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Influence of age on Diastolic Blood Pressure

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ABSTRACT

The cardiac cycle involves the rhythmic contraction and relaxation of the heart chambers, facilitating blood circulation. It encompasses two primary phases: systole (contraction) and diastole (relaxation). Diastole allows the heart chambers to fill with blood, with auricular diastole occurring as the atria receive blood from the vena cava and pulmonary veins. Ventricular filling happens when the atria contract, pushing blood into the ventricles. Blood Pressure (BP) is the force exerted by blood on arterial walls, divided into Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP). Elevated DBP, known as diastolic Arterial Hypertension (HTN), is diagnosed when DBP exceeds 85 mmHg. Complementary diagnostic methods, like Ambulatory Blood Pressure Monitoring (ABPM), aid in accurate diagnosis. ABPM, endorsed by the European Society of Hypertension guidelines, records BP over 24 hours, providing insights into daily fluctuations. Normal DBP values via ABPM are below 85 mmHg during the day, 70 mmHg at night, and 80 mmHg on average. DBP tends to decrease after 50 due to increased peripheral vascular resistance. This study aims to correlate age with DBP values. Data collection occurred from January to May 2023, involving individuals aged over 35, non-obese, non-smokers, and without antihypertensive medication. Participants underwent ABPM monitoring after providing informed consent and completing a questionnaire on risk factors and demographic information. Data analysis utilized IBM SPSS version 26, with non-parametric tests employed due to non-normal distribution.

Keywords: Cardiac cycle, Blood Pressure (BP), Diastolic Blood Pressure (DBP), Ambulatory Blood Pressure Monitoring (ABPM), Peripheral vascular resistance.

INTRODUCTION

The cardiac cycle consists of the alternating sequence of contraction and relaxation of the heart chambers, promoting the pumping of blood throughout the body. It consists of two main phases, systole (contraction) and diastole (relaxation).

It is during diastole that the heart chambers fill, while they are relaxed. Auricular diastole occurs when the atria is filled with blood from the Vena Cava, in the case of the right atrium, and the Pulmonary Veins, which fill the left atrium. The ventricles fill when the atria contract, expelling all the blood into these cavities.

Blood Pressure (BP) is defined as the force that blood exerts to cross the arteries, which in turn is divided into Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP).

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PAD occurs during the period of cardiac relaxation, when the heart fills with blood. Normal pressure values, measured with an electronic sphygmomanometer or manually with a stethoscope and aneroid sphygmomanometer, must be below 85 mmHg. If these values are above this limit, diastolic Arterial Hypertension (HTN) can be diagnosed.

To better evaluate these data, it is necessary to use complementary diagnostic methods that help in a differentiated diagnosis of this clinical condition, the most used method being Ambulatory Blood Pressure Monitoring (ABPM).

ABPM is the most suitable BP assessment method used to measure BP values, in environments outside the clinical context, which reflect the patient's normal daily conditions. This device consists of an armband and an electronic device and coordinates BP measurements, according to the 2023 guidelines of the European Society of Hypertension, every 20 minutes during and during the night.

Normal DBP values when assessed by ABPM must be less than 85 mmHg during the day, 70 mmHg at night and 80 mmHg on a 24-hour average. This parameter from the age of 50 presents a decrease in its values due to the increase in peripheral vascular resistance inherent to the adaptation of arterial stiffness typical of age, reducing the diastole period.

OBJECTIVE

Check whether there is a correlation between age and DBP values.

METHODOLOGY

The sample collection took place from January 2023 to May 2023.

Participants went to DOClinic with a prescription/request for a 24-hour ABPM test from a prescribing physician. Before starting data collection, each individual read the informed consent to authorize their participation in the study. After signing the informed consent, they answered a questionnaire to research risk factors, such as hypertension, Diabetes Mellitus, heart diseases such as arrhythmias or valvular diseases, smoking and alcoholic habits and diagnosis of an anxiety or sleep disorder. With this questionnaire, demographic data from the participants was also collected, such as age, sex, height and weight for later calculation of BMI.

The individual was then monitored with the ABPM equipment, and instructions were given for the normal carrying out of the exam. The following day, the individual went to the clinic to collect the equipment where he also handed over the ABPM diary. Individuals aged over 35 years of both sexes, without antihypertensive medication, non-obese and non-smokers were included in this study.

All data collected was treated confidentially, coded with numbers and letters and entered into an IBM SPSS database (Statistical *Package for the Social Sciences)* version 26 ®. Sample normality distribution tests were carried out and non-parametric tests were used.

DEVELOPMENT

The sample consists of 29 participants, both male (N=14) and female (N=15). Divided into three age groups, where 24-hour DBP values, daytime DBP, nighttime DBP and Circadian DBP Variability were studied.

As shown in table 1, it is possible to observe that the 24-hour DBP of individuals aged 35-50 years is the one with the highest value of all age groups, presenting a statistically significant difference between the groups with p = 0.025.

In daytime DBP, it was possible to observe that there were also higher values in the 35-50 age group, with a statistically significant difference between the age groups, and this relationship can be seen in table 1.

In the circadian variability of DBP, it was possible to observe, again, that it was the age group of 35-50 years that showed the greatest percentage of drop in DBP values from day to night, verifying that there was a statistically significant difference between the age groups with a *p* =0.006 (table 1).

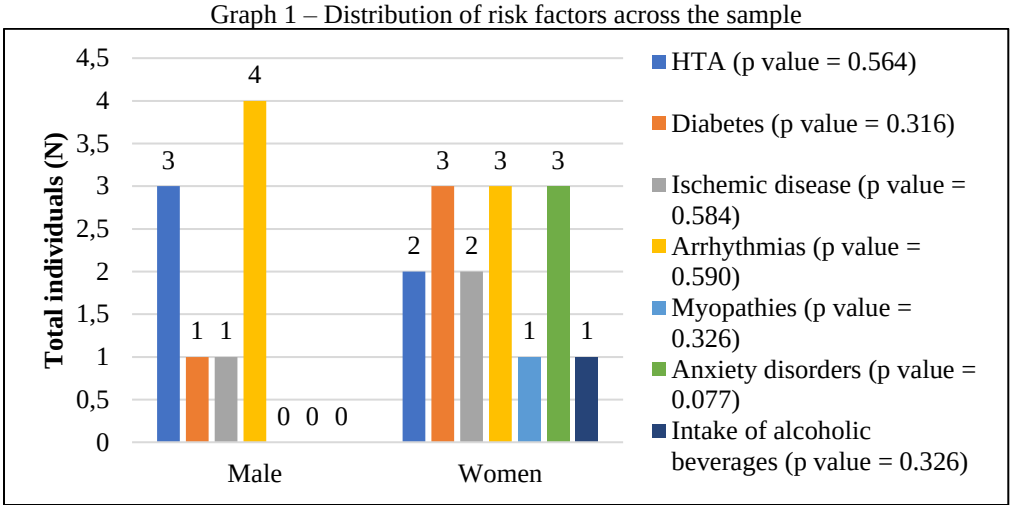
For the analysis of nocturnal DBP, it was found that diastolic blood pressure values were lower in the group aged over 65 years, and there were no statistically significant relationships between the groups, as can be seen in table 1.

Table 1: Study Results. Caption: *statistically significant differences

Age range (years)	**24h PAD (mmHg)**	**Daytime DBP (mmHg)**	**Nocturnal DBP (mmHg)**	**Circadian Variability of DBP (%)**
35-50 years	80.27±8.765	88.18±8.268	68.09±10.454	21.55±7.980
50-65 years old	76.10±7.593	79.90±6.822	68.90±9.492	13.90±5.646
>65 years old	68.88±8.871	71.88±9.387	64.25±8.860	10.25±7.555
p-value	**0.025***	**0.001***	0.574	**0.006***

Of this group, only five individuals were previously diagnosed with HTN of both sexes. In males, the presence of all risk factors was observed with the exception of valvular diseases, myopathy, ingestion of alcoholic beverages and anxiety disorders, which can be seen in graph 1. In females, the existence of all risk factors present in the study questionnaire with the exception of valvular diseases. It was females who were the only individuals with myopathies, as can be seen in graph 1. No statistically significant differences were observed between the groups.

Graph 1 – Distribution of risk factors across the sample



FINAL CONSIDERATIONS

DBP over 24 hours, daytime DBP and circadian DBP variability (DBP variation between day and night) decrease with increasing age, being highest in individuals aged 35-50 years, presenting statistically significant differences between the age groups presented. Nocturnal DBP also tends to decrease with age, with no statistically significant value.

Several studies report that after the age of 50, DBP decreases (7), *Oliveira et al* report, in their review, that the middle layer of the arteries contains distensible properties, and as cardiac aging occurs, more cardiac cycles are performed, causing structural changes, with the replacement of elastic material by collagen and a more rigid vasculature (5,6), making the total distensibility of the vessel difficult, that is, reducing the diastole period.

It is concluded that there is a relationship between age and DBP values, with a decrease in these values with advancing age.

ETHICAL ISSUES

This study was approved by the ethics committee of the Instituto Politécnico de Castelo Branco with opinion Nº66 CE-IPCB/2022.

INTEREST CONFLICTS

The research team declares that they have no conflicts of interest.

REFERENCES

Hansen, J. T., & Koeppen, B. M. (2002). Netter's atlas of human physiology [Internet]. 1st ed. 74–74 p. Available from: https://iucat.iu.edu/iub/5549250

VanPutte, C. L., Regan, J. L., & Russo, A. F. (2016). Anatomia e Fisiologia de Seeley. 10th ed.

Mancia, G., Kreutz, R., Brunstr, M., Burnier, M., Grassi, G., Januszewicz, A., et al. (2023). ESH Guidelines [Internet]. Available from: www.jhypertension.com

Stergiou, G. S., Palatini, P., Parati, G., O'Brien, E., Januszewicz, A., Lurbe, E., et al. (2021). 2021 European Society of Hypertension practice guidelines for office and out-of-office blood pressure measurement. J Hypertens, 39(7), 1293–1302.

Oliveira, A. C., Cunha, P. M. G. M., Vitorino, P. V. de O., Souza, A. L. L., Deus, G. D., Feitosa, A., et al. (2022). Vascular Aging and Arterial Stiffness. Arq Bras Cardiol, 119(4), 604–615.

Boutouyrie, P., Chowienczyk, P., Humphrey, J. D., & Mitchell, G. F. (2021). Arterial Stiffness and Cardiovascular Risk in Hypertension. Circ Res [Internet], 128(7), 864–886. Available from: www.ahajournals.org/journal/res

Solan, M. (2022). Harvard Health Publishing. A look at diastolic blood pressure. Available from: https://www.health.harvard.edu/heart-health/a-look-at-diastolic-blood-pressure