

## Behavioral risk factors related to stroke in hypertensive patients

### Fatores de risco comportamentais relacionados ao acidente vascular cerebral em pacientes hipertensos

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#### ABSTRACT

**Objective:** to describe behavioral risk factors related to stroke in individuals with systemic arterial hypertension. **Methods:** cross-sectional study conducted with 327 patients diagnosed with hypertension and treated at Primary Health Care Units. Data were collected using a structured questionnaire. Descriptive and inferential analyses were performed. **Results:** the highest food consumption frequencies were for vegetables or legumes (mean=3.40) and red meat (mean=3.31). Replacing lunch with snacks was the least frequent practice (mean=0.46). More than 14% of participants reported consuming alcoholic beverages once or more per month. Around 60% did not practice physical exercise. Current smoking was identified in 13.5% of participants and past smoking in 36.4%, with a mean duration of 28.42 years. Among individuals with a history of stroke, a higher prevalence of smoking, sedentary lifestyle, and high red meat consumption was observed. **Conclusion:** behavioral risk factors were identified among hypertensive individuals, especially among those with a history of stroke. **Contributions to practice:** this study contributes to the early identification of modifiable risk factors, reinforces the importance of behavioral screening in clinical routines, and supports the planning of multiprofessional care.

**Descriptors:** Stroke; Hypertension; Life Style; Risk Factors.

#### RESUMO

**Objetivo:** descrever os fatores de risco comportamentais relacionados ao acidente vascular cerebral em indivíduos com hipertensão arterial sistêmica. **Métodos:** estudo transversal realizado com 327 pacientes diagnosticados com hipertensão atendidos em Unidades Básicas de Saúde. A coleta de dados ocorreu por meio de questionário estruturado. Foi realizada análise descritiva e inferencial. **Resultados:** os maiores consumos alimentares foram de verduras ou legumes (média=3,40) e carne vermelha (média=3,31). A substituição do almoço por lanches foi a prática menos frequente (média=0,46). Mais de 14% dos participantes relataram consumo de bebida alcoólica uma vez ou mais por mês. Cerca de 60% não praticavam exercícios físicos. O tabagismo atual foi identificado em 13,5% dos participantes e o pregresso em 36,4%, com tempo médio de 28,42 anos. Dentre indivíduos com histórico de acidente vascular cerebral, observou-se maior prevalência de tabagismo, sedentarismo e elevado consumo de carne vermelha. **Conclusão:** evidenciou-se a presença de fatores comportamentais de risco em hipertensos, sobretudo dentre aqueles com histórico de acidente vascular cerebral. **Contribuições para a prática:** contribui para a identificação precoce de fatores de risco modificáveis, o reforço da importância do rastreamento comportamental na rotina clínica e subsídio para o planejamento do cuidado multiprofissional. **Descritores:** Acidente Vascular Cerebral; Hipertensão; Estilo de Vida; Fatores de Risco.

## Introduction

Cerebrovascular diseases comprise a series of injuries that occur in the central nervous system as a result of endothelial changes. These injuries are caused by different conditions, including stroke, in its ischemic and hemorrhagic forms, and vascular abnormalities such as intracranial aneurysms and arteriovenous malformations<sup>(1-2)</sup>. Cerebrovascular diseases are characterized as one of the main causes of long-term disability and mortality, and stroke is the most frequent among them<sup>(3)</sup>.

Stroke is defined as the sudden development of signs related to global or focal disturbances of brain function, with symptoms lasting at least 24 hours. It has a vascular origin, involves one or more blood vessels, and causes changes in cognitive and sensorimotor domains, depending on the affected area and the severity of the lesion<sup>(4)</sup>. It may also manifest as a transient deficit with symptoms such as weakness, sudden numbness, speech difficulties, mental confusion, and severe headache, or may leave serious sequelae such as cognitive changes, hemiplegia or hemiparesis, emotional disorders, and chronic pain. The clinical condition varies from individual to individual, and treatment is essential to maintain quality of life<sup>(5)</sup>.

Stroke is the second leading cause of death and one of the main causes of permanent disability worldwide, occurring mainly among individuals aged 50 years and older<sup>(6-7)</sup>. It was responsible for 6.24 million deaths in 2015, and this position is expected to remain unchanged until 2030. In Brazil, the high incidence (137 cases per 100,000 inhabitants per year) reflects the health challenges faced by the population, especially considering the scarcity of public policies related to health care<sup>(8)</sup>.

Regarding risk factors for stroke, they are generally divided into non-modifiable factors, including sex, age, ethnicity, hereditary diseases, and family history, and modifiable factors, such as sedentary lifestyle, diet, alcohol consumption, drug use, and smoking<sup>(9)</sup>. Almost 50% of deaths are caused by poor

control of modifiable risk factors<sup>(10)</sup>, and increasingly early exposure to various lifestyle-related risk factors has a significant influence on the population<sup>(11)</sup>.

In other words, if unfavorable trends persist in the population-attributable fraction of some of the main risk factors, such as high body mass index, high fasting blood glucose, a diet rich in sugar-sweetened beverages, low physical activity, high systolic blood pressure, lead exposure, and a diet low in omega-6 polyunsaturated fatty acids, the total burden of disease in absolute numbers of cases will increase, which may overload the health system in the coming decades<sup>(12)</sup>.

Systemic arterial hypertension is considered the main modifiable risk factor for stroke, showing a direct relationship with blood pressure levels. Risk increases proportionally with elevated systolic and/or diastolic blood pressure. Thus, treatment aimed at reducing blood pressure contributes significantly to decreasing the incidence of the disease. However, blood pressure control in individuals affected by stroke is complex due to the diversity of its causes and associated hemodynamic repercussions<sup>(13)</sup>.

Therefore, the crucial way to prevent stroke is to keep systemic arterial hypertension within the optimal or normal classification, which is the most effective approach for primary cerebrovascular prevention. However, adherence to treatment and healthy habits faces important barriers; factors such as educational level, family support, and the role of primary health care are decisive aspects<sup>(14)</sup>.

Although consolidated evidence exists on the influence of behavioral factors on the development and recurrence of stroke, Brazilian studies describing these factors specifically among individuals with arterial hypertension followed in Primary Health Care remain scarce. Identifying these behaviors is relevant to support the planning of health promotion actions, prevention of complications, and strengthening of longitudinal care provided by Family Health Strategy teams.

Thus, understanding the behavioral profile of this population may contribute to directing interventions aimed at controlling modifiable risk factors and

reducing morbidity and mortality from cerebrovascular diseases. In view of the above, this study aimed to describe behavioral risk factors related to stroke in individuals with systemic arterial hypertension.

## Methods

### Study type and setting

This is an analytical cross-sectional study with a quantitative data approach and is part of a larger study entitled: Analysis of stroke and its association with cardiovascular health in people with arterial hypertension. It was conducted in 20 Primary Health Care Units (PHCUs) in the urban area of the municipality of Picos, Piauí, and in 25 Family Health Strategy (FHS) units, from September 2024 to December 2025.

This study was prepared and reported according to the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative for cross-sectional observational studies.

### Population and sample

Data were collected from the Health Information System for Primary Care, through direct research at the Municipal Health Department of Picos, where the number of visits by people with hypertension, with consultation and blood pressure measured in the third four-month period of 2023, was surveyed in all PHCU/FHS units located in the urban area of the municipality. Thus, the study population consisted of 6,256 individuals.

For the simple random sample calculation, the formula applied to studies in finite populations was used. For this purpose, a stroke prevalence of 31.4%<sup>(15)</sup>, a 95% confidence interval (CI), and a 5% sampling error were used. A safety margin (7%) was considered for losses or exclusions, resulting in a minimum sample of 318 people. However, in the end, 327 hypertensive individuals were approached.

The inclusion criteria were age 18 years or older and having a medical diagnosis of systemic arterial hypertension recorded in the PHCU follow-up form. Exclusion criteria were: people with decompensated mental disorder at the time of data collection, people hospitalized for treatment, or those living at an address different from that registered at the PHCU.

### Data collection

Participants were recruited by convenience sampling, with support from Community Health Agents linked to the Family Health Strategy teams. Initially, these agents identified individuals diagnosed with arterial hypertension registered in the units and accompanied the researchers to their homes to conduct the interviews. After clarification of the study objectives and signing of the Informed Consent Form, participants were interviewed individually in a private setting in their own homes. The interviews were conducted by previously trained researchers and lasted on average between 20 and 30 minutes.

Data were obtained using a structured questionnaire developed based on indicators from the National Health Survey<sup>(16)</sup>, an instrument widely used in national epidemiological surveys. It included sociodemographic, clinical, and behavioral variables related to lifestyle.

Behavioral variables included the frequency of food consumption (vegetables and legumes, red meat, chicken, fish, sweet foods, and replacement of main meals with fast snacks), recorded as number of days per week, ranging from zero to seven days. Alcohol consumption was categorized as: never consumed, less than once a month, and once or more per month, according to criteria adopted by the National Health Survey<sup>(16)</sup>.

Smoking was classified as current use, past use, and never smoked. Physical activity or sports practice was investigated through a question about whether or not participants engaged in these activities, subsequently categorized as "yes" or "no." The average time

required to administer the instrument was approximately 20 to 30 minutes.

In addition, participants were asked about previous occurrence of stroke (self-report). In cases of affirmative responses, the information was confirmed through presentation of exams made available during the home visit. Individuals who did not report a history of stroke constituted the comparison group.

Data analysis

Descriptive data analysis was performed using frequencies, percentages, and 95% confidence intervals for qualitative variables, and mean, median, standard deviation, and 95% confidence intervals for quantitative variables. Regarding association with the outcome, the distribution of quantitative data was initially assessed using the Shapiro-Wilk test. The hypothesis tests applied were Student’s t test and the Mann-Whitney test, depending on data distribution. Results were presented as mean and standard deviation. To test the association of categorical variables, Pearson’s Chi-square and Fisher’s exact tests were used. All tests were evaluated at a 5% significance level. The software used was Stata, version 18.0.

Multivariate logistic regression was not performed due to the small number of participants with a history of stroke (n=14), a condition that would compromise model stability and increase the risk of imprecise estimates. Thus, the results presented should be interpreted as exploratory bivariate associations. Finally, no missing data were observed for the variables included in the analysis.

Ethical aspects

The study was approved by the Research Ethics Committee of the Federal University of Piauí, under opinion no. 6.852.234/2024 and Certificate of Presentation for Ethical Appraisal no. 79136024.5.0000.8057. All participants were informed about the objectives and methodology of the research and, after agreeing to participate, signed the Informed Consent Form.

Results

A total of 327 individuals with arterial hypertension participated in the study, with a predominance of females (66.4%) and a mean age of 64.35 years (standard deviation (SD)=11.27). Most had incomplete elementary education (42.5%), were married (48.3%), and had individual income between one and two minimum wages (62.4%). The observed prevalence of stroke was 14 (4.3%).

Table 1 shows that the highest weekly consumption frequencies were for vegetables or legumes (Mean=3.40; CI=3.16-3.64) and red meat (Mean=3.31; CI=3.08-3.54). Replacing lunch with fast snacks occurred on the lowest mean number of days per week (Mean=0.46; CI=0.35-0.57), followed by fish consumption (Mean=1.04; CI=0.92-1.16).

Table 1 – Characterization of food consumption among individuals with arterial hypertension treated at Primary Health Care Units. Picos, PI, Brazil, 2025

| Variables                        | Mean (95%CI)     | Median | SD   |
|----------------------------------|------------------|--------|------|
| Vegetable or legume consumption  | 3.40 (3.16–3.64) | 3.00   | 2.19 |
| Red meat consumption             | 3.31 (3.08–3.54) | 3.00   | 2.15 |
| Chicken consumption              | 2.64 (2.45–2.82) | 2.00   | 1.72 |
| Fish consumption                 | 1.04 (0.92–1.16) | 1.00   | 1.12 |
| Sweet food consumption           | 1.23 (1.03–1.43) | 0.00   | 1.83 |
| Replacing lunch with fast snacks | 0.46 (0.35–0.57) | 0.00   | 1.03 |

CI: Confidence interval; SD: Standard deviation

In addition, more than 14% (CI=10.7-18.3) of those evaluated consumed alcoholic beverages once or more per month. Almost 60% (59.6; CI=54.2-64.8) did not practice physical exercise or sports, and the mean number of weekly days among those who practiced was 1.27 (CI=1.06-1.48). A total of 44 (13.5%) (CI=10.2-17.6) currently used tobacco daily. In the past, this habit was present in 36.4% of those evaluated (CI=31.3-41.8), with a mean duration of use of 28.42 years (Table 2).

**Table 2** – Characterization of behavioral risk factors among individuals with arterial hypertension treated at Primary Health Care Units. Picos, PI, Brazil, 2025

| Variables                            | n (%)      | 95%CI     |
|--------------------------------------|------------|-----------|
| Alcoholic beverage consumption       |            |           |
| Never drank                          | 234 (71.6) | 66.4-76.2 |
| Less than once a month               | 47 (14.4)  | 11.0-18.6 |
| Once or more per month               | 46 (14.1)  | 10.7-18.3 |
| Physical exercise or sports practice |            |           |
| Yes                                  | 132 (40.4) | 35.2-45.8 |
| No                                   | 195 (59.6) | 54.2-64.8 |
| Current tobacco use                  |            |           |
| Yes, daily                           | 44 (13.5)  | 10.2-17.6 |
| Yes, less than daily                 | 6 (1.8)    | 0.8-4.0   |
| No, never smoked                     | 277 (84.7) | 80.4-88.2 |
| Past tobacco use                     |            |           |
| Yes, daily                           | 119 (36.4) | 31.3-41.8 |
| Yes, less than daily                 | 7 (2.1)    | 1.0-4.4   |
| No, never smoked                     | 201 (61.5) | 56.1-66.6 |

CI: Confidence interval

When comparing hypertensive individuals with and without a history of stroke, it was observed that most participants did not consume alcoholic beverages (85.7%), did not practice physical activity or sports (78.6%), and did not currently use tobacco (85.7%). However, a high frequency of past smoking was found in this group, since 57.1% reported having smoked daily in the past, a percentage higher than that observed among individuals without a history of the disease (35.6%) (Table 3).

Although without statistical significance, a higher proportion of physical inactivity (78.6% versus 59.0%) and past smoking (57.1% versus 35.6%) was also observed among participants with a history of stroke. These findings suggest the presence of behaviors potentially unfavorable to cardiovascular health in this group, even after the occurrence of the cerebrovascular event.

**Table 3** – Comparison of behavioral risk factors between individuals with arterial hypertension with and without a history of stroke treated at Primary Health Care Units. Picos, PI, Brazil, 2025

| Variables                            | No         | Yes       | p-value |
|--------------------------------------|------------|-----------|---------|
|                                      | n (%)      | n (%)     |         |
| Alcoholic beverage consumption       |            |           |         |
| Never drank                          | 222 (71.2) | 12 (85.7) | 0.374*  |
| Less than once a month               | 47 (15.1)  | 0 (0.0)   |         |
| Once or more per month               | 43 (13.8)  | 2 (14.3)  |         |
| Physical exercise or sports practice |            |           |         |
| Yes                                  | 128 (41.0) | 3 (21.4)  | 0.143†  |
| No                                   | 184 (59.0) | 11 (78.6) |         |
| Current tobacco use                  |            |           |         |
| Yes, daily                           | 42 (13.5)  | 2 (14.3)  | 1.000*  |
| Yes, less than daily                 | 6 (1.9)    | 0 (0.0)   |         |
| No, never smoked                     | 264 (84.6) | 12 (85.7) |         |
| Past tobacco use                     |            |           |         |
| Yes, daily                           | 111 (35.6) | 8 (57.1)  | 0.066*  |
| Yes, less than daily                 | 6 (1.9)    | 1 (7.1)   |         |
| No, never smoked                     | 195 (62.5) | 5 (35.7)  |         |

\*Fisher's exact test; †Pearson's Chi-square test

Regarding eating habits, participants with a history of stroke had a higher weekly frequency of chicken consumption compared with the other hypertensive individuals (3.93 versus 2.57 days per week;  $p=0.002$ ). Conversely, red meat consumption was lower among those with stroke (1.79 versus 3.39 days per week;  $p=0.008$ ). It was also observed that no participant with a history of stroke reported replacing lunch with fast snacks, whereas this practice was present among individuals without the disease ( $p=0.030$ ) (Table 4).

The associations between stroke and red meat consumption, chicken consumption, and replacing lunch with fast snacks were statistically significant.

**Table 4** – Comparison of food consumption between individuals with arterial hypertension with and without a history of stroke treated at Primary Health Care Units. Picos, PI, Brazil, 2025

| Variables                        | No          | Yes         | p-value |
|----------------------------------|-------------|-------------|---------|
|                                  | Mean (SD)   | Mean (SD)   |         |
| Vegetable or legume consumption  | 3.38 (2.21) | 3.86 (1.96) | 0.432*  |
| Red meat consumption             | 3.39 (2.15) | 1.79 (1.48) | 0.008†  |
| Chicken consumption              | 2.57 (1.70) | 3.93 (1.69) | 0.002†  |
| Fish consumption                 | 1.04 (1.12) | 1.07 (1.27) | 0.915†  |
| Sweet food consumption           | 1.22 (1.83) | 1.50 (2.03) | 0.862†  |
| Replacing lunch with fast snacks | 0.49 (1.05) | 0.00 (0.00) | 0.030†  |

\*Student's t test; †Mann-Whitney test; SD: Standard deviation

## Discussion

In this study, a high frequency of behaviors potentially harmful to cardiovascular health was observed among hypertensive individuals treated in primary care, especially low physical activity, history of smoking, and frequent red meat consumption. Among participants with a history of stroke, a higher proportion of physical inactivity and previous smoking was found, as well as differences in dietary consumption patterns when compared with hypertensive individuals without stroke. These findings reinforce the importance of systematic assessment of lifestyle habits in primary care, especially among individuals with chronic conditions and higher cardiovascular risk.

Regarding food consumption, vegetables and legumes showed the highest mean weekly consumption frequency among participants. Although this result suggests the presence of potentially protective dietary behaviors, the observed frequency is still below the standard recommended by the World Health Organization (WHO), which recommends daily consumption of fruits, vegetables, and legumes. Adequate intake of these foods is associated with reduced cardiovascular risk due to their high content of fiber, vitamins, minerals, and antioxidant compounds, which contribute to blood pressure control and prevention of cerebrovascular events<sup>(17)</sup>.

Red meat consumption showed a high mean frequency among the hypertensive individuals evaluated. Although individuals with a history of stroke had a lower frequency of consumption, this result may reflect changes in eating habits after the event occurred. Similar findings have been described in studies showing greater adherence to dietary recommendations after the diagnosis of cardiovascular diseases<sup>(17-19)</sup>. Even so, the frequent consumption of red meat in the sample reinforces the need for educational actions focused on healthy eating.

Although participants with a history of stroke had a lower consumption frequency compared with the other hypertensive individuals, this result may reflect dietary changes adopted after the cerebrovascular event, a hypothesis that could not be confirmed due to the cross-sectional design of the study.

In this study, a stroke prevalence of 4.3% was observed. A similar result was identified in a study on the association between duration of arterial hypertension diagnosis and the risk of this condition, in which prevalence was 6.4% in a sample of 27,310 participants followed for a median of 12.4 years<sup>(20)</sup>.

The low practice of physical activity observed in the sample is a relevant finding, since approximately six out of every 10 participants reported not practicing physical exercise or sports. Among those with a history of stroke, this proportion was even higher. Similar results were observed in national and international studies conducted with hypertensive individuals, which also identified a high prevalence of sedentary behavior in this population<sup>(18)</sup>. Participation in the minimum levels of physical activity recommended by the WHO was associated with reduced blood pressure, with a decrease of at least seven mmHg in systolic blood pressure and three mmHg in diastolic blood pressure<sup>(21)</sup>. Therefore, strategies to encourage regular physical activity should be strengthened within Primary Health Care.

Although most participants did not report current tobacco use, a high frequency of past smoking was observed, especially among those with a history of stroke. This result corroborates studies showing

that prolonged exposure to tobacco remains an important factor related to the occurrence of cerebrovascular events, even after cessation of the habit. Thus, it is highly valuable for Primary Health Care to act actively and encourage the National Tobacco Control Program, as well as the implementation of cognitive-behavioral therapies associated with medication use<sup>(22)</sup>. Another strategy is to provide brief counseling to all smokers during routine visits, a measure that may result in a significant reduction in deaths and avoidable costs<sup>(23)</sup>.

Regarding the analysis of variables in the group of stroke patients with significant associations, red meat consumption in this group was low (1.79 days per week) compared with those who had not had a stroke (3.39 days per week). This result may be understood as a possible change in eating habits after stroke and may indicate an effect of the event rather than its cause. One study showed that consumers have growing interest in food: 43% consider it very important and approximately 43.2% classify it as important<sup>(24)</sup>. These data show that the population may be more aware of the impact that habits and lifestyle have on health.

Regarding chicken consumption, the data indicate higher consumption among stroke patients, which may be related to an attempt to replace red meat. However, the influence of food preparation methods is known; therefore, fattier cuts such as thighs, drumsticks, and wings should be roasted or grilled to reduce fat content<sup>(17)</sup>. A healthy diet is low in red meat<sup>(18)</sup>. However, dietary patterns in society are influenced by several factors, such as culture, income, education, gender, and household conditions, which influence access to adequate food<sup>(25)</sup>.

When analyzing replacement of lunch with snacks, none of the stroke patients reported this practice. This result contrasts with findings from a study that showed a high frequency of inadequate dietary patterns among Brazilian adults, including higher consumption of ultra-processed foods and replacement of traditional meals, factors associated with increased risk of cardiovascular and cerebrovascular diseases<sup>(26-27)</sup>. However, although a positive result was

observed in this regard, the dietary pattern before the event could not be evaluated; therefore, it is important to consider whether the habit was adopted before or after the event.

Overall, the findings of this study reinforce the significant influence of behavioral factors on the health of hypertensive individuals, especially in relation to the occurrence of stroke. A higher frequency of physical inactivity and past smoking was observed among participants with a history of stroke. On the other hand, behaviors such as replacing the main meal were not present in this group, suggesting adherence to healthier habits.

Thus, the importance of prevention strategies and interventions within primary care is evident, taking into account the lifestyle and diversity of the population served, with a focus not only on hypertension treatment but also on promoting healthy and sustainable long-term behaviors.

## Study limitations

Study limitations include the cross-sectional design, which makes it difficult to establish causal relationships. In addition, the low prevalence of stroke observed in the sample limited the performance of multivariate analyses, such as logistic regression, which restricts the identification of factors independently associated with the outcome. Another limitation is the collection of self-reported data, which is subject to recall bias or underreporting of behaviors considered socially undesirable. Nevertheless, the findings provide relevant support for public health and for strategies related to health education and prevention of cerebrovascular complications.

## Contributions to practice

This study contributes to the early identification of modifiable risk factors, reinforces the importance of behavioral screening in clinical routines, and supports the planning of multiprofessional care.

## Conclusion

A high frequency of cardiovascular risk behaviors was identified among hypertensive individuals treated in Primary Health Care, especially low physical activity, history of smoking, and frequent red meat consumption. Among participants with a history of stroke, a higher proportion of physical inactivity and past smoking was observed, as well as differences in dietary consumption patterns when compared with hypertensive individuals without a history of the disease.

## Authors' contributions

Conception and design or data analysis and interpretation: **Ribeiro VLD, Beleza CMF**. Manuscript writing or relevant critical review of intellectual content; final approval of the version to be published; agreement to be responsible for all aspects of the manuscript related to the accuracy or integrity of any part, ensuring that they are properly investigated and resolved: **Ribeiro VLD, Moura MCS, Silva ARV, Sousa ASJ, Beleza CMF**.

## Data availability

The authors declare that the entire dataset supporting the results of this study is available upon request to the corresponding author.

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