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original article

# Ballroom dance: chronic responses on blood pressure in medicated hypertensives

## *Dança de salão: respostas crônicas na pressão arterial de hipertensos medicados*

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**Abstract** – The importance of physical exercise for patients with systemic hypertension is well established in the literature. However, ballroom dance has been little investigated in this context. The objective of this study was to determine the chronic effect of ballroom dance on blood pressure in medicated hypertensives. The sample was the number of blood pressure measurements obtained during the patients' participation in the dance program. Thus, 92 blood pressure measurements were taken and divided into four groups: 1) pre-session systolic blood pressure, 2) post-session systolic blood pressure, 3) pre-session diastolic blood pressure, 4) post-session diastolic blood pressure. We used a mercury sphygmomanometer and stethoscope. As measuring protocol, we considered the Brazilian Guidelines. Blood pressure was measured before and after each ballroom dance session. The mean age of the 23 medicated hypertensive patients studied was 62.5 ± 7 years and 34.8% of them were male. Forty sessions were held three times a week, lasting one hour/session. The mean pre-session systolic blood pressure was 131,8 ± 17mmHg and 117,8±13mmHg after the session, with statistically significant difference ($p < 0.001$); in diastolic blood pressure values were 70,7±6mmHg and 67,7±9mmHg ($p < 0.075$). We conclude that ballroom dance can contribute to a better control of blood pressure in medicated hypertensive patients, which may be considered as a cardiac rehabilitation exercise.

**Key words**: Blood pressure; Dancing; Hypertension; Motor activity.

**Resumo** – *A importância da prática de exercícios físicos para portadores de hipertensão arterial sistêmica está bem estabelecida na literatura, entretanto, a Dança de Salão, neste contexto, tem sido pouco explorada. O objetivo do estudo foi verificar o efeito crônico da prática de dança de salão sobre a pressão arterial sistêmica de hipertensos medicados. Considerou-se como amostra o número de medidas obtidas da pressão arterial dos pacientes durante a participação no programa de dança. Assim, 92 medidas da pressão arterial foram realizadas, sendo divididas em quatro grupos: 1) pressão arterial sistólica pré-programa; 2) pressão arterial sistólica pós-programa; 3) pressão arterial diastólica pré-programa e; 4) pressão arterial diastólica pós-programa. Utilizaram-se esfigmomanômetro de coluna de mercúrio e estetoscópio. Considerou-se o protocolo de mensuração da Diretriz Brasileira. A pressão arterial foi aferida antes e após cada sessão de dança. Os 23 hipertensos medicados estudados tinham idade média de 62,5±7 anos e 34,8% eram do sexo masculino. Quarenta sessões de dança foram realizadas, três vezes/semana, com duração de uma hora/sessão. O valor médio da pressão arterial sistólica pré-programa foi de 131,8±17mmHg e após 117,8±13mmHg com diferença estatística significativa ($p<0,001$); na pressão arterial diastólica os valores foram 70,7±6mmHg e 67,7±9mmHg ($p<0,075$). Pode-se concluir que a dança de salão pode contribuir para um melhor controle da pressão arterial de hipertensos medicados, o que a qualifica como possibilidade de exercício físico a ser considerado no contexto da reabilitação cardiovascular.*

**Palavras-chave**: *Dança; Exercício físico; Hipertensão; Pressão arterial*

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## INTRODUCTION

Systemic hypertension is one of the leading risk factors for cardiovascular morbidity and mortality, incurring high medical and socioeconomic costs[1]. It is estimated that one billion of the world's population is hypertensive and approximately 7.6 million deaths can be attributed to systemic hypertension[2]. In Brazil, about 30% of the adult population is hypertensive and the disease is a major public health problem[3]. Within this context, the prevention and treatment of systemic hypertension are fundamental healthcare measures.

Since physical activity has known and proven hypotensive effects that contribute to blood pressure control, the combination of exercise and medicamentous treatment is an interesting and advisable approach[4]. Studies have shown the acute efficacy of aerobic exercise in lowering blood pressure in hypertensive patients, particularly systolic blood pressure, at rest, in ambulatory settings and after exercise[5-7]. However, the adherence to cardiac rehabilitation programs is low, with 50% of patients remaining in the program in the first year and 30% in the second year[8]. Traditionally, most programs in Brazil include walking, jogging and cycling on ergometers. Changes are necessary to make these activities more attractive. Within this context, other types of exercise that are pleasant and increase patient adherence to treatment without the loss of efficacy are desirable. Little has been done to reassess this situation and to encourage new methods[9].

Ballroom dancing is a promising alternative for cardiac rehabilitation due to its physiological, psychological and social benefits[10,11]. However, studies investigating the effects of ballroom dancing on the cardiovascular system are rare[12,13]. In this respect, it is important to validate ballroom dancing as an exercise alternative for the prevention of systemic hypertension and cardiac rehabilitation.

The objective of the present study was to evaluate the chronic effect of ballroom dancing on the blood pressure of medicated hypertensive patients participating in cardiac rehabilitation.

## METHODOLOGICAL PROCEDURES

A cross-sectional, semi-experimental study was conducted to analyze blood pressure variations in a group of hypertensive patients before and after a ballroom dance program lasting 3 months.

The sample consisted of the number of blood pressure measurements obtained during participation of the patients in a ballroom dance program. Ninety-two measurements were obtained from 23 patients. The mean age of the participants was 62.5 ± 7 years and 34.8% were male. The patients were referred by their physicians with a clinical diagnosis of systemic hypertension to participate in a cardiac rehabilitation program at the State University of Santa Catarina (Universidade do Estado de Santa Catarina), Brazil. This rehabilitation program consists of aerobic exercises on ergometric devices,

muscle endurance training with free weights, and ballroom dance classes. Patients of the sample were enrolled in the ballroom dance program according to interest, with a minimum class attendance of 90%. The medications prescribed to the patients were maintained during the study period. Comorbidities and the results of maximal exercise tests requested by the physicians before the rehabilitation program were obtained from the patient records. Criteria for inclusion were stably medicated hypertension for at least 6 months, an ergometer test in the current year, and no participation in a regular exercise program for at least 2 months. Excluded were patients with osteoarticular problems worsening with dance movements, and patients developing medical complications during the program.

Blood pressure was measured at the following times: 1) pre-session systolic blood pressure; 2) post-session systolic blood pressure; 3) pre-session diastolic blood pressure, and 4) post-session diastolic blood pressure. Systemic blood pressure was measured over a period of 15 min before the beginning of the classes and up to 10 min after the end of the dance sessions. The same examiner performed the blood pressure measurements with a mercury column sphygmomanometer (Sankey) and stethoscope (Premium) according to the Brazilian Guidelines on Systemic Hypertension (2010)[14]. The intensity of the dance classes was monitored with a portable heart rate monitor (Polar FS1) and was established at 70-80% of the peak heart rate achieved in the individual maximal exercise test obtained from the patient record.

The ballroom dance modality started in March 2010 and was offered in a single group from 7:30 to 8:30 am, three times per week for 3 months, for a total of 40 sessions. The classes consisted of a warm-up period of 10 min during which the students separately and continuously practiced the basic steps of the rhythms to be learned, imitating the teacher without concern about excellence. The main part of the class lasted 40 min, with rest periods when learning the steps and in the intervals between dancing continuously a whole music. Depending on the objective of each class and the need to maintain a moderate training intensity, smooth and strong movements were combined in the same session. The following rhythms were learned: Forro, Bolero, Samba, Merengue, Rock, and Salsa. The patients learned the basic and intermediate steps of each rhythm. Relaxation exercises, particularly stretching, were performed in the last 10 min of the class.

Training intensity was prescribed individually according to peak heart rate achieved in the maximal exercise test performed prior to the program. Since the exercise tests used different protocols, the results could not be compared between participants of the groups and were only used to objectively determine the moderate intensity for each subject. The patients were instructed to exercise at 70-80% of peak heart rate in all sessions. During the classes, heart rate was measured at intervals of 5 min by the patient himself using the wrist watch of the heart rate monitor. These values were not the subject of this study and only served to maintain the exercise intensity in each session.

The results were analyzed by descriptive statistics and their distribution was evaluated by the Shapiro-Wilk test. The paired Student *t*-test was used to compare mean systolic (SBP) and diastolic (DBP) blood pressure before and after the ballroom dance program. A level of significance of 5% was adopted. Statistical analysis was performed using the SPSS 15.0 program.

The study was approved by the Ethics Committee on Human Research of Universidade do Estado de Santa Catarina (Permit No. 136/06). The subjects received detailed information about the procedures and agreed to participate in the study by signing a free informed consent form.

## RESULTS

Table 1 shows the age, gender, anthropometric indices and associated risk factors of the subjects. As can be seen, most subjects were overweight and had dyslipidemia, in addition to hypertension previously diagnosed by their physicians.

**Table 1.** Characteristics of the subjects studied.

| Gender (female/male) | 15/8 |
|---|---|
| Age (years) | 62.5 ± 7 |
| Body weight (kg) | 72.34 ± 12.7 |
| Height (m) | 1.65 ± 0.1 |
| BMI (kg/m$^2$) | 26.57 ± 3.6 |
| Waist circumference (cm) | 95.33 ± 11.6 |
| Associated risk factors, n (%) | |
| Overweight (BMI 25 to 29 kg/m$^2$)* | 14 (60.9) |
| Obesity (BMI >30 kg/m$^2$)* | 2 (8.7) |
| Dyslipidemia | 17 (73.9) |

BMI: body mass index. * WHO classification (1997).

The characteristics shown in Table 1 are commonly seen in patients undergoing cardiopulmonary and metabolic rehabilitation. The relationship between obesity and hypertension is well established in the literature, with a weight loss of 1 kg resulting in a 1-mmHg reduction of blood pressure[15].

The number and class of medications used by the subjects are shown in Table 2.

As can be seen in Table 2, patients with systemic hypertension use more than one type of medication for blood pressure reduction because of the different mechanisms involved in the etiology of the disease[14]. Only few hypertensive patients are able to control their blood pressure with only one drug and combination therapy is required, especially in older adults with comorbidities[16]. In addition, hypertensive patients usually take medications for the control of dyslipidemia, in agreement with the results reported in Table 1.

**Table 2.** Number and class of medications used by the patients.

| Number of medications used | n (%) |
|---|---|
| 1 | 3 (13.0) |
| 2 | 11 (47.9) |
| 3 or more | 9 (39.1) |
| Drug class | n (%) |
| ACE inhibitor | 4 (17.4) |
| Beta-blocker | 9 (39.1) |
| Diuretic | 7 (30.4) |
| Hypolipidemic agent | 7 (30.4) |
| Angiotensin II antagonist | 2 (8.7) |
| Calcium channel blocker | 4 (17.4) |

ACE inhibitor: angiotensin-converting enzyme inhibitor.

The mean systemic blood pressure values obtained before and after the ballroom dance program and the difference between them are shown in Table 3.

**Table 3.** Comparison of systemic blood pressure before and after the ballroom dance program.

| Systemic blood pressure | Before | After | Δ (before-after) | p |
|---|---|---|---|---|
| SBP (mmHg) | 131.83 ± 16.9 | 117.83 ± 13.1 | -14.0 | <0.001 |
| DBP (mmHg) | 70.70 ± 6.0 | 67.71 ± 9.1 | -2.99 | <0.075 |

SBP: systolic blood pressure; DBP: diastolic blood pressure. n = 23 per time point.

The baseline mean SBP and DBP values were lower than the cut-off used for the diagnosis of systemic hypertension (140/90 mmHg)[14]. This finding can be explained by the fact that the patients received pharmacological treatment. The hypotensive effect of exercise has been shown to be more expressive in patients with high baseline systemic blood pressure[17]. A marked decline in blood pressure, particularly in SBP, was observed after the ballroom dance program. DBP reductions usually do not accompany the reduction in SBP and are always of lower magnitude, as reported in other studies[17,18].

## DISCUSSION

The chronic effect of a ballroom dance program on the blood pressure of medicated hypertensive patients participating in cardiac rehabilitation was demonstrated by reductions in SBP and DBP after the dance sessions. These results were statistically (SBP) and clinically (SBP and DBP) significant. In the general population, 2-mmHg reductions in SBP and/or DBP result in reductions of 14% and 17% in cerebrovascular accident, respectively, and reduce the risk of coronary artery disease by 9% and 6%, respectively[19]. In contrast, in hypertensive subjects, a reduction of 2 mmHg in SBP reduces mortality due to cerebrovascular accident by 6% and due to coronary artery disease by 4%[20].

The physiological mechanisms involved in chronic post-exercise hypotension are multifactorial and are related to adaptations that occur during training. Factors associated with this hypotension are the improvement of endothelial function[21,22] and a reduction of sympathetic nerve activity and baroreflex sensitivity[23,24]. Sympathetic nerve activity, which is responsible for the control of heart rate and vasoconstriction, is inhibited during post-exercise hypotension, reducing peripheral vascular resistance[25]. In addition, vasoactive substances, such as adenosines, prostaglandins and nitric oxide, contribute to blood pressure reduction after exercise[25]. Chronic exercise increases baroreflex sensitivity and improves endothelial function, which are compromised by the presence of hypertension[26].

The hypotensive response to ballroom dancing was promising and statistically significant for SBP, although the component of this modality differs from that of walking, the exercise modality traditionally prescribed for the non-medicamentous treatment of patients with hypertension. Ballroom dancing uses interval training, with rest periods when learning the steps and intervals between dancing continuously a whole music. This interval training minimizes cardiovascular overload when compared to continuous exercise at the same intensity[27,28], indicating that intermittent exercise is adequate for cardiac rehabilitation programs.

Studies evaluating the efficacy of hypotension after exercise programs in medicated hypertensive patients are scarce. These studies used walking[17,18] and mixed exercise programs (walking and cycle ergometer)[29] for the treatment of hypertension. Comparison of the walking[17,18] and mixed exercise programs[29] with the ballroom dance program showed that the last modality resulted in lower post-exercise SBP. The mean reduction of post-exercise SBP in medicated hypertensive patients in response to walking was -13 mmHg[17], -8 mmHg[18] and -6 mmHg[29], whereas an SBP reduction of -14 mmHg was observed after ballroom dancing. With respect to DBP, only small differences were observed between pre- and post-exercise values, which were -2.99 mmHg for the ballroom dance program, -3 to -4 mmHg for walking trainings[17,18] and -3 mmHg for the mixed exercise program[29]. These magnitudes of blood pressure reductions favor the implementation of ballroom dancing as an exercise modality for the treatment of medicated hypertensive patients.

Although not the objective of the present study, it should be noted that the blood pressure reductions that occur in response to the acute effect of exercise persist for at least 48 h[30], a fact supporting the proposal of ballroom dancing as an adequate exercise modality for cardiac rehabilitation. This modality can be performed three times per week on alternate days to maintain the pressure reduction for most days of the week. Furthermore, the effect of training has been shown to be reversible, with the loss of its beneficial effects after return to physical inactivity[30].

Finally, another positive factor related to ballroom dancing is the easy treatment adherence. In the present study, adherence to the ballroom dance program was high when compared to another study in which non-

adherence to a walking program was 40%[18]. No subject was lost during the 3 months of the program, with a class attendance higher than 90% (absence in a maximum of four classes/3 months). One of the main advantages of ballroom dancing is that it is a lucid and pleasant activity, increasing quality of life and adherence to rehabilitation. This set of positive factors of ballroom dancing, together with the health benefits of regular physical activity, favors the long-term reduction of all-cause morbidity and mortality in patients who require cardiopulmonary and metabolic rehabilitation[9].

One limitation of the present study was the lack of a control group, which would increase the precision of the magnitude of blood pressure reductions in response to ballroom dancing and would contribute to better understand the effect of the medications used. However, this was the objective of the study, i.e., to evaluate medicated hypertensive patients in a rehabilitation setting and also to select the subjects in such a way as to demonstrate to them their reality in terms of plurality. Patients undergoing rehabilitation generally present other hypertension-associated risk factors for heart disease and use several types of medications for the treatment of their conditions. In this setting, the ballroom dance program showed positive effects in terms of SBP and DBP reductions.

## CONCLUSIONS

The ballroom dance program showed an interesting chronic hypotensive response in the treatment of patients with systemic hypertension. The blood pressure reduction observed in the present study suggests that ballroom dancing combined with pharmacological treatment improves blood pressure control and may be used as an exercise modality for cardiac rehabilitation.

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