BLOOD PRESSURE PROFILE IN UNIVERSITY STUDENTS WHO PRACTICE SPORTS VERSUS SEDENTARY INDIVIDUALS

PERFIL TENSIONAL EM INDIVÍDUOS UNIVERSITÁRIOS QUE PRATICAM DESPORTO VERSUS SEDENTÁRIOS

PERFIL DE PRESIÓN ARTERIAL EN ESTUDIANTES UNIVERSITARIOS QUE PRACTICAN DEPORTE EN COMPARACIÓN CON PERSONAS SEDENTARIAS

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Beatriz Rato Conceição[1], António Filipe Pinto Rodrigues[2], Patrícia Margarida dos Santos Carvalheiro Coelho[3]

ABSTRACT
Hypertension is a clinical condition that has been increasing significantly in recent years, both in the elderly population and in young adults. It is characterized by a persistent elevation of blood pressure and is considered hypertension when systolic blood pressure values are equal to or greater than 140 mmHg and/or diastolic blood pressure values are equal to or greater than 90 mmHg. Hypertension is one of the main risk factors for the development of cardiovascular diseases, and is therefore of great importance.

Keywords: Risk Factors. Obesity. Dietary Habits. Physical Exercise. Hypertension.

RESUMO
A hipertensão arterial é uma condição clínica que tem vindo a aumentar significativamente nos últimos anos tanto na população mais idosa, como nos jovens adultos. Caracteriza-se por uma elevação persistente da pressão arterial sendo considerada hipertensão quando os valores da pressão arterial sistólica são iguais ou superiores a 140 mmHg e/ou os da pressão arterial diastólica iguais ou superiores a 90 mmHg. A hipertensão arterial constitui um dos principais fatores de risco para o desenvolvimento de doenças cardiovasculares, tendo uma grande importância.

Palavras-chave: Fatores de Risco. Obesidade. Hábitos Alimentares. Exercício Físico. Hipertensão Arterial.

RESUMEN
La hipertensión es una afección clínica que ha aumentado significativamente en los últimos años, tanto en la población anciana como en los adultos jóvenes. Se caracteriza por una elevación persistente de la presión arterial y se considera hipertensión cuando los valores de presión arterial sistólica son iguales o superiores a 140 mmHg y/o los valores de presión

[1] Instituto Politécnico de Castelo Branco. E-mail: beatriz.conceicao1103@gmail.com
[2] Unidade Local de Saúde Cova da Beira, Instituto Politécnico de Castelo Branco.
E-mail: afrorodrigues6@gmail.com
[3] Sport Physical Activity and Health Research & Innovation Center (Sprint), Instituto Politécnico de Castelo Branco. E-mail: patriciacoelho@ipcb.pt

arterial diastólica son iguales o superiores a 90 mmHg. La hipertensión es uno de los principales factores de riesgo para el desarrollo de enfermedades cardiovasculares y, por lo tanto, reviste gran importancia.

Palabras clave: Factores de Riesgo. Obesidad. Hábitos Alimentarios. Ejercicio Físico. Hipertensión.

1 INTRODUCTION

The incidence and mortality rates of cardiovascular disease (CVD) are declining in many countries in Europe, but it is still a major cause of morbidity and mortality. The World Health Organization (WHO) estimates that by 2030, more than 23 million people will die from CVD (1).

CVD is associated with multiple risk factors, which can be divided into modifiable and non-modifiable, the greater the aggregation or accumulation of factors in an individual, the greater the risk of developing CVD (2).

The most important way to prevent CVD is to promote a healthy lifestyle throughout life, with emphasis on regular physical activity, healthy eating, smoking cessation and moderate alcohol intake. The absence of this lifestyle associated with the presence of cardiovascular risk factors in young stages of life, such as adolescence, influences health in adult life (1).

Obesity and overweight are considered one of the main epidemics of the 21st century, influenced by unhealthy lifestyles. Excess body fat is a chronic condition associated with several health problems, and its main cause is an inadequate diet, characterized by excessive consumption of calories, saturated fatty acids, sugar and processed foods, as well as low intake of fruits and vegetables. In addition, physical inactivity and sedentary lifestyle contribute significantly to the problem (3,4).

According to the National Institute of Health Doutor Ricardo Jorge, in Portugal there is a high prevalence of risk factors for brain and cardiovascular diseases and a low rate of their control, especially of HTN and diabetes mellitus. These data highlight the need for strategies to screen the general population for CVD risk factors and promote healthy lifestyle measures and health literacy in Portugal (5).

The prevention of CVD continues to be a major challenge, requiring the implementation of lifestyle changes, primary and secondary prevention measures, as well as appropriate therapies and early diagnosis. To this end, it is essential to conduct studies to understand the aggregation of cardiovascular risk factors in the young population. This study aims to evaluate the prevalence of risk factors for hypertension in university students, comparing regular practitioners of physical activity with non-practitioners.

2 OBJECTIVE

To evaluate the prevalence of risk factors for hypertension in university students, comparing regular practitioners of physical activity with non-practitioners.

3 METHODOLOGY

This is a cross-sectional study with a mixed approach (quantitative and qualitative). Data collection took place during the month of December 2024. The participation of individuals was voluntary, ensuring the freedom to decide on their inclusion in the study and the possibility of withdrawing at any time, even after signing the informed consent. An individual questionnaire was applied to the target population to obtain demoFigureic data and risk factors; then, weight and height and abdominal circumference were measured.

Qualitative variables included race (black or Caucasian), sex, dietary patterns (frequency of fast food and fruit/vegetable consumption, salt consumption), subjective perception of sleep, and regular physical activity. For the latter, two subgroups were defined: participants who perform ≥150 minutes of exercise per week and those who practice <150 minutes. Among the quantitative variables, age, weight, height, BMI, blood pressure, and waist circumference were assessed.

To collect the weight, the individuals wore light clothing and were barefoot, using a properly tested and calibrated scale. Height was recorded with the aid of a stadiometer, in which the participant stood with the heels and head aligned, looking forward. Following these measurements, BMI was calculated by dividing the weight by the square of the height. To assess the abdominal perimeter, a tape measure positioned between the top of the hip bone and the last rib was used, ensuring that the participant had no clothing in that territory.

Blood pressure was assessed using the auscultatory method using an aneroid sphygmomanometer, tested and calibrated. Before each measurement, the participants sat for 5 minutes to ensure the stability and comfort expected for the evaluation, as recommended by the 2024 European Society Cardiology guidelines(6). During this process, appropriate conditions were respected, such as a calm environment, absence of previous consumption of stimulants, tobacco or exercise in the previous 30 minutes. The measurement was performed in both arms, with a maximum interval of two minutes and maintaining an adequate posture, sitting with back and arms supported.

After data collection, the variables were evaluated in order to test the hypotheses previously outlined. The statistical analysis included a descriptive approach for the qualitative variables and the calculation of the mean, standard deviation and percentages for the quantitative variables. For research and organization purposes, a database was created by the research team in Microsoft Excel ®. For the statistical analysis, the statistical data analysis and processing program SPSS Statistics ® (Statistical Product and Service Solutions) version 25 was used.

The normality of the data was tested according to the Kolmogorov-Smirnov test, applying parametric and non-parametric tests. Finally, parametric tests were used for a normal sample distribution or non-parametric tests for an abnormal sample distribution, for a 95% confidence interval and a p-value ≤0.05.

The research team declares that there is no conflict of interest and undertakes to protect the participants involved in this project. The research was previously approved by the Ethics Committee of the Polytechnic Institute of Castelo Branco, under code no. 174/CE-IPCB/2024. All data collected were treated anonymously and confidentially, being coded by numbers or letters, in accordance with the principles established in the Declaration of Helsinki. The information obtained was used exclusively for academic and scientific purposes, and was not intended for any commercial or profitable use.

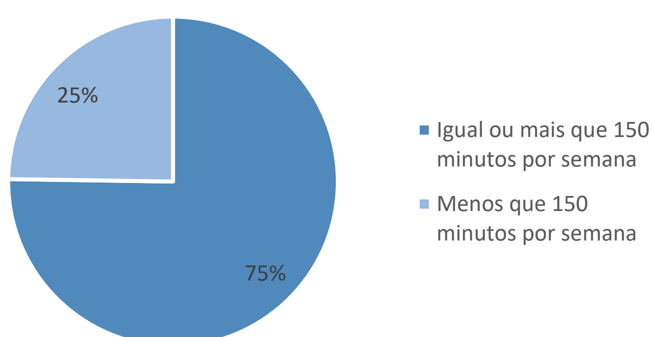
4 DEVELOPMENT

4.1 SAMPLE CHARACTERIZATION

The study sample consists of 105 exclusively male individuals, of which 79 belong to the group that practices 150 minutes or more of sports activity per week, designated as the group of regular sports practitioners (RD) and 26 who practice less than 150 minutes per week, being classified as non-regular sports practitioners (RDN) (Figure 1).

Figure 1

Distribution of individuals by NDR and RD



Source: Authors.

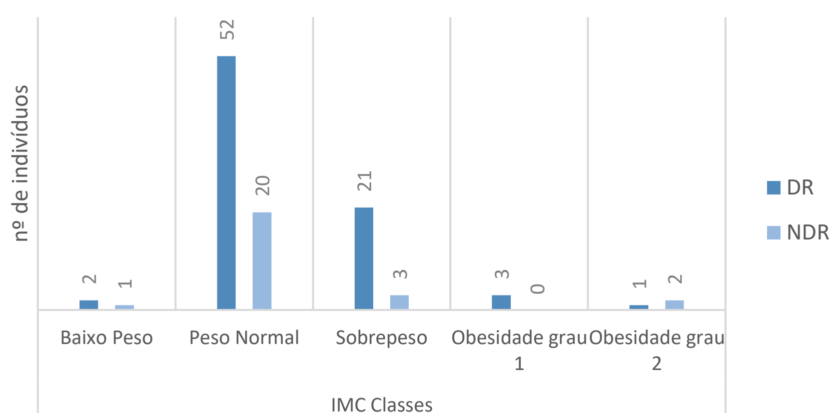
The age of the individuals varies between 18 and 27 years, with a mean of 20.22±2.00 years, with the most prevalent age group being 19 years (22.9%). Regarding body weight, the average is 71.76 kg, with extreme values ranging from 48 kg to 120 kg. Regarding height, the average observed is 174.51 cm. Regarding the distribution of race, the sample is

composed of Caucasian and black individuals, with a total of 103 Caucasian and 2 black individuals.

Regarding abdominal circumference, 16 individuals (15.2%) had increased values. Regarding body mass index (BMI), there was a higher prevalence of overweight among individuals in the RD group (20%) compared to the NDR group (2.9%). Regarding grade 1 obesity, only cases were identified in the RD group. On the other hand, grade 2 obesity is more prevalent among individuals in the NDR group.

Figure 2

Distribution of BMI classes by NDR and RD individuals



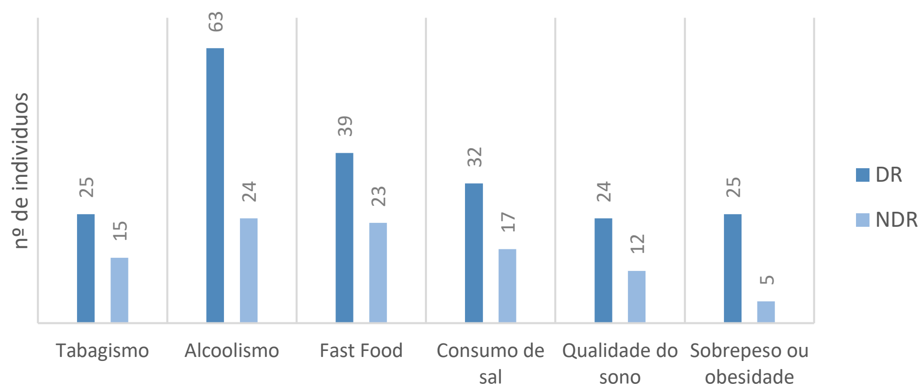
Source: Authors.

Regarding family history of cardiovascular diseases, 32.4% of the sample had a family history, 21.9% of whom belonged to the RD group and 10.5% to the RDN group.

4.2 RISK FACTORS

Figure 3

Distribution of risk factors by the RD and NDR groups



Source: Authors.

When analyzing all risk factors, it can be seen that alcoholism is the most prevalent, both in the group of regular sports practitioners (RD) (60%) and in the group of non-regular practitioners (RDN) (22.9%), followed by the consumption of fast food and excessive salt intake.

4.3 SMOKING

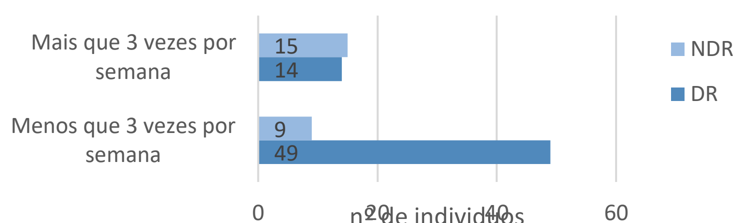
With regard to smoking, a higher number of smokers was observed among individuals in the RD group (23.8%) compared to those in the NDR group (14.3%). The mean duration of tobacco consumption is 3.13 ± 2.00 years, with an average daily smoking history of 9.37 ± 6.25 cigarettes per day. When asked whether entering higher education influenced the initiation of tobacco consumption, 21% of the individuals in the RD group answered affirmatively, while in the NDR group this percentage was only 13.3%. However, no statistically significant association was identified between sports practice and smoking initiation after entering higher education ($p = 0.545$).

4.4 ALCOHOL HABITS

Regarding the consumption of alcoholic beverages, the data show that the RD group has a higher prevalence of consumption, with 60% of the individuals. However, regarding regularity, the individuals in the RDN demonstrate a more frequent consumption. About 14.3% consume alcohol more than three times a week, while among the RD this percentage is only 13.3%. When asked whether entering higher education influenced adherence to alcohol consumption, 18.1% of the RDN and 33.3% of the RD answered affirmatively. There was a statistically significant association between sports practice and alcohol consumption ($p = 0.015$), weekly frequency ($p = 0.001$) and initiation after entering higher education ($p = 0.011$). Less active individuals consume alcohol more frequently.

Figure 4

Regularity of alcohol intake between the NR and NDR groups



Source: Authors.

4.5 FEEDING

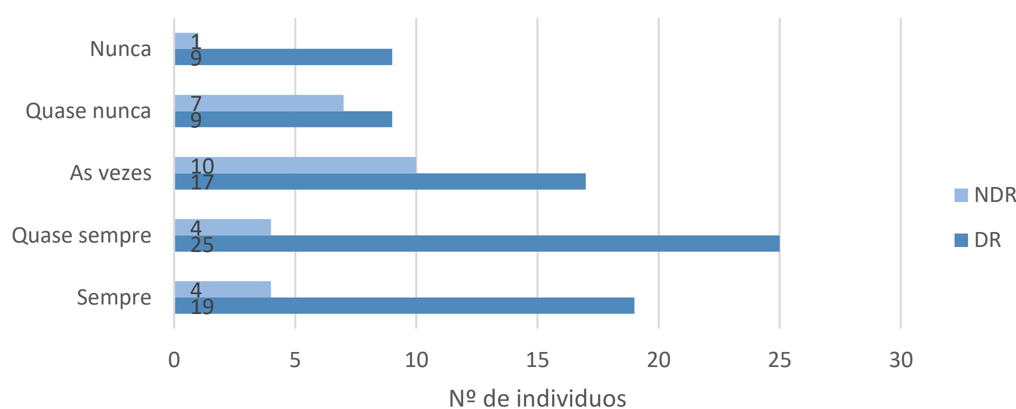
Regarding eating habits, the frequency of fast food consumption was analyzed. Considering the answers "sometimes", "almost always" and "always", it was observed that RD individuals register a higher percentage of *fast food* consumption (37.1%), compared to RDN individuals (21.9%). Although the percentage of fast food consumption is apparently higher in the most active group, statistical tests showed that individuals with less sports practice significantly have a higher frequency of consumption of this type of food (p = 0.006).

Regarding salt intake, 30.5% of the RD reported excessive consumption, while among the RDN this percentage was 16.2%. No significant association was found between sports practice and salt consumption (p = 0.165).

With regard to vegetable consumption, RD individuals show healthier eating practices, with 54.3% indicating regular consumption, a value higher than that recorded in the RDN. However, the relationship between vegetable consumption and sports practice was not statistically significant (p = 0.552). Similarly, with regard to the preparation of their own meals, 58.1% of the RD stated that they cooked their own meals, contrasting with 17.1% of the RDN (Figure 5). The relationship between sports practice and meal preparation showed a trend towards significance (p = 0.060), suggesting that more active individuals may be more predisposed to prepare their own food.

Figure 5

Regularity of the preparation of the meals themselves in the DR and NDR



Source: Authors.

Regarding the quality of the diet, most individuals considered that they had improved their eating habits. However, 32.3% of the participants in the RD group and 5.7% in the NDR group reported a worsening in relation to the last year. There was a significant association

between sports practice and the perception of food quality in relation to the previous year (p = 0.019), as well as with the self-perception of having a healthy diet (p = 0.002).

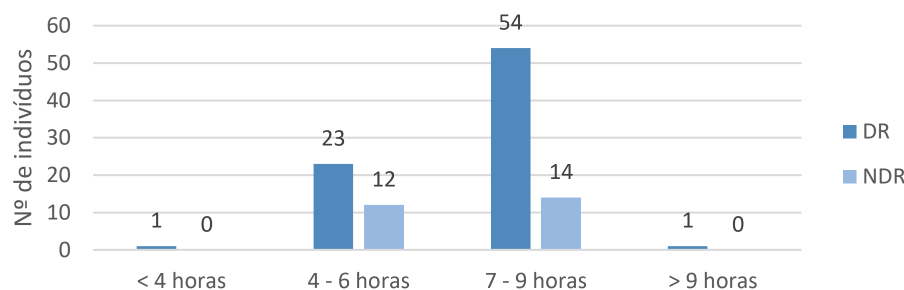
4.6 SLEEP HYGIENE

Regarding sleep quality, RD individuals reported sleeping more hours, with 51.4% reporting sleeping between 7 and 9 hours per night. However, it is observed that 11.4% of NDRs and 21.9% of RDDs sleep only between 4 and 6 hours per night (Figure 8). The relationship between the number of hours of sleep and sports practice was not statistically significant (p = 0.392).

Even so, there is a higher percentage of RD individuals who consider that the quality of their sleep has decreased in relation to the last year (21.9%), while 10.5% of NDR individuals. When asked if they considered themselves to have enough time to sleep, 41% of individuals answered negatively. A marginally significant association was identified between sports practice and the feeling of getting enough sleep (p = 0.045), with the most active individuals being more likely to consider that they get enough sleep.

Figure 6

Distribution of hours of daily sleep by DR and NDR individuals



4.7 BLOOD PRESSURE

Regarding systolic blood pressure (SBP), individuals in the RD group have a higher prevalence of Grade 1 hypertension (HTN) (32.4%) compared to the NDR group (9.5%). The same is true for Grade 2 HTN, with 6.7% in RD and 2.9% in NDR.No with regard to diastolic blood pressure (DBP), the prevalence of Grade 1 HTN is higher in the NDR group (6.7%) compared to the RD group (3.8%). In the case of Grade 2 HTN, only one case was recorded, belonging to the NDR group (Table 1).

When analyzing the relationship between the variable systolic blood pressure (SBP) and the two groups under study, no statistically significant differences were found. On the

other hand, when diastolic blood pressure (DBP) was related to the same groups, statistically significant differences were found, according to the *Kruskal-Wallis test* (*p< 0.005).*

Table 1

Relationship of DBP and SBP levels in the two groups

	PAS Normal	High normal SBP	HTA Grade 1	HTA Grade 2	HTA Grade 3	Normal DBP	Elevated normal DBP	HTA Grade 1	HTA Grade 2	HTA Grade 3
No. of DR Individuals	8	30	34	7	0	31	43	4	0	1
No. of NDR Individuals	1	12	10	3	0	5	13	7	1	0

Legend: SBP – Systolic Blood Pressure; DBP – Diastolic Blood Pressure. Source: Authors.

5 DISCUSSION

The practice of physical activity is recognized as essential for health and human development, regardless of the modality practiced. However, there is an increase in sedentary lifestyle in modern societies — especially among university students — which reduces the need for physical exertion and negatively impacts general health (7). The systematic review "health benefits of physical activity and fitness in school-aged children and youth" indicates that physically active individuals have better cardiorespiratory and muscular fitness, adequate body composition, higher bone density, and lower rates of anxiety and depression. Additionally, inactivity in youth is associated with increased risk of chronic diseases and reduced life expectancy (8).

The transition to higher education is often accompanied by significant changes in students' routines, particularly due to distance from family and home community. This period is marked by an increase in autonomy and responsibility, which can make it difficult to maintain a balanced and healthy lifestyle (9).

The present study, carried out at the School of Education (ESE), included 105 male individuals. The mean body weight was 71.76 kg and the mean height was 174.51 cm, values that are in line with those obtained in the IPB study in Bragança, where the mean weight was 72.2 kg and the mean height was 173.8 cm (10). Regarding abdominal perimeter, 15.2% of

the individuals had increased values, a percentage higher than the prevalence of 5.8% reported in another national study (11).

Regarding BMI, a higher prevalence of overweight was observed among individuals in the RD group (20%) compared to the NDR group (2.9%). This result may be justified, in our study, by the high number of participants in the RD group. This finding contradicts the results of Motevalli et al., which indicate a significantly lower BMI among physically active individuals, although the literature also presents studies with inconclusive results regarding this association (12,13).

Regarding family history of cardiovascular diseases, 32.4% of the sample had a family history, a value considerably higher than that observed in previous studies (14.15), with 21.9% belonging to the RD group and 10.5% to the NDR group.

Among the main risk factors associated with hypertension identified in this study, alcohol consumption, fast food consumption, and excessive salt intake stood out. Alcohol consumption is the most prevalent, both in the RD (60%) and in the RDN (22.9%) groups. This data differs from the results of Cicekli, according to which physical inactivity was the most common risk factor, with a prevalence of 89.2% (16).

Regarding smoking, the prevalence of smokers was higher in the RD group with 23.8%, compared to the NDR, which registered 14.3%. These data contrast with most of the literature, which generally associates sports practice with lower rates of substance consumption. This paradox may reflect a sports culture where physical performance is not necessarily linked to healthy choices outside the competitive context. In some contexts, excessive emphasis on victory and performance can devalue ethical principles and healthy behaviors, leading to practices such as the use of harmful substances or unsportsmanlike attitudes. Thus, sports culture, when focused only on performance, can neglect fundamental values such as respect, integrity, and the overall well-being of athletes (17). In the total sample, a prevalence of 38.1% of smokers was observed in the total sample, a value significantly higher than that reported by André M. et al., who indicated only 12.6%. However, the highest proportion of smokers is among the RD group (23.8%), in line with the data from the same study, which also reported a higher prevalence among RD (18).

Regarding alcohol consumption, 60% of RDDs reported consuming alcoholic beverages, in contrast to 22% of NDRs. Although most participants indicated that entering higher education did not significantly influence the initiation of consumption, it was observed that NDRs reported a higher frequency of consumption (more than three times a week).

The prevalence of alcohol consumption among RDs (60%) is lower than that reported by another study, which indicated 80.4% (18). However, the trend of higher consumption

among RDs continues. On the other hand, a different study points out that college athletes are less likely to have frequent alcohol consumption. These data suggest that social factors, such as the academic environment and university parties, may have a significant impact on alcohol consumption patterns among higher education students (19). In addition, the majority of participants in both groups indicated that entry into higher education did not significantly influence the onset of alcohol consumption, suggesting that other factors, such as the social environment, may have a greater impact.

Inadequate diet is widely recognized as one of the main risk factors for obesity and, therefore, should be a central focus in health promotion strategies aimed at the university population (9,20,21). In this study, the frequency of fast food consumption was analyzed, considering the answers "sometimes", "almost always" and "always": 37.1% of the RD reported consuming fast food frequently, compared to 21.9% of the RDN. Although these values may seem contradictory, the statistical tests revealed a significant association between less sports practice and higher frequency of fast food consumption ($p = 0.006$), confirming the trend of less healthy eating behaviors among inactive individuals.

Regarding salt consumption, 46.7% of the individuals reported adding more than one dessert spoon of salt to their meals, a value similar to that identified by Zobo et al.(22), in which 41.5% of the participants reported the same habit. Despite this, no statistically significant association was observed between sports practice and salt consumption, which may indicate that this eating behavior is influenced by factors other than physical activity.

Regarding the consumption of legumes and vegetables, 58.1% of the RD stated that they cooked their own meals, in contrast to only 17.1% of the RDN. Overall, 75.1% of the participants indicated that they prepared their own meals, corroborating the findings of Dias Fernandes J. et al., who highlight a positive association between physical activity and healthy eating habits, including higher vegetable intake (23). This data was reinforced by another study, in which 80.5% of the individuals reported cooking their own meals (24), suggesting that food autonomy can be a protective factor in the university context.

The self-assessment of diet quality revealed that, although most indicated an improvement in eating habits, 32.3% of RD and 5.7% of NDR reported a worsening compared to the last year. When asked if they considered themselves to have a healthy diet, 81.9% of participants answered affirmatively. According to the WHO (25), lifestyle and diet changes can prevent up to 50% of diabetes cases and 40% of cancer cases. In addition, poor diet quality is associated with the development of several chronic diseases, such as cardiovascular disease, type 2 diabetes, and certain types of cancer.

Research on sleep health revealed that 51.4% of RDs sleep between 7 to 9 hours per night. However, 33.3% of participants in the total sample sleep only between 4 to 6 hours per night, indicating a pattern of partial sleep deprivation. This pattern is consistent with data from the systematic review What is Known About Students and Sleep, which reported an average of 6.95 hours of sleep per night among college students (26).

Although there was no statistically significant association between the number of hours slept and the level of sports practice, there was a marginal association with the subjective perception of getting enough sleep ($p = 0.045$), suggesting that perceived well-being may be higher among the most active, even if the duration of objective sleep does not differ significantly. In addition, a higher percentage of RD indicated that the quality of their sleep decreased in the last year, and 41% of participants said they did not have enough time to rest.

With regard to SBP, it was found that individuals in the RD group have a significantly higher prevalence of Grade 1 hypertension (HTN) (32.4%) compared to RDN (9.5%), this fact may be justified by factors that have been explored, such as the exaggerated response of blood pressure to physical exercise, the type of exercise practiced, anthropometric factors or the use of substances and supplements(27–29). The same was observed in Grade 2 HTN, with 6.7% among RD and 2.9% among RDN. These results are in line with the study "Sports activities at a young age decrease hypertension risk—The J-Fit+ study" (23), which suggests that sports practice from youth has a preventive role in blood pressure control, so it would be beneficial for students, guidelines for university health programs, with the promotion of regular physical activity, education and awareness, as well as monitoring and evaluation (30).

In a previous study (15), it was observed that individuals classified as physically inactive had significantly higher levels of SBP and DBP ($p < 0.05$). In the present study, although the prevalence of systolic HTN was higher among RDs, it was the NDRs that presented higher levels of diastolic HTN in the Grade 1 and 2 classifications, with statistically significant differences between the groups according to the Kruskal-Wallis test ($p < 0.005$).

Finally, a study conducted by João Lopes observed that athletes showed a more pronounced reduction in DBP after low-intensity exercise (50% of heart rate reserve), compared to non-athletes — especially in the 1st, 5th, and 6th hours post-exercise. These results reinforce the hypothesis that regular physical activity contributes positively to the regulation of diastolic blood pressure (31).

In the present study, limitations were identified, such as the sample being composed exclusively of students from a single higher education institution, which limits the

generalization of the results to other university populations or young adults in different socioeconomic and cultural contexts. Factors such as the emotional state of the participants and the technique used can influence the results. The evaluation of the participants' lifestyle and eating patterns was carried out through subjective questionnaires, without defined standard doses, which can compromise the accuracy of the information collected. The use of validated instruments, such as the Food Frequency Questionnaire developed by the Harvard T.H. Chan School of Public Health, would have been beneficial for a more rigorous assessment of the participants' eating habits(32).

In addition, an unequal distribution was observed between the two groups under study, with a predominance of regular practitioners of physical activity, which may limit the comparison between the groups. For future investigations, it is important to minimize the subjectivity inherent in the data collection in the study, it is recommended to standardize food portions and implement consistent schedules for blood pressure assessment. These measures aim to reduce variabilities associated with external factors, such as circadian rhythm and the measurement environment, promoting greater precision and reliability in the results obtained.

6 FINAL CONSIDERATIONS

In future investigations, it is essential to ensure a balanced distribution among groups of participants to avoid selection bias, ensuring data comparability. In addition, the use of validated and objectively measurable instruments for collecting data on students' lifestyles is essential to reduce subjectivity and increase the accuracy of results. Finally, it is necessary to expand scientific research focused on the often neglected university age group to support effective preventive interventions that promote healthy lifestyles and prevent chronic diseases in this population.

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