

Effects of «Bougarabou» Traditional Diola Dance on Cardiovascular Variables in Senegalese Women Aged 22–28 Years

Mountaga Diop¹, Ndiack Thiaw¹, Ndaraao Mbengue¹, Mame Ngoné Bèye¹, Papa Serigne Diène¹, Daouda Diouf¹, El Hadji Mamouthiam Diop¹, Thierno Diouf¹, Amadou Diouf¹, Sékou Mané¹, Abdoulaye Ba², and Abdoulaye Samb²

¹Laboratory in Sciences and Techniques of Physical and Sports Activities, Youth and Leisure of the Institut National Supérieur de l'Education Populaire et du Sport, Cheikh Anta Diop University, Dakar, Senegal

²Laboratory of Physiology, Physiological Functional Explorations and Biology Applied to Sports. Faculty of Medicine, Pharmacy and Odontostomatology. Cheikh Anta Diop University. B.P. 5005, Dakar, Senegal

Copyright © 2025 ISSR Journals. This is an open access article distributed under the **Creative Commons Attribution License**, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Senegalese women have become sedentary. A sedentary lifestyle is undoubtedly one of the main causes of diabetes and hypertension. Dance, a physical activity based on bodily expression, can be a source of motivation for Senegalese women to engage in regular physical activity. To study the effects of a 2-month 'bougarabou' dance program involving two 2- hour sessions per week on the heart rate and resting blood pressure of 16 sedentary Senegalese women aged between 22 and 28 is our objective. The heart rate and resting systolic and diastolic blood pressure of 16 sedentary women aged 22 to 28 from the town of Ziguinchor were measured before and after a two (2) month «bougarabou dance» program, with two 2-hour sessions per week. Resting heart rate (before 78.81 beats/min \pm 9.31 vs after 64.38 \pm 6.05 beats/min), systolic blood pressure (before 13.13 cmHg \pm 0.96 vs after 11.44 cmHg \pm 1.09) and diastolic blood pressure (before 7.75 cmHg \pm 0.93 vs after 6.68 cmHg \pm 1.01) fell significantly ($P < 0.05$) at the end of the «bougarabou» dance program. This study shows that an 8-week «bougarabou» dance program, consisting of two 2-hour sessions, has a significant effect on the heart rate and blood pressure of our sample of sedentary Senegalese women aged between 22 and 28.

KEYWORDS: Sedentary lifestyle, «danse bougarabou», resting heart rate, resting systolic blood pressure, resting diastolic blood pressure.

1 INTRODUCTION / LITERATURE SURVEY

The revolution in means of transportation, the creation of machines that replace women in carrying out daily tasks, and women's access to office-based jobs are all responsible for the significant reduction in Senegalese women's daily energy expenditure. Senegalese women have become sedentary, as they no longer walk or carry out domestic chores themselves.

Unfortunately, it is only a minority of Senegalese intellectual women who practise physical activity indoors or outdoors in search of health benefits. The majority of Senegalese women do not engage in regular physical activity because they are unaware of its benefits or because they are constrained by religious, traditional or customary reasons.

Consequently, this sedentary lifestyle is undoubtedly one of the main causes of diseases such as obesity, diabetes and hypertension, because physical activity has positive effects on health. It improves cardiovascular fitness, physiological and psychological health and musculoskeletal strength. Physical activity also helps to prevent and treat strokes, diabetes, high blood pressure and certain cancers. Physical activity also helps to maintain a healthy weight, improve quality of life and contribute to individual well-being (WHO, 2020).

Dance, a physical activity involving bodily expression, provides participants with physical and mental well-being (Tao et al., 2021), consolidates body image, illuminates the ego, relieves physical tension, anxiety and aggression, and reduces cognitive

and kinaesthetic confusion. Dance also increases the capacity for interaction, pleasure, fun and impulsivity (Jeong et al., 2005). African women in general, and Senegalese women in particular, love to dance. As soon as the clapping of hands or drums resound during ceremonies, Senegalese women immediately go out and start dancing. While dance is performed in different ways by the different ethnic groups that make up Senegal, we are going to focus on the dance of the Diola ethnic group, known as "bougarabou", which is performed by women and men at traditional festivals and ceremonies. Every dance is performed to a given rhythm, in which the upper and lower limbs express themselves in a coordinated way according to the sound emitted by an instrument, by the voice or both. The expression of the limbs is mostly associated with jumps in Africa. As a result, when you dance, you expend energy, sweat and increase your heart rate and breathing frequency. This "bougarabou" dance could therefore be a source of motivation for Senegalese women in general, and Diola women in particular, to engage in regular physical activity. However, what effect does regular practice of the "bougarabou" have on women? Does it lower their resting heart rate? Does it lower their blood pressure towards the reference value (12/8 cmHg) ?

To provide some answers to these questions, we decided to study the effects of a 2-month 'bougarabou' dance program of two 2-hour sessions per week on the resting heart rate and blood pressure of 16 sedentary Senegalese women aged between 22 and 28.

2 METHODOLOGY

2.1 MATERIAL

2.1.1 STUDY FRAMEWORK

Our protocol took place in the youth center of Lyndiane, a populous suburb of Ziguinchor inhabited by Diolas, Ballantes, Mandingues and Peuls. Most of the women trade at the market or at home.

2.1.2 STUDY SAMPLE

Our study sample was composed of 16 sedentary women from the Bignona women's association, aged between 22 and 28, with no disabilities, who knew how to dance the "bougarabou", and who had given their consent to take part in our study.

2.1.3 MEASURING INSTRUMENTS

During our study, we used:

- A DIGITAL BLOOD PRESSURE MONITOR electronic blood pressure monitor (wrist) with the following references model BP600w, 2 AAA 1.5V batteries, SYS/DIAS 30- 280mmhg, HR 40-200 beats/min, dimensions 75W times 74D times 30Hmm. This monitor enabled us to measure the systolic and diastolic blood pressure as well as the heart rate of the subjects at rest before and after a "bougarabou" dance program;
- Manual stopwatches from SPORT WATCH, KALENJI, POLAR, CASIO, etc. To check the duration of a dance sequence, the rest time between one sequence and the next and, above all, the total duration of a session;
- Four "bougarabou" drums ("foumpafou, toutorabou, boufédjintenabou, boubakirénabou") to liven up the sessions;
- Wooden sticks, "ouléw" in Diola, used by the women to accompany the sounds produced by the player;
- The cultural activities room at the Lyndiane youth hostel, where sessions can be held.

2.2 METHODS

2.2.1 PROTOCOL PHASES

Our experimental protocol consisted of five phases.

- The first phase consisted of an interview with two elderly men and three elderly women from the commune of Ziguinchor, who had some knowledge and experience of 'bougarabou'. The two men were drummers and the three women singers and dancers of the 'bougarabou'. We also carried out a pilot study to verify the information they provided about the 'bougarabou': the total duration of a dance session, the duration of a sequence, the number of sequences a woman aged between 22 and 28 could perform and the recovery time she observed before starting a new dance sequence. We then summarized the results of the interviews and the pilot study.

- The second phase concerns the evaluation of the variables before (pre-testing) the implementation of the dance program, which will last two (2) months.
- The third phase concerns the two (2) month dance program with two (2) sessions per week carried out entirely by the women. This training program is based on the summary drawn up after the interview with the elderly and the pilot study.
- The fourth part is reserved for re-evaluating the variables at the end of the dance program (post-test).
- The fifth part consists of a comparison of the mean values of the variables obtained before and after the dance program.

2.2.1.1 INTERVIEWS WITH THE ELDERLY

We interviewed two former drummers and three former "bougarabou" singers and dancers from the commune of Ziguinchor. The aim of this interview was to find out about the different phases of a "bougarabou" session, the duration of a session, the dance rhythm, the number of dance sequences, the duration of a sequence and the rest time observed by a woman aged between 22 and 28 before starting another dance sequence.

INTERVIEW GUIDE

- 1) How long does a bougarabou dance session last for women aged between 22 and 28?
- 2) How many dance phases do they perform during the "bougarabou" ceremonies?
- 3) What is the rhythm of the "bougarabou" dance?
- 4) How long is a dance sequence performed by a woman aged between 22 and 28?
- 5) How many "bougarabou" dance sequences can a woman aged between 22 and 28 perform?
- 6) What is the rest period between two "bougarabou" dance sequences performed by a woman aged between 22 and 28?

Table 1. Results of interviews with elderly people about "bougarabou"

	<i>Duration</i>	<i>Phases</i>	<i>Rhythm</i>	<i>Duration of a sequence</i>	<i>Number of sequences</i>	<i>Time of rest</i>
<i>female 1</i>	2 hours	2 phases	High	10" to 20"	08 to 10	03 to 05 minutes
<i>women 2</i>	1 to 2 hours	2 phases	High	10" to 15"	10 to 12	05 to 06 minutes
<i>man 3</i>	1 to 2 hours	2 phases	High	15" to 30"	05 to 08	02 to 03 minutes
<i>man 4</i>	1 to 2 hours	2 phases	High	10" to 20"	10 to 15	04 to 06 minutes
<i>male 5</i>	2 hours	2 phases	High	10" to 20"	05 to 08	04 to 06 minutes

The interview with the elderly revealed that:

- A "bougarabou" session organised by women aged between 22 and 28 can last 1 to 2 hours;
- This session consists of two (02) phases (a pre-dance and a dance)
- Women aged between 22 and 28 dance at a high tempo;
- A woman aged between 22 and 28 produces sequences lasting between 11 and 21 seconds;
- A woman aged between 22 and 28 can perform 07 to 10 dance sequences during a "bougarabou" session;
- A woman aged between 22 and 28 observes a rest period of 03 to 05 minutes between two sequences.

2.2.1.2 PILOT STUDY

After using the interviews with the elderly, we carried out a pilot study in which we observed six women aged between 22 and 28 during a two-hour "bougarabou" dance ceremony. The women were unaware that they were being observed. We recorded the total duration of the session, the dance phases, the number of sequences, the duration of each sequence and the rest time between the different sequences.

Each of the six women was observed by a well-informed expert (trained in observation). Each was equipped with a stopwatch to measure the duration of the woman's dance sequences and the rest periods between sequences. He also counted the number of sequences performed by the woman under observation during the 'bougarabou' session.

The "bougarabou" dance session we observed consisted of two phases:

- An initial warm-up phase consisting of going back and forth, either in waves or individually, called "backou" in Wolof, "ka ha ia" in Diola, lasting 13 minutes 46 seconds,
- A second phase of the dance itself, called "djibôm" in Diola, which lasted 1 hour 37 minutes. The values of the variables recorded during the pilot study are shown in Table 2 below.

Table 2. Sequence durations, rest times observed between sequences and number of sequences performed by the six sedentary women aged 22 to 28 in the pilot study

Subjects	S1	R1	S2	R2	S3	R3	S4	R4	S5	R5	S6	R6
1	10"28	01'36	12"89	03'16	08"86	05'40	11"40	02'56	14"74	05'20		
2	14"12	04'18	10"66	02'38	09"59	06'56	12"89	07'12				
3	08"99	05'30	11"37	03'41	07"39	04'28	12"45	05'28	11"40	06'55	06"40	03'18
4	12"40	03'15	10"13	02'60	08"40	06'12	07"89	01'49	12"78	05'33	10"40	08'23
5	07"96	04'17	13"30	03'39	10"40	02'28	08"30	07'24				
6	10"40	05'30	13"28	06'40	11"78	04'56	09"28	04'19	10"28	06'48		
Avg	10"69	03'91	11"93	03'55	09"40	04'86	10"36	04'64	12"30	03'92	08"40	05'70

Avg = average

S = dance sequence duration in seconds

R = rest time observed between two dance sequences

We first averaged the duration of sequence 1, sequence 2, sequence 3, sequence 4, sequence 5 and sequence 6. We did the same for the rest time between sequences. Then we averaged the averages, and the result of this pilot study is shown above (table 2):

- Sequences lasting an average of 10 seconds,
- An average rest time of 4 minutes,
- The average value for the number of sequences performed is 5.

2.2.1.3 SUMMARY

Having carried out the interview and the pilot study, we can conclude that a sedentary woman aged between 22 and 28 can perform an average of 1 to 2 hours of "bougarabou" during a session:

- A pre-dance called "backou" which lasts 13 to 15 minutes and the dance itself called "djibôm");
- 06 to 08 dance sequences during the dance session;
- Dance sequences lasting between 11 and 18 seconds;
- Dance sequences separated by rest periods of 03 to 05 minutes.

2.3 DESCRIPTION OF THE MEASURES

2.3.1 MEASURING CARDIOVASCULAR PARAMETERS

2.3.1.1 MEASUREMENT OF RESTING HEART RATE AND SYSTOLIC AND DIASTOLIC BLOOD PRESSURE

We had arranged to meet the women at the Lyndiane youth hostel. They were asked to take off their shoes and relax in a supine position on mattresses for 30 minutes. At the end of the 30 minutes, the nurse began the measurements, following the order in which the women arrived. The electronic sphygmomanometer was placed on the subject's right wrist, then the device was switched on and 15 seconds later the value was communicated to us. Within a few minutes, we had recorded the heart rate and systolic and diastolic blood pressure of each woman.

2.4 DANCE PROGRAM

The dance program lasted two (2) months, with two 2-hour sessions per week, giving a total of 16 sessions over 8 weeks. The dance sessions were held on Wednesdays and Saturdays from 4.30pm to 6.30pm. The number of sequences increased by one (01) unit each week and the duration of a sequence increased by two (02) units. However, the rest time between the sequences and the pre-dance (backou) decreased by one (01) unit every fortnight.

Table 3. Presentation of the "bougarabou" dance program developed following the interview and pilot study and to which the 12 women in our sample are subjected

NUMBER OF WEEKS	NUMBERS OF SESSIONS	DURATION PRE-DANCE↓	NUMBER OF SEQUENCES↑	DURATION O SEQUENCE↑	TIME REST↓
WEEK 1	1&2	15 minutes	06	11"	05mns
WEEK 2	3&4	15 minutes	07	13"	05mns
WEEK 3	5&6	14 mins	08	15"	04mns
WEEK 4	7&8	14 mins	09	17"	04mns
WEEK 5	9&10	13 mins	10	19"	03 mins
WEEK 6	11&12	13 mins	11	21"	03 mins
WEEK 7	13&14	12 mins	12	23"	02mns
WEEK 8	15&16	12 mins	13	25"	02mns

2.4.1 DANCE PROGRAM SEQUENCE

The dance sessions took place on Wednesdays and Saturdays at the Lyndiane youth center. Other women who were not part of the experimental group took part in the 'bougarabou' dance sessions to maintain the atmosphere of an ordinary 'bougarabou' dance session, usually organized in the various villages of the region.

The women were dressed in loincloths and held small wooden sticks to accompany the sounds produced by the 'bougarabou' drums. The women entered in the middle by couple, which made it easy to control the length of the sequence and the length of time each woman recovered. Each pair of women was watched by an observer equipped with a stopwatch. The latter was responsible for timing the duration of the dance sequence, the rest time and counting the number of sequences performed by the two women performing their dance sequences together. The observer asks the women to stop their sequence once the execution time has elapsed. At the end of the rest period, he asks them to return to the middle to start another dance sequence. Once the required number of sequences has been completed, he tells the two women to stop dancing. As soon as a couple's rest time is over, they immediately enter the circle to start another sequence, even if other couples are finishing their sequence. This maintains the traditional character of the bougarabou.

2.5 MEASUREMENT OF VARIABLES AT THE END OF THE DANCE PROGRAM

One day after the end of the dance program, we reassessed the value of the same variables.

STATISTICAL PROCESSING

After collecting the individual values of the cardiovascular variables measured before and after the program, we calculated the mean and standard deviation. We then compared the mean values recorded before and after the dance program to confirm or refute our hypothesis. These comparisons were made using the STUDENT T-test after checking for homoscedasticity.

Our statistical hypothesis is:

H: there is a significant difference between the mean values of heart rate and resting blood pressure measured in the women in our sample before and after the "bougarabou" dance program.

Our probability of error α is set at **5% (0.05)**, i.e. the error that we accept to make when deciding on the hypothesis.

If the probability of error **P** found in the Student test is less than or equal to α ($P \leq \alpha$), our hypothesis is confirmed: there is a significant difference between the mean variables being compared.

If the probability of error P is greater than α ($P > \alpha$), our hypothesis is invalidated: there is no significant difference between the mean variables compared.

3 RESULTS

Table 4. Comparison of the mean resting heart rate (HR) values (bmp) recorded before and after the dance program

VARIABLES	Values (bmp)
Before	$78,81 \pm 9,31$
After	$64,38 \pm 6,05$
α (fixed probability of error)	0,05
P (probability of error found)	$4 \cdot 10^{-7}$
Decision	Significant difference

Table 5. Comparison of mean resting PAS values recorded before and after the dance program

VARIABLES	Values (mmHg)
Before	$130,13 \pm 0,96$
After	$110,44 \pm 1,09$
α (fixed probability of error)	0,05
P (probability of error found)	10^{-7}
Decision	Significant difference

Table 6. Comparison of mean resting PAD values recorded before and after the dance program

VARIABLES	Values (mmHg)
Before	$70,75 \pm 0,93$
After	$60,68 \pm 1,01$
α (fixed probability of error)	0,05
P (probability of error found)	10^{-7}
Decision	Significant difference

The probability of error α set is 0.05.

- If the probability of error P is greater than α (**0.05**), there is no statistically significant difference between the averages compared.
- If the probability of error P is less than α (**0.05**), there is a statistically significant difference between the averages compared.

The **STUDENT T-test** carried out to compare the mean values obtained before and after the dance program revealed error probabilities P that were always less than the fixed error probability α (0.05). Thus, there was a statistically significant difference between the mean values recorded before and after the dance program.

4 DISCUSSION

4.1 RESTING HEART RATE

Before the program, the average resting heart rate of our sample was $78.81 (\pm 9.31)$ beats per minute. This could be explained by the fact that our subjects were sedentary, with a very low level of physical activity. In absolute terms, six subjects (37.5% of our sample) had a resting heart rate of between 86 and 90 beats per minute, above the normal value set for a healthy adult (**Garnier and Rouillon, 1991**)

Thus, we can say that the average resting heart rate of our sample before the "bougarabou" dance program was high. However, after the dance program, the mean resting heart rate (64.38 ± 6.05) fell significantly ($P=4 \cdot 10^{-7}$). This significant reduction of around 14 beats could be explained by a strengthening of the vagus nerve, the cardio moderator (**Monod and al., 2007**) induced by the 'bougarabou' dance program.

Looking at the women individually, we found that the resting heart rate of eleven women, or 68.75% of our sample, fell by 10 beats per minute. This shows that our 'bougarabou' dance program had a considerable effect on some of the women in our sample.

Our results are not consistent with those of **Ndèye Diarra Ndiaye (2012)** who reported a non-significant decrease in resting heart rate in 16 sedentary Senegalese women who participated in an 8-week 'tiéboudiène' dance program. This difference in results between Ndèye Diarra Ndiaye's study and ours can be explained by the difference in the way the two dances ('tiéboudiène' and 'bougarabou') were performed. Bougarabou" has two dance phases whereas "tiéboudiène" has only one. In addition, the duration of our dance sequences during the "bougarabou" program changed from one week to the next by 2 seconds, reaching 25 seconds in the last week.

4.2 SYSTOLIC BLOOD PRESSURE

Before our dance program, the average resting systolic blood pressure in our sample was 13.13 (± 0.96) cm Hg. As this figure is well below 14 cm Hg, the systolic blood pressure of our sample is considered normal according to the WHO (**Lawes and al., 2008**). Nevertheless, 43.75% of our sample (seven women) had a systolic blood pressure equal to 14 cm Hg. This confirms that they were indeed sedentary.

However, after the "bougarabou" dance program, mean systolic blood pressure (11.44 cm Hg ± 1.09) fell significantly ($P=10^{-7}$). If we look at the women individually, we find that the systolic blood pressure of nine of them (56.25% of our sample) fell by at least 2 cm Hg. This shows that our "bougarabou" dance program has had a considerable effect on some women. And our results are in line with those of **Grassi and al (1994)** who reported that regular exercise reduces blood pressure by an average of 10/7.

4.3 DIASTOLIC BLOOD PRESSURE

Before our dance program, the average diastolic blood pressure in our sample was 7.75 cm Hg (± 0.93). As this figure was well below 9 cm Hg, the diastolic blood pressure of our sample was considered normal according to the WHO (**Lawes et al., 2008**). Five subjects (31.25% of our sample) had a diastolic blood pressure below 8 cm Hg. Three subjects (18.75% of our sample) had a diastolic blood pressure of 9 cm Hg. This again shows that our subjects were sedentary.

However, after the "bougarabou" dance program, mean diastolic blood pressure (6.69 cm Hg ± 1.01) fell significantly ($P=10^{-7}$). Taking the subjects individually, we found that the diastolic blood pressure of 12 subjects (75% of our sample) fell by 1 cm Hg. This shows that our "bougarabou" dance program had a significant effect on women's diastolic blood pressure.

With regard to blood pressure, our results are not in line with those of **Ndèye Diarra NDIAYE (2012)**. This difference in results between Ndèye Diarra NDIAYE's and ours could always be explained by the difference in the way the two dances are performed. Bougarabou has two dance phases, including a long, moderate predance that does not exist in "tiéboudiène". Furthermore, the duration of our dance sequences during the "bougarabou" program evolved from one week to the next by 2 seconds, reaching 25 seconds in the last week. On the other hand, in Ndèye Diarra NDIAYE's "tiéboudiène" program, the duration of the sequence was fixed at 17 seconds. On the other hand, the significant drop in blood pressure in our sample is comparable to the result of **Grassi et al (1994)** in his study where he obtained an average blood pressure of 10/7 at the end of the physical activity program.

However, **Grassi et al (1994)** specify that the effect of regular physical exercise begins to show measurable results on blood pressure after 4 to 5 weeks, while the maximum reduction is obtained after 20 weeks. This effect remains as long as the exercise is maintained, but disappears after ten weeks of inactivity. These findings by Grassi et al (1994) are corroborated by those of **Humberto et al (2010)**, who reported that the prevalence of hypertension in the population living in the city of Porto is higher among people who do not exercise regularly. It should also be noted that the antihypertensive effect of physical exercise is equally apparent in women and men, regardless of age (**Hagberg, 1989**).

5 CONCLUSION

Most Senegalese women are sedentary. This sedentary lifestyle is perhaps considered to be the main cause of cardiovascular disease, diabetes and obesity, whereas our traditional dances can be an excuse for them to be physically active.

Based on this strong observation, the aim of our investigation was to study the effects of a "bougarabou" dance program on the cardiovascular variables of sedentary Senegalese women aged between 22 and 28. To do this, we proposed a

‘bougarabou’ dance program to 16 sedentary Senegalese women aged 22 to 28. It lasted 2 months, with 2 x 2- hour sessions per week.

We first conducted interviews with elderly women who had lived and danced the ‘bougarabou’ for a long time, then with ‘bougarabou’ players, and finally we carried out a pilot study. Heart rate and blood pressure were assessed before and after the bougarabou dance program. At the end of the dance program, the mean values for heart rate and blood pressure fell significantly.

This study shows that an 8-week ‘bougarabou’ dance program, consisting of two 2-hour sessions, has a significant effect on heart rate and blood pressure in our sample of sedentary Senegalese women aged between 22 and 28.

It would be interesting to continue this study by extending the duration of the program, increasing the number of sessions, the duration and the number of sequences, and above all by reducing the rest time between sequences to see what effect it has on body composition.

REFERENCES

- [1] WHO (2020).
- [2] WHO guidelines on physical activity and sedentariness.
- [3] Tao D, Supriya R, Gao Y, Li F, Liang W, Jiao J., et al. Dementia and Dance: Medication or Movement? *Phys. Activity Health.* 2021; 5 (1), 250-254.
- [4] Jeong YJ, Hong SC, Lee MS., Park MC, Kim YK., Suh CM. Dance Movement Therapy Improves Emotional Responses and Modulates Neurohormones in Adolescents with Mild Depression. *Int. J. Neurosci.* 2005; 115 (12), 1711-1720.
- [5] Garnier A and Rouillon JD. *Biologie appliquée au sport.* Paris, Amphora sport et connaissance, 1991.
- [6] Monod H, Flandrois R, Vandewalle H. *Physiologie du sport. Bases physiologiques des activités physiques et sportives.* 6ème édition. Paris: Elsevier Masson; 2007.
- [7] Ndéye Diarra. Ndiaye, l’effet de la danse traditionnelle wolof « tieboudieune » sur la composition corporelle et les variables cardiovasculaires de femmes sénégalaises sédentaires âgées de 22 à 27 ans. Master’s thesis es-STAPS, Dakar, INSEPS, 2012.
- [8] Lawes C, Vander Hoorn S, Rodgers A. «Global burden of blood-pressure-related disease», *Lancet*, 2008; 371: 1513-1518.
- [9] Grassi G and al. Physical training and baroreceptor control of sympathetic nerve activity in humans. *Hypertension*, 1994; 23: 294-301.
- [10] Humberto Machado et al. High blood pressure prevalence in Oporto sedentary and regular exercise practicing people. *Acta Med. Port.* 2010; 23 (2): 153-8.
- [11] Hagberg J M, Mountain S J, Martin W H 3rd, Ehsani A A. Effect of exercise training in 60- to 69-year-old persons with essential hypertension. *Am J Cardiol.* 1989; 1; 64 (5): 348-53.