Int J Cardiovasc Sci. 2025; 38:e20240038

ORIGINAL ARTICLE

Lifestyle and Hypertension in Brazil and Spain

Giovanna Lucieri Alonso Costa,[1,2] Jurema Correa Mota,[1] Marina Ururahy Soriano de Sousa,[1,2] Flavio Kapczinski,[3,4,5] Jose Cervera-Martínez,[6] Vicent Balanzá-Martínez,[6,7] Raquel B. De Boni[1]

Instituto de Comunicação e Informação Científica e Tecnológica, Fundação Oswaldo Cruz (ICICT), Oswaldo Cruz Foundation (FIOCRUZ),[1] Rio de Janeiro, RJ – Brazil
Universidade Federal do Estado do Rio de Janeiro (UNIRIO), Escola de Medicina e Cirurgia (EMC),[2] Rio de Janeiro, RJ – Brazil
McMaster University,[3] Hamilton, Ontario – Canada
HCPA, Instituto Nacional de Ciência e Tecnologia Translacional em Medicina (INCT-TM),[4] Porto Alegre, RS – Brazil
UFRGS,[5] Porto Alegre, RS – Brazil
Teaching Unit of Psychiatry and Psychological Medicine, Department of Medicine, University of Valencia, CIBERSAM, INCLIVA,[6] Valencia – Spain
VALSME (Valencia Salut Mental i Estigma) Research Group[7] Valencia – Spain

Abstract

Background: Hypertension is the main risk factor for cardiovascular mortality worldwide. Lifestyle medicine (LM) assesses health through seven domains (diet, physical activity, substance use, sleep, social support, stress management, and environmental exposure), which also include risk factors for hypertension.

Purpose: To evaluate the association between lifestyle and hypertension in Brazil and Spain.

Methods: Secondary analysis of data from two web surveys conducted in 2020 in Brazil and Spain, which assessed lifestyle through a multidimensional scale. We enrolled 5224 individuals of both genders, aged > 18 years, living in Brazil and Spain, and with Internet access. The main outcome was a self-reported hypertension diagnosis. We calculated the absolute and relative frequency of the independent variables and evaluated the factors associated with hypertension in logistic regression models.

Results: 76.2% of participants were women, 57.9% were > 42 years old, and 66.9% had finished higher education. Over the last 12 months, 19.6% of Brazilians and 9.2% of Spanish reported diagnosis/treatment of hypertension. Male and older groups living in Brazil, with lower education and worse lifestyles, were more likely to report hypertension. General lifestyle score was not associated with hypertension in Brazil, while hypertensive individuals had better scores in Spain ($p < 0.001$). Hypertensive individuals had worse lifestyle scores in physical activity ($p < 0.05$) and sleep ($p < 0.05$) in Brazil and better diet scores in Spain ($p < 0.001$). Environmental exposure was better among hypertensive individuals in both countries ($p < 0.001$). Our results point to cultural and socioeconomic differences between both countries.

Conclusion: LM is an important strategy for the prevention/treatment of chronic diseases such as hypertension.
Keywords: Life Style; COVID-19; Hypertension; Diet.

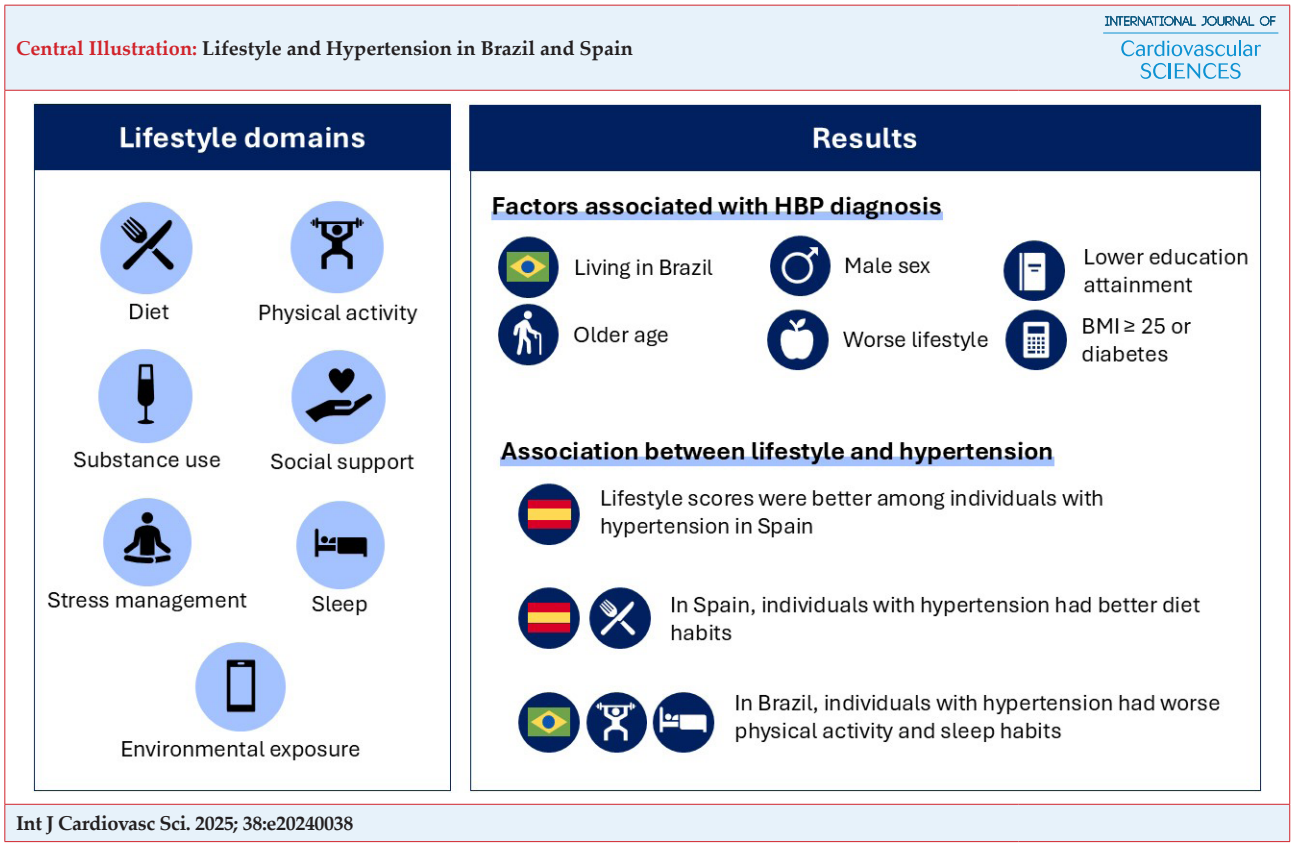
Introduction

High blood pressure (HBP) is the main preventable risk factor for morbidity and mortality from cardiovascular causes in the world. It has a more unfavorable impact on low- and middle-income countries.[1] The global estimate of hypertension for 2019 among individuals aged 30 to 79 years was 626 million cases among women and 652 million among men,[2] with a prevalence of 32% and 34%, respectively.[2] In Brazil, the National Health Survey from 2019 estimated HBP self-reported prevalence at 23.9%: 2.29% in individuals 18-24 years old, 7.25% in individuals 25-39 years old, 27.21% in individuals 40-59 years old, and 54,99% in individuals over 60 years old.[3] In Spain, the IBERICAN cohort study has found a prevalence of 1.5% of hypertensive individuals under 40 years old,

Mailing Address: Giovanna Lucieri Alonso Costa
Oswaldo Cruz Foundation, ICICT. Avenida Brasil, 4365. Postal code: 21040-900. Rio de Janeiro, RJ – Brazil
E-mail: costa.giovanna17@gmail.com
Editor responsible for the review: Fernando Wyss

DOI: https://doi.org/10.36660/ijcs.20240038

Manuscript received March 13, 2024; revised manuscript August 25, 2024; accepted January 13, 2025.



7.1% in individuals 40-49 years old, 20.5% in individuals 50-59 years old, 31.2 in individuals 60-69 years old, 30.7% in individuals 70-79 years old, and 9.0% in individuals over 80 years old.[4]

HBP prevention can be achieved both through initiatives by individuals and public health interventions.[1,5] In the first case, lifestyle changes are important for preventing and treating hypertension,[6] bringing to light the role of lifestyle medicine (LM) in the care of hypertensive patients. LM is an evidence-based medical specialty[7] that proposes health interventions in primary and secondary prevention to reduce the impact of chronic diseases.[7,8] The domains assessed by LM are diet, physical activity, substance use, sleep, social support, stress management, and environmental exposure. Lifestyle habits are assessed in a multidimensional way,[7,9-12] and the main risk factors for hypertension and cardiovascular mortality are directly related to these domains. The Lancet Commission on Hypertension cites a healthy diet, physical activity, weight loss, stress management, and a reduction in alcohol consumption and smoking as key measures to prevent and treat hypertension.[1]

In 2020, due to social isolation, the world population changed behavior patterns associated with lifestyle, such as diet, physical activity, and sleep. Some studies have shown a reduction in physical activity,[13] worsening in eating habits[14] and in sleep quality,[15] increased screen time and alcohol and tobacco use,[15-17] as well as increased cases of depression and anxiety.[15] On the other hand, certain studies have shown improvements in workout[18] and in the quality of family relationships.[15] Evidence is controversial when concluding about the consequences of these behaviors, even if temporary, on HBP.[5,19] In this context, the purpose of this study was to analyze the association between lifestyle and HBP during the first year of the COVID-19 pandemic in Brazil and Spain. In a previous work, we found that the lifestyles in Spain and Brazil are different and that Brazilians had a worse lifestyle.[20]

Methods

Study design

Secondary analysis of data obtained from two cross-sectional web surveys conducted between August and October 2020 (Brazil) and November and December 2020 (Spain), which assessed the participants' lifestyles through a questionnaire consisting of 87 questions.

The questionnaire was disseminated through social media, and participants were recruited using the "snowball sampling" technique, in which recruited individuals could also identify other potential participants.[21] Methodological details were published elsewhere.[9,20,22]

Study population

We recruited 5224 individuals of both genders, aged over 18 years, living in Brazil and Spain, with Internet access and who agreed to participate in the research. Participation was voluntary, and potential duplicate responses were previously excluded by asking whether the individual had responded to the survey previously. The response rate is unknown since it is not possible to estimate how many individuals have seen the questionnaire advertise to determinate an estimate.

Main outcome

The main outcome was a self-reported HBP diagnosis, assessed by the question: "Were you diagnosed by a physician or healthcare provider or received treatment for hypertension over the last 12 months?"

Independent variables

Demographic variables included gender, age group (over or under 42 years old), country of residence (Brazil or Spain), and education. Body Mass Index (BMI) was calculated using self-reported weight and height and categorized into underweight/normal (18.5 – 24.9 kg/m²), overweight (25.0 – 29.9 kg/m²), and obesity (> 30kg/m²). Previous diagnoses of diabetes, depression, and anxiety analyzed were self-reported using the Patient Health Questionnaire-2 (PHQ-2, cut-off point ≥ 3) and Generalized Anxiety Disorder 7-item (GAD-7, cut-off point ≥ 10) questionnaires. Alcohol consumption was assessed using the Alcohol Use Disorder Identification Test (AUDIT-C, cutoff point ≥ 3) score.[23]

To evaluate lifestyle, we used the Short Multidimensional Instrument for Lifestyle Evaluation – Confinement (SMILE-C),[9] designed and validated[9] specifically for the COVID-19 social isolation moment. It consists of 27 items, which cover the seven domains of lifestyle (diet, physical activity, substance use, stress management, social support, sleep, and environmental exposure). Responses are evaluated using a 4-point Likert scale. The score for each domain was calculated by summing the answers divided by the number of questions in the domain. Then, the results of the domains were added together and multiplied by 10. The higher the score, the better the lifestyle.

Statistical analysis

We calculated the absolute and relative frequency of independent variables in total, stratified by HBP diagnosis and country. Frequencies were compared using the chi-squared test and the Mann-Whitney test, with a statistical significance of 5%. To evaluate the factors associated with HBP, two logistic regression models were adjusted, one built with the total SMILE-C score and the other with the scale domains. Variables whose association in the bivariate analysis showed a significance of $p < 0.2$ were included in the models, and the stepwise backward procedure was followed until obtaining the most parsimonious model. Lifestyle variables (SMILE) were kept in the models because they are associated with hypertension in previous studies. We assessed the models' goodness of fit using the Hosmer-Lemeshow test. We provide a separate analysis for each country in the supplemental material. The analysis was performed using IBM SPSS 20 statistical software (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

Ethical aspects

This study was approved by both the Institutional Review Boards of Hospital das Clínicas de Porto Alegre (CAAE 31520620.0.1001.5327) and of Hospital Universitari i Politècnic La Fe, in Valencia, Spain (2020-149-1). Surveys were anonymous (no identification data of participants, such as name, city, or IP address, were collected). Participants read the consent form and confirmed their interest in participating on the first screen of the online questionnaires.

Results

A total of 5224 individuals responded to the survey, 1590 in Brazil and 3634 in Spain. We analyzed data from 5216 individuals (99.8% of the total), who responded about the HBP diagnosis. Most participants (76.2%) were female and 66.9% had finished higher education. When analyzing age ranges, we found that 38.3% were between 18 and 39 years old, 45.4% were between 40 and 59 years old, and 16.2% were over 60 years old. Table 1 shows the

Table 1 – Sociodemographic information, comorbidities, and substance use, according to the country. Brazil and Spain, 2020.

Variables	Brazil		Spain		p-value
	N	%	N	%	
Sex					
Male	279	17.6	963	26.5	< 0.001
Female	1303	82.4	2671	73.5	
Age					
18-39	516	32.6	1483	40.8	< 0.001
40-59	691	43.7	1679	46.2	
60+	375	23.7	472	13.0	
BMI					
Low or normal weight	684	43.5	2201	60.6	< 0.001
Overweight	557	35.4	1021	28.1	
Obesity	333	21.2	409	11.3	
Education					
Basic/high school/technical education	463	29.3	1262	34.7	0.001
College degree	770	48.7	1642	45.2	
Master's degree/PhD	349	22.1	730	20.1	
Alcohol consumption ("risky drinking")					
Negative	1001	64.1	3123	85.9	< 0.001
Positive	560	35.9	511	14.1	
Tobacco use					
Always/often	152	9.6	522	14.4	< 0.001
Occasionally/never	1428	90.4	3112	85.6	
Marijuana use					
Always/often	37	2.3	52	1.4	0.019
Occasionally/never	1539	97.7	3582	98.6	
Illicit drug use					
Always/often	5	0.3	3	0.1	0.047
Occasionally/never	1570	99.7	3631	99.9	
Diabetes diagnosis/treatment					
No	1438	91.3	3465	95.3	< 0.001
Yes	137	8.7	169	4.7	
Depression screening					
No	842	54.5	2939	80.9	< 0.001
Yes	702	45.5	695	19.1	
Anxiety screening					
No	844	55.3	2912	80.1	< 0.001
Yes	683	44.7	722	19.9	

sociodemographic characteristics, alcohol and substance use, and comorbidities stratified by country. Brazil displayed higher frequencies of women, individuals over 60 years, overweight and obesity, alcohol abuse, depression, and anxiety as compared to Spain (p<0.001).

The overall self-reported HBP prevalence was 19.6% (in Brazil) and 9.2% (in Spain). Table 2 displays the sociodemographic characteristics, according to the HBP diagnosis and stratified by country.

Scores from the SMILE-C scale, including its domains, according to the previous diagnosis of HBP and stratified by country, are found in Table 3. Overall, lifestyle was better (higher SMILE-C scores) in Spain as compared to Brazil. Among the Brazilian population, no statistically significant differences were found in the general lifestyle score, according to the diagnosis of hypertension. Among the Spanish population, we did find a statistically significant better lifestyle score among hypertense individuals ($p < 0.001$). When observing the results by domains, individuals with HBP had lower SMILE-C scores (worse lifestyle) in the physical activity ($p < 0.05$) and sleep ($p < 0.05$) domains in Brazil and higher SMILE-C scores (better lifestyle) in the diet in Spain ($p < 0.001$). Environmental exposure was better among people with HBP in both countries ($p < 0.001$).

The results of the adjusted logistic models (Tables 4 and 5) showed that the factors associated with a higher likelihood of self-reported HBP were: living in Brazil, male gender, older age, lower educational attainment, self-reported diagnosis of diabetes, and BMI greater than or equal to 25 (overweight or obesity). Regarding lifestyle, a better lifestyle was associated with a decreased likelihood of HBP ($p = 0.034$), but scores by domains did not show significant associations. The supplementary tables show that the association of education and lifestyle with HBP was only statistically significant in Brazil. We present a summary of our main results in the Central Illustration.

Discussion

In our study, approximately twice as many Brazilians as Spanish people reported hypertension diagnosis or treatment (19.60% vs. 9.22%, respectively). The prevalence of risk factors for HBP (such as overweight/obesity and alcohol abuse) was also higher in Brazil, while the lifestyle score was worse. After adjusting for confounding, male and older individuals living in Brazil, with lower educational attainment and worse lifestyles, were more likely to report HBP.

Hypertension prevalence was lower than that estimated by the WHO,[2] 40.0% - 50.0% in Brazil and 20.0% - 40.0% in Spain (probably because the WHO estimates refer to individuals between 30 and 79 years old).[2] However, our results from Brazil are similar to the ones found in the National Health Survey,[3] and rates in Spain were similar to the IBERICAN cohort in some age ranges.[4] These numbers provide some evidence that, although our sample was not probabilistic, our results are still comparable to those that were collected using a similar question. It is worth noting that the HBP may still be underestimated in our study because it was not objectively measured, and some individuals may not be aware of their diagnosis.

We observed a huge difference in the frequencies of risk factors for HBP between the countries. Obesity prevalence in Brazil was twice the obesity prevalence in Spain, for instance, which is similar to results from other studies.[24,25] Those differences likely reflect cultural habits, as well as socioeconomic and environmental factors that have a role in obesity epidemics. Regarding cultural habits, it is important to highlight the differences in dietary patterns among countries, since diet is one of the key factors for the primary and secondary prevention of hypertension.[26,27] We found that the SMILE-C diet score was better in Spain, which may reflect the historical adherence to the Mediterranean diet in the country. The Mediterranean diet has been studied as a tool for HBP[28] and cardiovascular disease[29] prevention since the late 1990s and is recommended for the prevention and management of HBP. Other studies have also identified improvements in dietary habits of some populations during the pandemic period,[13,30,31] including in Spain,[32] and an increased adherence to the Mediterranean diet during the pandemic.[32]

Diet, however, is only one of the seven lifestyle domains evaluated by the SMILE-C. We found that the multidimensional evaluation of lifestyle was better in Spain and was an independent protective factor associated with HBP. There are many factors associated with better lifestyle behaviors, including demographic and socioeconomic factors. Thus, some of the differences observed in lifestyle between the countries may be due to the differences in those characteristics of the samples. For instance, older individuals often exhibit better lifestyle behaviors, such as healthier diets and increased compliance with health promotion activities, although they may also show higher physical inactivity.[33,34] Men are more likely to engage in physical activity, while

Table 2 – Sociodemographic information, comorbidities, and substance use, according to the hypertension diagnosis. Brazil and Spain, 2020.

Variables	Total	Brazil			Spain		
		No	Yes	p-value	No	Yes	p-value
	N = 5216 (%)	N (%) 1272 (80.4)	N (%) 310 (19.2)		N (%) 3299 (90.8)	N (%) 335 (9.2)	
Sex							
Male	1242 (23.8)	223 (79.9)	56 (20.1)	0.825	828 (86.0)	135 (14.0)	< 0.001
Female	3974 (76.2)	1049 (80.5)	254 (19.5)		2471 (92.5)	200 (7.5)	
Age							
18-39	1999 (38.3)	492 (95.3)	24 (4.7)	<0.001	1461 (98.5)	22 (1.5)	< 0.001
40-59	2370 (45.4)	545 (78.9)	146 (21.1)		1508 (89.8)	171 (10.2)	
60+	847 (16.2)	235 (62.7)	140 (37.3)		330 (69.9)	142 (30.1)	
BMI							
Low or normal weight	2885 (55.4)	590 (86.3)	94 (13.7)	<0.001	2102 (95.5)	99 (4.5)	< 0.001
Overweight	1578 (30.3)	456 (81.9)	101 (18.1)		872 (85.4)	149 (14.6)	
Obesity	742 (14.3)	220 (66.1)	113 (33.9)		322 (78.7)	87 (21.3)	
Education							
Basic/high school/technical education	1725 (33.1)	355 (76.7)	108 (23.3)	0.015	1125 (89.1)	137 (10.9)	0.006
College degree	2412 (46.2)	621 (80.6)	149 (19.4)		1492 (90.9)	150 (9.1)	
Master's degree/PhD	1079 (20.7)	296 (84.8)	53 (15.2)		682 (93.4)	48 (6.6)	
Alcohol consumption ("risky drinking")							
Negative	4124 (79.4)	787 (78.6)	214 (21.4)	0.018	2820 (90.3)	303 (9.7)	0.013
Positive	1071 (20.6)	468 (83.6)	92 (16.4)		479 (93.7)	32 (6.3)	
Tobacco use							
Always/often	674 (12.9)	110 (72.4)	42 (27.6)	0.008	472 (90.4)	50 (9.6)	0.759
Occasionally/never	4540 (87.1)	1161 (81.3)	267 (18.7)		2827 (90.8)	285 (9.2)	
Marijuana use							
Always/often	89 (1.7)	33 (89.2)	4 (10.8)	0.173	49 (94.2)	3 (5.8)	0.386
Occasionally/never	5121 (98.3)	1234 (80.2)	305 (19.8)		3250 (90.7)	332 (9.3)	
Illicit drug use							
Always/often	8 (0.2)	2 (40.0)	3 (60.0)	0.023	3 (100.0)	-	-
Occasionally/never	5201 (99.8)	1264 (80.5)	306 (19.5)		3296 (90.8)	335 (9.2)	

Diabetes diagnosis/treatment							
No	4903 (94.1)	1197 (83.2)	241 (16.8)	<0.001	3190 (92.1)	275 (7.9)	< 0.001
Yes	306 (5.9)	70 (51.1)	67 (48.9)		109 (64.5)	60 (35.5)	
Depression screening							
No	3781 (73.0)	678 (80.5)	164 (19.5)	0.765	2650 (90.2)	289 (9.8)	0.008
Yes	1397 (27.0)	561 (79.9)	141 (20.1)		649 (93.4)	46 (6.6)	
Anxiety screening							
No	3756 (72.8)	683 (80.9)	161 (19.1)	0.487	2625 (90.1)	287 (9.9)	0.008
Yes	1405 (27.2)	543 (79.5)	140 (20.5)		674 (93.4)	48 (6.6)	

Table 3 – SMILE-C scale score, general and by domains, according to the HBP diagnosis. Brazil and Spain, 2020.

SMILE-C and domains	Total	Brazil				Spain			
		Total	Hypertension		p-value	Total	Hypertension		p-value
			No	Yes			No	Yes	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	Mean (SD)	
SMILE- C (score total)	195.4 (24.8)	191.8 (26.6)	192.3 (26.8)	189.8 (25.7)	0.151	196.9 (23.9)	196.5 (23.8)	200.9 (24.1)	0.001
Diet	30.6 (4.6)	30.0 (5.1)	30.0 (5.1)	30.0 (5.1)	0.995	30.9 (4.3)	30.8 (4.3)	31.7 (4.2)	0.000
Substance use	37.7 (3.4)	37.7 (3.4)	37.7 (3.2)	37.5 (3.8)	0.344	37.7 (3.5)	37.7 (3.5)	37.8 (3.1)	0.681
Physical activity	24.4 (10.1)	22.6 (10.4)	22.9 (10.5)	21.1 (9.5)	0.004	25.3 (9.9)	25.2 (9.9)	25.7 (10.0)	0.399
Stress management	23.6 (4.9)	25.4 (5.4)	25.4 (5.4)	25.4 (5.3)	0.876	22.8 (4.4)	22.7 (4.4)	23.2 (4.5)	0.087
Sleep	29.5 (6.3)	29.3 (6.4)	29.6 (6.2)	28.4 (6.8)	0.008	29.6 (6.3)	29.5 (6.2)	29.7 (6.8)	0.729
Social support	29.7 (5.8)	28.8 (6.2)	28.9 (6.1)	28.4 (6.4)	0.251	30.1 (5.6)	30.1 (5.6)	29.7 (5.5)	0.171
Environmental exposure	19.6 (9.4)	17.7 (8.5)	17.4 (8.4)	18.5 (8.8)	0.042	20.5 (9.7)	20.3 (9.6)	23.0 (9.6)	0.000

women tend to have better dietary habits and lower rates of smoking and alcohol consumption. Besides, higher education and higher income are associated with increased physical activity, better dietary habits, lower alcohol and tobacco use and more frequent health check-ups.[35]

Social determinants of health and social disparity may also influence lifestyle. In a 2021 study, Zhou et al. argued hypertension patterns must be analyzed differently between high-income and middle- and low-income countries because the two groups have, for instance, different access to fresh diet and low-sodium diet, hence different factors causing hypertension trends.[5] Urban violence might discourage individuals from working out outdoors, increasing sedentarism and obesity. Food insecurity and the burden of malnutrition are also of particular interest.[36] Considering that lifestyle is directly correlated with HBP in our study, promoting strategies to improve lifestyle may be an important step for primary and secondary hypertension prevention.

The limitations of this study encompass the non-probabilistic nature of the sample, which generates a

Table 4 – Factors associated with previous HBP diagnosis, considering the total SMILE-C score. Brazil and Spain, 2020.

Variables	Adjusted OR (95% CI)	P (LR-test)
Brazil vs. Spain	1.936 (1.592 – 2.353)	< 0.001
Male vs. Female	1.476 (1.194 – 1.824)	< 0.001
40 to 59 years old vs. 18 to 39 years old	5.559 (4.014 – 7.699)	< 0.001
> 60 years old vs. 18 to 39 years old	16.154 (11.439 – 22.813)	< 0.001
Basic/high school/technical education vs. post-doctoral degree	1.628 (1.234 – 2.148)	0.001
College vs. post-doctoral degree	1.359 (1.046 – 1.767)	0.022
Overweight vs. low/normal weight	1.542 (1.239 – 1.921)	< 0.001
Obesity vs. low/normal weight	2.737 (2.137 – 3.505)	< 0.001
Diabetes – Yes vs. no	3.097 (2.334 – 4.108)	< 0.001
SMILE – total score (for each 1-point increase)	0.996 (0.992 – 1.000)	0.034
Hosmer-Lemeshow test for model fitness: p = 0.804		

Table 5 – Factors associated with previous HBP diagnosis, considering the SMILE-C domains. Brazil and Spain, 2020.

Variables	Adjusted OR (95% CI)	P(LR-test)
Brazil vs. Spain	1.908 (1.541 – 2.362)	< 0.001
Male vs. Female	1.525 (1.228 – 1.894)	< 0.001
40 to 59 years old vs. 18 to 39 years old	5.273 (3.784 – 7.349)	< 0.001
> 60 years old vs. 18 to 39 years old	15.143 (10.646 – 21.539)	< 0.001
Basic/high school/technical education vs. post-doctoral degree	1.622 (1.227 – 2.143)	0.001
College vs. post-doctoral degree	1.358 (1.044 – 1.767)	0.022
Overweight vs. low/normal weight	1.558 (1.250 – 1.942)	< 0.001
Obesity vs. low/normal weight	2.761 (2.147 – 3.551)	< 0.001
Diabetes – Yes vs. no	3.091 (2.328 – 4.104)	< 0.001
SMILE – domains		
Diet	1.013 (0,990 – 1.038)	0.268
Physical activity	0.990 (0.980 – 1.000)	0.060
Substance use	0.987 (0,960 – 1.015)	0.366
Sleep	0.986 (0.971 – 1.001)	0.072
Social support	0.992 (0.974 – 1.010)	0.378
Stress management	1.008 (0.985 – 1.030)	0.501
Environmental exposure	0.999 (0,989 – 1.010)	0.905
Hosmer-Lemeshow test for model fitness: p = 0.410		

selection bias (including more individuals with higher education and women), and results may not be extended to the entire population; the nature of data collection, which excludes individuals without access to the Internet and, therefore, represents a vulnerable portion of the population (in Brazil, around 19% of the population aged >10 years does not have Internet access).[37] The third limitation is the use of self-reported measures, which may underestimate the HBP prevalence, given the lack of knowledge about the diagnosis itself. Finally, this is a cross-sectional study and, therefore, does not allow inferring causality.

Conclusions

Our data reinforce the importance of primary and secondary prevention in the population strategy to combat hypertension, where LM can be a useful tool. In this sense, health professionals must be familiar with the main lifestyle domains to implement habit change strategies.

Author Contributions

Conception and design of the research, acquisition of data: Kapczinski F, Balanzá-Martínez V, Boni RB; analysis and interpretation of the data: Mota JC, Boni RB; statistical analysis: Mota JC; writing of the manuscript: Costa GLA, Mota JC, Sousa MUS, Boni RB; critical revision of the manuscript for intellectual content: Costa GLA, Mota JC, Sousa MUS, Kapczinski F, Cervera-Martínez J, Balanzá-Martínez V, Boni RB

Potential Conflict of Interest

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

Sources of Funding

RBDB acknowledges funding from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) #307284/2023-9.

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 Ethics Committee of the Hospital das Clínicas de Porto Alegre / Universitari i Politècnic La Fe under the protocol number 31520620.0.1001.5327 / 2020-149-1. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

References

1. Olsen MH, Angell SY, Asma S, Boutouyrie P, Burger D, Chirinos JA, et al. A Call to Action and a Lifecourse Strategy to Address the Global Burden of Raised Blood Pressure on Current and Future Generations: The Lancet Commission on Hypertension. Lancet. 2016;388(10060):2665-712. doi: 10.1016/S0140-6736(16)31134-5.
2. 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):957-80. doi: 10.1016/S0140-6736(21)01330-1.
3. Malta DC, Bernal RTI, Ribeiro EG, Moreira AD, Felisbino-Mendes MS, Velásquez-Meléndez JG. Arterial Hypertension and Associated Factors: National Health Survey, 2019. Rev Saude Publica. 2023;56:122. doi: 10.11606/s1518-8787.2022056004177.
4. Prieto-Díaz MA, Pallares-Carratala V, Micó-Pérez RM, Escobar-Cervantes C, Martín-Sanchez V, Coca A, et al. Clinical Characteristics, Treatment, and Blood Pressure Control in Patients with Hypertension Seen by Primary Care Physicians in Spain: The IBERICAN Study. Front Cardiovasc Med. 2023;10:1295174. doi: 10.3389/fcvm.2023.1295174.
5. Zhou B, Perel P, Mensah GA, Ezzati M. Global Epidemiology, Health Burden and Effective Interventions for Elevated Blood Pressure and Hypertension. Nat Rev Cardiol. 2021;18(11):785-802. doi: 10.1038/s41569-021-00559-8.
6. Valenzuela PL, Carrera-Bastos P, Gálvez BG, Ruiz-Hurtado G, Ordovas JM, Ruilope LM, et al. Lifestyle Interventions for the Prevention and Treatment of Hypertension. Nat Rev Cardiol. 2021;18(4):251-75. doi: 10.1038/s41569-020-00437-9.
7. American College of Lifestyle Medicine. What is Lifestyle Medicine? [Internet]. Chesterfield: American College of Lifestyle Medicine; 2024 [cited 2025 Jan 23]. Available from: https://lifestylemedicine.org/.
8. GBD 2017 Risk Factor Collaborators. Global, Regional, and National Comparative Risk Assessment of 84 Behavioural, Environmental and Occupational, and Metabolic Risks or Clusters of Risks for 195 Countries and Territories, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392(10159):1923-94. doi: 10.1016/S0140-6736(18)32225-6.
9. Balanzá-Martínez V, Kapczinski F, Cardoso TA, Atienza-Carbonell B, Rosa AR, Mota JC, et al. The Assessment of Lifestyle Changes During the COVID-19 Pandemic Using a Multidimensional Scale. Rev Psiquiatr Salud Ment. 2021;14(1):16-26. doi: 10.1016/j.rpsm.2020.07.003.
10. Boni RB, Ribeiro-Alves M, Mota JC, Gomes M, Balanzá-Martínez V, Kapczinski F, et al. The Cumulative Effect of Multiple Dimensions of Lifestyle on Risky Drinking During the Covid-19 Pandemic. Prev Med. 2021;150:106718. doi: 10.1016/j.ypmed.2021.106718.
11. Castro R, Ribeiro-Alves M, Oliveira C, Romero CP, Perazzo H, Simjanoski M, et al. What are We Measuring When We Evaluate Digital Interventions for Improving Lifestyle? A Scoping Meta-Review. Front Public Health. 2022;9:735624. doi: 10.3389/fpubh.2021.735624.

12. European Lifestyle Medicine Organization. What is Lifestyle Medicine? [Internet]. Geneva: European Lifestyle Medicine Organization; 2024 [cited 2025 Jan 23]. Available from: https://www.eulm.org/what-is-lifestyle-medicine.

13. Molina MDCB, Aprelini CMO, Meireles AL, Griep RH, Giatti L, Almeida MDCC, et al. Impact of Socioeconomic Factors on Lifestyle Changes Among Employees of Public Higher Education Institutions in ELSA-Brasil During COVID-19 Pandemic. Cad Saude Publica. 2023;39(11):e00047123. doi: 10.1590/0102-311XEN047123.

14. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, et al. Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey. Nutrients. 2020;12(6):1583. doi: 10.3390/nu12061583.

15. Tahir SM, Imran N, Haider II, Mustafa AB, Rehman AU, Azeem MW, et al. A Study to Evaluate the Impact of COVID-19 on Lifestyle of Medical Students. Pak J Med Sci. 2022;38(7):1730-7. doi: 10.12669/pjms.38.7.6031.

16. Malta DC, Gomes CS, Barros MBA, Lima MG, Almeida WDS, Sá ACMGN, et al. Noncommunicable Diseases and Changes in Lifestyles During the COVID-19 Pandemic in Brazil. Rev Bras Epidemiol. 2021;24:e210009. doi: 10.1590/1980-549720210009.

17. Malta DC, Szwarcwald CL, Barros MBA, Gomes CS, Machado ÍE, Souza PRB Jr, et al. The COVID-19 Pandemic and Changes in Adult Brazilian Lifestyles: A Cross-Sectional Study, 2020. Epidemiol Serv Saude. 2020;29(4):e2020407. doi: 10.1590/S1679-49742020000400026.

18. Awadi S, Khamees A, Almdallal W, Alzoubi M, Talafha L, Alsheikh AM, et al. A Cross-Sectional Study of the Impact of COVID-19 Pandemic on the Physical Activity of Jordanian Population. Health Sci Rep. 2022;5(6):e896. doi: 10.1002/hsr2.896.

19. Mattioli AV, Ballerini Puviani M, Nasi M, Farinetti A. COVID-19 Pandemic: The Effects of Quarantine on Cardiovascular Risk. Eur J Clin Nutr. 2020;74(6):852-5. doi: 10.1038/s41430-020-0646-z.

20. Boni RB, Balanzá-Martínez V, Mota JC, Cardoso TA, Ballester P, Atienza-Carbonell B, et al. Depression, Anxiety, and Lifestyle Among Essential Workers: A Web Survey from Brazil and Spain During the COVID-19 Pandemic. J Med Internet Res. 2020;22(10):e22835. doi: 10.2196/22835.

21. Oregon State University. Division of Research and Innovation [Internet]. Oregon: Oregon State University; 2024 [cited 2025 Jan 23]. Available from: https://research.oregonstate.edu/irb/policies-and-guidance-investigators/guidance/snowball-sampling.

22. Giner-Murillo M, Atienza-Carbonell B, Cervera-Martínez J, Bobes-Bascarán T, Crespo-Facorro B, Boni RB, et al. Lifestyle in Undergraduate Students and Demographically Matched Controls during the COVID-19 Pandemic in Spain. Int J Environ Res Public Health. 2021;18(15):8133. doi: 10.3390/ijerph18158133.

23. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT Alcohol Consumption Questions (AUDIT-C): An Effective Brief Screening Test for Problem Drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. Arch Intern Med. 1998;158(16):1789-95. doi: 10.1001/archinte.158.16.1789.

24. Gutiérrez-González E, García-Solano M, Pastor-Barriuso R, Larrea-Baz NF, Rollán-Gordo A, Peñalver-Argüeso B, et al. Socio-Geographical Disparities of Obesity and Excess Weight in Adults in Spain: Insights from the ENE-COVID Study. Front Public Health. 2023;11:1195249. doi: 10.3389/fpubh.2023.1195249.

25. Kodaira K, Abe FC, Galvão TF, Silva MT. Time-Trend in Excess Weight in Brazilian Adults: A Systematic Review and Meta-Analysis. PLoS One. 2021;16(9):e0257755. doi: 10.1371/journal.pone.0257755.

26. Tejada T, Fornoni A, Lenz O, Materson BJ. Nonpharmacologic Therapy for Hypertension: Does it Really Work? Curr Cardiol Rep. 2006;8(6):418-24. doi: 10.1007/s11886-006-0099-6.

27. Hedayati SS, Elsayed EF, Reilly RF. Non-Pharmacological Aspects of Blood Pressure Management: What are the Data? Kidney Int. 2011;79(10):1061-70. doi: 10.1038/ki.2011.46.

28. Aljuraiban GS, Gibson R, Chan DS, Van Horn L, Chan Q. The Role of Diet in the Prevention of Hypertension and Management of Blood Pressure: An Umbrella Review of Meta-Analyses of Interventional and Observational Studies. Adv Nutr. 2024;15(1):100123. doi: 10.1016/j.advnut.2023.09.011.

29. Laffond A, Rivera-Picón C, Rodríguez-Muñoz PM, Juárez-Vela R, Viñaspre-Hernández RR, Navas-Echazarreta N, et al. Mediterranean Diet for Primary and Secondary Prevention of Cardiovascular Disease and Mortality: An Updated Systematic Review. Nutrients. 2023;15(15):3356. doi: 10.3390/nu15153356.

30. Tholla TS, Sawicki CM, Bhupathiraju SN. The Intersection between COVID-19, Cardiovascular Disease, and Diet: A Review. Curr Atheroscler Rep. 2023;25(10):643-52. doi: 10.1007/s11883-023-01138-7.

31. Mignogna C, Costanzo S, Ghulam A, Cerletti C, Donati MB, Gaetano G, et al. Impact of Nationwide Lockdowns Resulting from the First Wave of the COVID-19 Pandemic on Food Intake, Eating Behaviors, and Diet Quality: A Systematic Review. Adv Nutr. 2022;13(2):388-423. doi: 10.1093/advances/nmab130.

32. Rodríguez-Pérez C, Molina-Montes E, Verardo V, Artacho R, García-Villanova B, Guerra-Hernández EJ, et al. Changes in Dietary Behaviours During the COVID-19 Outbreak Confinement in the Spanish COVIDiet Study. Nutrients. 2020;12(6):1730. doi: 10.3390/nu12061730.

33. Adorni R, Lonati E, Zanatta F, Belingheri M, Rossetti M, Colleoni M, et al. Lifestyle Profiles and Their Sociodemographic Correlate in an Academic Community Sample. Int J Environ Res Public Health. 2022;20(1):231. doi: 10.3390/ijerph20010231.

34. Rezayatmand R, Pavlova M, Groot W. Socio-Economic Aspects of Health-Related Behaviors and Their Dynamics: A Case Study for the Netherlands. Int J Health Policy Manag. 2015;5(4):237-51. doi: 10.15171/ijhpm.2015.212.

35. Smith AM, Smith C. Dietary Intake and Lifestyle Patterns: Correlates with Socio-Economic, Demographic and Environmental Factors. J Hum Nutr Diet. 1994;7(4):283–94. doi: 10.1111/j.1365-277X.1994.tb00271.x

36. World Health Organization. Obesity and Overweight [Internet]. Geneva: World Health Organization; 2024 [cited 2025 Jan 23]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

37. Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação. Comitê Gestor da Internet no Brasil. TIC Domicílios: Pesquisa sobre o Uso das Tecnologias de Informação e Comunicação nos Domicílios Brasileiros. São Paulo: Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação; 2022 [cited 2025 Jan 23]. Available from: https://cetic.br/pt/.

*Supplemental Materials

For additional information, please click here.