# Effect of an adapted physical activity program on the morphological and physiological profile of hypertensive patients of University Clinics of Kinshasa

**Teddy Bofosa, Betty Miangindula, Godefroid Kusuayi, Nicaise Kiana, Constant Nkiama**

*Department of Physical Medicine and Rehabilitation, University Clinics of Kinshasa, University of Kinshasa School of Medicine, Kinshasa, Democratic Republic of Congo*

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## ABSTRACT

**Objectives:** The treatment of arterial hypertension requires a comprehensive care because it is necessary not only to take the prescribed medication but also to apply certain rules of hygiene. The purpose of this study was to evaluate the effect of a program of physical activity adapted to the morphological and physiological state of the hypertensive patients.

**Methods:** An experimental study was conducted on a sample of 31 male hypertensive patients with an average age of 58.16 ± 3.7 years undergoing an aerobic and anaerobic physical activity program treadmill walking, cycling, ergonomics and aerobic exercise and muscle building exercises of moderate intensity, duration of forty-five minutes and a frequency of three times a week associated with low calorie nutrition education low in cholesterol and saturated fatty acids (bad fats) , low sodium rich in vegetables, fruits and vitamins for 4 months at the University Clinics of Kinshasa between January 2017and May 2017.

**Results:** After 4 months of intervention, we found statistically significant reductions in weight -7.2 kg, waist circumference -7.61 cm, body mass index -5.42 kg/m2, visceral fat percentage -1.4%, systolic blood pressure -6 mmHg, low-density lipoprotein -22 mg/dL, triglyceride -26.7 mg/dL with the exception of high-density lipoprotein and muscle that statistically increased +7.42 mg/dL and +15.3% while diastolic blood pressure -3.4 mmHg was not statistically modified.

**Conclusion:** The practice of adapted physical activities combined with nutritional education improves the morphological and physiological status of hypertensive patients.

**Keywords:** Adapted physical activity, morphological state, physiological

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It was stated that non-communicable diseases (cardiovascular diseases and related risk factors in 2020) would create problems in sub-Saharan African countries [1]. In addition, the prevalence of arterial hypertension in the Democratic Republic of the Congo has been reported to be high in both rural areas and urban areas of Kinshasa, while it has been reported to cause cerebrovascular disease and infarction. Three-step screening was performed in chronic diseases using the world health organization (WHO) STEPS [2-5]. As a result, the prevalence of hypertension was 11% in diabetic adults and 15.5% in diabetic patients

***Address for correspondence:*** *Teddy Bofosa, MD., Medical Fitness Laboratory and Functional Exercises, University Clinics of Kinshasa, Kinshasa University School of Medicine, Department of Physical Medicine and Rehabilitation, Kinshasa, Democratic Republic of Congo*
*E-mail: bofosa.linkoko@unikin.ac.cd, Tel: +243 85 014 32 32*

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[6]. More than 20 million people in sub-Saharan Africa are said to have high blood pressure [7]. The WHO and all learned societies of cardiology or sports medicine recommend physical activity as a front-line intervention for treating hypertensive patients in combination with dietary measures. While being an inexpensive procedure with few adverse effects, physical activity is particularly interesting because of its favorable effects on other cardiovascular risk factor [8, 9]. However, the Congolese medicines rarely apply this prescription. We found that in the Democratic Republic of Congo, in the management of hypertensive patients, no study evaluated the effects of a physical activity program associated with nutrition education.

## METHODS

### Population

The population from which the sample was derived is made up of patients hypertendus from Medical fitness laboratory and functional exercises of the Department of Physical Medicine and Rehabilitation of University Clinics of Kinshasa whose average age is 58.16 ± 3.7 years. The total sample of 31 male hypertensive patients were submitted for 4 months to a physical activity program associated with nutrition education. All male hypertensive patients voluntarily participated in the program.

### Measurements and Data Collection

The anthropometric, physiological and biological parameters collected were as follows: weight (kg) using a SECA brand weigh scale calibrated in kilograms (kg) to 100 grams near, size (cm) using of a mark of SECA mark, the waist circumference measurement using a tape measure of tailors, the percentage of visceral fat and muscle percentage using a brand Omeron BF-511 impedance meter, the tension arterial blood pressure (mmHg) using a mechanical tensiometer and HDL (mg/dL), LDL (mg/dL) were measured in the clinical biology laboratory of University Clinics of Kinshasa.

### Protocol of the Intervention Program

The experimental program of aerobic physical exercises (treadmill exercise and ergocycle) and anaerobic (muscle strengthening exercises of the abdominals, upper and lower limbs). Participants exercised three times per week, with training progressing gradually in length and intensity. Heart rate monitors (Polar Electro) were used to adjust workloads to achieve target heart rate. Participants progressed from 15 to 20 min per session at 60% of maximum heart rate to 45 min per session at 75% of measured maximum heart rate.

The nutritional program consisted of a nutritional education which consisted on the basis of a list to feed hypertensive patients to eat at least 5 fruits and vegetables a day, reduce their total consumption of fats

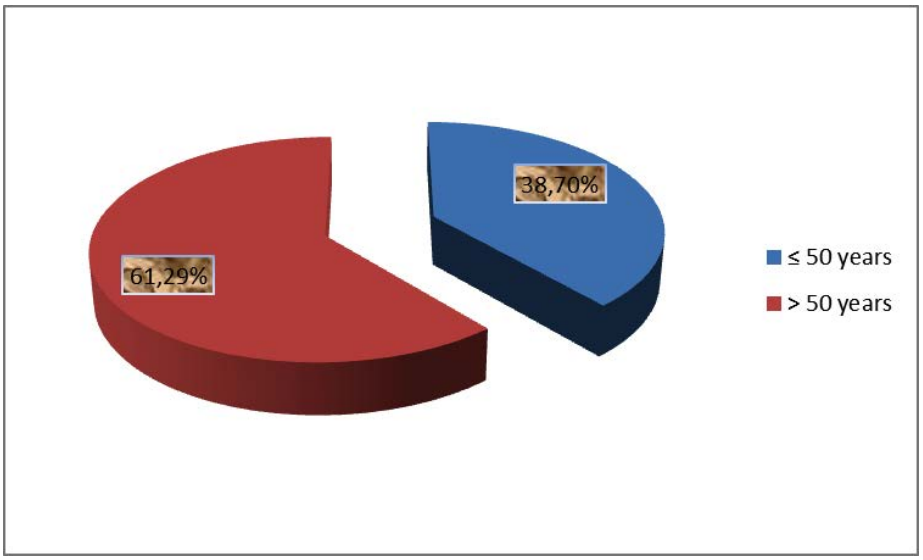


**Figure 1.** Distribution of subjects by age.

**Table 1.** Evolution of morphological parameters before and after the intervention

| Variables | Before | After | *p* value |
|---|---|---|---|
| Weight (kg) | 77.10 ± 3.2 | 69.9 ± 7.8 | **0.0001** |
| WC (cm) | 102.2 ± 11.09 | 94.59 ± 5.8 | **0.0001** |
| BMI (kg/m$^2$) | 31.6 ± 1.36 | 26.18 ± 1.3 | **0.001** |
| %Visceral fat | 10.1 ± 3.9 | 8.7 ± 2.2 | **0.002** |
| %muscle | 24.51 ± 1.6 | 39.21 ± 6.2 | **0.0001** |

WC = waist circumference, $p < 0.05$ = significant

(especially saturated) and incorporate but with moderation, healthy fats such as those found in olive oil, nuts and seeds.

### Statistical Analysis

The data collected was entered using the Microsoft Excel 2013 software and imported into SPSS software version 21.0 (Statiscal Package For Social Sciences). The data were represented as mean ± standard deviation in the tables. The paired student parametric test t was used to compare the averages at the beginning and end of the intervention. The statistical test results used are interpreted at the significance level $p < 0.05$ for statistical decision making.

## RESULTS

It is clear from this study that hypertensive subjects older than 50 years were more numerous with 61.29%, whereas subjects aged 50 or less accounted for only 38.70% (Figure 1).

### Comparison of Means Before and After the Intervention Program

Table 1 shows that hypertensive patients significantly changed their morphological state after the intervention program.

The physiological parameters of hypertensive patients were significantly modified after the intervention program with the exception of diastolic blood pressure (Table 2).

## DISCUSSION

This study found that high blood pressure was more prevalent in subjects aged 50 and over with 61.29% versus only 38.70% of subjects under 50 years of age. These results corroborate with those of the study conducted by Strokes [10] which emphasizes that the percentage of hypertensive treated varies by a factor of 10 according to the age groups, increasing in 2007 by 5% for the less from 45 to 59% for the over 75 years. In 2002, the figures at the same ages were 4.2% and 51.8%.

In analyzing the results of the morphological features, this study shows that hypertensive patients have significantly improved after-intervention program their weight ($p$ <0.0001), waist circumference ($p < 0.0001$), body mass index ($p$ <0.0001) and visceral fat ($p$ <0.002), but their muscle increased ($p$ <0.0001).

These results corroborate those of Zrnzević and Zrnzević [11], who showed in his study that weight, waist circumference, visceral fat, and muscle mass depend greatly on diet and practice physical activity.

**Table 2.** Evolution of physiological parameters before and after the intervention

| Variables | Before | After | *p* value |
|---|---|---|---|
| SBP (mmHg) | 145.9 ± 2.75 | 139.9 ± 3.4 | 0.0001 |
| DBP (mmHg) | 92.9 ± 2.19 | 89.5 ± 3.05 | 0.07 |
| HDL Cholesterol (mg/dL) | 64.21 ± 12,49 | 71.37 ± 9.39 | 0.0001 |
| LDL Cholesterol (mg/dL) | 193.33 ± 16.6 | 171.33 ± 18.94 | 0.0001 |
| Triglycerides (mg/dL) | 161.9 ± 27.8 | 135.2 ± 29.2 | 0.0001 |

SBP = systolic blood pressure, DBP = diastolic blood pressure

Regarding the physiological parameters, we noticed that after the intervention program the hypertensive subjects significantly improved their systolic blood pressure while their diastolic blood pressure was not statistically modified. Our results corroborate those of Sikiru and Okoye [12] who demonstrated that physical activity has a faster effect on systolic blood pressure than diastolic. A recent meta-analyses by Bangalore *et al*. [13], indicate that by training 3 to 5 times a week for 4 months at a rate of 20 to 60 minutes per training session, a decrease of -7.6 to 11.1 mmHg systolic pressure and - 6.7 to 7.6 mmHg diastolic pressure. These reductions compare favorably with what is achieved with some antihypertensive drugs [13]. A medline-type research conducted by Grassi *et al*. [14] using the arsenal anti hypertension key words and exercises, teaches us that more than 1,500 articles were written on the subject over the past 20 years. All of these articles confirm that regular exercise reduces blood pressure (BP) values by an average of 10/7.1. Or, we know that such an improvement in BP allows to expect a reduction incidence of stroke and myocardial infarction by 34% and 19% respectively, which is comparable to the effect of any antihypertensive drug used as monotherapy [14-17].

In regards to the biological parameters were statistically modified with a high density lipoprotein 64.21 ± 12.49 before 71.37 ± 9.39 mg/dL after (+ 7.42 mg/dL, $p < 0.0001$) and a lipoprotein of low density 193.33 ± 16.6 before 171.33 ± 18.94 mg/dL after (-22 mmg/dL, $p < 0.0001$).

In overweight individuals, exercise combined with low-calorie cholesterol and saturated fatty acids (bad fats) results in a greater increase in blood levels of good cholesterol (HDL) than in subjects diet. This is the conclusion of a study published in the New England Journal of Medicine that examined 264 men and women with moderate overweight [18, 19].

It has been shown that changes in HDL and triglyceride levels typically occur after a few months of moderate aerobic training, while there is often no change in LDL levels, even after about a year of training. However, a large volume of training at a high intensity can make LDL particles less damaging to health, even if their concentration in the blood does not change [20-22].

The literature shows that the HDL-cholesterol reacts quite well to physical activity. Indeed, improvements can be observed after 3 months of moderate aerobic training. Regular exercise can lead to an increase of about 10% in HDL levels. Although moderate intensity is usually sufficient to increase HDL, it appears that high intensity is even more effective. In addition, the increase in HDL is even more marked when training is accompanied by weight loss [23, 24].

## CONCLUSION

It emerges from this study that the practice of physical activities adapted to a nutritional education makes it possible to significantly improve the anthropometric and physiological parameters of hypertensive subjects.

*Conflict of interest*

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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