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Effect of slow and guided breathing exercise on blood pressure in institutionalized hypertensive elderly

Efeito do exercício de respiração lenta e guiada na pressão arterial de idosos hipertensos institucionalizados

Diógenes Alexandre da Costa Lopes[1], André Luiz Thomaz de Souza[2], Josiane Lima de Gusmão[3]

[1] Master in nursing from the University of Guarulhos (UnG-SP). Coordinator of the nursing course at the Faculdade do Vale do Rio Arinos, Juara (MT), Brazil; [2] PhD in Sciences by the Fundamental Nursing Program at the Ribeirão Preto School of Nursing (EERP/USP). Professor at the Nursing course of the University Center of Vale do Ribeira (UNIVR) Registro (SP), Brazil; [3] PhD in Nursing from the University of São Paulo (USP). Professor in the Nursing course at Centro Universitário do Vale do Ribeira (UNIVR) Registro (SP), Brazil.

***Corresponding author**: Josiane Lima de Gusmão - E-mail: josigusmao@gmail.com

ABSTRACT
This study aimed to evaluate the effect of device-guided slow breathing exercises on the hypertensive elderly individuals' blood pressure, in stages 1 and 2 of a long-term institution. It is a prospective, randomized, open-label study with elderly people divided into two groups. The intervention group used the Resperate® device to guide breathing exercises for 15 minutes, three times a week for eight weeks. The control group used an MP3 device listening to relaxing music during the same period. An automatic oscillometric device was used to measure blood pressure. The intervention group had a significant reduction ($p < 0.05$) in systolic blood pressure after eight weeks (149.8 ± 10.4 mmHg to 141.5 ± 3.4 mmHg) and diastolic pressure (93.2 ± 4.8 mmHg to 88.3 ± 3.8 mmHg). It is concluded that the slow and guided breathing exercise can be an alternative in the non-medication treatment for hypertensive residents of long-term institutions.

Keywords: Health of the elderly. Homes for the aged. Hypertension. Respiratory rate.

RESUMO
Este estudo teve como objetivo avaliar o efeito do exercício de respiração lenta e guiada sobre a pressão arterial em idosos hipertensos estágios 1 e 2 de uma instituição de longa permanência. Trata-se de um estudo prospectivo, randomizado e aberto com 31 idosos divididos em dois grupos. O grupo intervenção realizou exercícios de respiração lenta e guiada com auxílio do dispositivo Resperate® por 15 minutos, três vezes por semana, durante oito semanas. O grupo controle utilizou um aparelho de MP3 para ouvir música relaxante no mesmo período. Um dispositivo oscilométrico automático foi usado para medição da pressão arterial. O grupo intervenção apresentou redução significativa ($p < 0,05$) na pressão arterial sistólica após oito semanas (de 149,8±10,4 mmHg para 141,5 ± 3,4 mmHg) e na pressão diastólica (de 93,2±4,8 mmHg para 88,3±3,8 mmHg). Concluiu-se que o exercício de respiração lenta e guiada pode ser uma alternativa no tratamento não medicamentoso para hipertensos residentes instituições de longa permanência.

Palavras-chave: Hipertensão. Instituição de longa permanência para idosos. Saúde do idoso. Taxa respiratória.

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INTRODUCTION

Hypertension is highly prevalent among the elderly, reaching 68% of Brazil's population group over 60 years old[1]. Due to this fact, cardiovascular diseases such as stroke, coronary disease and renal failure are more evident within this age group[2]. In the last decade (2000 to 2010), the elderly population in the country increased from 6.7% to 10.8% and current life expectancy has risen to 74.9 years old. This outline directly impacts on the prevalence of hypertension, since the disease has a direct and linear association with ageing[3,4].

Due to Brazilian population ageing, homes for the aged have played a crucial role in giving the elderly assistance. Although they are not establishments aimed at clinical or therapeutic activities, these practices do happen and are actually the most frequent ones in Brazilian institutions[5]. A study conducted in private and municipal long-term care institutions has demonstrated that 85% of the elderly have chronic diseases, and hypertension is the most prevalent one[6]. For this reason, instituting non-drug activities such as changes in lifestyle assumes relevance in controlling hypertension among this population.

Studies show that Dietary Approaches to Stop Hypertension (DASH)/Mediterranean diets, reduced sodium intake[7], regular physical exercise, body weight control and limitation in alcohol consumption reduce blood pressure[4]. In addition to these resources, relaxation techniques[8], yoga practice[9] and meditation[10] may also reduce blood pressure, but with less evidence.

From this perspective, the device-guided slow breathing exercise performed with the use of an electronic device called Resperate®-Inter Cure Ltd., has been recommended by the 7th Brazilian Guideline of Arterial Hypertention[4] as another non-drug treatment modality that helps with the control of blood pressure. This device interacts with the individual through a melody composed of two different tones, one for inspiration and one for expiration.

This exercise consists in the individual synchronizing their breathing with the melody emitted by the device that gradually, with the aid of a respiratory strap, prolongs the tone of exhalation, inducing the user to breathe more slowly, in a frequency less than 10 respiratory movements per minute[11].

Therapeutic effects of device-guided slow breathing exercises have been achieved from three to five weekly sessions of 15 minutes (minimum 45 minutes weekly). Device-guided slow breathing exerts a stretch in the baroreceptors reducing sympathetic activity and, in parallel; this practice increases parasympathetic activity, resulting in veno-arteriolar dilatation, bradycardia, myocardial contractility decrease and consequently reduction of blood pressure[12,13].

Systematic review with meta-analysis included eight clinical trials to evaluate the results of using Resperate® as a non-pharmacological treatment for hypertension. Primary outcomes included a decrease in systolic and diastolic blood pressure and secondary outcomes included alterations in heart rate and changes in quality of life, with a maximum duration of a nine-week intervention[13].

Research that verified the limitations and indications of using device-guided slow breathing exercises for blood pressure control have shown there are neither adverse effects nor contraindications of this practice in hypertensive patients and it can be combined with drug treatment and other non-pharmacological interventions for hypertension. For this reason, the practice has also been approved and indicated in Europe, Canada, Australia, Korea, Thailand and China[14].

Several studies demonstrate the efficacy of device-guided slow breathing exercises for hypertensive patients; however, nothing specific has been evidenced among residents of aged care homes. Thus, the present study aims at evaluating the effect of this non-pharmacological therapy on the blood pressure of elderly hypertensive stages 1 and 2 in an aged care home.

METHODOLOGY

This is a prospective, open-label, randomized, controlled, study conducted at an aged care home, located in Varginha, Minas Gerais, Brazil. Thirty-two elderly patients with a diagnosis of hypertension who met the following inclusion criteria were selected: hypertensive patients with antihypertensive-drug therapy at stages 1 or 2 of hypertension, observed by the office blood pressure measurement (systolic pressure between 140 and 179 mmHg and/or diastolic pressure between 90 and 109 mmHg); elderly over 60 years; both genders; with degrees of dependence I and II and who accepted to participate in the study by signing the term of Free and Informed Consent Form. Criteria for exclusion were taken into consideration, such as diagnosis of secondary hypertension, chronic respiratory disease, chronic renal insufficiency, congestive heart failure, body mass index (BMI) ≥ 30 kg/m^2, deafness, and cognitive impairment that might interfere in breathing exercise performance and understanding of instruments.

For the sample calculation, the two-tailed hypothesis test was used, considering a standard deviation of 6 mmHg for blood pressure, a significance level of 5% and a power of test of 80%. The expected difference between the groups (intervention and control) was 6 mmHg of blood pressure reduction (literature data)[15,16]. The determined sample was 16 patients in each study group, totalling 32.

Selection for the participants of the study was carried out by means of an evaluation of the patient charts from the aged care home, where the elderly who met the inclusion criteria were identified. They were then personally invited to participate in the study and after signing the TCLE, they were referred to a private room where they answered a questionnaire regarding sociodemographic and clinical aspects and were taken three blood pressure measurements with a validated oscillometric device[17], weight, height, BMI and abdominal circumference.

The elderly were randomly chosen to participate in the intervention group (who underwent device-guided slow breathing exercises) or the control group (who listened to lounge music). In order to divide these two groups, each elderly person was given a number that served as a code to carry out the randomization, with the aid of the randomization table generated by the program available at www.randomization.com.

Intervention group performed device-guided slow breathing exercises with the aid of Resperate® electronic equipment in a quiet room of the institution, reserved for that purpose, sitting in a comfortable armchair for eight weeks for 15 minutes daily, three times a week. The intervention period (15 minutes) started to be considered at the moment when the respiratory rate was reduced to 10 (or less) respiratory movements per minute (mpm).

The control group listened to lounge music with an MP3 and did not perform breathing exercises; they kept the respiratory rate free during the same period and in the same place as the intervention group. Both groups were followed and guided by the researcher throughout the study period to make sure the procedures were being carried out correctly and in order to prevent the elderly from sleeping. Figure 1 shows the flowchart of the study steps.

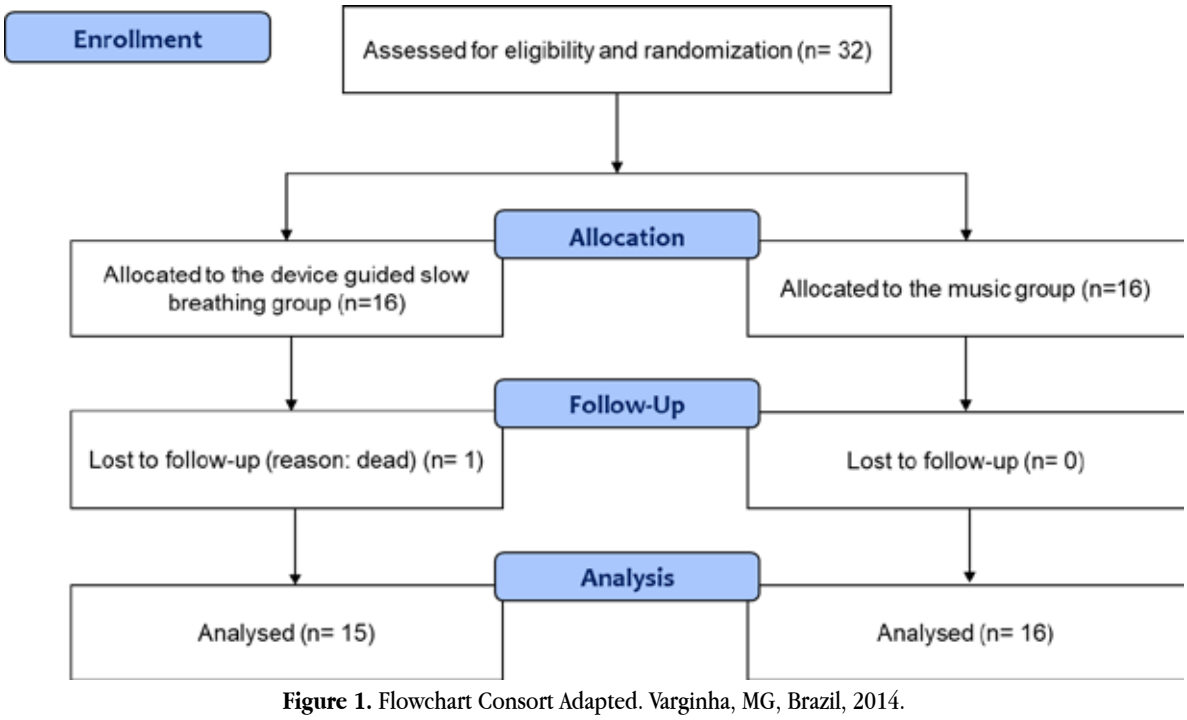

Figure 1. Flowchart Consort Adapted. Varginha, MG, Brazil, 2014.

A descriptive analysis of the data was carried out by means of absolute and relative frequencies, measures of central tendency (average) and dispersion (standard deviation). To assess the association between qualitative variables and the group outcome, the Chi-squared test and the Fisher's exact test were used. Quantitative variables were subjected to verification of normality by the Kolmogorov-Smirnov test. In the comparison between the groups, for those who did not adhere to the normal curve, the Mann-Whitney non-parametric test was applied, in the others, the t-Student parametric test was used. In order to verify the difference between the groups according to the quantitative variables over time, the ANOVA test was applied for two factors. For statistical significance, a descriptive level of 5% ($p<0.05$) was assumed. Data was analyzed by *Statistical Package for the Social Sciences* (SPSS) software version 22.0.

The trial followed the recommendations of the Declaration of Helsinki II and was approved by the Research Ethics Committee of the Guarulhos University (nº 356.643/2013). In addition, patients gave their informed written consent after receiving oral and written information about the study.

RESULTS

The present study started with thirty-two elderly subjects and ended with thirty-one, sixteen subjects belonging to the control group and fifteen subjects to the intervention group. Data in Table 1 show the age of the intervention group was significantly higher ($p<0.05$) compared to the control group. For the other variables, there was no statistically significant difference, which indicates the homogeneity of the groups.

Table 1. Distribution of study groups according to sociodemographic characteristics. Varginha, MG, Brazil, 2014

Sociodemographic characteristics	GROUPS				p-value
	Control (n=16)		Intervention (n=15)		
	N	%	N	%	
Age					
(average ± sd–years)	69±5.4		73±11.3		0.0185
Sex					
Female	13	81.25	11	73.33	0.5980
Male	3	18.75	4	26.67	
Ethnic					
White	11	68.75	8	53.33	
Black	5	31.25	5	33.33	0.4860
Asian	-	-	2	13.33	
Marital Status					
Single	8	50.00	9	60.00	
Married	0	0	1	6.67	0.2300
Widow(er)	8	50.00	4	26.67	
Divorced	-	-	1	6.67	
Educational Level					
Literate	8	50.00	7	46.67	
Basic Education (complete/incomplete)	8	50.00	6	40.00	0.8506
Higher Education (complete/incomplete)	-	-	2	13.33	
Family Income					
Up to 01 minimum wage	14	87.50	14	93.33	1.0000
From 01 to 03 minimum wages	2	12.50	1	6.67	
Retirement Time					
0 to 10 years	12	75.00	7	46.67	
11 to 20 years	4	25.00	6	40,00	0.2970
21 to 30 years	-	-	1	6.67	
More than 30 years	-	-	1	6.67	

Sd=Standard deviation
Source: Research data

Table 2 shows the majority of the elderly in both groups did not drink, did not smoke and did not practice physical activity. Regarding the perception of stress, the control group reported being significantly less stressed (87.5%) than the intervention group (46.6%), $p < 0.05$.

Table 2. Distribution of study groups according to living habits. Varginha, MG, Brazil, 2014.

Life Habits	GROUPS				p-value
	Control (n=16)		Intervention (n=15)		
	N	%	N	%	
Intake of alcoholic beverage					
Never ingested	10	62.50	9	60,00	
Stopped	5	31.25	6	40,00	0.5730
Yes	1	6.25	-	-	
Smoking					
Never smoked	10	62.50	8	53.33	
Stopped	3	18.75	4	26.67	0.8470
Yes	3	18.75	3	20.00	
Physical activity practice					
No	16	100	13	86.67	0.2260
Yes	-	-	2	13.33	
Stress (perception)					
No	14	87.5	7	46.67	0.0233
Yes	2	12.5	8	53.33	

Source: Research data

Data in Table 3 show BMI was similar between control and intervention groups. However, when considering the abdominal circumference, data show women in the intervention group had significantly higher values (86.9cm, sd=12.2) than the control group (79.6cm, sd=8.0). Systolic and diastolic blood pressure values at baseline were similar in both groups

Table 3. Distribution of study groups according to clinical data at baseline. Varginha, MG, Brazil, 2014.

Clinical Data	GROUPS		p-value
	Control (n=16)	Intervention (n=15)	
BMI (Kg/m²) (average ± sd)	25.7±2.1	24.3±3.5	0.1044
Abdominal circumference (cm) (average ± sd)	82.4±9.6	88.3±10.8	0.0575
Men	94.7±6.1	92.0±5.2	0.3043
Women	79.6±8.0	86.9±12.2	0.0342
Blood pressure			
Systolic blood pressure (mmHg) (average ± sd)	151.8±10.3	149.8±10.4	0.7796
Diastolic blood pressure (mmHg) (average ± sd)	94.2±5.5	93.2±4.8	0.6023

Sd=Standard deviation; BMI=body mass index

Source: Research data

Figure 2 presents blood pressure evaluated at the beginning of the study (pre-intervention) and during the fourth and eighth weeks (intervention). Statistically significant reductions were observed in both systolic pressure (-8.3 mmHg, $p < 0.05$) in the intervention group and in diastolic pressure (-4.9 mmHg, $p < 0.05$) between the 8th week and the beginning of the study.

During the eighth week, systolic blood pressure in the control group was significantly higher than in the intervention group (150.4 (sd = 8.2) vs 141.5 (sd = 3.4) mmHg, respectively). The same occurred with diastolic pressure (93 (sd=3.8) vs 88.3 (sd=3.8) mmHg, respectively), $p < 0.05$.

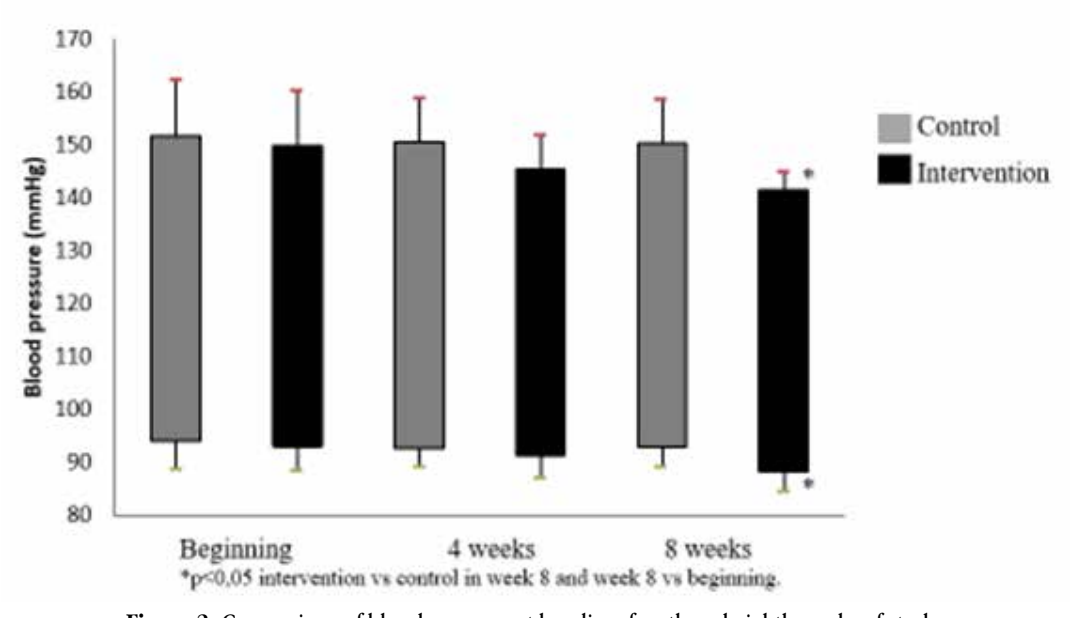

Figure 2. Comparison of blood pressure at baseline, fourth and eighth weeks of study.
Source: Research data

DISCUSSION

The main finding of the present study was the significant reduction of systolic and diastolic pressure levels in the group that performed device-guided slow breathing exercises with Resperate®, for 15 minutes a day, three times a week, for eight weeks. In addition to being statistically significant, pressure reduction was also clinically important, an evidence stated by the difference between the end and the beginning of the intervention of 8.3 mmHg and 4.9 mmHg in systolic and diastolic pressures, respectively.

The effects on blood pressure reduction achieved by the technique of slow and guided breathing exercises with the aid of the electronic device Resperate® are well established in the hypertensive population[18,19]. Currently, the technique is recommended as an aid in the non-pharmacological treatment of hypertension[4,20].

Studies evaluating this technique in the elderly population are scarce. Despite this, a case report of a 67-year-old white woman with a diagnosis of hypertension 40 years ago and a non-controlled disease for six months, under drug treatment, showed consistent and even more expressive results than the findings of the present study. After performing device-guided slow breathing exercises with Resperate® for eight weeks, the reduction in casual blood pressure was significant, from 147/91 mmHg to 130/77 mmHg (17/14 mmHg decrease)[21].

A clinical trial performed with 79 stage I hypertensive patients aged 40 to 75 years also showed

a significant decrease in the casual systolic and diastolic pressures (5.5/3.6 mmHg, respectively - $p < 0.05$) in the group that performed device-guided slow breathing exercises with Resperate® for eight weeks. Significant reductions were also obtained in the systolic and diastolic pressures obtained by the Residential Blood Pressure Monitoring (5.4/3.2 mmHg, respectively - $p < 0.001$), which did not occur in the control group[22].

Reduction of respiratory rate has a modulating effect on the cardiorespiratory system, improving the baroreflex sensitivity and the autonomic balance resulting from the reduction of sympathetic nervous activity[23]. In hypertensive patients who underwent device-guided slow breathing exercises an improvement in baroreflex sensitivity with a consequent reduction in blood pressure[24] is observed. Blood pressure regulation is influenced both by mechanisms originating from the central nervous system and by peripheral reflexes at the level of cardiopulmonary mechanoreceptors and arterial baroreceptors that lead to changes in heart rate, sympathetic activity and peripheral vascular resistance.

The arterial baroreflex is the primary mechanism of control of acute fluctuations of blood pressure, acting through the inhibition of sympathetic activity and increased parasympathetic activity, with consequent reduction of heart rate and peripheral vascular resistance, aiming to reduce pressure levels. In systemic arterial hypertension, an adaptation of these baroreceptors occurs at higher pressures, with consequent reduction of baroreflex sensitivity.

In the present study, another aspect that must be considered is that the elderly received differentiated attention for eight weeks, with changes in the routine involving affection and respect, which can contribute to improving some dimension of quality of life. Although this aspect has not been evaluated, this may represent a bias in the interpretation of the results, since changes in quality of life can impact blood pressure parameters.

In addition to promoting blood pressures control, slow breathing and device-guided exercise can be considered a form of recreation, which is also beneficial for residents of aged care homes. Studies have shown that the quality of life residents of age care homes tends to be worse than that of non-residents[25], especially in institutions that do not offer recreational alternatives. This was evidenced in a study carried out with three different institutions, showing low overall quality of life, especially among the idle elderly people[26].

Although this study reveals data on the effect of guided breathing on lowering blood pressure, some limitations should be considered in the results interpretation. Casual blood pressure measurement was the only way used for evaluating blood pressure, which did not allow to know the extent of the reduction found. Therefore, ambulatory blood pressure measurement would be important in order to understand the behavior of 24-hour blood pressure and the magnitude of its reduction during this period, including sleep.

As new discoveries and contributions to health, this study stands out for showing the effectiveness of slow breathing exercises guided by apparatus for hypertensive patients living in aged care homes. The study demonstrating that the use of Resperate®, 15 minutes a day, three times a week, for eight weeks significantly reduced blood pressure levels. Finally, we suggest that other studies be developed in order to assess the effects of slow and guided breathing in different population groups, which in the long run can contribute to the collection of robust evidence about its effects in reducing blood pressure levels.

CONCLUSION

Based on the results of the present study, one can conclude that device-guided slow breathing exercises significantly reduced the blood pressure of residents of aged care homes. It is a simple method, with no contraindications and whose cost-benefit is quite positive for the non-pharmacological treatment of hypertension.

Considering that hypertension is harmful to the individual and to society, nursing and other health care professionals, play an important role in the health promotion, prevention and recovery process, as it aims to provide assistance that allows changes in lifestyle to be monitored, so necessary for the control of the disease, as well as for the strengthening of the guidelines for self-care.

In order to do so, health care professionals can take advantage of new technologies that aid in this assistance attention, making it essential to deepen its knowledge in the physiological mechanism of the disease, and especially on the technique of device-guided slow breathing with the aid of this technology.

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