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ORIGINAL ARTICLE

COMPARATIVE ASSESSMENT OF BLOOD PRESSURE IN HYPERTENSIVE PATIENTS USING ANEROID AND DIGITAL MONITORS AVALIAÇÃO COMPARATIVA DOS NÍVEIS PRESSÓRICOS DE HIPERTENSOS COM MEDIDORES ANERÓIDE E DIGITAL EVALUACIÓN COMPARATIVA DE LA PRESIÓN ARTERIAL EN PACIENTES HIPERTENSOS CON MEDIDORES ANEROIDES Y DIGITALES

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ABSTRACT

Objective: to assess blood pressure levels comparing the results of hypertensive patients of the HIPERDIA Program at the Eldorado Basic Health Unit of SJRP/SP using aneroid and digital monitors. **Method:** exploratory, descriptive and quantitative study conducted with hypertensive patients enrolled in a HIPERDIA Program. The instrument for data collection was structured by the researchers. The research project was approved by the Research Ethics Committee, CAAE No. 01444912.5.0000.5494. **Results:** the results between levels of systolic blood pressure (SBP) and diastolic blood pressure (DBP) regarding linear dependence revealed moderate association of the three monitors of Group 1 and weak association of the monitors of Group 2. According to the analysis of variance (ANOVA), the mean differences found in the measurements were statistically significant in the SBP of Group 1 in the aneroid and standard digital monitors, and between standard digital and digital monitors in the SBP/DBP of groups 1 and 2. **Conclusion:** there was significant statistical difference between the auscultatory and oscillometric methods and good linear correlation in the monitors of Group 1, and weak in the monitors of Group 2. **Descriptors:** Blood Pressure; Hipertensão; Hipertensive Patients; Monitors.

RESUMO

Objetivo: avaliar os níveis pressóricos ao comparar os resultados dos clientes hipertensos do Programa HIPERDIA da Unidade Básica de Saúde Eldorado de SJRP/SP com medidores aneróide e digital. **Método:** estudo exploratório, descritivo e quantitativo, com hipertensos cadastrados em um Programa HIPERDIA. O instrumento de coleta de dados foi estruturado pelos pesquisadores. A pesquisa teve o projeto de pesquisa aprovado pelo Comitê de Ética em Pesquisa, CAAE n° 01444912.5.0000.5494. **Resultados:** os resultados entre os níveis de pressão arterial sistólica (PAS) e pressão arterial diastólica (PAD) para a dependência linear revelaram associação moderada para os três medidores no Grupo 1 e fraca para os medidores do Grupo 2. Na análise de variância (ANOVA), as diferenças médias encontradas nas aferições foram estatisticamente significativas para PAS do Grupo 1 nos medidores aneróide e digital padrão e entre os medidores digital padrão e digitais dos clientes para PAS/PAD dos grupos 1 e 2. **Conclusão:** ocorreu diferença estatística significativa entre os métodos auscultatório e oscilométrico e boa correlação linear nos medidores do Grupo 1 e fraca nos medidores do Grupo 2. **Descritores:** Pressão Arterial; Hipertensão; Hipertensos; Medidores.

RESUMEN

Objetivo: evaluar los niveles de presión arterial al comparan los resultados en pacientes hipertensos del Programa HIPERDIA de la Unidad de salud Básica Eldorado de SJRP/SP usando medidores aneroides y digitales. **Método:** estudio exploratorio, descriptivo y cuantitativo llevado a cabo con pacientes hipertensos inscriptos en un Programa HIPERDIA. El instrumento de recogida de datos fue estructurado por los investigadores. El proyecto de investigación fue aprobado por el Comité de Ética en Investigación, CAAE N° 01444912.5.0000.5494. **Resultados:** los resultados entre los niveles de presión arterial sistólica (PAS) y presión arterial diastólica (PAD) a respecto de la dependencia linear revelaron asociación moderada de los tres medidores del Grupo 1 y débil en los medidores del Grupo 2. En el análisis de varianza (ANOVA), las diferencias promedio encontradas en las mediciones fueron estadísticamente significativas para la PAS del Grupo 1 en los medidores aneróide y digital estándar y entre los medidores digital estándar y digitales de la PAS/PAD de los pacientes de los grupos 1 y 2. **Conclusión:** hubo diferencia estadística significativa entre los métodos oscilométrico y auscultatorio y buena correlación lineal en los medidores del Grupo 1 y débil en los medidores del Grupo 2. **Descriptores:** Presión Arterial; Hipertensión; Pacientes Hipertensos; Medidores.

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INTRODUCTION

Systemic arterial hypertension (SAH) is the first cause of mortality in Brazil and an important risk factor for the emergence of cardiovascular diseases, accounting for 46.2% of deaths from coronary artery disease.¹

The correct measurement of blood pressure (BP) is essential to plan a drug therapy for hypertensive patients, since it allows guiding individual therapeutic procedures, monitoring population prevalence, and identifying risk factors associated with SAH. The procedure has become fundamental for semiologic assessment of the cardiovascular system. The routine determination of BP, for the most part, is performed in a non-standard way, almost always without observing the basic recommendations to avoid errors in measurements.²

Despite the limitations in measuring the variables of BP, non-invasive monitoring devices are more practical and more widely used than invasive systems. Among the devices available on the market, monitors that use the auscultation method are traditionally used, although the use of digital devices has been widely disseminated.³

Studies on BP that used techniques that allow measuring heartbeat to heartbeat, led to considerable advances in the knowledge of the factors that influence BP in daily activities in order to measure its variability and diagnose SAH.⁴⁻⁵

Due to these factors, the Association for the Advancement of Medical Instrumentation (AAMI) in the United States and the British Hypertension Society (BHS) in Europe have developed protocols for the validation of blood pressure monitors, in order to control the quality of the new devices launched on the market.⁶⁻⁸

Although the technology for the diagnosis of this pathology is advancing, the devices for measuring BP have not evolved much and those available on the market, for the most part, are not recommended by the VI Brazilian Guidelines of Hypertension (VI BGH). Validated devices, when found, are of high cost, becoming a public health problem of great importance.⁷

The present study has relevant significance, since the SAH is considered a serious disease, which is silent at first and difficult to diagnose, because the patients only seek health services when they exhibit some more severe signs and symptoms. Moreover, recently, hypertensive patients are purchasing non-validated and non-reliable digital monitors due to their low cost and

practicality. In the face of this situation, there was the need to conduct this study, since the subject matter is of great importance and of high risk for hypertensive patients.

OBJECTIVES

- To assess blood pressure levels comparing the results in hypertensive patients of the HIPERDIA Program of Eldorado Basic Health Unit (BHU), SJRP/SP using aneroid and digital monitors.
- To suggest the development of an educational brochure to the health team that works in the HIPERDIA Program addressing the blood pressure monitors recommended by the National Health Surveillance Agency (ANVISA) and their proper use as prevention in complement to the Health Policy Guidelines of the mentioned program, seeking greater awareness of the risks and harms of SAH, thus improving the quality of life.

METHOD

This is a comparative, quantitative, qualitative and descriptive study conducted with patients enrolled in the HIPERDIA Program of Eldorado BHU of SJRP/SP after the authorization of the Municipal Department of Hygiene and Health (SMHS) of the municipality to carry out the research and signature of an informed consent form in March 2013.

Of the 1,667 patients enrolled at the HIPERDIA Program of Eldorado BHU, 211 were selected for the study. The inclusion criteria were: only hypertensive patients enrolled at the HIPERDIA Program; aged between 30 and 87 years old, with 128 women and 83 men; body mass index (BMI) between 18.5 and 24.9; using correctly and continuously antihypertensive drugs and guided to come to Eldorado BHU at 8 a.m. on the day of the assessment after breakfast; without coffee consumption and with their digital monitors calibrated, of which two had the seal of the National Institute of Metrology Standardization and Industrial Quality (INMETRO).

The exclusion criteria considered: obese individuals; diabetics; smokers; chronic drinkers; pregnant women; sedentary individuals; and consumers of other drugs, since these factors interfere in BP values. The study complied with the requirements envisaged by Resolution No. 196/96 of the National Health Council, which regulates research involving human beings (CEP/UNICASTELO), CAAE No. 01444912.5.0000.5494.

The study involved blood pressure monitors recognized in the market. The BP was measured using the monitors called standard digital (A), aneroid (B), and digital of the patients (C and D). Two groups were considered, namely: Group 1, patients whose BP were measured using the monitors B, C, and A; and Group 2, whose BP were measured using the monitors B, D and A.

The results were presented by means of a univariate analysis based on descriptive statistics for general characterization, followed by an analysis of variance (ANOVA).⁹ The comparison was made between the monitors with retaining structure due to the intra-individual interdependence arising from the fact that the BP of the same patient had been measured in three distinct forms, i.e., each patient was regarded as a block. Dunnett's test was used for multiple comparisons and Student's *t*-test was used for paired samples, applied for the comparison of means.⁹

The bivariate analysis of pressure levels was based on calculations of Pearson's correlation coefficient and on bidimensional dispersion charts. Histograms and charts of sectors were used to illustrate the results of age and sex, respectively. The statistical significance level adopted was 5% in all the tests. Statistical calculations were obtained using the Minitab® 15 software.¹⁰

RESULTS

The total sample of the study consisted of 211 patients, whose age ranged between 30 and 87 years old, with a mean of 59.3 years. The standard deviation was 13.8 years and 50% of the patients were aged over 61 years old. It was found that 128 (60.7%) patients were women and 83 (39.3%) men. Of the total of 211 patients, 142 (67.3%) (Group 1) had the monitor C and 69 (32.7%) had the monitor D (Group 2).

Despite the slight difference in the age distribution pattern of each subgroup of patients, it was observed that approximately 65% of the patients who had the monitor C fell within the range of 55 to 75 years old, with a mean age of 61.1 years and standard deviation of 12.3 years. In the case of the monitor D, due to the greater number of younger patients, there was no such significant prevalence in this age group and a slightly higher dispersion was observed. Regarding the patients who used the monitor D, ages ranged between 30 and 86 years old, with a mean of 55.6 years and a standard deviation of 16 years (Figure 1, a and b).

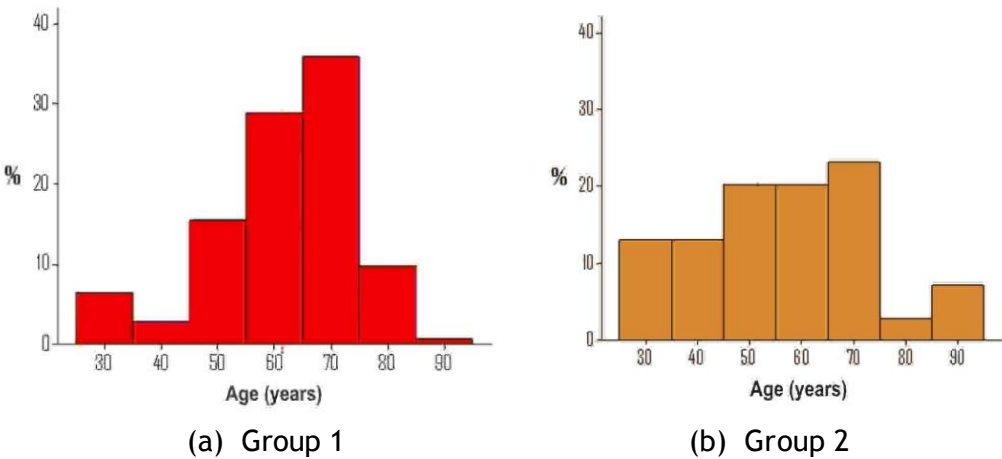


Figure 1. Age groups distribution in each group of patients.

Figure 2, (a) and (b), illustrates the division with respect to sex of patients with each monitor. Both cases had greater frequency of female patients. The division by sex was 88 (62%) women and 54 (38%) men in Group 1, and, in Group 2, 40 (58%) were women and 29 (42%) men.

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reproducibility for SBP and good for DBP. These results diverge from the results found in the present work, since there was significant statistic difference in Group 1 for SBP and good for Group 2. With respect to DBP in the two groups, the results were similar to those referenced in the studies.¹⁵⁻¹⁷

In the present study, the digital monitors (standard and patients) in groups 1 and 2 showed significant statistical differences for DBP. In another study, the use a digital monitor was recommended for monitoring BP changes in the same individual, due to its high level of concordance for SBP and the ease of use.¹⁸⁻²⁰

Previous studies have shown that in individuals with an average age of 16.3 years and using digital monitors the results found were: mean of 101.4 mmHg for SBP; and 59.5 mmHg for DBP. These values differ from the results found in the present study, which revealed mean values—for the same pressure levels— of 140.7 and 81.4 mmHg in Group 1, and 131.5 and 81.2 mmHg in Group 2 mmHg, respectively.²¹⁻³

For a validation study of the digital monitor DIXTAL DX2710, a mercury column monitor was used as standard method. They found that there was concordance for SBP, whereas the mean of the PAD in the monitor tested was significantly lower, differing from the present study, in which there was significant divergence of SBP in Group 1 and concordance in Group 2.²⁴⁻²⁵

With respect to DBP in groups 1 and 2, there was concordance between the aneroid and standardized digital monitors and statistical divergence between the standardized digital monitor and the patients' digital monitors, data that were not assessed in the study referenced. In a study conducted with a semi-automatic oscillometric type monitor (Visomat OZ D2 International), it was also found that the monitor tested showed lower means for DBP.²⁶⁻²⁷

The results of the present study are in line with the results for DBP in the two groups between aneroid and standardized digital monitors. However, using the oscillometric method for SBP, close values were observed between the standardized monitor and the patients' monitors in the two groups, and relatively greater results between the standardized digital and aneroid monitors, an analysis not conducted by the study referenced.

Still, with respect to the comparison of the means obtained using these methods for BP measurement, there were similarities between them, disagreeing with the present

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study,²⁸ since the oscillometric method can provide significantly discrepant measures without considering them incorrect. This finding may be related to the fact that the values obtained by digital monitors are the result of estimates of SBP and DBP (mean arterial pressure) contrasting with aneroid monitors, which provide absolute values of BP, a situation observed in the present study.²⁸⁻⁹

A study on accuracy of the oscillometric method, which compared it with the auscultatory method using a monitor with mercury column in children, found greater correlation for SBP (0.83), than for DBP (0.47). In the present study, although conducted with hypertensive adults, the results were similar, observing moderate association in the three monitors: 0.68 in Group 1 with monitor B, 0.65 with C, and 0.57 with C; and lower association in Group 2 with 0.53 using monitor B, 0.44 with D, and 0.59 with A.²⁹

Despite aneroid monitors are still the most used in outpatient units, the practicality of digital monitors and their application in home care should not be discarded as a form of frequent monitoring and prevention of SAH. However, based on these results, it is suggested that the measurement of BP is always conducted using the same method, thus avoiding a possible damage to the clinical follow up of patients.²⁹

CONCLUSION

By conducting the comparative assessment of the pressure levels in groups 1 and 2, this study showed significant statistical differences. There was significant statistical divergence between digital monitors (standard and patients) for SBP and DBP and, in Group 1, between the standard digital and aneroid monitors for SBP. In this way, such devices can lead to distinct diagnoses of SAH, culminating in different procedures. According to the VI BGH, it is recommended that patients have their BP always checked using the same monitor, aiming at presenting reliable concordance.

It is also suggested that the team that works in the HIPERDIA Program develops an educational brochure addressing the monitors recommended by ANVISA, using this instrument complementary with the Health Policy Guidelines of this program, seeking the awareness of the risks and harms of SAH, thus improving the quality of life.

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