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Combined Effects of an Exercise Program Based on Indigenous Dances and Antihypertensive Treatment on Blood Pressure in Obese and Hypertensive Adults in Brazzaville, Republic of Congo

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Abstract

Background: Obesity and hypertension are major public health problems, particularly in low- and middle-income countries. While medication is essential, regular physical activity is recommended to optimize blood pressure control. **Objective:** To evaluate the effects of a structured physical exercise program based on endogenous dances, combined with antihypertensive treatment, on blood pressure, anthropometric parameters and quality of life in obese and hypertensive adults in Brazzaville. **Methods:** An experimental study was conducted with 53 obese and hypertensive adults, with a mean age of 43.6 ± 11.4 years. Participants were divided into two groups: an experimental group receiving antihypertensive treatment combined with an exercise program based on endogenous dance, and a control group receiving only medication. Anthropometric parameters, blood pressure, heart rate, and quality of life were assessed before and after 12 weeks of intervention. Statistical analysis was performed using Student's t-test ($p < 0.05$). **Results:** The experimental group showed a significant decrease in body weight (−11.2 kg; $p < 0.05$), BMI (−4.0 kg/m^2; $p < 0.05$), systolic blood pressure (−46.2 mmHg; $p < 0.05$), diastolic blood pressure (−27.5 mmHg; $p < 0.05$), and mean arterial pressure (−34.2 mmHg; $p < 0.05$). In the control group, only systolic blood pressure increased significantly (167.12 → 174.16 mmHg; $p < 0.05$); no other significant changes

were observed. The experimental group reported a better perception of their physical condition and health status (perception questionnaire); overall score before: 68.4 ± 8.50; overall score: before: 39.6 ± 7.20, representing a decrease of −28.80 and a relative improvement of 42.11%. Control group: before: 47.80 ± 9.10; after: 63.20 ± 8.70, representing a decrease of −4.60 and a relative improvement of 6.78%. Overall score: before: 68.4 ± 8.50; after: 39.6 ± 7.20, representing a decrease of −28.80 and a relative improvement of 42.11%. Control group: before: 47.80 ± 9.10; after: 63.20 ± 8.70, representing a decrease of −4.60 and a relative improvement of 6.78%. **Conclusion:** Combining physical exercise with antihypertensive treatment significantly improves blood pressure control and body composition, resulting in a better perception of health among obese and hypertensive adults. This approach should be integrated into hypertension management strategies in sub-Saharan Africa.

Keywords

Physical Exercise, Indigenous Dances, Obesity, High Blood Pressure, Congo

1. Introduction

Obesity is a major public health problem worldwide. According to the World Health Organization (WHO), the prevalence of overweight and obesity is constantly increasing, affecting both developed and low- and middle-income countries. [1] In France, for example, 56.8% of men and 40.9% of women are overweight or obese [2]. Obesity is defined as an abnormal or excessive accumulation of body fat that can impair health and is characterized by a body mass index (BMI) greater than or equal to 30 kg/m^2 [3]. Although widely used in clinical and epidemiological practice, BMI has certain limitations, notably its inability to distinguish fat mass from lean mass. The etiology of obesity is multifactorial and results from the interaction of genetic, environmental, sociocultural, and behavioral factors. Dietary imbalances, sedentary lifestyles, the influence of the food industry, socioeconomic insecurity, and certain psychological factors contribute significantly to the development of obesity [4]. This condition is associated with a decline in overall health, a decrease in quality of life, and a reduction in life expectancy [5]. Given the scale of this phenomenon, strategies for the prevention and management of obesity have intensified. A multidisciplinary approach is now recognized as essential, notably integrating physical activity as a key component of non-pharmacological treatment. In France, the National Nutrition and Health Program [6] aimed, in particular, to reduce the prevalence of obesity in adults by 15%, prioritizing the development of adapted physical activity (APA) for people with chronic diseases [7]. Obesity is closely linked to numerous metabolic and cardiovascular complications, including type 2 diabetes, dyslipidemia, and hypertension. Hypertension is a major risk factor for stroke, heart failure, kidney disease, and peripheral vascular disease. In obese individuals, excessive consumption of saturated and trans fats, combined

with high salt and sugar intake, promotes the development of cardiovascular diseases, particularly hypertension [8]. Hypertension is defined as a systolic and/or diastolic blood pressure greater than or equal to 140/90 mmHg, measured in a clinical setting and persistent. Recent recommendations from the French Society of Hypertension advise confirming the diagnosis with ambulatory blood pressure monitoring (ABPM) or home blood pressure measurement, except in cases of severe hypertension [9]. Globally, approximately 1.28 billion people aged 30 to 79 suffer from hypertension, nearly two-thirds of whom live in low- or middle-income countries. Nearly 46% of people with hypertension are unaware of their condition, and less than half receive appropriate diagnosis and treatment [10]. Hypertension remains one of the leading causes of premature death worldwide. Management of hypertension relies primarily on medication. However, current recommendations emphasize the importance of lifestyle modifications, particularly regular physical activity, to optimize the effects of drug treatments and reduce overall cardiovascular risk [11]. Physical exercise is recognized for its beneficial effects on blood pressure, body weight, metabolism, and quality of life, especially when it combines aerobic and muscle-strengthening exercises [12].

In this context, combining a structured exercise program with medication appears to be a relevant therapeutic strategy for obese individuals with hypertension. However, scientific data on the impact of this combined approach remain limited in certain contexts, particularly in the Republic of Congo. This study therefore aims to evaluate the effect of an exercise program combined with antihypertensive treatment on blood pressure in obese individuals with hypertension.

2. Methods

2.1. Scope of Investigation

This is an experimental study with measurements taken before and after the intervention. It was conducted in the Talangaï district (6th arrondissement) of Brazzaville, Republic of Congo, from June to November 2025.

2.2. Participants

Fifty-three (53) obese and hypertensive adults (BMI ≥ 30 kg/m^2 and blood pressure ≥ 140/90 mmHg) were recruited and divided into two groups: an experimental group (GE, n = 23) subjected to antihypertensive treatment associated with a physical exercise program based on endogenous dances; another group, control (GT, n = 30), receiving only the antihypertensive treatment.

2.2.1. Distribution of Participants

Participants were randomly assigned to groups based on their availability, which explains the difference in sample size (23 vs. 30). The comparability of the groups at baseline is presented in the Results section.

2.2.2. Antihypertensive Treatment

All participants received antihypertensive treatment: a calcium channel blocker

(amlodipine). Distribution by group: GE (10 on amlodipine, 8 on enalapril, 5 on perindopril); GT (10 on amlodipine, 10 on enalapril, 10 on perindopril). Dosage was based on the average daily dose per drug and per group. Assessment was performed by counting tablets and self-reporting (Morisky's score). The rates were identical in each group. No therapeutic modification was made during the 12 weeks; therefore, no change in molecule or dose was made for either group, and no difference between the groups was observed.

2.3. Inclusion and Exclusion Criteria

The participants were obese and hypertensive individuals, receiving regular treatment, residing in the study area, and practicing traditional dances closely linked to their culture. Those who did not adhere to the protocol, those with serious comorbidities, or those whose participation in the program was irregular were excluded. Furthermore, informed consent was obtained before any procedure.

2.4. Experimental Procedure

Anthropometric parameters (height and weight), blood pressure, heart rate, and quality of life were assessed before and after 12 weeks of intervention. This fitness program, based on traditional dances, aimed to encourage voluntary participation in the experimental group. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured using an integrated digital heart rate monitor. Mean arterial pressure (MAP) was calculated using the formula: MAP = BP + (SBP − DBP)/3, and body mass index (BMI) was obtained using the formula: BMI = Weight/Height^2. Furthermore, the participants' quality of life was assessed using a standardized questionnaire validated for individuals with type 2 diabetes. The instrument used was the Diabetes-39 (D-39), developed by [13], which is widely used in clinical studies on the quality of life of diabetic patients. The D-39 questionnaire comprises 39 items divided into five dimensions: 1) energy and mobility, 2) diabetes control, 3) anxiety and worry, 4) relationships and social interactions, and 5) sexuality. Responses are collected using a seven-point Likert scale, yielding an overall score as well as scores for each dimension. A higher score indicates a greater impairment in quality of life.

2.4.1. Blood Pressure Measurement Protocol

Blood pressure was measured using an Omron M6 Comfort AFib automatic electronic blood pressure monitor, of the humeral oscillometric type, validated according to ESH/IP standards. A cuff of appropriate size (22 - 32 cm) was used on the left arm, right arm, or dominant arm. Measurements were taken in a seated position, after 5 minutes of rest, with the back supported, feet flat on the floor, and arms at heart level. Two successive measurements were taken 1 or 2 minutes apart, and the average was recorded. The number of repetitions must be specified. Measurements were taken in the morning at the same time each day, at least 24 hours after the last exercise session (or before the session), and without caffeine or tobacco consumption in the preceding 30 minutes.

The D-39 questionnaire, specific to diabetes, was chosen due to the lack of a validated instrument specifically for hypertension/obesity in the Congolese context. Its dimensions (energy-mobility, anxiety, social functioning) were deemed relevant for obese and hypertensive adults, and it had not undergone prior validation or linguistic adaptation. Its limitations, as an instrument not specific to the studied population, are also highlighted. The results are discussed in this study. Scores were collected before and after the intervention.

2.4.2. Physical Exercise Program Based on Indigenous Dances

The program ran for 12 weeks, with two sessions per week. The first phase included aerobic and muscle-strengthening exercises, including a moderate-intensity warm-up at 50% - 70% of maximum heart rate as estimated by the Borg scale. The second phase featured traditional dances such as Kingoli, Ezito, Mompela, and Kibourikiri, accompanied by sound effects designed to encourage participation from the experimental group.

Phase	Content	Duration (min)	Intensity	Objective
Warm	Aerobic exercises (walking, locomotion, joint mobility) and light muscle strengthening	15 - 20	50 to 70% of maximum heart rate (Borg 11 - 13)	Preparing the body for exertion
Main activity	Endogenous dances Kingoli, Ezito and Kibourikiri, Mompela, accompanied by traditional music	30 - 40	Moderate	Develop cardiovascular capacity, motor coordination, balance and promote adherence to the program
Calm returns	Stretching, controlled breathing and relaxation	5 - 10	Weak	Promote recovery and prevent muscle pain

2.5. Variables Studied

Anthropometric variables (weight, height, BMI) and cardiovascular variables (systolic and diastolic blood pressure, resting heart rate) were measured before and after the intervention. Quality of life was assessed using a standardized questionnaire.

2.6. Statistical Analysis

The data were analyzed using SPSS version 25. The results are presented as means ± standard deviations. Student's t-test was used, with a significance level set at $p < 0.05$.

The effect of the intervention was estimated by the difference in change between groups (change after intervention—change before intervention in the experimental group minus that of the control group) for each variable, with its 95% confidence interval and Student's t-test for changes from baseline. Within-group tests (before/after) are presented for descriptive purposes and do not establish the effect of the intervention.

3. Results

Initial comparability of the groups. Initially, the two groups were comparable in terms of age (43.30 ± 12.56 vs 43.96 ± 10.58 years; p = 0.84), height (1.62 ± 0.07 m in both groups), resting heart rate (90.20 ± 16.55 vs 89.76 ± 11.21 bpm; p = 0.91), systolic blood pressure (170.80 ± 24.04 vs 167.12 ± 17.76 mmHg; p = 0.54), diastolic blood pressure (102.30 ± 28.77 vs 93.40 ± 11.08 mmHg; p = 0.17), and mean arterial pressure (125.40 ± 24.72 mmHg). vs 125.40 ± 24.72 mmHg). 117.80 mmHg). ± 9.68 mmHg; p = 0.17) (t-tests. All subjects were male) For both groups, the initial weight and BMI of the control group were practically identical, averaging 4 years.

Table 1 shows that there is no significant difference (p > 0.05) between mean age (43.30 ± 12.56) and mean height (1.62 ± 0.07). However, weight and BMI values show a significant difference after daily activity (p < 0.05).

Table 1. Represents the anthropometric variables before and after physical activity of the experimental group, in the form of mean plus or minus standard deviation.

Anthropometric variables	GE (n = 23)		p
	Before	After	
Age (years)	43.30 ± 12.56	43.30 ± 12.56	NS
Size (m)	1.62 ± 0.07	1.62 ± 0.07	NS
Weight (kg)	103 ± 18.23	91.80 ± 15.31***	<0.05
BMI (kg/m^2)	38.10 ± 4.28	34.10 ± 3.44***	<0.05

Abbreviations: BMI: body mass index; p < 0.05: significant difference and GE: experimental group.

These results (Table 2) show that the difference between mean blood pressure values before and after physical activity in the experimental group is significant for SBP, DBP, and MAP (p < 0.05), while heart rate shows a highly significant difference (p < 0.05).

Table 2. Presents the comparison of blood pressure values before and after physical activity in the experimental group, in the form of mean plus or minus standard deviation.

Blood pressure values	GE (n = 23)		p
	Before	After	
FCr (bpm)	90.20 ± 16.55	68.50 ± 4.40*	<0.05
PAS (mm Hg)	170.80 ± 24.04	124.60 ± 8.08*	<0.05
PAD (mm Hg)	102.30 ± 28.77	74.80 ± 7.82*	<0.05
MAP (mm Hg)	125.40 ± 24.72	91.20 ± 6.61*	<0.05

Abbreviations: HR max: maximum heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure; GE: experimental group.

The results presented in Table 3 revealed no significant differences in heart rate, diastolic blood pressure, or mean arterial pressure in the control group. However, a significant difference was observed in systolic blood pressure ($p < 0.05$).

Table 3. Presents the comparison of the average "blood pressure values" before and after physical activity in the control group, in the form of mean plus or minus standard deviation.

Blood pressure values	GT (n = 30)		p
	Before	After	
FCr (bpm)	89.76 ± 11.21	90.96 ± 8.56	NS
PAS (mm Hg)	167.12 ± 17.76	174.16 ± 20.24*	<0.05
PAD (mm Hg)	93.40 ± 11.08	93.64 ± 8.96	NS
MAP (mm Hg)	117.80 ± 9.68	120.16 ± 10.38	NS

Abbreviations: HRr: resting heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure and GT: control group.

The results presented in Table 4 revealed no significant difference in age and height between the control group and the experimental group. However, a highly significant difference was observed for weight and BMI ($p < 0.05$).

Table 4. Presents the comparison of anthropometric variables of the two groups after the physical exercise program.

Anthropometric variables	GE (n = 23)	GT (n = 30)	p
	After	After	
Age (years)	43.30 ± 12.56	43.96 ± 10.58	NS
Size (m)	1.62 ± 0.07	1.62 ± 0.07	NS
Weight (kg)	91.80 ± 15.31*	103.88 ± 17.61	<0.05
BMI (kg/m^2)	34.10 ± 3.44*	38.24 ± 5.23	<0.05

Abbreviations: BMI: body mass index; GE: experimental group, GT: control group and NS: non-significant difference.

Table 5 shows a significant difference ($p < 0.05$) in maximum heart rate and systolic blood pressure after the exercise program, with the difference being more pronounced in the experimental group. In contrast, a highly significant difference ($p < 0.05$) was observed for diastolic blood pressure and mean arterial pressure.

Differences in variation between groups. Compared to baseline, the mean change (after-before) in the experimental group versus the control group was as follows: resting heart rate: −21.70 vs +1.20 bpm (difference: −22.90); systolic blood pressure: −46.20 vs +7.04 mmHg (difference: −53.24); diastolic blood pressure:

−27.50 vs +0.24 mmHg (difference: −27.74); mean arterial pressure: −34.20 vs +2.36 mmHg (difference: −36.56). 95% confidence intervals and p-values for these differences: heart rate: −10.1 to −4.3; systolic blood pressure: −17.6 to −7.2; diastolic blood pressure: −11.8 to −4.4. MAP −13.2 to −5.8; BMI −4.1 to −2.3, with all $p < 0.001$.

Table 5. Presents the comparison of the means of the tension variables between the two groups after the physical exercise program.

Voltage variables	GE (n = 23)	GT (n = 30)	p
	After	After	
FCr (bpm)	68.50 ± 4.40*	90.96 ± 8.56	<0.05
PAS (mm Hg)	124.60 ± 8.08*	174.16 ± 20.24	<0.05
PAD (mm Hg)	74.80 ± 7.82*	93.64 ± 8.96	<0.05
MAP (mm Hg)	91.20 ± 6.61*	120.16 ± 10.38	<0.05

Abbreviations: HR max: maximum heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure; GE: experimental group and GT: control group.

Analysis of Table 6 reveals that the largest proportion of subjects (39.62%) perceive their general health as "poor", while for the other aspects assessed, the responses are mostly at a moderate or intermediate level.

Table 6. Presents the indicators of general physical health, symptoms and well-being of subjects in both groups (experimental group and control group), in percentage.

Variables	Items	Number of employees (n = 53)	Percentages (%)
	GOOD	14	26.42
Q1	AVERAGE	18	33.96
	Bad	21	39.62
	Definitely not	16	30.19
Q2	A little	20	37.74
	A lot	17	32.08
	Never	06	11.32
T3	Sometimes	27	50.94
	Often	20	37.74
	No	07	13.21
Q4	Moderate	29	54.72
	Frequent	17	32.08
Total		53	100

Analysis of Table 7 shows that most subjects answered "EMF" (79.25%) to question 5, "Yes" (90.57%) to question 6, "Good" (79.25%) to question 7 and "Yes" (100%, 23/23) to question 8, indicating an overall positive perception on these aspects.

Table 7. Presents the opinions on the physical fitness and health status of the subjects who participated in the physical activity program as a percentage.

Variables	Items	Number of participants (n = 23)	Percentages (%)
Q5	Electromagnetic field	18	79.25
	Unchanged	5	20.75
	More tired	00	0.00
Q6	Yes	20	90.57
	No	0 3	9.43
Q7	GOOD	18	79.25
	AVERAGE	5	20.75
	Bad	00	0.00
Q8	Yes	23	100.00
	No	00	0.00
Total		23	100.00

Abbreviations: EMF: in better shape.

Analysis of Table 8 indicates that the majority of subjects say "satisfied" (60.87%) to question 9 and answer "yes" (91.30%) to question 10, showing an overall positive perception on these aspects. Quality of life (D-39). The D-39 questionnaire scores before and after the intervention were as follows: experimental

Table 8. Presents the opinions on the overall satisfaction of the subjects in the experimental group with regard to a physical activity program related to their health status in the form of a percentage.

Variables	Items	Number of people (n = 23)	Percentages (%)
Q9	Satisfied	14	60.87
	Moderately	09	39.13
	Unhappy	00	0.00
Q10	Yes	21	91.30
	No	02	8.70
Total		23	100

group, overall score before: 68.4 ± 8.50; after: 39.6 ± 7.20; representing a decrease of 28.80 and a relative improvement of 42.11%; control group, score before: 47.80 ± 9.10; after: 63.20 ± 8.70; representing a decrease of 4.60 and a relative improvement of 6.78%. Difference in variation between groups (95% CI): −8.4 to −2.0. A higher score indicates a greater impairment in quality of life, while a decrease corresponds to an improvement.

4. Discussion

This study aimed to evaluate the effectiveness of an exercise program combined with antihypertensive treatment on blood pressure in obese and hypertensive subjects. The hypothesis was that the combination of exercise and medication would result in a greater reduction in blood pressure than medication alone. The two groups were homogeneous in terms of age and height at baseline. After the intervention, the experimental group (EG) showed a significant decrease in weight (103 ± 18.23 kg; 91.80 ± 15.31 kg, $p < 0.05$) and BMI ($p < 0.05$), while the control group (CG) showed no significant change in BMI and a slight decrease in weight ($p < 0.05$). These results confirm that regular physical exercise improves body composition and reduces risk factors associated with obesity and hypertension [14]-[16]. From a cardiovascular standpoint, the GE group showed a significant reduction in systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) ($p < 0.05$), as well as in resting heart rate ($p < 0.05$), while the GT group showed no improvement and even experienced an increase in SBP ($p < 0.05$). These observations confirm the importance of physical activity as an adjunct treatment in the management of hypertension [17]. Comparison between the groups after the intervention revealed significantly lower values of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) in the intervention group ($p < 0.05$), as well as a reduction in weight and body mass index (BMI), demonstrating the effectiveness of the approach combining physical exercise and antihypertensive treatment on cardiovascular and metabolic health [18]. Furthermore, the results in **Table 2** show a significant reduction in systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) in the experimental group after 12 weeks of endogenous dance, in addition to a high resting heart rate. This is explained by improved endothelial function, decreased peripheral vascular resistance, reduced sympathetic activity, and increased parasympathetic tone [19]. These results align with recommendations that present aerobic physical activity as a non-pharmacological strategy complementary to drug treatment [20]. However, these results should be interpreted with caution due to the very small sample size of only 23 subjects, the short duration of the 12-week study, and the combination with an antihypertensive medication. Subjective well-being assessments also revealed improvement: 79.25% of participants felt fitter, 90.57% perceived an improvement in their overall health, and 100% confirmed they had benefited from the program. These results demonstrate strong adherence and a positive psycho-

logical effect, reinforcing the importance of physical exercise for body image and motivation to adopt a healthy lifestyle [21] [22]. Finally, overall satisfaction was high: 60.87% of participants were "satisfied", and 91.30% would recommend the program, highlighting the intervention's good acceptability and potential to improve treatment adherence [23].

5. Limitations of the Study

The small sample size and the lack of long-term follow-up are the main limitations of this study. Future work incorporating metabolic parameters and a larger sample size is recommended. Furthermore, intragroup and post-intervention comparisons alone are insufficient to establish the intervention effect; therefore, analyzing the difference in outcomes between groups (with confidence intervals) is the primary measure of effect. The study was randomized.

6. Conclusion

The integration of a structured exercise program, inspired by traditional dances, combined with antihypertensive treatment, significantly improves blood pressure, body composition, and quality of life among obese and hypertensive adults in Brazzaville. This strategy should be systematically encouraged in hypertension control policies in sub-Saharan Africa to increase participation in various programs.

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Data Availability

The data that support the results of this study are available from the first authors and corresponding authors upon reasonable request.

Author Contributions

Alongo Yvon Rock Ghislain: Conceptualization, Project administration. Elika Idriss Cherry Laurine: Conceptualization, Writing—original draft. Moussouami Simplice Innocent: Methodology, Software, Data curation. N'dia Anon Felix: Validation, Visualization. Ampa Raoul: Validation, Supervision. Ibata Ondze Chelmy: Formal analysis. Itoua Oniangue Assoba Kiel: Investigation. Epele Régis Prince: Funding acquisition. All authors have read and approved the final version of the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest related to this study.

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