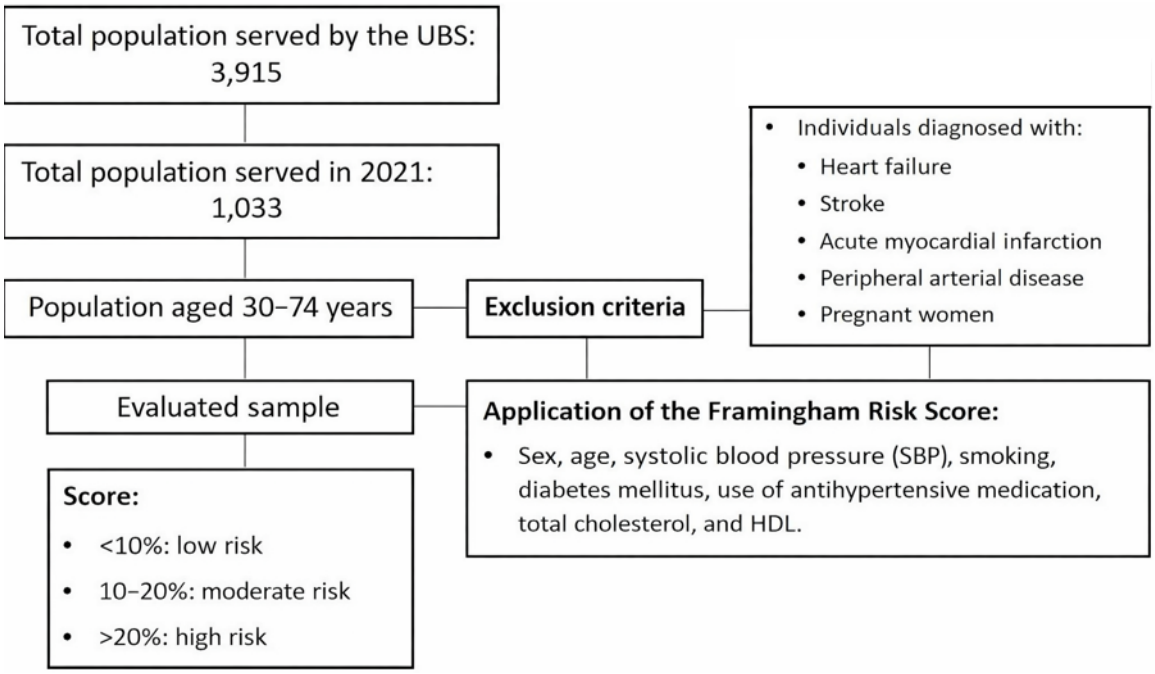
This study was approved by the Research Ethics Committee (*Comitê de Ética em Pesquisa* – CEP) under protocol number 5.497.915.

Medical records of patients treated at the Amarante UBS in the municipality of Videira, Santa Catarina (SC), Brazil, in 2021 were evaluated. During the study period, a total of 1,033 patients were treated at the unit. Among the records, those of patients aged 30 to 74 years were included, considering the following variables: age, gender, smoking status, total cholesterol, HDL, presence of diabetes, SBP, and treatment for hypertension. The selection of the age range between 30 and 74 years followed the criteria of the traditional Framingham score, which recommends this range as applicable to the original model. Patients younger than 30 years old or older than 75 years lack adequate validation within this scoring system and were therefore excluded.

Conversely, patient records with diagnoses of HF, stroke, acute myocardial infarction, peripheral arterial disease, atrial fibrillation, valvular heart disease, or a history of cardiac surgery, as well as those of pregnant women, were excluded. Additionally, records lacking information on variables required for the Framingham Risk Score were excluded from the analysis. Based on these data, the risk of developing CVD was assessed using the Framingham risk score (Figure 1).

The results obtained from the Framingham Risk Score analysis indicate the probability of cardiovascular events over a 10-year period. Based on these results, patients were stratified according to cardiovascular risk as follows: <10%, classified as low risk; 10 to 20%, moderate risk; and >20%, high risk.

For the data obtained through the Framingham Risk Score, sample normality was assessed using the Kolmogorov–Smirnov test. Based on these results, correlation analyses were performed between the evaluated risk factors and the Framingham score, using the GraphPad Prism® software (GraphPad Software, 2004), with $p<0.05$ considered statistically significant. The potential influence of the presence of risk factors — diabetes mellitus (DM), smoking, and use of antihypertensive medication — on the Framingham Score results was evaluated using the unpaired *t* test with Welch's correction. In contrast, the correlations between age, SBP, total cholesterol, and HDL and the percentage risk of developing cardiovascular disease, as determined by the score, were assessed using Spearman's correlation test.

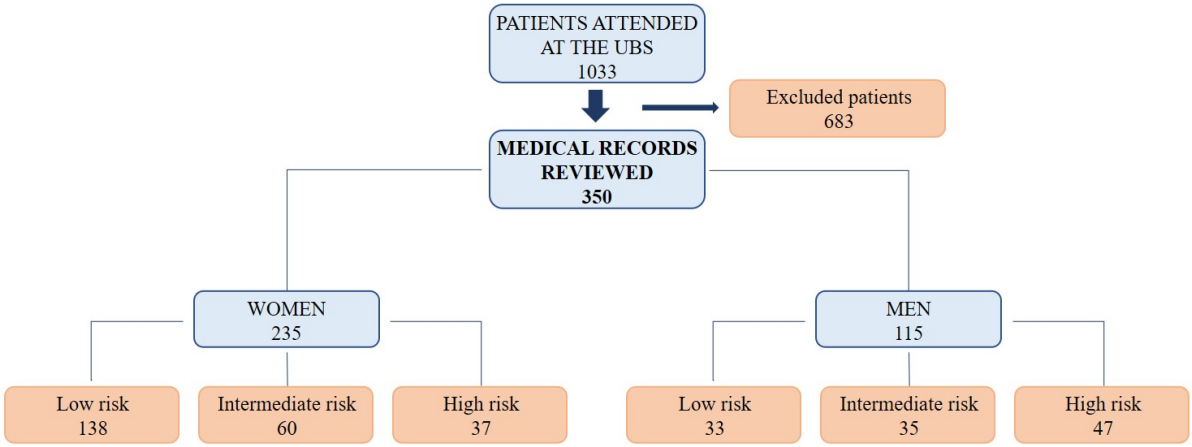


UBS: Primary Care Units (*Unidade Básica de Saúde*); SBP: systolic blood pressure; DM: diabetes mellitus; HDL: high-density lipoprotein.
Source: Research data, 2023.

Figure 1. Flowchart of the sample selection and analysis process.

RESULTS AND DISCUSSION

The Amarante UBS, located in the municipality of Videira (SC), Brazil, serves 3,915 users. In 2021, 1,033 individuals sought care, corresponding to 28% of the population covered by the UBS. After the application of the inclusion and exclusion criteria, medical records from 350 patients were included in the study, comprising 235 women and 115 men (Figure 2). The following variables were considered for the Framingham Score assessment: age (30–74 years), SBP, total cholesterol, HDL, use of antihypertensive medication, smoking status, and DM. The data from the study population used in the calculation of the Framingham Score are presented in Table 1.



Source: Research data, 2023.

Figure 2. Flowchart of the population profile served according to the Framingham Score.

Table 1. Characteristics of the study population in relation to the variables assessed in the Framingham Score.

Characteristic assessed	Female (n=235)	Male (n=115)
Age (years)		
Mean±SD	53.6±10.67	54.64±10.38
Min/Max	30/74	30/74
Systolic Blood Pressure (mmHg)		
Mean±SD	124.17±17.03	125.73±18.92
Min/Max	90/200	80/170
Total Cholesterol (mg/dL)		
Mean±SD	194.59±40.96	190.04±43.57
Min/Max	90/327	113/337
HDL (mg/dL)		
Mean±SD	45.08±12.08	40.09±10.92
Min/Max	15/83	21/82
LDL* (mg/dL)		
Mean±SD	118.34±35.40	116.38±38.84
Min/Max	0/243	0/245
Antihypertensive medication (%)		
Present	56.17	46.95
Absent	43.82	53.04
Smoking (%)		
Present	8.51	14.78
Absent	91.48	85.21
Diabetes mellitus (%)		
Present	25.95	26.95
Absent	74.04	73.04
Framingham Score (%)		
Mean±SD	15.58±11.79	30.64±17.79
Min/Max	1.6/64.4	2.9/75.8

* Not included in the calculation of the Framingham Score.
HDL: high-density lipoprotein; LDL: low-density lipoprotein.
Source: Research data; 2023.

In the analyzed records, the mean age was 53.66 years for females and 54.64 years for males.

Total cholesterol levels in the female population ranged from 90 to 327 mg/dL, with a mean of 194.59 mg/dL. In males, values ranged from 113 to 337 mg/dL, with a mean of 190.04 mg/dL.

Among the women, 132 were using antihypertensive medication, corresponding to more than 55% of the female patient records analyzed. Among the men, 54 were using medication for blood pressure control, representing approximately 47% of the male patient records analyzed.

Regarding DM, its prevalence was 25% among women and 27% among men. With respect to smoking, 8.5% of women and 14.7% of men were smokers.

Considering the values obtained for modifiable risk factors, the risk of developing CVD among the patients whose medical records were evaluated was calculated using the Framingham Risk Score. Among

the 235 women included in the study, the Framingham Risk Score indicated a mean cardiovascular risk of 15.58%. In contrast, among the 115 men analyzed, the mean cardiovascular risk was 30.64%.

In the present study, a higher proportion of women was observed compared with men. This finding may be attributed to the greater tendency of women to seek medical care more frequently than men; consequently, a larger number of women are monitored within health services, allowing for increased risk prediction and prevention, as reported in the study by Larré and Almeida.[8] It is important to consider that, after menopause, women present an increased cardiovascular risk due to the loss of the protective effects of estrogen during this stage.[1] Estrogen deficiency contributes to endothelial dysfunction, promoting arterial stiffness and alterations in lipid metabolism.[9] Furthermore, a history of six or more pregnancies is associated with a substantial increase in the risk of coronary heart disease in postmenopausal women.[9,10]

Regarding the male population, the low utilization of health services is a matter of concern, as it may hinder the diagnosis of conditions that increase cardiovascular risk, thereby rendering this population more vulnerable to the development of cardiovascular diseases. According to Cichocki et al.[11], this vulnerability is associated with the lack of adequate treatment, whether pharmacological or related to lifestyle modifications. In addition to this sociocultural perspective, cardiovascular risk factors such as smoking, dyslipidemia, and endothelial and aortic diseases are more prevalent in men than in women.[10,11,12]

According to the Framingham Risk Score results, 138 women were classified as low risk (<10%), 60 as intermediate risk (10 to 20%), and 37 as high risk (>20%). Among men, 33 were classified as low risk, 35 as intermediate risk, and 47 as high risk (Figure 2).

Table 2 presents the analyzed data for female patients, stratified by age group. Women aged 70 to 74 years exhibited the highest mean SBP compared with the other age groups (129.23 mmHg), whereas the highest mean values for total cholesterol (208.38 mg/dL) and HDL cholesterol (48.05 mg/dL) were observed in the 50 to 54 age group. An increase in cardiovascular risk was observed with advancing age. This finding may be explained by the aging process, which is associated with increased blood pressure and may affect approximately 60% of older adults, according to data from the 2013 National Health Survey (*Pesquisa Nacional de Saúde* – PNS). These findings may be related to age-associated changes, including increased arterial stiffness, a higher prevalence of comorbidities among older individuals, and increased peripheral vascular resistance.[1] Aging is considered an independent risk factor for CVD, as senescence involves metabolic, cellular, and molecular alterations associated with low-grade systemic inflammation, insulin resistance, dysregulation of lipid metabolism, micro- and macrovascular remodeling, and structural and functional cardiac changes, among other processes.[10]

Regarding the use of antihypertensive medication, it was observed that, among women aged 50 years old and older, 116 out of 158 individuals reported using antihypertensive drugs, corresponding to 74%.

The mean Framingham Risk Score for women across the analyzed age groups was highest in the 70 to 74 age group, with a mean cardiovascular risk of 20.29%, ranging from 8.9 to 64.4%, compared with the other age groups. In contrast, in the 30–34 age group, the mean cardiovascular risk was 1.96%, with values ranging from 0.72 to 7.11%.

Table 3 shows that, among male patients, the age group with the highest mean SBP was 65 to 69 years (131 mmHg). Regarding total cholesterol, the 40 to 44 age group presented the highest mean value (209.66 mg/dL), whereas the highest mean HDL cholesterol level (43.71 mg/dL) was observed in the 70 to 74 age group. Data analysis indicated an increase in the use of antihypertensive medication among male

Table 2. Evaluation of characteristics of female patients by age range.

Age range	30–34 years (n=14)	35–39 years (n=17)	40–44 years (n=15)	45–49 years (n=31)	50–54 years (n=34)	55–59 years (n=52)	60–64 years (n=33)	65–69 years (n=26)	70–74 years (n=13)
Age (years)									
Mean±SD	32±1.35	37.41±1.46	41.4±1.12	47.19±1.49	51.65±1.39	57.38±1.25	61.78±1.40	66.65±1.26	71.69±1.37
Min/Max	30/34	35/39	40/43	45/49	50/54	55/59	60/64	65/69	70/74
SBP (mmHg)									
Mean±SD	119.28±14.39	116.47±13.20	121.33±15.05	123.22±17.96	125±20.63	124.23±17.86	127.27±16.63	126.92±13.78	129.23±16.56
Min/Max	100/160	90/140	100/160	100/160	100/200	90/170	100/160	100/150	110/170
Total cholesterol (mg/dL)									
Mean±SD	174.85±26.43	163.23±28.70	178.93±33.60	171.38±37.32	208.38±44.10	207.88±39.72	204.75±36.99	201.38±13.78	201.61±42.36
Min/Max	134/243	122/230	110/227	90/241	139/327	118/296	143/303	139/266	124/271
HDL (mg/dL)									
Mean±SD	44.5±12.48	41.23±9.69	42.8±12.47	43.48±9.24	48.05±12.89	45.46±12.91	46.06±13.45	44.23±11.59	47.07±12.59
Min/Max	25/75	24/56	26/67	28/63	29/76	15/79	25/83	22/74	30/70
LDL* (mg/dL)									
Mean±SD	107.21±14.39	101±22.86	114.2±44.24	105.93±31.41	121.64±40.29	128.52±34.27	122.54±29.06	118.24±39.63	122.30±42.99
Min/Max	80/138	68/159	61/243	41/172	41/230	63/211	56/186	0/167	56/196
Antihypertensive medication (%)									
Present	21.42	11.76	20	25.80	64.70	65.38	75.75	88.46	92.30
Absent	78.57	88.23	80	74.19	35.29	34.61	24.24	11.53	7.69
Smoking									
Present	0	5.88	13.33	6.45	8.82	7.69	18.18	0	15.38
Absent	100	94.11	86.66	93.54	91.17	92.30	81.81	100	84.61
Diabetes mellitus									
Present	14.28	11.76	13.33	12.90	26.47	30.76	36.36	42.30	23.07
Absent	85.71	88.23	86.66	87.09	73.52	69.23	63.63	57.69	76.92
Framingham Score (%)									
Mean±SD	1.96±1.81	2.54±3.17	3.67±2.03	4.77±2.92	9.47± 8.07	12.41±8.44	16.19±10.39	18.73±12.15	20.29±14.07
Min/Max	0.72/7.11	0.91/14.67	1.01/7.71	1.36/12.02	2.8/40.54	1.6/40.9	3.1/55.4	6.2/59.2	8.9/64.4

SD: standard deviation; SBP: systolic blood pressure; HDL: high-density lipoprotein.
Source: Research data, 2023.

patients from the age of 45 years onward. In the 30 to 34 age group, only one of the six patients reported using medication, whereas in the 60 to 64 age group, 10 out of the 16 patients analyzed reported the use of antihypertensive drugs.

Calculation of the Framingham Risk Score for men demonstrated that the highest mean value occurred in the 70 to 74 age group, with a cardiovascular risk of 38.85%.

The influence of risk factors DM, smoking, and the use of antihypertensive medication on the Framingham Risk Score was evaluated by comparing the cardiovascular risk scores of patients with each risk factor to those of patients without these conditions.

In the total study population, 26% of the participants were diabetic, among whom 40.21% presented a high cardiovascular risk (Figure 2A) ($p<0.0001$). Regarding gender, males exhibited higher scores than females, with mean values of 70.96% and 50.8%, respectively (Figures 3A and 3B).

Regarding smoking in the total population evaluated (Figure 3C), most participants were non-smokers (89.5%); however, among smokers (10.5%), 40.54% presented a high cardiovascular risk. Smoking exerted

Table 3. Evaluation of characteristics of male patients by age group.

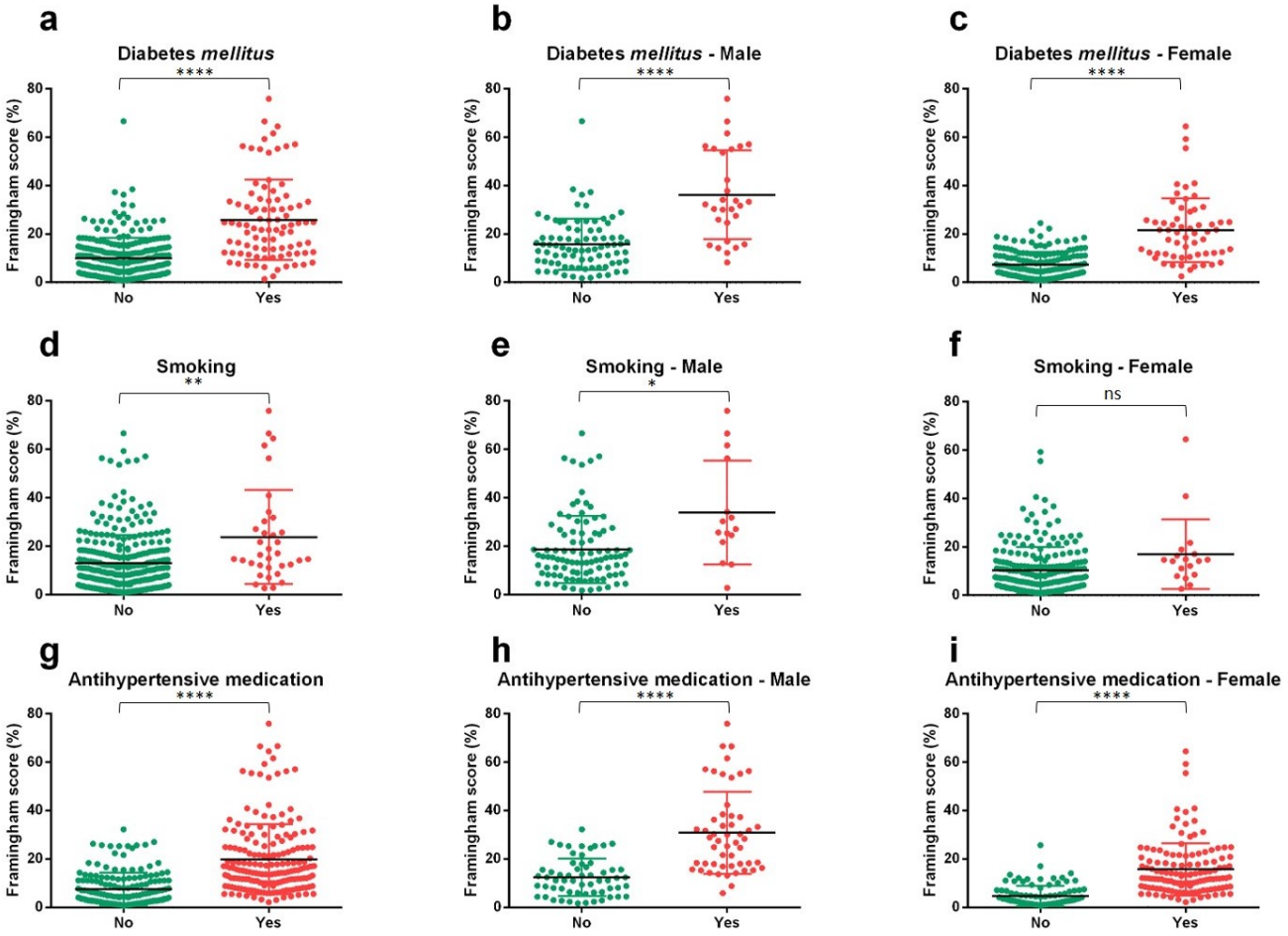
Age range	30–34 years (n=6)	35–39 years (n=4)	40–44 years (n=12)	45–49 years (n=10)	50–54 years (n=20)	55–59 years (n=26)	60–64 years (n=16)	65–69 years (n=14)	70–74 years (n=7)
Age (years)									
Mean±SD	32.33±1.63	36.5±1	42.25±1.48	47.3±1.25	52.4±1.23	57.11±1.27	61.68±1.25	66.64±1.59	73±0.81
Min/Max	30/34	35/37	40/44	45/49	50/54	55/59	60/64	64/69	72/74
SBP (mmHg)									
Mean±SD	128.16±26.46	125±20.81	127.5±17.12	124±21.70	126.5±14.96	121.53±14.33	124.37±22.5	131.42±21.07	128.57±27.94
Min/Max	100/170	100/150	110/160	90/160	100/150	90/ 140	80/170	90/170	90/170
Total cholesterol (mg/dL)									
Mean±SD	178.33±39.37	182.75±28.92	209.66±58.10	194.6±43.91	193.1±40.40	197.11±47.26	175.62±37.98	179.5±42.57	183.14±34.22
Min/Max	120/242	154/218	147/337	140/249	127/318	114/285	124/253	113/247	138/229
HDL (mg/dL)									
Mean±SD	31±3.68	37.25±14.59	42.33±9.03	38.7±10.26	36.65±6.56	42.34±12.74	41.56±11.77	41.14±12.64	43.71±12.25
Min/Max	26/36	28/59	31/55	25/57	24/49	30/82	21/68	26/67	32/64
LDL* (mg/dL)									
Mean±SD	105.8±15.13	120.5±32.31	31.08±52.14	113.44±25.88	112.77±41.66	134.2±40.26	92.64±36.62	108.42±28.62	109.28±28.86
Min/Max	80/120	88/165	77/245	73/149	0/211	71/211	0/151	50/149	74/145
Antihypertensive medication (%)									
Present	16.66	50	16.66	80	45	34.61	62.50	57.14	71.42
Absent	83.34	50	83.34	20	55	65.39	37.50	42.86	28.58
Smoking									
Present	0	25	8.34	0	15	23.07	21.42	21.42	0
Absent	100	75	91.66	100	85	76.93	78.58	78.58	100
Diabetes mellitus									
Present	33.33	0	16.66	50	15	26.92	31.25	28.58	42.85
Absent	66. 66	100	83.34	50	85	73.08	68.75	71.42	57.15
Framingham Score (%)									
Mean±SD	5.31±5.47	5.30±1.71	8.77±6.03	15.98±11.00	17.80±11.93	21.8±15.18	25.95±19.40	32.64±11.86	38.85±19.69
Min/Max	1.71/15.29	2.75/6.39	4.21/24.63	3.05/42.31	6.34/56.23	8/75.8	2.9/66.5	20.5/57	12.2/66.6

SD: standard deviation; SBP: systolic blood pressure; HDL: high-density lipoprotein; LDL: low-density lipoprotein.
Source: Research data, 2023.

a more pronounced effect in men (Figure 3D), with $p<0.0001$, indicating an increased cardiovascular risk among smokers. In contrast, among women, no significant association was observed between smoking and the Framingham Risk Score or increased cardiovascular risk (Figure 3E), highlighting that the majority of women were non-smokers.

Of the total patients studied, 53.14% had hypertension, among whom 35.48% presented a high cardiovascular risk (Figure 3F). Among male patients, 46.95% were hypertensive, of whom 61.11% were classified as having a high cardiovascular risk (Figure 3G). Among female patients, 56.17% were hypertensive, of whom approximately 23% presented a high cardiovascular risk (Figure 3H).

DM is another important factor, characterized by elevated glycemic levels — above 100 mg/dL — resulting from insulin resistance or impaired insulin production.[13] Individuals with DM exhibit higher mortality from CVDs compared with individuals of the same age group without DM.[13-15] Corroborating these findings, an association between diabetes and an increased risk of developing CVD was observed in the present study. This relationship may be explained by the fact that DM and CVDs share common environmental determinants, with insulin resistance representing a principal underlying mechanism.[11,16,17] Patients with



DM; diabetes mellitus.

DM – total population (A); DM – male population (B); DM – female population (C) smoking – total population (D); smoking – male population (E); smoking – female population (F); antihypertensive medication – total population (G); antihypertensive medication – male population (H); antihypertensive medication – female population (I).

Source: Research data, 2023.

Figure 3. Framingham Score for the study population.

DM present a more atherogenic profile than non-diabetic individuals, including risk factors such as obesity, hypertriglyceridemia, and elevated plasma fibrinogen levels.[14,15]

Smoking is a significant modifiable risk factor associated with CVD, as even the consumption of a single cigarette per day is sufficient to increase the risk of cardiac and cerebrovascular complications. This effect is mediated by endothelial dysfunction, increased platelet aggregation, and reduced HDL cholesterol levels, thereby contributing to the development of atherosclerosis.[14,15] Smoking cessation has been shown to reduce the risk of future cardiovascular events, including mortality, by up to 36%. Furthermore, within approximately one year, cessation is associated with a 50% reduction in the risk of recurrent myocardial infarction among individuals with a prior episode of acute myocardial infarction.[16,17]

In the present study, the majority of the patients analyzed were non-smokers, which represents a favorable finding with respect to CVDs and other conditions, given that smoking is a recognized risk factor for multiple diseases. However, male patients who used tobacco exhibited a high cardiovascular risk, as exposure to toxic agents such as nicotine induces hemodynamic alterations, increased

myocardial oxygen consumption, endothelial dysfunction, and the development of atherosclerosis. Thus, smoking is closely associated with an increased risk of developing CVDs.[18]

Hypertension is a multifactorial chronic condition involving genetic and environmental factors, characterized by persistently elevated blood pressure (BP), defined as systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg.[19] The management of hypertension involves two complementary approaches: pharmacological and non-pharmacological. Pharmacological treatment is based on drug classes such as angiotensin-converting enzyme inhibitors (ACE inhibitors), angiotensin II receptor blockers (ARBs), calcium channel blockers (CCBs), and thiazide diuretics, including hydrochlorothiazide. Non-pharmacological management consists of lifestyle modifications, such as reducing sodium intake to 2 g/day, engaging in regular physical activity, increasing the consumption of fruits and vegetables, and reducing the intake of fats and sugar-sweetened beverages. Adequate control of hypertension is associated with improved prevention of target organ damage, particularly in organs such as the kidneys and heart.[19,20]

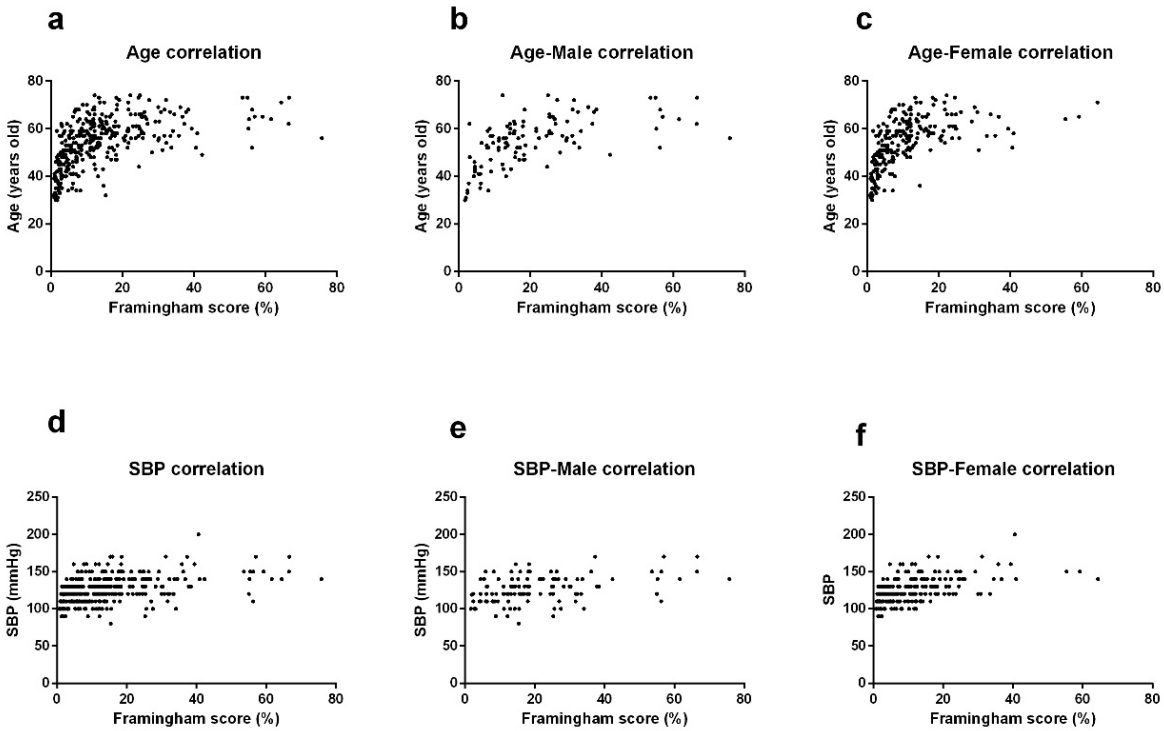
Regarding the analyzed SBP levels, the mean values observed were 124 mmHg for women and 125 mmHg for men, which classify these individuals as prehypertensive. Although these levels are not markedly elevated, even within this SBP range there is an increased likelihood of progression to hypertension. Furthermore, these individuals are more susceptible to complications resulting from cardiovascular events. According to the VII Brazilian Guidelines on Arterial Hypertension, mortality from CVDs increases progressively with rising BP levels from 115/75 mmHg onward, in a continuous, linear, and independent manner.[19,20]

The use of antihypertensive medication was associated with a significant increase in the Framingham Risk Score among men. In contrast, values remained lower among women, although the proportion of women using antihypertensive medication was high, reflecting a lower cardiovascular risk even in the presence of pharmacological treatment.[21,22]

Data from meta-analyses have demonstrated that a 5 mmHg reduction in blood pressure levels, maintained for a minimum period of four years, is sufficient to reduce the risk of adverse cardiovascular outcomes by approximately 10%, including an estimated 13% reduction in stroke, 8% reduction in acute myocardial infarction, and 13% reduction in decompensated HF.[14,15]

Given that the study presents a nonparametric sample, the correlation between age, SBP, total cholesterol, and HDL cholesterol was assessed using Spearman's correlation test.

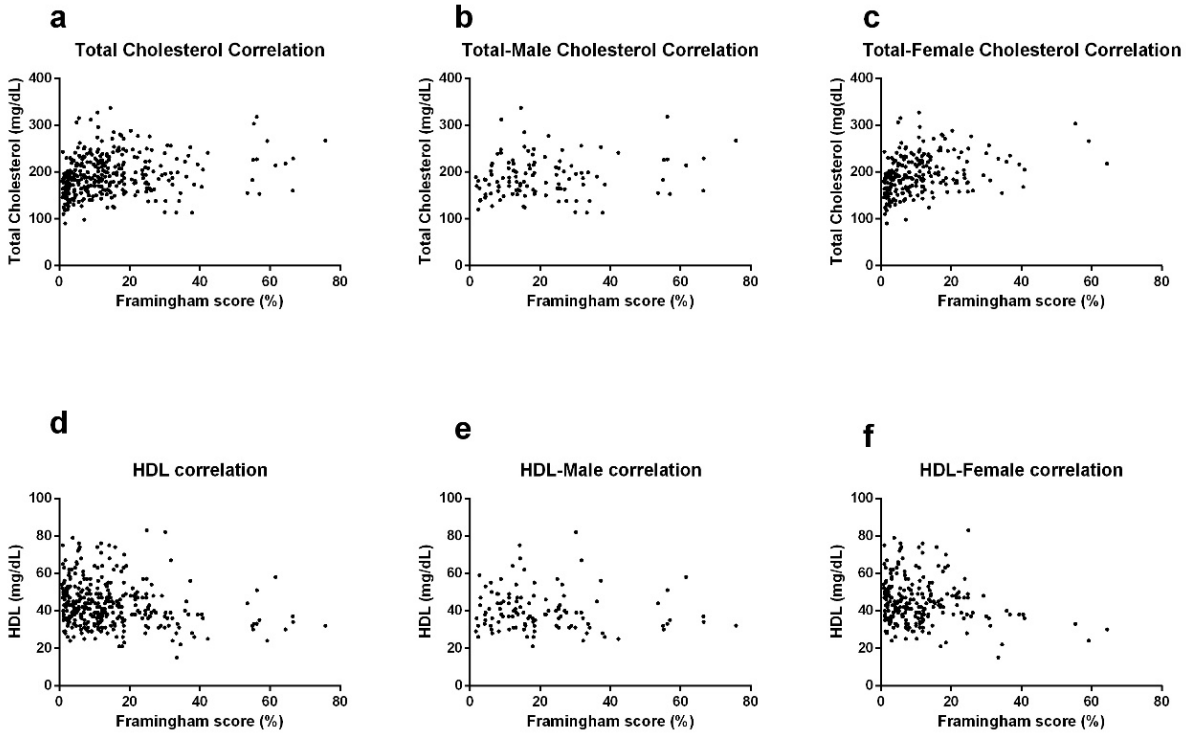
The correlation between age and the Framingham Risk Score was positive in the studied population (Figure 4A), including both genders ($R=0.6531$; $p<0.0001$). When this correlation was analyzed separately for men and women (Figures 4B and 4C), a similar pattern was observed, with increasing age associated with higher scores ($R=0.6465$; $p<0.0001$; $R=0.7267$; $p<0.0001$, respectively). Most records for women aged 40 to 60 years indicated a cardiovascular risk below 20%. In contrast, among men, the age distribution showed greater variability between 40 and 80 years, without concentration at a specific risk percentage. The correlation between SBP and the Framingham Risk Score was also positive in the overall population (Figure 4D) for both genders, indicating that higher BP values were associated with higher scores ($R=0.4993$; $p<0.0001$). When males were analyzed separately (Figure 4E), most of the sample presented SBP values ranging from approximately 100 to 180 mmHg, with cardiovascular risk varying from 0 to 80%, predominantly between 0 and 40% ($R=0.4351$; $p<0.0001$). In contrast, in the analysis of SBP and cardiovascular risk among females (Figure 4F), most individuals presented SBP values



SBP: systolic blood pressure.
Correlation between age and SBP with the Framingham Score Correlation between age and the Framingham Score in the total population (A); correlation between age and the Framingham Score in males (B); correlation between age and the Framingham Score in females (C); correlation between SBP and the Framingham Score in the total population (D); correlation between SBP and the Framingham Score in males (E); correlation between SBP and the Framingham Score in females (F).
Source: Research data, 2023.
Figure 4. Spearman correlation between age, SBP, and the Framingham Score for the study population.

between approximately 100 and 150 mmHg (Figure 4F), with cardiovascular risk ranging from 0 to 70%, predominantly between 0 and 20% (R=0.5609; p<0.0001).

Based on Figure 5A, the relationship between total cholesterol and the Framingham Risk Score was positive in both genders (R=0.2628; p<0.0001). Among males, cholesterol levels predominantly ranged from 100 to 300 mg/dL (Figure 5B), with greater variability in cardiovascular risk compared with females, among whom the highest prevalence ranged from 0 to 60% (R=0.1545; p≤0.1007). In females, most patients also presented cholesterol levels between 100 and 300 mg/dL (Figure 5C); however, cardiovascular risk predominantly ranged from 0 to 20% (R=0.3800; p<0.0001). Regarding the relationship between HDL cholesterol and the Framingham Risk Score, a positive correlation was observed in the studied population (Figure 5D), in both females and males (R=0.1939; p=0.0003). Among male patients, most had HDL levels between 20 and 60 mg/dL (Figure 5E), with cardiovascular risk ranging from 0 to 80%. However, individuals with cardiovascular risk exceeding 60% presented HDL levels between 20 and 80 mg/dL (R=0.1246; p=0.1865). In contrast, in the analysis of HDL/female gender and cardiovascular risk, a large proportion of patients presented HDL levels between 20 and 80 mg/dL (Figure 5F), with cardiovascular risk ranging from 0 to 60% and a predominance around 20%. Notably, all patients with cardiovascular risk exceeding 40% had HDL levels below 40 mg/dL (R=0.1327; p=0.0425).



Correlation between total cholesterol and HDL with the Framingham Score. Correlation between total cholesterol and the Framingham Score in the total population (A); Correlation between total cholesterol and the Framingham Score in males (B); Correlation between total cholesterol and the Framingham Score in females (C); Correlation between HDL and the Framingham Score in the total population (E); Correlation between HDL and the Framingham Score in males (F); Correlation between HDL and the Framingham Score in females.

Source: Research data, 2023.

Figure 5. Spearman correlation between total cholesterol, high-density lipoprotein (HDL), and the Framingham Score for the study population.

Dyslipidemia is defined as a disorder of lipid metabolism, identified through laboratory testing and classified into four categories: isolated hypercholesterolemia (elevated total cholesterol levels), isolated hypertriglyceridemia (elevated levels of triglyceride – TG), mixed hyperlipidemia (elevated levels of TG and total cholesterol – TC), and isolated low HDL-c, either alone or in combination with elevated LDL-c and/or TG.[19,20] Dyslipidemia is recognized as a major risk factor for atherosclerosis, primarily due to elevated levels of LDL cholesterol in the bloodstream, which promote the accumulation of lipid-rich plaques.[21,22] However, plaque instability, often driven by lipid imbalance, may lead to severe cardiovascular complications, including acute myocardial infarction (AMI).[23-25]

Randomized clinical trials have demonstrated that reductions in total cholesterol and LDL cholesterol levels are effective in decreasing mortality from atherosclerotic coronary events, both in primary and secondary prevention settings. LDL levels within the normal range may still be associated with subclinical atherosclerotic disease, reinforcing the importance of lipid control as a strategy for the prevention and management of adverse cardiovascular outcomes.[16,17]

Regarding total cholesterol levels, the present study identified mean values within the normal reference range (<200 mg/dL). However, maximum values exceeding 300 mg/dL were also observed, which may contribute to increased cardiovascular risk among patients presenting such

levels. As reported by Freitas et al.[26], elevated total cholesterol constitutes a significant risk factor for mortality from CVDs.[24]

Regarding HDL cholesterol levels, the mean observed in this study was close to the reference value (>40 mg/dL). However, the lowest values identified were approximately 20 mg/dL, which may contribute to increased cardiovascular risk. HDL is an important protective factor against CVD, and an increase of 1 mg/dL in HDL is associated with an approximate reduction of 2 to 3% in cardiovascular risk in men and women, respectively.[23-25]

Although this study provides relevant contributions to the understanding of cardiovascular risk profiles in primary care, some limitations should be considered. The cross-sectional design does not allow for the establishment of causal relationships, and the use of data from 2021, still influenced by the COVID-19 pandemic, may have affected the sample composition. Furthermore, the absence of multivariate analysis limits the assessment of the independent effect of each risk factor. In addition, variables related to social determinants and behavioral factors, which may also influence cardiovascular risk, were not included. Nevertheless, the findings provide important contributions to clinical practice and may inform future studies with larger sample sizes and more comprehensive analytical approaches.

CONCLUSION

The results of this study indicate that all analyzed factors influence cardiovascular risk, with DM, the use of antihypertensive medication, and age demonstrating the greatest impact in both genders. HDL cholesterol exhibited a protective effect, particularly among women. Total cholesterol showed a stronger association with cardiovascular risk in women, whereas smoking demonstrated a more pronounced effect in men. These findings reinforce the importance of cardiovascular risk stratification in primary care, enabling targeted interventions such as intensified glycemic control, smoking cessation strategies, and improved adherence to antihypertensive therapy. The systematic use of the Framingham Risk Score may optimize clinical management, support the establishment of individualized therapeutic goals, and strengthen preventive strategies in primary care settings.

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AUTHORS' CONTRIBUTIONS

KC: Project administration, Formal analysis, Conceptualization, Data curation, Writing – original draft, Investigation, Methodology, Validation. MVF: Project administration, Formal analysis, Conceptualization, Data curation, Writing – original draft, Investigation, Methodology, Validation. MOB: Data curation, Writing – review & editing, Visualization. LSS: Investigation, Methodology. GCDP: Project administration, Formal analysis, Conceptualization, Data curation, Writing – original draft, Writing – review & editing, Investigation, Methodology, Software, Supervision, Validation, Visualization. AC: Project administration, Formal analysis, Conceptualization, Data curation, Writing – original draft, Writing – review & editing, Investigation, Methodology, Software, Supervision, Validation, Visualization.

CONFLICT OF INTERESTS

Nothing to declare.

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