

Hypertension in Older Adults: Associations With Female Sex, Insufficient Physical Activity, Abdominal Obesity, Diabetes Mellitus, And Falls – A Cross-Sectional Study

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Abstract

Background: Systemic Arterial Hypertension (SAH) is a major public health issue, particularly among older adults, due to its high prevalence and impact on morbidity and mortality.

Objective: To investigate factors associated with SAH in older adults from a small municipality in northeastern Brazil.

Methods: A population-based cross-sectional epidemiological study was conducted among 232 community-dwelling older adults. Independent variables included socioeconomic, behavioral, and health-related factors, with SAH as the outcome. Prevalence ratios (PR) and 95% confidence intervals (CI) were calculated using Poisson regression with a robust estimator. Crude models were followed by a hierarchical multiple explanatory model (Level 1: socioeconomic variables; Level 2: behavioral aspects; Level 3: health conditions). Associations were considered statistically significant at the 5% level ($p < 0.05$).

Results: The prevalence of SAH was 59.1% (men: 50.0%; women: 65.4%). An increased likelihood of SAH was associated with female sex (PR: 1.33; 95% CI: 1.05–1.68), insufficient physical activity (PR: 1.24; 95% CI: 1.01–1.54), abdominal obesity (PR: 1.40; 95% CI: 1.09–1.79), diabetes mellitus (PR: 1.30; 95% CI: 1.03–1.64), and falls (PR: 1.37; 95% CI: 1.07–1.74).

Conclusion: A high prevalence of SAH was identified, particularly among women and those with insufficient physical activity, abdominal obesity, diabetes mellitus, and a history of falls.

Keywords: Aging; Epidemiology; Arterial Pressure; Public Health.

Introduction

Systemic Arterial Hypertension (SAH) is a chronic disease characterized by persistently elevated blood pressure.¹ It is highly prevalent in adults, with its occurrence increasing significantly with age.² In Brazil, for example, the self-reported prevalence of SAH reaches 50.10% among

individuals aged 55–64 years and 65.10% among those aged 60 years and older.³

This epidemiological scenario represents a major public health concern, as SAH is a leading risk factor for cardiovascular and cerebrovascular diseases, as well as chronic kidney disease. It is implicated in approximately 40% of stroke-related deaths and 25% of deaths due to coronary artery disease. Furthermore, together with diabetes mellitus, it accounts for 62.10% of primary diagnoses among individuals undergoing dialysis.¹

Given that SAH is a multifactorial disease, it is hypothesized that socioeconomic, behavioral, and health-related factors may increase the likelihood of its occurrence. However, research in smaller urban centers in Brazil – particularly those with rural characteristics and

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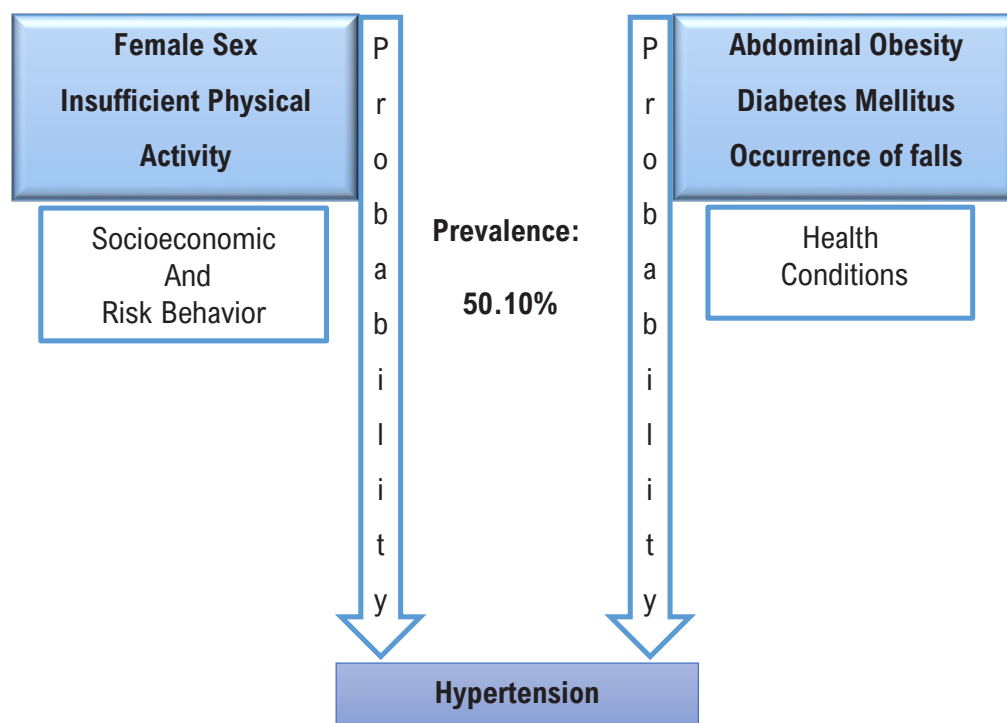
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Central Illustration: Hypertension in Older Adults: Associations With Female Sex, Insufficient Physical Activity, Abdominal Obesity, Diabetes Mellitus, And Falls – A Cross-Sectional Study

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Factors associated with hypertension in older adults.

populations of fewer than 5,000 inhabitants – remains limited.⁴ This gap underscores the need for studies investigating the epidemiological profile of SAH among older adults living in these underserved areas.

Brazil's continental dimensions and pronounced social inequalities underscore the importance of epidemiological investigations that account for regional disparities. The less developed North and Northeast regions, given their distinct socioeconomic profiles, present unique challenges and specific needs for public health interventions.⁵

These regions often demonstrate more limited access to health services compared with the more developed Southeast, even after adjusting for variables such as age, sex, chronic diseases, education, and socioeconomic status.⁵ Moreover, the prevalence of unhealthy lifestyles is higher among residents of these less developed regions, particularly among older adults. For instance, by age 40, the loss of healthy years is 2.8 in the Southeast, compared with 5.3 in the Northeast.⁶

Therefore, conducting population health surveys in such localities is essential to investigate the occurrence of SAH, particularly among older adults. Such evidence can support the work of primary healthcare professionals and managers

in identifying older individuals at higher risk of SAH. This information may facilitate the planning and implementation of surveillance, health promotion, and disease management strategies, ultimately strengthening the right to comprehensive healthcare. Accordingly, this study aimed to investigate factors associated with SAH in older adults from a small municipality in northeastern Brazil.

Material and methods

Study Design, Location, and Population

This cross-sectional epidemiological study used baseline data from the population-based research project “*Health conditions and lifestyle of older adults residing in a small municipality*,”⁷ conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.⁸ The study was based on a census of older adults living in the urban area of Aiquara, Bahia, Brazil, who were registered with the Family Health Strategy. Aiquara is located in the south-central region of Bahia, has a population of 4,447, ranks 410th among the state's 417 municipalities, and has a Human Development Index of 0.583.⁷

Ethical Aspects

The research was conducted in accordance with the Declaration of Helsinki of the World Medical Association (1975, revised in 2013) and complied with Resolution No. 466/2012 of the Brazilian National Health Council. Approval was obtained from the Research Ethics Committee of the State University of Southwest Bahia (Opinion No. 171,464; Certificate of Presentation for Ethical Consideration No. 10786212.30000.0055). All participants provided informed consent after receiving an explanation of the study objectives, procedures, and voluntary nature.

Eligibility Criteria

To participate in this study, individuals had to meet the following inclusion criteria: age ≥ 60 years; not institutionalized; and residing in a fixed urban residence for at least four days per week. However, older adults with cognitive impairment, as assessed using the reduced and validated version of the Mini-Mental State Examination (MMSE)^{9,10} with a cutoff score < 13 , 10 neurological diseases, hearing problems that compromised comprehension of the questions, or who were bedridden were excluded.²

Data Collection

The study procedures were carried out in two stages: (1) interviews conducted at participants' homes to collect socioeconomic, behavioral, and health-related information; and (2) anthropometric measurements performed two to three days later in a facility provided by the Health Secretariat of Aiquara, Bahia, Brazil. A detailed description of the procedures and standardization is available in Santos et al.¹¹

Independent Variables

- **Socioeconomic factors:** Sex (male or female); age group (60–69, 70–79, ≥ 80 years); skin color (white or non-white); education (with or without formal education, where “without formal education” was defined as never having attended school and/or being unable to write one's own name); marital status (with or without a partner); and income (≤ 1 minimum wage or > 1 minimum wage).^{4,12}
- **Behavioral factors:** Physical activity level was assessed using the first four domains of the long version of the International Physical Activity Questionnaire (IPAQ),¹³ validated for the Brazilian older adult population.^{14,15} Older adults reporting fewer than 150 minutes per week of moderate-to-vigorous Physical Activity (PA) were classified as insufficiently active.¹⁶ Sedentary Behavior (SB) was quantified using the fifth domain of the IPAQ,¹³ considering time spent sitting on typical weekdays and weekend days. The weighted average of SB was calculated as follows: $(5 \times \text{minutes/weekday} + 2 \times \text{minutes/weekend day}) \div 7$. The cutoff for high SB was based on the 75th percentile of the weighted average (342.85 minutes/day).^{17,18} Behavioral factors also included tobacco use (yes or no); alcohol consumption in the 30 days preceding data collection (yes or no); consumption of fruits, vegetables, or legumes (at least

twice per day: yes or no); consumption of eggs, beans, lentils, or soy (at least once per week: yes or no); and consumption of meat, chicken, or fish (at least three times per week: yes or no).¹²

- **Health conditions:** Self-reported diagnosis of diabetes mellitus (yes or no); hypercholesterolemia (yes or no); self-perceived health (positive or negative); occurrence of falls in the 12 months preceding data collection (yes or no);¹² suspicion of common mental disorders, assessed using the Self-Reporting Questionnaire (SRQ-20) with a cutoff of ≥ 7 positive responses;¹⁹ and abdominal obesity, determined by elevated waist circumference (women: ≥ 88 cm; men: ≥ 102 cm).²⁰

Dependent Variables

The outcome was assessed using self-reported information from older adults. Participants were asked: “Has a physician ever told you that you have high blood pressure, that is, hypertension?” In addition, current use of physician-prescribed antihypertensive medication was verified. For the analyses, individuals were classified as having hypertension if they reported a medical diagnosis and/or use of antihypertensive drugs; otherwise, they were classified as not having hypertension.¹¹

This operational definition is consistent with approaches adopted in large-scale epidemiological surveys, such as the Brazilian Vigitel (Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey)³ and the National Health Survey (PNS),²¹ which monitor chronic diseases based on self-reported medical diagnosis and medication use.^{3,21}

Data Analysis

Population characteristics were described using absolute and relative frequencies. For descriptive analyses, means and standard deviations were calculated.²² For inferential analyses, crude models were initially constructed using Poisson regression with robust variance to estimate Prevalence Ratios (PRs) and their respective 95% Confidence Intervals (CIs).²³ In the crude analyses, independent variables with $p \leq 0.20$ were considered for inclusion in the multivariate hierarchical model, in which socioeconomic factors represented the most distal level (Level 1), behavioral factors the intermediate level (Level 2), and health conditions the most proximal level (Level 3) (Figure 1).

Model construction began with variables from the most distal level, with subsequent levels added progressively. Intra- and inter-level adjustments were performed to ensure that the effect of each independent variable on the outcome was controlled for by variables at the same level and by those from preceding levels, in accordance with the hierarchical structure. Only variables that maintained $p \leq 0.20$, as evaluated using the Wald test, were retained in the final model.^{4,12} Factors associated with SAH were identified as those with a significance level of 5% ($p < 0.05$). Data analyses were conducted using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 21.0; IBM Corp., Armonk, NY).

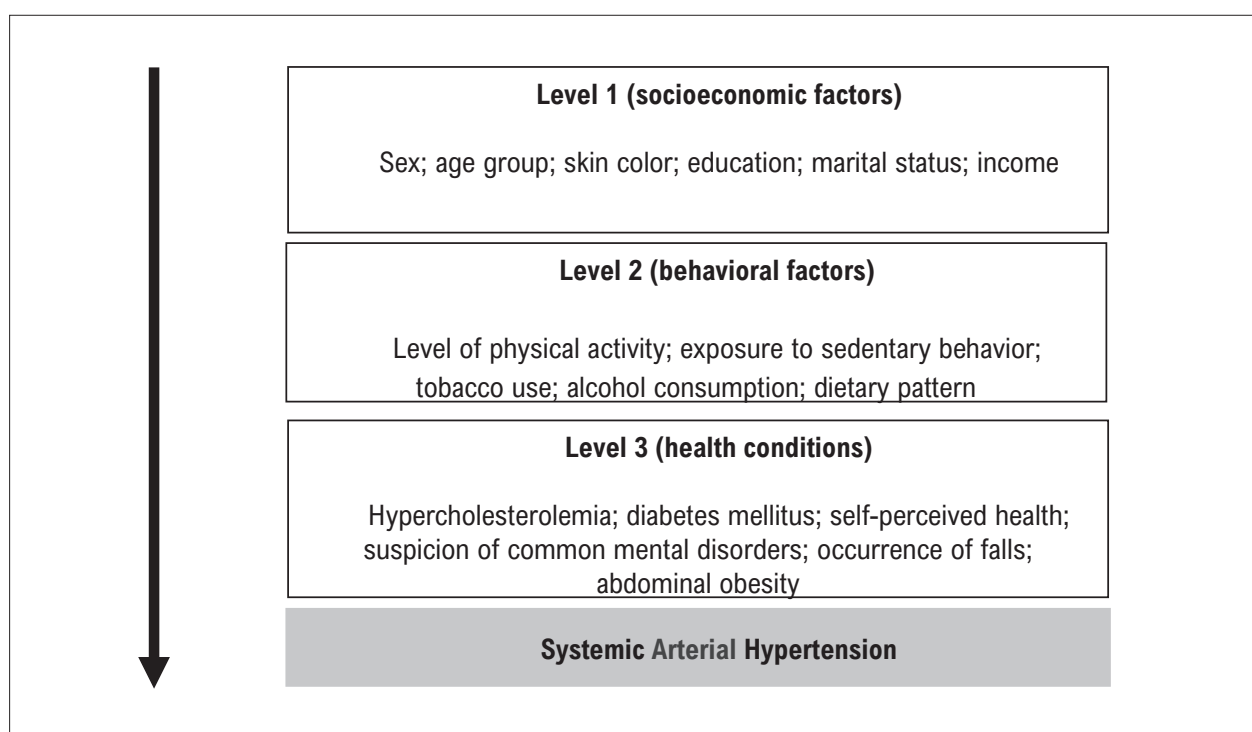


Figure 1 – Hierarchical model used to identify factors associated with systemic arterial hypertension in older adults.

Results

A census identified all older adults in the urban area of Aiquara, Bahia, Brazil, with the support of community health workers from the Family Health Strategy, thereby covering the entire municipality.⁷ All households were visited, and 263 older adults were identified.²⁴ Of these, 232 (58.60% women) were included in the study, as shown in Figure 2.

The mean age was 72.08 ± 8.06 years for men and 71.26 ± 7.02 years for women. The prevalence of SAH was 59.10% (95% CI: 53%–65%) in the overall population, with 50% among men and 65.40% among women. Additionally, 83.60% of participants reported non-white skin color, 61.10% had no formal education, 86.60% earned an income less than or equal to one minimum wage, 53.90% were insufficiently active, and 45.20% had abdominal obesity. Further details on the population are presented in Table 1.

Table 2 presents the bivariate analyses between independent variables and SAH. Variables such as sex, age group, skin color, marital status, alcohol consumption, tobacco use, physical activity level, abdominal obesity, diabetes mellitus, hypercholesterolemia, occurrence of falls, and self-perceived health met the criteria for inclusion in the hierarchical multivariate analysis.

In the multivariate analysis, intra- and inter-level adjustments were performed according to the hierarchical conceptual framework. Level 1 variables (socioeconomic) were adjusted within their level; Level 2 variables (behavioral) were adjusted for socioeconomic and behavioral variables; and Level 3 variables (health conditions) were adjusted for variables from Levels 1 and 2, as well as within their own level.

Marital status, alcohol consumption, tobacco use, self-perceived health, and hypercholesterolemia did not maintain $p \leq 0.20$ after adjustment and were therefore excluded from the final model. Female sex, insufficient physical activity, abdominal obesity, diabetes mellitus, and occurrence of falls were independently associated with SAH (Table 3 and Central Illustration).

Discussion

This study aimed to investigate factors associated with SAH in older adults from a small municipality in northeastern Brazil. The main findings indicated a high prevalence of SAH. Additionally, female sex, insufficient physical activity, abdominal obesity, diabetes mellitus, and the occurrence of falls were independently associated with SAH in this population.

Data from the São Paulo City Health Survey (ISA Capital), conducted with 3,184 adults and older adults, revealed a higher prevalence of SAH among women (26.5%; 95% CI: 24.2%–28.9%) than among men (19.5%; 95% CI: 17.3%–21.8%). In the ISA Capital study, SAH prevalence was also notably higher among individuals aged 60 years and older (54.9%; 95% CI: 51.0%–58.6%),²⁵ a finding similar to that observed in Aiquara, Bahia, Brazil (59.1%).

These results highlight the impact of aging on the cardiovascular system, which undergoes structural and functional changes that compromise its integrity. Aging leads to arterial stiffening, increasing resistance to blood flow and elevating blood pressure. At the same time, microcirculatory efficiency declines, affecting vital organs such as the heart,

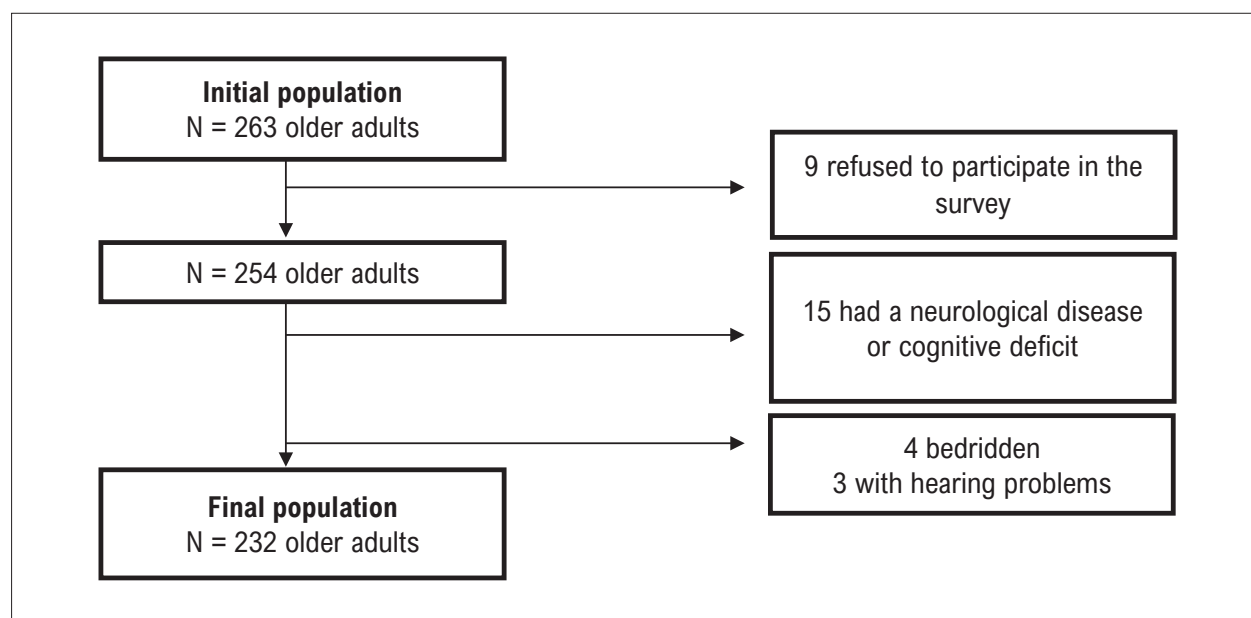


Figure 2 – Flowchart describing the eligibility process for the older adults participating in the study.

brain, and kidneys. This sequence substantially increases the risk of SAH, underscoring the need for targeted preventive and therapeutic interventions for older adults to mitigate hypertension-related effects and preserve organ function.²⁶

Globally, hypertension prevalence is similar between sexes, although men have a higher risk up to age 50.²⁵ After this age, the pattern reverses, possibly because women are generally more attentive to their health and seek medical care more frequently, which may result in higher diagnostic rates. Furthermore, hormonal changes during and after menopause — including reduced estrogen and progesterone production — may lower basal metabolic rate and increase caloric intake, contributing to weight gain.^{27,28} These changes are associated with an increased risk of obesity and, consequently, a higher prevalence of cardiovascular diseases.²⁹

In this study, abdominal obesity and diabetes mellitus were associated with hypertension. Both conditions involve oxidative stress and low-grade chronic inflammation, characterized by the release of TNF- α , IL-6, and leptin, which impair endothelial function and reduce nitric oxide bioavailability. This endothelial dysfunction contributes to increased vascular resistance, arterial stiffness, and hypertension. Additionally, insulin resistance increases sympathetic activity and renal sodium reabsorption, thereby elevating intravascular volume and blood pressure.³⁰

These findings suggest a concerning scenario, indicating a potentially high burden of chronic diseases among older adults in Aiquara, often linked to metabolic syndrome. Metabolic syndrome — which includes insulin resistance, hypertension, central obesity, and dyslipidemia — is associated with increased mortality risk. The interaction of these factors promotes a pro-inflammatory and pro-thrombotic state, contributing to cardiovascular diseases and other comorbidities.³¹ Therefore,

addressing these conditions in the older population requires an integrated clinical management approach, targeting both blood pressure control and broader interventions addressing components of metabolic syndrome to reduce overall morbidity and mortality.^{4,12}

Maintaining a healthy and balanced diet is essential for controlling body fat and promoting adequate nutritional status. Reducing saturated fat intake from sources such as red meat, high-fat dairy products, butter, sweets, and sugary foods, while limiting salt and alcohol consumption and increasing the intake of vegetables, fresh fruits, and fish, may help reduce obesity, improve blood pressure levels, and lower the occurrence of comorbidities such as diabetes mellitus, cardiovascular diseases, and neoplasms. Weight loss among overweight or obese individuals with hypertension is associated with improved blood pressure control, enhanced effectiveness of antihypertensive drugs, and a reduction in other cardiovascular risk factors.³²

This research identified an association between insufficient physical activity (PA) and hypertension. PA is a well-established protective factor against chronic non-communicable diseases, including obesity, hypertension, and diabetes mellitus. In addition to serving as a non-pharmacological therapy, regular PA has positive effects on mental health by helping to prevent depressive symptoms, anxiety, and cognitive decline, while promoting overall well-being. PA also provides cardiovascular benefits, such as inducing sinus bradycardia, lowering blood pressure, improving oxygen consumption, reducing blood viscosity, and decreasing platelet activity. Furthermore, it promotes collateral circulation and reduces vascular resistance through vasodilation.^{16,33}

Regular PA also exerts a modulatory effect on the autonomic nervous system, increasing parasympathetic tone and reducing sympathetic activity, which contributes to lower resting blood pressure.³⁴ Moreover, muscle contraction stimulates the

Table 1 – Descriptive analysis of the socioeconomic, behavioral, and health-related characteristics of the study population

Variables	N	%
Sex		
Male	96	41.40
Female	136	58.60
Age group		
60-69 years	98	42.20
70-79 years	93	40.10
≥ 80 years	41	17.70
Skin color		
White	37	16.40
Non-white	188	83.60
Education		
Yes	88	38.90
No	138	61.10
Marital status		
With a partner	127	54.70
Without a partner	105	45.30
Income		
> 1 minimum wage	29	13.40
≤ 1 minimum wage	188	86.60
Alcohol consumption		
No	183	78.90
Yes	49	21.10
Tobacco use		
No	209	90.10
Yes	23	9.90
C. of eggs, beans, lentils or soy		
Yes	219	94.40
No	13	5.60
C. of meat, chicken or fish		
Yes	226	98.30
No	04	1.70
C. of fruits and/or vegetables		
Yes	170	73.30
No	62	26.70
Level of physical activity		
Sufficient	107	46.10
Insufficient	125	53.90

Sedentary behavior

Low	174	75.00
High	58	25.00

Abdominal obesity

No	115	54.80
Yes	95	45.20

Hypertension

No	95	40.90
Yes	137	59.10

Diabetes mellitus

No	194	83.60
Yes	38	16.40

Hypercholesterolemia

No	152	65.50
Yes	80	34.50

Occurrence of falls

No	193	85.40
Yes	33	14.60

Suspicion of CMD

No	155	66.80
Yes	77	33.20

Self-perceived health

Positive	118	51.80
Negative	110	48.20

C: consumption. CMD: common mental disorders. %: percentage.
N: absolute frequency

release of myokines with anti-inflammatory properties, thereby reducing the meta-inflammatory state observed in individuals with obesity and diabetes mellitus.³⁵

These factors reinforce the importance of increasing PA as part of hypertension management. Accordingly, the World Health Organization (WHO)¹⁶ and the Brazilian Ministry of Health's Physical Activity Guidelines for the Brazilian Population (PAGBP)³³ recommend that older adults engage in regular PA. The guidelines recommend 150 to 300 minutes per week of moderate-intensity aerobic activity or 75 to 150 minutes per week of vigorous-intensity activity. WHO and PAGBP advise older adults to perform multicomponent activities focusing on strength and balance on two to three days per week to reduce fall risk. Activities may be divided into shorter time blocks and gradually increased to achieve greater health benefits.^{16,33}

Globally, approximately 646,000 people die from falls each year, primarily among older adults aged 65 years and over. Around 37 million falls annually require medical attention.³⁶

Table 2 – Prevalence of systemic arterial hypertension according to independent variables in the study population

Variables	Systemic Arterial Hypertension		
	Prevalence (%)	Crude PR (95% CI)	p-value
Sex			0.024[#]
Male	50.00	1	
Female	65.40	1.31 (1.03-1.65)	
Age group			0.200[#]
60-69 years	53.10	1	
70-79 years	65.60	1.23 (0.72-1.56)	
≥ 80 years	58.50	1.10 (0.80-1.51)	
Skin color			0.200[#]
White	48.60	1	
Non-white	61.20	1.25 (0.88-1.78)	
Education			0.304
Yes	54.50	1	
No	61.60	1.13 (0.89-1.42)	
Marital status			0.178[#]
With a partner	55.10	1	
Without a partner	63.80	1.16 (0.93-1.43)	
Income			0.400
> 1 minimum wage	51.70	1	
≤ 1 minimum wage	60.60	1.17 (0.81-1.69)	
Alcohol consumption			0.140[#]
No	61.70	1	
Yes	49.00	0.79 (0.58-1.08)	
Tobacco use			0.170[#]
No	60.80	1	
Yes	43.50	0.71 (0.44-1.15)	
C. of eggs, beans, lentils or soy			0.395
Yes	59.80	1	
No	46.20	0.77 (0.42-1.40)	
C. of meat, chicken or fish			0.395
Yes	58.40	1	
No	75.00	1.28 (0.72-2.28)	
C. of fruits and/or vegetables			0.378
Yes	58.20	1	
No	61.30	1.10 (0.88-1.40)	
Level of physical activity			0.041[#]
Sufficient	51.30	1	
Insufficient	66.30	1.25 (1.01-1.54)	
Sedentary behavior			0.580
Low	58.00	1	
High	62.10	1.07 (0.84-1.35)	
Abdominal obesity			<0,001[#]
No	47.00	1	
Yes	72.60	1.54 (1.22-1.94)	
Diabetes mellitus			<0.001[#]
No	54.60	1	
Yes	81.60	1.50 (1.22-1.82)	
Hypercholesterolemia			0.023[#]
No	53.90	1	
Yes	68.80	1.27 (1.03-1.57)	
Occurrence of falls			0.004[#]
No	57.50	1	
Yes	78.80	1.37 (1.10-1.69)	
Suspicion of CMD			0.465
No	57.40	1	
Yes	62.30	1.08 (0.87-1.35)	
Self-perceived health			0.150[#]
Positive	54.20	1	

"C": consumption; "CMD": common mental disorders; "%": percentage; "PR": prevalence ratio estimated using Poisson regression with robust variance. CI: confidence interval. #Variables with $p \leq 0.20$ in crude analysis were considered for multivariate modeling. p-values were obtained using the Wald test.

The association between falls and hypertension in older adults suggests a complex interaction between chronic conditions and the risk of adverse events. Hypertension may contribute to negative outcomes, including an increased risk of falls, through various pathophysiological and pharmacological mechanisms.³⁷

Hypertension may lead to cardiovascular and cerebrovascular changes that affect physical stability. Blood pressure fluctuations can impair cerebral perfusion, resulting in dizziness or imbalance, particularly during abrupt changes. Hypertension frequently coexists with comorbidities such as peripheral neuropathy and reduced muscle function, which further increase fall risk. Antihypertensive medications may induce symptoms such as orthostatic hypotension, vertigo, and even sedation, depending on their pharmacological profile. Orthostatic hypotension is a common cause of falls during sudden postural changes, such as standing up.³⁸

In addition to physical and medication-related factors, psychosocial and environmental aspects also play an important role. Health-related concerns may lead individuals to reduce physical activity due to fear of complications. However, reduced activity can further impair physical capacity, thereby increasing fall risk. Falls represent a significant public health problem because of their association with increased mortality.^{37,38}

From a pathophysiological perspective, aging combined with hypertension is associated with reduced baroreflex sensitivity and progressive arterial stiffness. This may significantly impair the autoregulation of cerebral perfusion, particularly in older adults with arterial stenosis or pre-existing baroreflex dysfunction. Acute blood pressure fluctuations, which are common in patients using antihypertensive medications, may result in transient cerebral hypoperfusion, leading to symptoms such as dizziness, postural instability, and, ultimately, falls. This condition is further aggravated by the presence of peripheral neuropathies, prevalent among individuals with diabetes, or by sarcopenia, which is often associated with physical inactivity.³⁹

Hypertension management requires an integrated approach that combines pharmacological treatment with healthy dietary habits, regular PA, stress management, and smoking cessation. Adherence to these measures may improve disease prognosis and requires continuous engagement from both patients and healthcare professionals. Inadequately treated hypertension may progress to more severe forms, leading to complications that impair daily activities such as eating, dressing, and self-care. These limitations negatively affect quality of life, reducing autonomy and mobility, and increasing dependency.¹

These findings in primary care settings may assist healthcare professionals in developing and implementing effective preventive strategies for hypertension, particularly among older adults. Such strategies include promoting a healthy lifestyle, continuously monitoring blood pressure, and conducting educational interventions that emphasize the importance of physical activity and a balanced diet. Furthermore, it is essential to encourage and ensure the quality of screening programs for the early identification of hypertension and related conditions, such as diabetes

Table 3 – Hierarchical model of the association between independent variables and hypertension in the study population

Level	Variables	Adjusted PR (95% CI)	p-value
1	Sex		0.016
	Male	1	
	Female	1.33 (1.05-1.68)	
	Age group		0.111
	60-69 years	1	
	70-79 years	1.28 (0.96-1.62)	
	≥ 80 years	1.18 (0.86-1.62)	
2	Skin color		0.102
	White	1	
	Non-white	1.33 (0.94-1.68)	
	Level of physical activity		0.045
3	Sufficient	1	
	Insufficient	1.24 (1.01-1.54)	
	Abdominal obesity		<0.001
	No	1	
	Yes	1.40 (1.09-1.79)	
	Diabetes mellitus		0.025
	No	1	
	Yes	1.30 (1.03-1.64)	
	Occurrence of falls		0.011
	No	1	
	Yes	1.37 (1.07-1.74)	

"PR": prevalence ratio; "CI": confidence interval

mellitus and abdominal obesity, which represent significant risks for this population. Implementing these measures in Aiquara, Bahia, Brazil, as well as in other areas with similar demographic and socioeconomic characteristics, may improve the prognosis of older adults with hypertension, reduce morbidity and mortality associated with the condition, and enhance quality of life.

This study has some limitations that should be acknowledged. One important limitation relates to the definition of the dependent variable. Hypertension was not assessed through direct blood pressure measurements but was based on self-reported medical diagnosis and current use of physician-prescribed antihypertensive medication. Although this operational definition does not necessarily reflect objectively measured blood pressure, it is widely used in large-scale population-based surveys conducted in

Brazil by the Ministry of Health, such as Vigitel (Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey)³ and the National Health Survey (PNS),²¹ due to its practicality and reliability in large samples. However, this approach may underestimate undiagnosed cases of hypertension or, conversely, overestimate prevalence because of recall bias. Nevertheless, it remains a valuable indicator for assessing diagnosis awareness, treatment coverage, and access to healthcare, which are essential for understanding the condition.

Other limitations include the use of self-reported data for conditions such as diabetes mellitus and hypercholesterolemia, which may not accurately reflect their true prevalence, given the often asymptomatic nature of these diseases in their early stages. This may delay medical diagnosis and contribute to underreporting. Furthermore, the indirect estimation of PA and SB through questionnaires may result in imprecise quantification, influenced by participants' recall capacity.

Nonetheless, this study has important strengths that reinforce the validity of its findings. The use of the MMSE to exclude individuals with cognitive impairment was a key step, as it helped reduce memory bias during data collection. The adoption of a census approach also enabled the comprehensive inclusion of the urban older adult population in Aiquara, a small municipality in northeastern Brazil characterized by socioeconomic vulnerability and limited healthcare infrastructure. Another strength was the inclusion of a broad range of socioeconomic, behavioral, and health-related variables, allowing for a comprehensive and contextually grounded analysis. The use of robust statistical methods, including multivariate modeling, further strengthened the validity of the findings by identifying independent factors associated with hypertension. This methodological rigor enhances the external validity of the study and supports the applicability of its results to settings similar to Aiquara, Bahia, Brazil.

Conclusion

The findings are consistent with the study hypothesis. Factors such as female sex, insufficient physical activity, abdominal obesity, diabetes mellitus, and the occurrence of falls were positively associated with hypertension in the older adult population of Aiquara, Bahia, Brazil. These results provide relevant information for clinical practice in primary healthcare by informing targeted interventions aimed at reducing the prevalence of hypertension and its related complications among older adults.

Aiquara, Bahia, Brazil, faces important limitations in its healthcare infrastructure. The lack of diversified physical activity programs restricts available options and may hinder the implementation of integrated initiatives to promote healthy habits and prevent chronic diseases. The development of public policies that encourage healthy lifestyles and support health-promoting initiatives is therefore essential. This includes expanding access to physical activity facilities, wellness programs, health promotion resources, and guidance for regular exercise. Such actions may contribute not only to the prevention and control of non-communicable chronic diseases such as hypertension but also to the improvement of overall quality of life.

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Author Contributions

Conception and design of the research: Silva EC, Valença Neto PF, Casotti CA, Almeida CB, Silva DJ, Santos L; acquisition of data: Valença Neto PF, Casotti CA, Silva DJ, Santos L; analysis and interpretation of the data: Silva EC, Valença Neto PF, Meira SS, Roriz BC, Viana JÁ, Viana VSS, Ribeiro RS, Silva KC, Novais DG, Marques MB, Sallet LAP, Santos L; statistical analysis: Santos L; obtaining financing: Novais DG; writing of the manuscript: Silva EC, Valença Neto PF, Casotti CA, Almeida CB, Silva DJ, Meira SS, Roriz BC, Viana JÁ, Viana VSS, Ribeiro RS, Silva KC, Novais DG, Marques MB, Sallet LAP, Santos L; critical revision of the manuscript for intellectual content: Silva EC, Valença Neto PF, Casotti CA, Almeida CB, Silva DJ, Meira SS, Roriz BC, Viana JÁ, Viana VSS, Ribeiro RS, Silva KC, Marques MB, Sallet LAP, Santos L.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Research Ethics Committee of the State University of Southwest Bahia (Opinion No. 171,464; Certificate of Presentation for Ethical Consideration No. 10786212.30000.0055). All procedures were conducted in accordance with the Declaration of Helsinki of the World Medical Association (1975, revised in 2013) and with Resolution No. 466/2012 of the Brazilian National Health Council. Written informed consent was obtained from all participants.

Use of Artificial Intelligence

During the preparation of this work, the authors used ChatGPT (OpenAI) to assist with grammar correction and stylistic editing of the text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Availability of Research Data

All datasets supporting the results of this study are available upon request from the corresponding author.

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