

Relationship Between Education Level and Worsening of Risk Factors in Systemic Arterial Hypertension

Relação Entre Escolaridade e Agravamento dos Fatores de Risco na Hipertensão Arterial Sistêmica

Relación Entre el Nivel Educativo y el Agravamiento de los Factores de Riesgo en la Hipertensión Arterial Sistémica

RESUMO

Objetivo: Mensurar por meio da Análise de Componentes Principais, os principais fatores de risco relacionados ao agravamento da hipertensão arterial em diferentes níveis de escolaridade no Município de Propriá, Brasil. **Métodos:** Estudo transversal onde foram coletadas informações sobre estilo de vida, condição clínica e características socioeconômicas de 350 hipertensos. A coleta de dados foi realizada nos domicílios entre novembro de 2022 a novembro de 2023. Foram realizadas: Análise de Componentes Principais e Regressão Polinomial. **Resultados:** Fatores socioeconômicos apresentaram um risco 3,37 vezes maior (IC95%, 2,06-5,51, $p < 0,001$) para o agravamento pressórico em indivíduos com baixa escolaridade, seguido pela inatividade física com um risco 1,73 vezes maior (IC95%, 1,2-2,46, $p < 0,002$). Para hipertensos com maior escolaridade, a obesidade foi o principal fator de risco, com chance 2,1 vezes maior (IC95%, 1,4-3,16, $p < 0,001$). **Conclusão:** Condição socioeconômica desfavorável foi o principal fator de risco para descontrolo da pressão arterial em hipertensos com baixa escolaridade.

PALAVRAS-CHAVE: Hipertensão; Fatores de Risco; Escolaridade; Estudos Transversais

ABSTRACT

Objective: To measure, through Principal Component Analysis, the primary risk factors associated with the exacerbation of arterial hypertension across varying levels of education in the Municipality of Propriá, Brazil. **Methods:** A cross-sectional study was conducted, in which information regarding lifestyle, clinical condition, and socioeconomic characteristics was collected from 350 individuals with hypertension. Data collection took place in households from November 2022 to November 2023. Principal Component Analysis and Polynomial Regression were performed. **Results:** Socioeconomic factors exhibited a risk 3.37 times greater (95% CI, 2.06-5.51, $p < 0.001$) for the exacerbation of blood pressure in individuals with low education levels, followed by physical inactivity, which presented a risk 1.73 times greater (95% CI, 1.2-2.46, $p < 0.002$). Among hypertensive individuals with higher education, obesity emerged as the primary risk factor, with a likelihood 2.1 times greater (95% CI, 1.4-3.16, $p < 0.001$). **Conclusion:** An unfavorable socioeconomic condition was identified as the principal risk factor for poor blood pressure control in hypertensive individuals with low educational attainment.

KEYWORDS: Hypertension; Risk Factors; Educational Status; Cross-Sectional Studies

RESUMEN

Objetivo: Medir, mediante el Análisis de Componentes Principales, los principales factores de riesgo relacionados con el agravamiento de la hipertensión arterial en diferentes niveles de escolaridad en el Municipio de Propriá, Brasil. **Métodos:** Estudio transversal en el que se recopilieron datos sobre estilo de vida, condición clínica y características socioeconómicas de 350 individuos hipertensos. La recolección de datos se llevó a cabo en los hogares entre noviembre de 2022 y noviembre de 2023. Se realizaron análisis de Componentes Principales y Regresión Polinómica. **Resultados:** Los factores socioeconómicos presentaron un riesgo 3.37 veces mayor (IC95%, 2.06-5.51, $p < 0.001$) para el agravamiento de la presión en individuos con baja escolaridad, seguido por la inactividad física, que mostró un riesgo 1.73 veces mayor (IC95%, 1.2-2.46, $p < 0.002$). Para los hipertensos con mayor escolaridad, la obesidad fue el principal factor de riesgo, con una probabilidad 2.1 veces mayor (IC95%, 1.4-3.16, $p < 0.001$). **Conclusión:** Una condición socioeconómica desfavorable fue el principal factor de riesgo para el descontrol de la presión arterial en hipertensos con baja escolaridad.

PALABRAS CLAVE: Hipertensión; Factores de Riesgo; Nivel Educativo; Estudios Transversales.

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INTRODUCTION

The association between socioeconomic level indicators, such as education, income and occupation, has been relevant for both communicable and non-communicable diseases.¹ According to the Surveillance System for Risk and Protection Factors for Chronic Diseases by Telephone Survey (VIGITEL) between 2007 and 2016, it was observed that the prevalence of Systemic Arterial Hypertension increased with advancing age and low education, with illiterate individuals having the highest prevalence.^{2,3}

The level of education significantly influences risk factors in hypertensive individuals, considering the high prevalence of systemic arterial hypertension and the severity of its health consequences. Therefore, the objective of this study was to measure, through a Principal Component Analysis, the main risk factors related to the worsening of arterial hypertension at different levels of education in the municipality of Propriá, Sergipe, Brazil.

METHOD

This is a cross-sectional analytical study with a quantitative approach, conducted through semi-structured interviews, which investigated the increase in blood pressure in hypertensive patients with different levels of education treated by the Unified Health System (SUS) in the munic-

ipality of Propriá, state of Sergipe, Brazil.

The research sought information on lifestyle (diet, physical exercise and harmful habits), health care (frequency of medical appointments, number of diseases, forgetting to take medication for hypertension), anthropometric measurements, diagnosis of anxiety and depression, in addition to the socioeconomic characterization of registered hypertensive patients.

The sample consisted of 329 hypertensive patients, calculated with a 95% confidence interval and a 5% margin of error. The sample was stratified to reflect the proportion of hypertensive patients living in urban (80%) and rural (20%) areas of the municipality of Propriá.

Data collection was carried out in the home in the morning, with the supervision of Community Health Agents. These professionals were previously instructed on the objective of the research and invited to assist in the active search and identification of hypertensive patients.

Patients' blood pressure was measured at the beginning and end of the interviews and the resulting average was used for statistical analysis. Anthropometric measurements, oximetry, pulse and blood glucose (fasting or postprandial) were taken only for diabetic patients. The collection period was from November 2022 to November 2023.

Inclusion criteria included hypertensive patients treated by the SUS, with or without health insurance,

living in the rural and urban areas of Propriá, who agreed to participate in the research and signed the Free and Informed Consent Form (FICF). The exclusion criteria were pregnant women (anthropometric alteration), people with some mental or physical disorder that made them unable to understand the questions in the questionnaire, in addition to physical restrictions that made anthropometric assessment difficult and possibly caused discomfort to the patient.

The NCD-RisC⁴ established the criteria for classifying patients in relation to blood pressure control. According to these criteria, patients aged between 18 and 79 years who use antihypertensive medications are considered to have controlled Systemic Arterial Hypertension if their blood pressure is below 140/90 mmHg. Very elderly patients, over 80 years old, are considered to have controlled blood pressure if their blood pressure is below 150/90 mmHg.⁵ Hypertensive patients with blood pressure values outside these ranges are classified as decompensated.

To conduct the interviews, the Brazilian Ministry of Health's VIGITEL-2022 questionnaire was used, which has been administered in all capitals of the 26 Brazilian states since 2006, as part of a system for monitoring lifestyle and health behaviors in chronic diseases.

Ethical approval

This study was approved by the Research Ethics Committee of Ti-

radentes University on November 25th, 2022 (Protocol 5.778,896). All hypertensive patients were informed about the objectives of the research and invited to sign the FICF, authorizing their participation and use of the information provided for research purposes.

Data analysis

Statistical analysis of the collected data was performed by entering the information into an electronic spreadsheet using Microsoft Excel 2013 software. Qualitative (nominal and ordinal) and quantitative variables were identified.

In the bivariate analysis, the comparison between the lack of hypertension control and other study variables was made using the Chi-Square and Fisher's Exact tests. The Prevalence Ratio (PR) was calculated in all cross-sections. Using Principal Component Analysis with Varimax Rotation Method, 29 independent variables were reduced into 11 independent scores, preserving 57.63% of the original information. The number of components was determined based on eigenvalues greater than or equal to 1.

The dependent variables were defined by combining the time of schooling with the lack of hypertension control. They were thus divided into two groups: illiterate individuals or those with elementary education (Group 1) and those with high school and higher education (Group 2). These variables were adjusted according to the scores using Multinomial Logistic Regression models. The results were presented in terms of Odds Ratio (OR) and confidence interval. The study adopted a significance level of 5%, a confidence level of 95%, and was carried out in the R software, version 4.3.2.

RESULTS

A total of 387 participants were approached. Of these, 33 did not want to complete the interview and four refused to sign the informed consent form. Thus, the total number of participants was 350, of which 250 (71.4%) were hypertensive with controlled blood pressure and the other 100 (28.6%) had uncontrolled blood pressure.

The age of the participants ranged from 21 to 99 years. The mean age was 56 years, with a standard deviation (SD) = 13.302. The median age was 57 years, with a predominance of the age group of 50 to 69 years, according to Table 1. Of the total number of participants, 219 (59%) were adults (up to 59 years) and 141 (41%) were elderly (over 60 years).

Table 1 - Sociodemographic characteristics of hypertensive people interviewed between November 2022 and November 2023 in the municipality of Propriá, Brazil.

Characteristics	N(%)	% ^a
Sex		
Male	176 (50,3)	50,3
Female	174 (49,7)	100
Race/Color of skin		
White	110(31,4)	31,4
Brown	187(53,5)	84,9
Black	53(15,1)	100
Education		
Illiterate	49 (14)	14
Incomplete Elementary School	122 (34,9)	48,9
Complete Elementary School	36 (10,3)	59,1
Incomplete High School	14 (4)	63,1
Complete High School	81 (23,1)	86,3
Incomplete Higher Education	7 (2)	88,3
Higher Education	41 (11,7)	100
Age group		
20 - 50 years old	100 (28,6)	28,6
51 - 69 years old	195 (55,7)	84,3
70 - 100 years old	55 (15,7)	100
Location		
Rural area	80 (22,9)	22,9
Urban area	270 (77,1)	100
Health insurance		
No	297 (84,9)	84,9
Yes	53 (15,1)	100
Health expenses		
Yes	134 (38,3)	38,3
No	216 (61,7)	100

a) Cumulative relative frequency

The average number of people per residence was 2.79 people (range 1 to 8 and SD=1.332). On average, each residence had 2.32 rooms (range 1 to 5 and SD=0.702). Approximately 26 interviewees (32.5%) of

the rural population were illiterate, while in the urban area the number was 24 (8%). Only one person from the rural area (1%) had an academic degree compared to 40 people (14.8%) in the urban area. Regarding people without education (49

people), none had health insurance and 45 (92%) earned up to two minimum wages.

Table 2 shows the prevalence relationship between the worsening of hypertension and the health condition of the individuals evaluated in the study. The variables that led to significant worsening of

hypertension ($p < 0.05$) were: alcohol consumption, weekly physical inactivity, poor or very poor self-rated health, presence of hypertension symptoms, lack of a blood pressure monitor at home, lack of guidance from a qualified health professional, having gone without antihypertensive medication

for more than 30 days, forgetting to take medication, being obese, having had fewer than two medical appointments per year, and not having seen a cardiologist for a period of one year.

Table 2- Prevalence relationship between lifestyle variables and health condition with worsening of BP among hypertensive patients interviewed in the Municipality of Propriá, Brazil (Nov. 2022/Nov. 2023).

Variable/Category	Aggravation		PR 95% ^a	P-value
	Yes	No		
Alcoholic beverage				
Yes	48 (36,4)	84 (63,6)	1,5 (1,1; 2,1)	0,010
No	52 (23,9)	166 (76,1)	1 (ref)	
Cigarette/ Smoking				
Yes	13 (35,1)	24 (64,9)	1,3 (0,8; 2)	0,450
No	87 (27,8)	226 (72,2)	1 (ref)	
Physical activity				
No	70 (34,3)	134 (65,7)	1,7 (1,2; 2,4)	0,007
Yes	30 (20,5)	116 (79,5)	1 (ref)	
Health (Regular or good)				
No	29 (44,6)	36 (55,4)	1,8 (1,3; 2,5)	0,003
Yes	71 (24,9)	214 (75,1)	1 (ref)	
Diabetes				
Yes	43 (33,9)	84 (66,1)	1,3 (1; 1,8)	0,126
No	57 (25,6)	166 (74,4)	1 (ref)	
Hypertension symptoms				
Yes	39 (39,4)	60 (60,6)	1,6 (1,2; 2,2)	0,001
No	61 (24,3)	190 (75,7)	1 (ref)	
Device using				
No	66 (34,6)	125 (65,4)	1,6 (1,1; 2,3)	0,001
Yes	34 (21,4)	125 (78,6)	1 (ref)	
Family Background				
Yes	80 (28,1)	205 (71,9)	0,9 (0,6; 1,4)	0,770
No	20 (30,8)	45 (69,2)	1 (ref)	
Healthy professional orientation				
No	35 (37,6)	58 (62,4)	1,5 (1,1; 2,1)	0,030
Yes	65 (25,3)	192 (74,7)	1 (ref)	
Ran Out of Medication				
Yes	15 (50)	15 (50)	1,9 (1,3; 2,8)	0,010
No	85 (26,6)	235 (73,4)	1 (ref)	
Side effect				
Yes	16 (43,2)	21 (56,8)	1,6 (1,1; 2,4)	0,050
No	84 (26,8)	229 (73,2)	1 (ref)	

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Forgetfulness (Medication)				
Yes	53 (37,9)	87 (62,1)	1,7 (1,2; 2,4)	0,001
No	47 (22,4)	163 (77,6)	1 (ref)	
Obesity (BMI>30kg/m ²)				
Yes	57 (35,8)	102 (64,2)	1,6 (1,1; 2,2)	0,001
No	43 (22,5)	148 (77,5)	1 (ref)	
Medical Consultations (2 or more)				
No	35 (45,5)	42 (54,5)	1,9 (1,4; 2,6)	0,001
Yes	65 (23,8)	208 (76,2)	1 (ref)	
Cardiologist (1 or more)				
No	72 (32,9)	147 (67,1)	1,5 (1,1; 2,2)	0,020
Yes	28 (21,4)	103 (78,6)	1 (ref)	

a) 95% PR = prevalence ratio in the 95% confidence interval

Based on the results obtained for the principal components, the 29 variables were reduced into 11 scores, which explain approximately 57.63% of all data variation (Table 3). The variables that obtained the highest values, regardless of the direction, were grouped into these scores. Thus, the scores were formed by people:

- Score 1: non-white, without health insurance and without a blood pressure monitor in their homes.
- Score 2: those who did not work, did not consume ultra-processed foods regularly

(less than 5 times a day), did not drink alcohol and had some physical/organic limitation.

- Score 3: without diabetes, without a diagnosis of anxiety and who did not suffer side effects from the prescribed antihypertensive medication.
- Score 4: did not regularly consume beans, salad/vegetables/fruit and natural fruit juice (less than 5 days a week).
- Score 5: had at least two annual medical appointments and for those who had at least one annual appointment with a cardiologist.
- Score 6: did not do physical activity and had symptoms of hypertension.

- Score 7: did not smoke, self-rated as being in good health and had not been diagnosed with depression.
- Score 8: did not have their own home, received family allowance and were obese (BMI >30 kg/m²).
- Score 9: with a family history of chronic diseases (hypertension, diabetes, stroke, cancer and heart problems) and suggestive of visceral obesity (WC above the WHO cutoff point, men <102 cm and women <88 cm).
- Score 10: did not receive guidance on hypertension care from a professional with a degree in the health area.
- Score 11: did not go without medication

Table 3 - Principal Component Analysis adjusted for Education among hypertensive patients interviewed in Propriá, Brazil (Nov.2022/Nov.2023).

Variable	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6	Score 7	Score 8	Score 9	Score 10	Score 11
Beans (5 days or more)	0,10	0,21	0,24	-0,43	-0,34	0,10	-0,04	-0,25	0,16	-0,26	-0,13
Salad (5 days or more)	-0,24	-0,08	0,22	-0,53	0,17	-0,16	0,09	-0,04	0,06	0,00	0,07
Fruit (5 days or more)	-0,29	0,09	0,07	-0,59	0,21	0,03	0,12	-0,09	-0,14	0,07	0,09
Juice (5 days or more)	0,10	-0,07	-0,22	-0,72	-0,10	-0,06	-0,15	0,03	0,02	-0,07	0,02
Ultra-processed foods (≥5 servings)	0,10	-0,38	0,18	0,28	-0,07	-0,03	-0,32	-0,05	0,28	-0,27	-0,01
Alcoholic beverage	-0,01	-0,71	-0,01	0,05	-0,11	-0,06	-0,05	0,01	0,11	0,14	-0,06
Cigarette	0,29	-0,25	0,13	-0,10	-0,08	-0,11	-0,60	-0,20	-0,19	0,04	-0,05
Physical Activity	-0,31	-0,11	0,13	-0,03	0,00	-0,66	0,01	-0,01	0,07	-0,11	-0,06
Physical Limitation	0,09	0,52	-0,11	0,02	0,05	0,43	-0,29	-0,01	0,13	0,08	0,08
Health (Satisfactory)	-0,03	-0,12	0,21	-0,01	0,06	-0,21	0,66	-0,12	0,02	-0,03	0,03

Diabetes	-0,14	0,26	-0,54	0,00	-0,28	0,22	-0,04	0,11	-0,10	-0,19	-0,01
Depression	-0,17	0,17	-0,03	0,03	0,17	0,10	-0,57	0,13	0,06	0,02	-0,07
Anxiety	-0,09	0,01	-0,36	-0,14	0,31	0,07	-0,20	0,20	0,24	0,05	-0,27
Symptoms of Hypertension	0,00	-0,09	0,07	0,11	0,08	0,63	-0,20	-0,06	0,00	0,03	-0,25
Blood Pressure Monitor	-0,60	-0,19	-0,20	-0,30	0,08	-0,05	-0,06	-0,07	0,04	-0,10	0,16
Health Guidance	-0,06	0,06	0,00	-0,05	0,18	-0,11	0,07	0,01	-0,02	-0,82	0,06
Forgot Medication	0,10	-0,20	0,05	0,03	-0,06	0,08	0,06	-0,07	0,03	0,35	-0,62
Ran out of Medication	0,04	0,01	-0,10	0,07	-0,04	0,05	-0,13	0,03	-0,03	-0,10	-0,72
Side effect	0,09	0,05	-0,78	0,03	0,08	-0,05	-0,06	-0,07	0,03	0,07	-0,06
Abdominal Circumference	0,19	-0,10	0,08	-0,02	0,06	-0,12	0,03	0,01	0,65	0,16	0,29
Obesity (BMI>30)	-0,10	-0,11	0,02	-0,09	-0,04	0,38	0,03	0,62	-0,08	-0,19	-0,01
Family history	0,19	-0,12	-0,07	0,02	-0,02	0,04	0,04	-0,03	0,67	-0,10	-0,18
Cardiologist	-0,22	0,11	0,01	0,06	0,69	0,06	0,07	-0,15	0,02	-0,15	-0,04
Medical appointments (≥2)	0,10	0,04	0,00	-0,14	0,72	0,02	-0,10	0,07	0,00	-0,07	0,11
Color of skin (White)	-0,66	0,20	0,27	0,07	-0,10	-0,14	-0,01	0,10	0,17	0,13	0,00
Works	-0,18	-0,63	0,14	-0,14	0,02	0,16	0,18	0,12	0,16	-0,01	-0,01
Housing (Own)	-0,04	0,08	-0,01	-0,12	-0,01	0,16	0,19	-0,64	0,01	-0,09	-0,10
Bolsa Família	0,35	0,21	-0,04	0,07	-0,05	-0,14	0,12	0,54	0,09	0,02	-0,34
Health insurance	-0,69	-0,18	-0,03	-0,09	0,19	-0,15	0,05	-0,09	-0,11	-0,12	0,00

*Only the highest values for each variable were considered in this study. These values are shown in bold.

** The lowest values (-) mean negation. For example: do not smoke, do not take medication, are not white....

*** Each score was defined by the distribution of the variables with the highest value (bold). Thus, score 1 was defined as: Those who do not have a blood pressure monitor at home, those who do not work and those who do not have health insurance.

In Table 4, non-white individuals, those without health insurance and without a blood pressure monitor, and those in group 1 (illiterate and with elementary education) were 337% more likely to have high blood pressure compared to individuals with Yesilar characteristics but with higher levels of education (group 2).

Table 4: Multinomial Logistic Regression Model on risk factors for hypertensive disease among hypertensive individuals with different levels of education interviewed (Nov. 2022 / Nov. 2023) in the Municipality of Propriá-Brasil.

Variable	Group 1 - OR 95%	P-value	Group 2 - OR 95%	P-value
Score 1	3.37 (2.06-5.51)	0,001	1.05 (0.71-1.56)	0,790
Score 2	1.01 (0.72-1.41)	0,961	0.48 (0.33-0.71)	0,010
Score 3	0.68 (0.51-0.92)	0,013	0.71 (0.49-1.03)	0,072
Score 4	1.52 (1.1-2.11)	0,012	1.25 (0.86-1.82)	0,248
Score 5	0.51 (0.36-0.72)	0,001	0.59 (0.4-0.86)	0,007
Score 6	1.73 (1.22-2.46)	0,002	1.47 (1.01-2.14)	0,044
Score 7	0.75 (0.56-1)	0,048	0.85 (0.59-1.23)	0,393
Score 8	1.67 (1.24-2.27)	0,001	2.1 (1.4-3.16)	0,010
Score 9	1.15 (0.84-1.56)	0,384	1.24 (0.82-1.86)	0,308
Score 10	1.61 (1.19-2.17)	0,002	0.71 (0.47-1.06)	0,097
Score 11	0.7 (0.52-0.93)	0,016	0.71 (0.5-1)	0,050

The irregular consumption of vegetables, fruits, natural juices and legumes resulted in a 152% higher risk of high blood pressure, while the lack of professional guidance contributed to a 161% increase in risk for group 1.

Scores 3 and 7 acted as exclusive protective factors for individuals in group 1, while score 2 was a protective factor only for group 2. On the other hand, scores 6 and 8 were identified as risk factors for both levels of education, presenting a 173% and 167% higher risk, respectively, for group 1, and 147% and 210% for group 2.

DISCUSSION

The data from this research showed that low levels of education were more associated with worsening hypertension. The relationship between education and skin color revealed that the proportion of illiterate black people was higher than that of illiterate white people (25% black and 14% white). Regarding higher education, the majority of graduates interviewed were white (60% white and 5% black). Although there has been an improvement in this scenario in recent decades, since in 1980 the number of illiterate black and mixed-race people was three times higher than that of white people,⁶ There is still a strong association between low education and skin color.

Among all the factors related to hypertension, socioeconomic status was the one that most influenced the worsening of the disease in individuals with less than nine years of education. This relationship was particularly evident when we analyzed aspects such as access to health care, education, employment and housing conditions, which were interconnected and impacted the quality of life of these people. In this study, ethnic issues and lack of financial resources also played a crucial role, making it

difficult to both adhere to health insurance plans and acquire equipment for home blood pressure monitoring.

Furthermore, individuals of low socioeconomic status face ² significant barriers to accessing health services, including difficulty in paying for medical appointments, medications and essential treatments to control hypertension. The scarcity of health services in underserved areas, combined with the lack of adequate transportation to get to health centers, contribute to the worsening of this situation, highlighting the urgent need for interventions to improve access to and the quality of health services for this vulnerable population.

Approximately 66% of illiterate people did not have a device to measure their blood pressure at home, compared to 25% of people with higher education. For the latter, forgetfulness was the main justification. To Gbemisola et al.⁷ low levels of education are also associated with fewer job opportunities and lower wages, which results in financial difficulties and limited spending on health care, making these patients more vulnerable to cardiovascular diseases.

As for adherence to private health plans, no illiterate hypertensive patients were included and only 2% (05 people) of a universe of 225 people with elementary education (complete or incomplete) had health insurance, in contrast to 38% (48 people) of individuals with secondary education and 68% (28 people) with higher education.

It is important to emphasize that the monthly fee for a private health plan is a distant reality for most Brazilians. In Brazil, the public health system, known as SUS, offers free and universal access to health care for all citizens, covering approximately 75% of the population. However, care in this system is predominantly provided by general practitioners, and consultations with cardiologists are

only possible in cases of established coronary disease, essential comorbidities, or secondary complications. As reported by Faria-Neto et al.,⁸ there is a delay in scheduling exams and consultations in the SUS. On the other hand, in the private system, the patient has the freedom to go directly to the desired specialist, regardless of their health status, and there is greater agility in scheduling exams.

Low education levels were also reflected in the lack of self-care in controlling blood pressure. According to Larki, Tahmasebi and Reisi,⁹ This results in difficulty understanding written health information, avoiding behaviors that are harmful to the body, or properly reading a medical prescription.

None of the hypertensive individuals interviewed with secondary or higher education sought out community health agents to clarify their health-related doubts. These professionals were widely sought out by many interviewees with low levels of education, who felt embarrassed to admit that they did not understand the guidance of higher-level health professionals at the Basic Health Units (UBS). According to Cavalcante et al.,¹⁰ these patients often avoid seeking out UBS, as they believe that professionals would not have the patience to repeat and explain in detail the information already provided.

Örsal et al.¹¹ highlighted the increase in health problems among users, especially chronic ones, due to lack of information or difficulty in understanding the information provided during consultations in the SUS. Given that most of the elderly interviewed did not complete elementary school, it is crucial that health teams improve communication. It is essential to adopt an effective approach to health promotion for these individuals to ensure adequate monitoring of treatment, even in the absence of the central doctor, according to Chehuen

et al.¹²

This aspect highlights the crucial role of the health professional in educating the patient about health, covering information, practices and healthy habits. Establishing a positive doctor-patient relationship is essential,¹³ as this strengthens the patient's confidence to adhere to the guidelines provided. Unfortunately, low-income and less educated individuals often have less access to health information, thus increasing the risk of adverse health consequences.

Low consumption of legumes, fruits and, especially, vegetables was a risk factor for worsening blood pressure among individuals with low education. Chehuen et al.¹² They claim that this is common among people who earn up to a minimum wage in Brazil and face greater challenges, due to the lack of financial resources, to maintain a healthy diet and practice physical activities.

Bezerra et al.¹⁴ observed that individuals with low financial status tend to consume ultra-processed foods due to their lower price and greater convenience in preparation. However, this type of diet contributes to a worsening of health, since these foods have high levels of carbohydrates, saturated fats, sugar and sodium, and low levels of vitamins and minerals. In addition, ultra-processed foods have a longer shelf life due to the addition of additives compared to natural or minimally processed foods.¹⁵

In the present study, it was identified that obesity was the main risk factor for individuals with a higher level of education, presenting a significantly higher risk compared to people with a lower level of education. As argued by Connelly et al.,¹⁶ a high Body Mass Index (BMI) indicating clinical obesity (BMI ≥ 30 kg/m²) is associated with a substantial increase in the risk of total and ischemic stroke, and this association is even stronger in women than in men.

Additionally, Uthman et al.¹⁷ emphasized that the combination of overweight/obesity with hypertension demonstrates the negative effect of excess body weight on the prevalence and worsening of hypertension.

The lack of physical exercise impacted everyone, especially hypertensive individuals with low levels of education. This can be attributed to a lack of knowledge about the benefits of a healthy lifestyle, including regular physical activity, and the adoption of unhealthy diets, which is particularly difficult in low-income communities. According to Faria-Neto et al.⁸ This lack of awareness among patients can be attributed to their lack of education and existing social inequalities.

Not using tobacco was a protective factor highlighted only for people with little education. Smoking is considered a risk factor for cardiovascular disease, as it leads to the constriction of coronary blood vessels, making them less flexible.¹⁸ Although tobacco consumption is stabilizing and even decreasing in some high-income countries, it is increasing in low- and middle-income countries due to the high number of tobacco-related deaths. In the 20th century, approximately 100 million deaths were attributed to tobacco, and this number is expected to reach 1 billion in the 21st century.¹⁹

Mental health conditions such as anxiety and depression can worsen hypertension and reduce patients' quality of life by influencing the release of vascular endothelial factor and increasing vascular resistance. The risk of hypertension in people with prolonged anxiety and worry is 1.18 times higher than in people without these conditions.²⁰

This research showed that regular adherence to medication had a protective effect at all educational levels. However, it was observed that forgetting to take medication increased

the risk of worsening hypertension,²¹ especially when the period of forgetfulness was prolonged. The data revealed that 38% of illiterate people and 21% of individuals with higher education reported forgetting to take their medication on some day during the week. In this sense, Cavalcante et al.¹⁰ highlighted the importance of regularly checking, at each consultation, whether patients have correctly understood the instructions provided and whether they are adhering adequately to conservative and drug treatment.

CONCLUSION

Socioeconomic status was the main factor for increased blood pressure in individuals with low levels of education, followed by lifestyle. For more educated individuals, obesity and lack of regular physical activity were the main risk factors. The lack of adequate guidance from health professionals worsens hypertension, especially among the less educated. The importance of an effective doctor-patient relationship is highlighted to improve care for less educated populations in the SUS, promoting trust and better health conditions.

REFERENCES

1. Chantarat T, Enns EA, Hardeman RR, McGovern PM, Myers SL Jr, Dill J. Occupational segregation and hypertension inequity: The implication of the inverse hazard law among healthcare workers. *Journal of Economics, Race, and Policy* 2022; 5(4): 267-282. Doi : 10.1007/s41996-022-00098-5.
2. Lélis BDB, Chaves KS, Matioli GRB, da Silva APS, de Oliveira Eulálio VGB. Hipertensão Arterial nas Capitais Brasileiras/Hipertensão Arterial nas Capitais Brasileiras. ID on-line. *Revista de psicologia*. 2022; 16 (63): 638-651. Doi: 10.14295/online.v16i63.3568
3. Hartmann M, Dias-da-Costa JS, Olinto MTA, Pattussi MP, Tramontini A. Prevalência de hipertensão arterial sistêmica e fatores associados: um estudo de base populacional em mulheres no Sul do Brasil. *Cad Saúde Pública* 2007; 23:1857-66. Doi: 10.1590/S0102-311X2007000800012
4. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet*. 2021 ;398(10304):957-980. DOI: 10.1016/S0140-6736(21)01330-1.
5. Philip R, Beaney T, Appelbaum N, Gonzalvez CR, Koldeveij C, Golestaneh AK,. Variation in hypertension clinical practice guidelines: a global comparison. *BMC*. 2021; 19(1): 1-13. DOI: 10.1186/s12916-021-01963-0
6. Guimarães EDF, Zelaya M. A política de cotas raciais nas universidades públicas do Brasil duas décadas depois: Uma análise. *Trab. Educ.* 2022 ;30(3):133-48. Doi: 10.35699/2238-037X.2021.26556
7. Gbemisola A. Adeseun, Christine C. Bonney, Sylvia E. Rosas, Health Literacy Associated With Blood Pressure but not Other Cardiovascular Disease Risk Factors Among Dialysis Patients, *American Journal of Hypertension*, Volume 25, Issue 3, March 2012, Pages 348–353. Doi: 10.1038/ajh.2011.252
8. Faria-Neto JR, Yarleque C, Vieira LF, Sakane EN, Santos RD. Challenges faced by patients with dyslipidemia and systemic arterial hypertension in Brazil: a design of the patient journey. *BMC Cardiovasc Disord.*2022; 22(1):237. doi: 10.1186/s12872-022-02669-8
9. Larki A, Tahmasebi R, Reisi M. Factors Predicting Self-Care Behaviors among Low Health Literacy Hypertensive Patients Based on Health Belief Model in Bushehr District, South of Iran. *Int J Hypertens*. 2018 Feb 13;2018:9752736. Doi: 10.1155/2018/9752736
10. Cavalcante, LR, Brito, LL, & Fraga-Maia, H. Functional health literacy: protective role in adherence to treatment for hypertensive patients. *Brazilian Journal of Health Promotion*. 2020; 33:1-12. Doi: 10.5020/18061230.2020.10503
11. Örsal Ö, Duru P, Örsal Ö, Tirpan K, Çulhacı A. Analysis of the relationship among health awareness and health literacy, patient satisfaction levels with primary care in patients admitting to primary care health centers. *Patient Educ Couns*. 2019 Feb;102(2):376-382. Doi: 10.1016/j.pec.2018.09.006.
12. Chehuen JÁ Neto, Costa LA, Estevanin GM, Bignoto TC, Vieira CIR, Pinto FAR, et al. Letramento funcional em saúde nos portadores de doenças cardiovasculares crônicas. *Ciênc Saúde Colet* .2019 ;24(3):1121-32. Doi: 10.1590/1413-81232018243.02212017.
13. Grosseman S, Patrício ZM. A Relação Médico-Paciente e o Cuidado Humano: Subsídios para Promoção da Educação Médica. *Rev bras educ med*. 2004;28(2):99–105. doi. org/10.1590/1981-5271v28.2-014.
14. Bezerra RKC, de Abreu Souza DL, Silva JCS, Pinto NS, de Alencar Mendes CF. Percepção de Usuários Hipertensos e Diabéticos Sobre Práticas de Educação Alimentar e Nutricional em um Grupo de Hiperdia no Sertão Cearense. *Saúde e Desenvolvimento Humano*.2020 ;10(1):1-10. Doi: 10.18316/sdh.v10i1.7629
15. Finger JAFF, Santos IM, Silva GA, Bernardino MC, Pinto UM, Maffei DF. Minimally Processed Vegetables in Brazil: An Overview of Marketing, Processing, and Microbiological Aspects. *Foods*. 2023 Jun 3;12(11):2259. doi: 10.3390/foods12112259.
16. Connelly PJ, Currie G, Delles C. Sex Differences in the Prevalence, Outcomes and Management of Hypertension. *Curr Hypertens Rep*. 2022 Jun;24(6):185-192. Doi: 10.1007/s11906-022-01183-8.
17. Uthman OA, Ayorinde A, Oyebode O, Sartori J, Gill P, Lilford RJ. Global prevalence and trends in hypertension and type 2 diabetes mellitus among slum residents: a systematic review and meta-analysis. *BMJ Open*. 2022 Feb 24;12(2):e052393. Doi: 10.1136/bmjopen-2021-052393.
18. Arca KN, Halker Singh RB. The Hypertensive Headache: A Review. *Current Pain and Headache Reports*. 2019; 23(5):30. Doi: 10.1007/s11916-019-0767-z.
19. Lima AKL, et al. Atuação da enfermagem na prevenção da hipertensão arterial. *Revista Eletrônica Acervo Saúde*.2021;13(5):1-8. Doi: 10.25248/reas.e7373.2021
20. Teo KK, Rafik, T. Cardiovascular risk factors and prevention: a perspective from developing countries. *Canadian Journal of Cardiology*.2021; 37(5):733-743. Doi: 10.1016/j.cjca.2021.02.009.
21. Cao M, Zhang Z. Adjuvant music therapy for patients with hypertension: a meta-analysis and systematic review. *BMC Complement Med*. 2023; 23(1):110. Doi: 10.1186/s12906-023-03929-6