Study of Orthostatic Hypotension in the adult population of the Municipality of Vila Velha de Ródão - Portugal

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ABSTRACT
Introduction: Orthostatic Hypotension (OH) is characterized by a significant drop in blood pressure values when a person transitions from a seated position to an upright one, with a variation equal to or greater than 20mmHg for systolic values and/or equal to or greater than 10 mmHg for diastolic values. This condition occurs due to failures in neurological mechanisms and/or circulatory compensation during venous return. Objectives: This study aims to investigate the prevalence of Orthostatic Hypotension in the municipality of Vila Velha de Ródão and its relationship with other cerebrocardiovascular risk factors. Materials and Methods: A prospective, observational, and quantitative study was conducted, involving random cluster sampling of 795 adult individuals over 18 years of age residing in the study area. Anthropometric data and blood pressure measurements were collected, and a research questionnaire was administered. The statistical software SPSS (Statistical Package for the Social Sciences) was used for data analysis. Results: The sample comprised 795 individuals, with 53.1% being female and 46.9% male. Ages ranged from 18 to 99 years, with a mean of 56.98 years and a standard deviation of 18.521 years. In this population, the three most prevalent risk factors were a sedentary lifestyle at 80.3%, BMI ≥ 25 Kg/m² at 59.1%, and alcohol consumption at 52.5%. The prevalence of Orthostatic Hypotension in this municipality was 6.8%, which was statistically significantly associated only with Diabetes Mellitus and alcoholism. Conclusions: More than half of the population is obese or overweight. Orthostatic Hypotension in this municipality should be a concern for local authorities.

Keywords: Blood Pressure, Orthostatic Hypotension, Risk Factors.

1 INTRODUCTION

An individual is considered to have orthostatic hypotension (OH) when there is a significant drop in blood pressure upon transitioning from a supine to an upright position. The reduction in Systolic Blood Pressure (SBP) and/or Diastolic Blood Pressure (DBP) is equal to or greater than 20 mmHg and 10 mmHg, respectively, occurring after 3 minutes of the change in position.

When an individual shifts to an upright position, various mechanisms come into play to restore blood flow or ensure adequate venous return, involving cardiac function, cerebral regulation, among others. Upon standing, there is an increased demand on the cardiac system, and to counteract the effects of gravity, blood flow must quickly move to the lower limbs. In individuals without any underlying medical conditions, the heart rate typically increases by 10 to 20 beats per minute (bpm), and DBP rises by 5 mmHg, while SBP experiences a slight change.

Muscular contractions assist venous return through one-way valves in individuals without this pathology, preventing blood reflux. The nervous system, particularly the Autonomic Nervous System, regulates positional changes by causing veins and arteries to constrict, increasing heart rate, and enhancing cardiac muscle contractility. When these mechanisms fail to function properly, OH can occur, characterized by inadequate venous return, resulting in decreased blood pressure and a risk of cerebral ischemia. Factors such as medications, non-neurogenic causes (such as inadequate venous return, heart failure, and hypovolemia), and neurogenic causes (multisystem atrophy and diabetic neuropathy) may be associated with the onset of OH (1). OH can manifest as acute or chronic, symptomatic or asymptomatic. OH symptoms are attributed to cerebral hypoperfusion and excessive sympathetic activity. The study of OH is crucial for evaluating individuals' health because it ranks as the second leading cause of syncope, accounting for 15% of cases. Research indicates a correlation between OH prevalence and an increased risk of all-cause mortality, coronary incidents, and cardiac issues (1, 2).

In Portugal, the prevalence of OH ranges from 4.8% to 5.5% (3). This condition cannot and should not be disregarded, as its prevention holds significant relevance in the initiation and progression of cerebrocardiovascular diseases.

The primary objective of this study was to determine the prevalence of OH in the adult population of Vila Velha de Ródão Municipality, Portugal, and its association with the cerebrocardiovascular risk factors under investigation.

2 OBJECTIVE

The main objective of this study was to assess the prevalence of Orthostatic Hypotension in the Municipality of Vila Velha de Ródão and establish its relationship with cerebrocardiovascular risk factors.

3 MATERIALS AND METHODS

3.1 STUDY TYPE

This was a prospective, observational, and quantitative study, with random cluster sampling of 795 individuals aged 18 years or older, who were mandatory residents in the studied municipality.

3.2 INCLUSION CRITERIA

Inclusion criteria defined individuals aged 18 years or older and residents of the municipality of Vila Velha de Ródão.

3.3 STUDY PROTOCOL

Individuals from selected streets were approached at their homes and invited to participate in the study voluntarily. They were provided with a thorough explanation of the study procedures, risks, and benefits, and were informed that they could withdraw from the study at any time without consequences. If they agreed to participate, participants were required to sign an informed consent form and complete a brief questionnaire to assess existing risk factors. The questionnaire included questions to evaluate risk factors.

Modifiable risk factors considered in the study were obesity, the presence of cardiac pathology, hypercholesterolemia, diabetes mellitus, smoking, alcoholism, physical activity/sedentary lifestyle, and obesity, which were our qualitative variables. Non-modifiable factors included heredity, gender, and age, which were our quantitative variables. Anthropometric data collection, including weight and height, was then initiated.

For weight measurement, subjects were asked to remove their shoes and step onto a properly calibrated scale to record their weight. Height was measured with the individual in an upright position, leaning against a stadiometer, with arms hanging down, straight back, heels together, toes apart, head at a 90º angle to the ground, and eyes fixed on a point. The measurement result was recorded on a subject data sheet. Subsequently, the Body Mass Index (BMI) was calculated, and subjects were grouped into classes according to the WHO classification (4), as shown in Table 1.

Table 1 - Categorization of Body Mass Index

Body mass index - (Kg/ m²)	Reference
≤ 18,5	Low weight
18,5- 24,9	Normal weight
25 - 29,9	Overweight
30 - 34,9	Class I Obesity
35 - 39,9	Class II Obesity
40 or more	Class III Obesity

Source: Adapted from the World Health Organization (5)

Proceeding to evaluate blood pressure (BP) values with the individual sitting, at rest, and relaxed. After the BP measurement step, a final assessment was performed after 3 minutes in the orthostatic position to obtain OH. OH was considered when there was a reduction in SBP > 20mmHg or DBP > 10mmHg.

3.4 COLLECTED VARIABLES

As mentioned, the variables in this study were divided into qualitative and quantitative categories. The qualitative variables included sedentary lifestyle, gender, smoking, alcoholism, dyslipidemia, diabetes mellitus, hypercholesterolemia, cardiovascular diseases, and a family history of heart diseases. The quantitative variables included age, weight, height, BMI, systolic blood pressure, and diastolic blood pressure.

3.5 STATISTICAL ANALYSIS

In the descriptive analysis, results were expressed as maximum and minimum numbers, means, modes, and standard deviations. After verifying the normal distribution of the sample using the Kolmogorov-Smirnov test, the Pearson Chi-Square test was used at a significance level of 95% and $p \leq 0.05$. The statistical software SPSS (Statistical Package for the Social Sciences) was used for data processing.

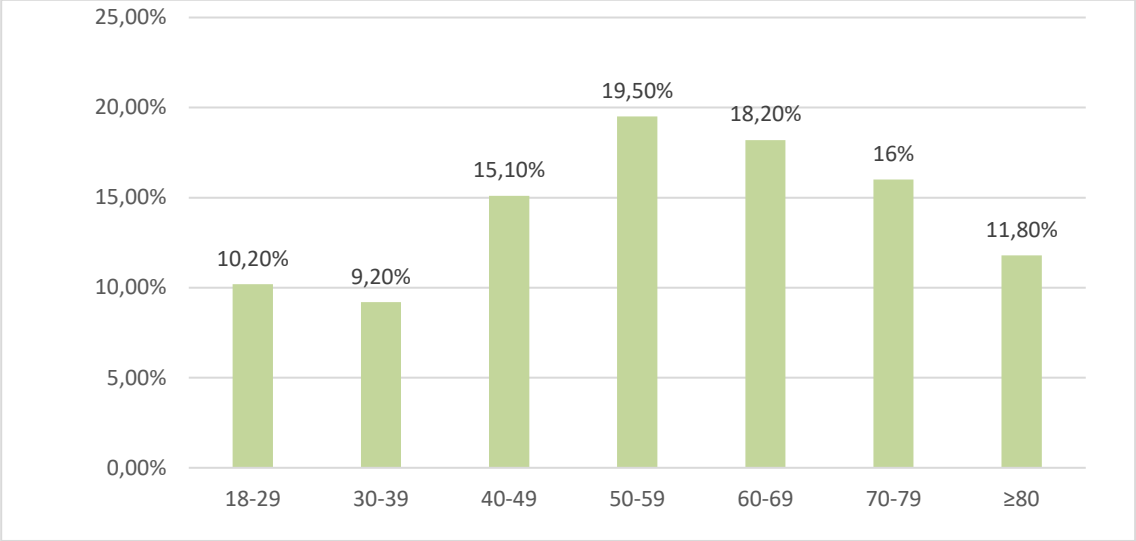
3.6 ETHICAL PRINCIPLES

For data collection related to the sample, the project was submitted and approved by the Ethics Committee, coded with the number 80/CE-ESALD/2018. The research team declares no conflicts of interest and has adhered to the Helsinki Declaration for research involving human subjects.

4 RESULTS

The sample consisted of 795 individuals, including 422 females (53.1%) and 373 males (46.9%), with an age range of 18 to 99 years and a mean age of 56.98 ± 18.521 years. Graph 1 describes the age distribution of the participants, with the most prevalent age group being between 50 and 59 years, accounting for 19.5%.

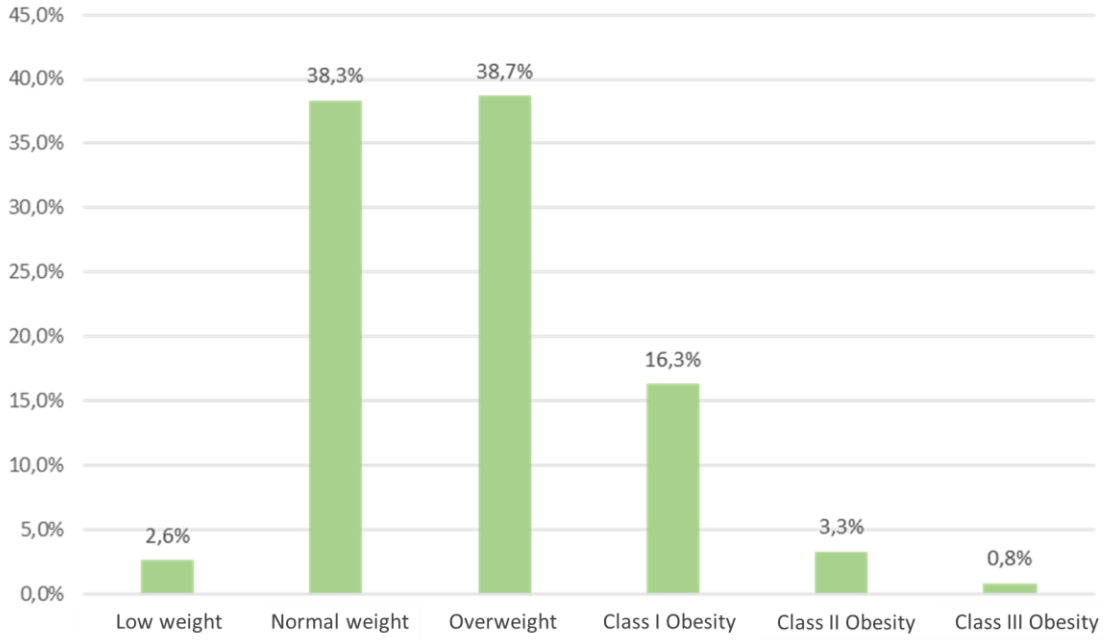
Graph 1 - Age Distribution by Age Group



Legend: %- percentagem

In the analysis of BMI (Body Mass Index), it was found that the minimum value observed was 15.6 kg/m², and the maximum was 46.3 kg/m², with an average of 26.4 kg/m² ± 4.7 kg/m². As shown in Figure 2, the majority of the individuals studied were found to be overweight (38.7%) and obese (20.4%), while 40.9% had a BMI within the normal range, with 38.3% classified as having a normal weight, and 2.6% falling into the underweight category.

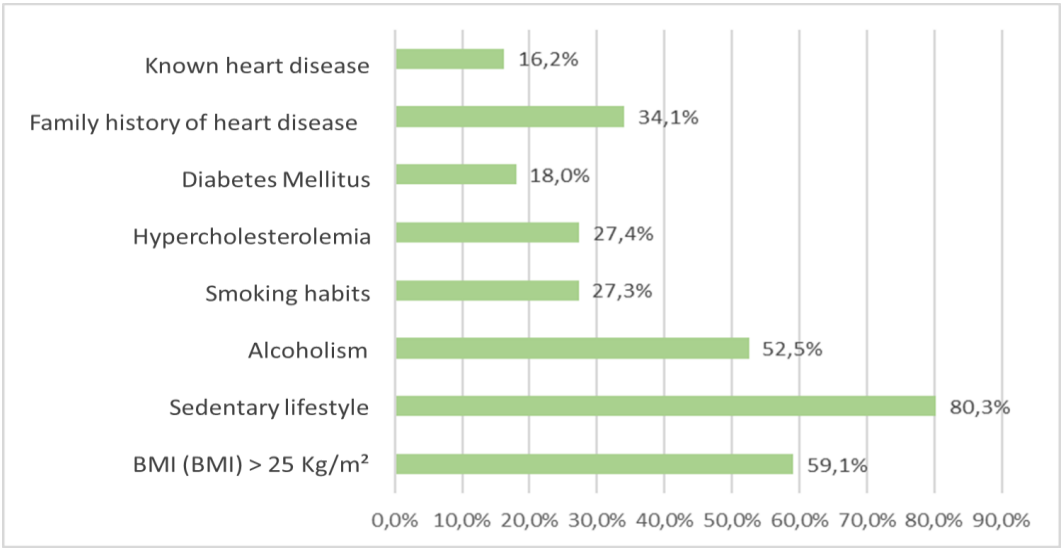
Graph 2 - Distribution of Body Mass Index by classes - Legend: %- percentage



In the analysis of Figure 3, the risk factors for cerebrocardiovascular diseases (CCVD) are described. It can be observed that the three most prevalent risk factors are a sedentary lifestyle (80.3%),

BMI ≥ 25 Kg/m² (59.1%), and alcohol consumption (52.5%). The percentage of alcoholism corresponds to individuals who reported consuming alcohol during meals, outside of meals, both during and outside of meals, occasionally,and every day

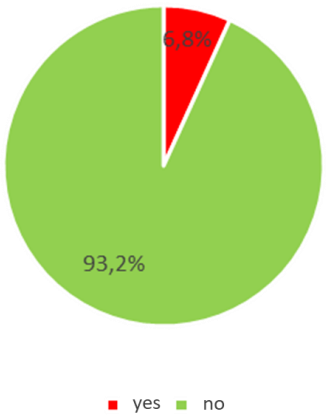
Chart 3 - Risk Factors for Cerebrocardiovascular Disease



Legend: BMI - Body Mass Index; HTN - Arterial Hypertension

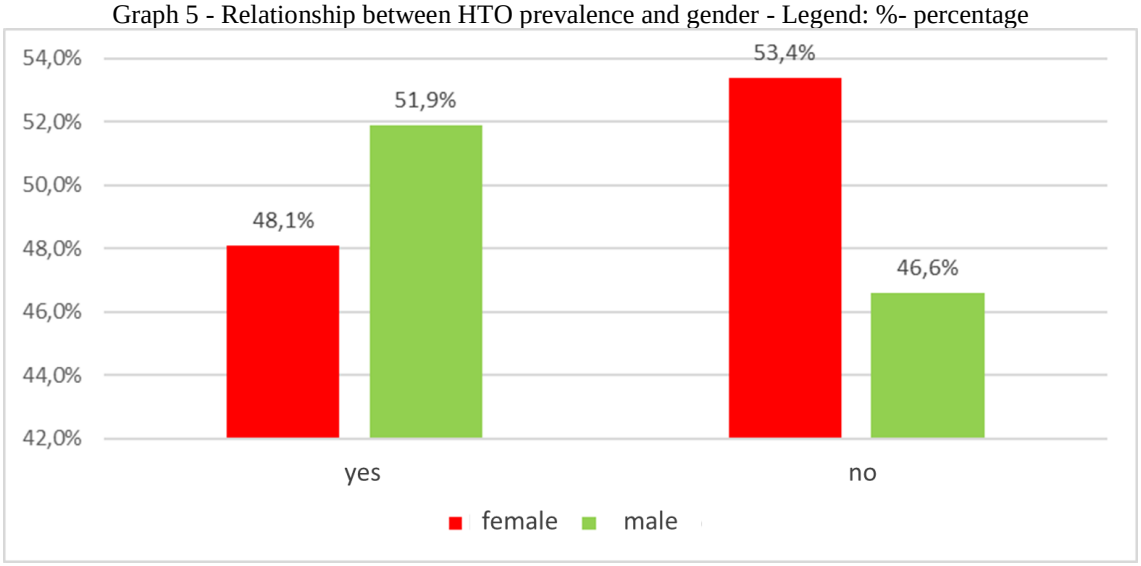
In VVR, a prevalence of OH of 6.8% was observed, as seen in Figure 4.

Chart 4 - Prevalence of High Blood Pressure in the Municipality under Study Legend: %- percentage



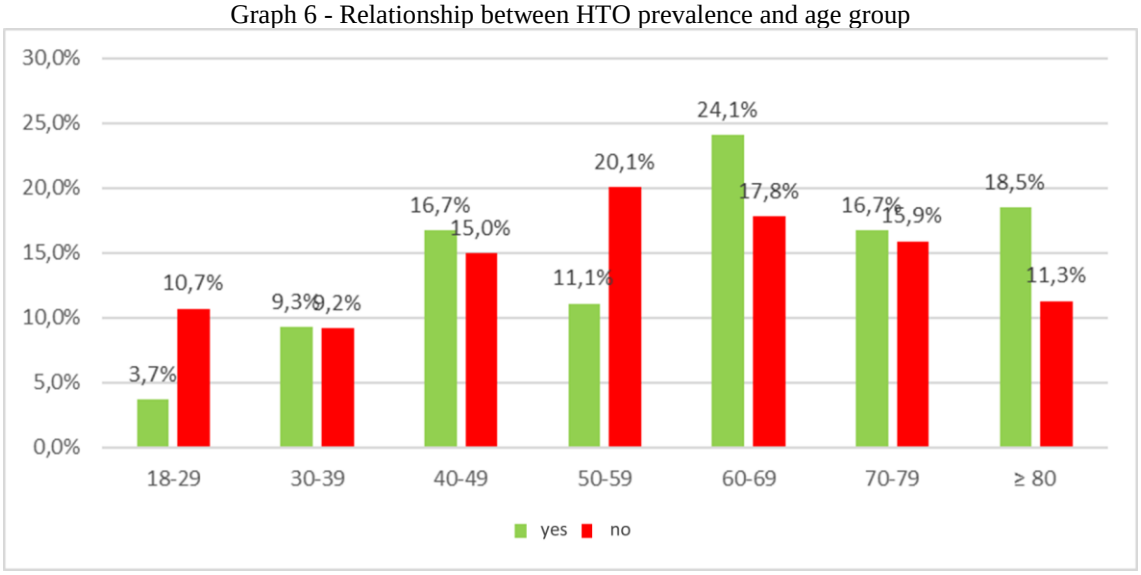
In the intersection of gender with OH, it was observed that the male gender had a higher prevalence at 51.9%, as shown in Figure 5.

Graph 5 - Relationship between HTO prevalence and gender - Legend: %- percentage



When studying the distribution of individuals with OH by age groups, it was observed that it was more prevalent among those aged 60 to 69 years (24.1%), as shown in Figure 6, followed by the 80-year-old age group.

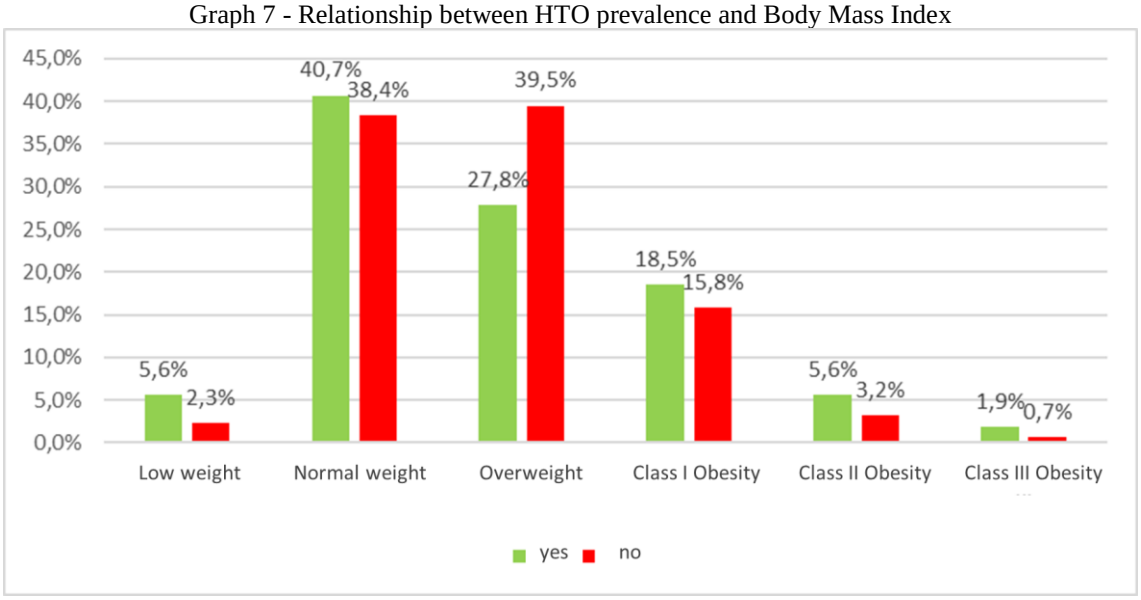
Graph 6 - Relationship between HTO prevalence and age group



Legend: %- percentage

In the study of BMI in the VVR population, it can be observed that Orthostatic Hypotension was more prevalent in individuals with normal weight (40.7%) compared to the overweight or obese groups, as shown in Figure 7.

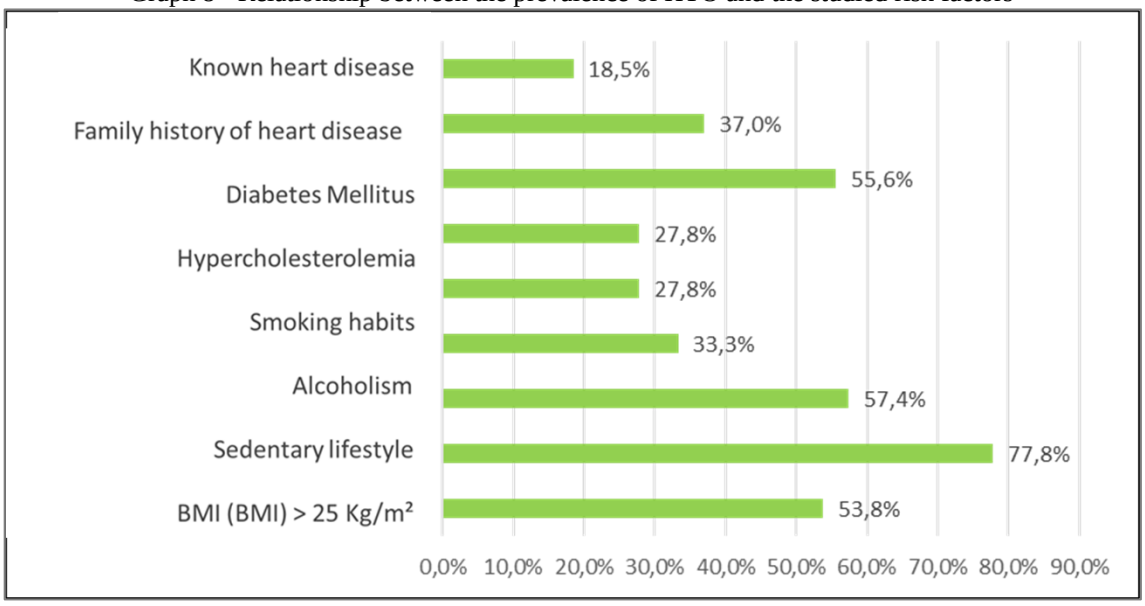
Graph 7 - Relationship between HTO prevalence and Body Mass Index



Legend: %- percentage

In Figure 8, it is demonstrated that sedentary lifestyle (77.8%), alcoholism (57.4%), the presence of known hypertension (HTA), and BMI > 25Kg/m2 are the risk factors that have the most cases of Orthostatic Hypotension (OH).

Graph 8 - Relationship between the prevalence of HTO and the studied risk factors



A Pearson Chi-Square test was used to relate the various studied risk factors to orthostatic hypotension, as demonstrated in Table 3. A statistically significant relationship was found with the presence of known hypertension (HTA), diabetes mellitus (DM), and alcoholism.

Table 3 - Significance Level Between Risk Factors and HTO

Risk factors	Significance Level
Sex	0,452
Age group	0,248
BMI	0,315
Presence of known heart disease	0,587
Family histoery of heart disease	0,636
Presence of Known hypertension (HTA)	**0,007**
Diabetes Mellitus (DM)	**0,052**
Hipercholesterolemia	0,952
Smoking	0,470
Alcoholism	**0,037**
Sedentary lifestyle	0,599

Legend: DM - Diabetes Mellitus; BMI - Body Mass Index

5 DISCUSSION

Cerebrocardiovascular diseases (CCVD) have constituted a severe and concerning public health issue in recent years, being the main causes of high mortality and disability rates worldwide. The World Health Organization predicts that by 2030, approximately 23.6 million people will die from CCVD (66). In Portugal, in the year 2020, the National Institute of Statistics (INE) revealed that the mortality rate due to strokes accounted for 9.2% of the population (equivalent to 11,439 individuals), a number that increased compared to 2019. Pathologies such as heart attacks (28%) also caused 34,593 deaths in the Portuguese population (6).

The PPABB is a public health program in Portugal aimed at understanding the prevalence of Orthostatic Hypotension (OH) in the adult population of the Beira Baixa region and providing the community with means for its prevention and awareness. The studied municipality is part of the PPABB and was conducted in the municipality of Vila Velha de Ródão, where 795 subjects participated, with females predominating at 53.1% compared to males (46.9%). These results were similar to another study conducted by the PPABB in the municipality of Fundão, with 55.3% of females and 44.7% of males (7). Of the municipalities studied by the program, so far, only the municipality of Proença-a-Nova had a higher percentage of males prevailing, with 61.4% compared to 59.7% females (8).

In the population of VVR, ages were grouped into age classes, with a minimum age of 18 years and a maximum of 99 years, with an average of 56.98 ± 18.521 years. Nearly half of the population of Vila Velha de Ródão (46%) in the study were aged 60 years or older. The age group that predominated in this municipality was between 50 and 59 years, accounting for 19.5%, followed by 18.2% between the ages of 60 and 69. In Fundão, the prevailing age group was 60 to 69 years, accounting for 21.6% (7). This prevalence of ages could be due to the fact that in VVR, there are more workers in both factories and residential areas.

In 2015, INSA stated that risk factors such as hypertension (HTA) significantly predispose individuals to the development of cardiovascular and cerebrovascular diseases (9). Risk factors such as age,

gender, obesity, smoking, diabetes mellitus (DM), family history of heart disease, hypercholesterolemia, alcoholism, smoking, and sedentary lifestyle are gateways to the development of HTA. In the analysis of the results in the municipality of Vila Velha de Ródão, it was found that the three most prevalent risk factors were a sedentary lifestyle at 80.3%, followed by BMI ≥ 25 Kg/m² at 58.9%, and alcoholism at 52.5%, while the least prevalent were the presence of known heart pathology (16.2%) and DM (18%). In another study conducted in the municipality of Castelo Branco, the most predominant risk factors were a sedentary lifestyle (57.7%), a family history of HTA (50.7%), and a family history of heart disease (42.4%), while the least prevalent were the presence of heart disease at 13.5% and DM at 24.9% (10).

OH occurs when blood pressure (BP) drops drastically when a person goes from a seated or lying position to a standing position. When we are lying down, blood flow is evenly distributed throughout the circulatory system. When we change to the orthostatic position, due to the force of gravity, blood flow shifts to the lower limbs, initiating a mechanism of vasoconstriction and a slight increase in heart rate to provide adequate blood supply to the upper part of the body and counteract gravity. The prevalence of OH is around 6% in the Portuguese population and is directly proportional to age, with a prevalence of up to 20% in those aged over 65. In VVR, a prevalence of 6.8% of individuals with OH was obtained, which was in line with expectations based on research. In the analysis of OH by age groups, it was, as expected, more prevalent in older age groups: 24.1% in those aged 60 to 69, 16.7% in those aged 70 to 79, and 18.5% in those aged 80 or older. Regarding the presence of OH and BMI, in this population of Vila Velha de Ródão, it was found that individuals with BMI ≥25 kg/m² had a rate of 53.8%. As for the other risk factors, a sedentary lifestyle (77.8%) and alcoholism (57.4%) were the most prevalent.

As limitations of this study, it was observed that two paraplegic individuals were found, and more support should be provided to assist them in measuring anthropometric data.

6 CONCLUSION

It is important to work on and find solutions to the lack of access to adequate healthcare services in this region of the country in order to combat the high prevalence of these risk factors.

A significant portion of the population in Vila Velha de Ródão is overweight or obese, which is a concern that should prompt local health authorities to promote healthy eating and physical activity.

A prevalence of Orthostatic Hypotension was observed that aligns with the national average, affecting the older population. It is proposed that the assessment of this risk indicator be included in the routine of family medicine consultations.

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