

COMPARATIVE ANALYSIS OF THE CARDIOVASCULAR SYSTEM IN ADULT MEN AND WOMEN THROUGH PARTICIPATION IN SPINNING CLASSES

Adelina SCHEULEAC¹

Abstract: *The aim of this study was to compare the functions of the cardiovascular system (heart rate, blood pressure, cardiorespiratory capacity, etc.) in adult men and women following participation in spinning classes. The participants were divided into two adult age groups, men and women, and were monitored before and after an 8-week spinning training program. The hypothesis of the study was that men and women would exhibit different cardiovascular system responses to moderate-intensity exercise, considering physiological sex differences. The methodology included monitoring heart rate, blood pressure, and other cardiorespiratory parameters during each spinning session at Wender Gym in Suceava. Additionally, we utilized physical tests to assess improvements in the participants' cardiorespiratory capacity. The study's objectives were to analyze changes in cardiovascular functions following spinning exercises and to observe differences between men and women in terms of recovery and adaptation to training. The study results indicated significant differences in how the cardiovascular system of men and women responds to spinning exercises, particularly concerning heart rate recovery and blood pressure changes.*

Key words: *spinning, functions, cardiovascular system, adults, analysis.*

1. Introduction

Nowadays, being overweight is an expanding problem worldwide, being considered a sign of cardiovascular conditions [1].

The cardiovascular system is an essential component of the human body, and the

diseases associated with it are among the most serious health issues. Studies indicate that there is a direct link between cardiovascular conditions and the concentration of lipids in the blood [7].

Cardiovascular diseases have become a significant problem for many nations, including Romania. They also represent the

¹ Institute of Physical Education and Sports, 22 Andrei Doga Street, University of Physical Education and Sports, Chişinău, Republic of Moldova

* Corresponding author: adelinanegrileasa@gmail.com

leading source of cases of mortality and morbidity.

Categories of cardiovascular and cerebrovascular diseases include heart conditions, pathologies related to cerebral circulation, and diseases of the circulatory system. This grouping encompasses all heart diseases and blood circulation issues such as hypertension, ischemic heart disease, heart failure, and strokes [21].

Cardiovascular diseases are the leading causes of mortality in Romania [14], [15].

The World Health Organization suggests that individuals engage in physical activities or/and exercises of moderate intensity for at least 150 minutes weekly [6].

Recent studies indicate that growing physical activity provides significant health benefits, both physically and psychologically, making exercise a potential new social routine [19].

Spinning has a positive effect on the functioning of the cardiorespiratory system and the overall metabolism of the body at various intensity levels [16].

Spinning practice is regarded as a cardiovascular exercise because it enhances the efficiency of the heart, lungs, and blood circulation. Better functioning of the cardiovascular system helps reduce the risk of heart attack, stroke, and hypertension [7].

Spinning combines stamina, energy and strength with the challenge of overcoming personal weaknesses and physical limitations. Additionally, it provides significant satisfaction and joy through the achievement of fitness and mental goals. This physical activity is a genuine passion for many people.

Further research has suggested that participating in spinning classes leads to an increase in heart rate. For this reason, individuals with a history of heart

problems should consult a doctor before starting this physical activity. Additionally, it is important for them to follow all the instructor's guidelines to avoid exceeding the maximum heart rate (HRmax) determined to be safe and personalized for each individual [20].

The hypothesis of the study was that men and women would exhibit different cardiovascular system responses to moderate-intensity exercise, considering physiological sex differences

Therefore, this article is aimed to *compare the functions of the cardiovascular system (heart rate, blood pressure, cardiorespiratory capacity, etc.) in adult men and women following participation in spinning classes.*

2. The Benefits of Spinning

Spinning is executed on a stationary bike known as a *spinner* bike and was initially created by the elite cyclist Johnny Goldberg [20]. His development of the Spinning exercise program led to the establishment of a highly effective training regimen that has gained remarkable popularity globally.

Regular physical exercise is highly significant in improving quality of life, helping to prevent various conditions associated with the pulmonary and cardiovascular systems, as well as reducing the risks of degenerative diseases of the musculoskeletal system [17].

Some research has highlighted the benefits of regular aerobic exercises, demonstrating that they significantly contribute to preventing obesity and improving people's physical fitness [12], [18].

This type of workout activates muscles on both sides of the body, taking place on a stationary bike and accompanied by

energetic music. Spinning has gained popularity particularly among women and men.

Additionally, it is recognized for its efficiency, capable of burning double the number of calories compared to traditional cycling. This characteristic makes it an appealing choice for those looking to enhance their fitness and lose weight [2], [3], [8], [10], [13].

It has been observed that in enclosed environments lacking adequate ventilation, such as specialized spinning studios, there is a significant increase in sweating. This is primarily due to the rise in the body's internal temperature, which, under conditions of intense exercise, requires an efficient thermoregulation mechanism. Consequently, excessive sweating not only reflects physical effort but also indicates the physiological adaptations of the body, which are essential for maintaining homeostasis in a high-temperature environment [9]. These training sessions demonstrate superior efficiency in the fat-burning process compared to outdoor cycling. This difference can be attributed to the controlled variables in the indoor environment, which allow for a consistent intensity and greater focus on the exercise, thus maximizing metabolic efficiency [5]. In addition to their beneficial effects on physical fitness, spinning workouts can lead to an increase in certain cardiac biomarkers, such as troponins and myoglobin. These biomarkers, which play a crucial role in assessing heart health, can become valuable indicators of cardiac stress resulting from intense physical activity. Fluctuations in their levels can provide important insights into the body's adaptations to training and can be used to

monitor potential health risks [4].

Research shows that spinning sessions result in a significant level of calorie consumption. This can be attributed to the varied intensity and duration of the workout, which stimulates metabolism and promotes calorie burning in a short period of time. As such, spinning proves to be an effective choice for those looking to improve weight control or maximize their weight loss efforts [11].

When the intensity of the exercise exceeds certain limits, the body can no longer eliminate lactic acid as quickly as it is produced, which may lead to lactic acid build-up and the onset of muscle cramps. Additionally, when focusing on heart rate during training, it is crucial to be aware of the so-called effort zones, which include recovery zones (dedicated to fat burning) and endurance zones. Understanding these zones, along with optimal heart rate values, is essential for conducting effective workouts tailored to the specifics of each physical activity.

The study's objectives were to analyze changes in cardiovascular functions following spinning exercises and to observe differences between men and women in terms of recovery and adaptation to training.

3. Material and Methods

This study was conducted in October-November 2024. The participants were divided into two adult age groups, men (25) and women (25), and were monitored before and after an 8-week spinning training program. The hypothesis of the study was that *men and women would exhibit different cardiovascular system responses to moderate-intensity exercise, considering physiological sex differences.*

The methodology included monitoring heart rate, blood pressure, and other cardiorespiratory parameters during each spinning session at Wender Gym in Suceava. Additionally, we utilized physical tests to assess improvements in the participants' cardiorespiratory capacity.

To conduct this study, measurements were taken both at the beginning of the analysis period (*initial testing - TI*) and at the end (*final testing - TF*).

3.1. Applied procedure for conducting the study

Measurements were taken on two samples of 25 subjects each, separately for men and women. Initially, a series of characteristics such as age, height, and weight were recorded. Also, in the initial phase, BMI was calculated to be later compared with the one obtained during the final testing after 8 weeks of training. Relevant statistical indicators were computed for both the initial and final tests, and comparative charts were created to analyze differences both between the time periods and between the subject categories (men vs. women).

3.2. Applied tests

To conduct this study, five tests were applied, briefly summarized as follows:

– *Cooper Test (12-minute Run Test)*

Participants are required to run or walk as far as possible within 12 minutes. The distance covered is measured, and the results are correlated with VO_2 max.

– *Ruffier-Dickson Test*

It involves stepping up and down on a step (40 cm for men, 33 cm for women) for 5 minutes at a steady pace.

The heart rate is measured after effort,

and the cardiac fitness index is calculated. During this test, the heart rate was recorded at the following times in both the initial testing (TI) and final testing (TF): at rest, after 30 squats, and after a 1-minute pause.

– *Six Minute Walk Test (6MWT)*

It is used to assess the functional capacity of the cardiorespiratory system. The distance covered in 6 minutes of brisk walking is evaluated, serving as an indicator of cardiovascular endurance.

– *Wingate Test (Anaerobic Power on a Bicycle)*

It is performed on an ergometer bike, pedaling maximally for 30 seconds. This test analyzes anaerobic capacity and power output, which are relevant for high-intensity exercises such as spinning.

– *Heart Rate Recovery Test - HRR*

The heart rate is measured immediately after exertion and at 1 and 3 minutes after stopping. The difference between the initial values and the recovery values reflects the efficiency of the cardiovascular system.

4. Results and Discussions

Following the measurements taken during the initial and final testing, the following was observed:

- For the group of women, the largest weight loss was 2.8 kg, while the smallest loss was 1 kg. Regarding IMC, positive changes were observed, ranging from a minimum of 0.4 to a maximum of 1.2.

- For the experimental group of men, the minimum and maximum weight loss points were 1.2 kg and 3.4 kg, respectively. In terms of BMI, the lowest value was 0.4 and the highest was 1.2, like the female experimental group.

Table 1

Weight and IMC differences between initial testing (TI) and final testing (TF) for women and men

S	Women group						S	Men group					
	Weight			IMC				Weight			IMC		
	TI	TF	Δd	TI	TF	Δd		TI	TF	Δd	TI	TF	Δd
1	64,1	62,6	1,5	24,7	24,2	0,5	1	71,5	70,1	1,4	25,6	25,1	0,5
2	56,7	54,4	2,3	21,6	20,7	0,9	2	70,5	68,1	2,4	23,8	23	0,8
3	65,3	62,7	2,6	22,6	21,7	0,9	3	71,9	69,2	2,7	25,2	24,2	1
4	66,4	64,3	2,1	23,5	22,8	0,7	4	89	86,4	2,6	25,2	24,4	0,8
5	65,3	63,2	2,1	21,8	21,1	0,7	5	84,5	82,9	1,6	24,7	24,2	0,5
6	66,9	65,4	1,5	24,9	24,3	0,6	6	73,6	70,8	2,8	22,5	21,6	0,9
7	61,2	60	1,2	24,8	24,3	0,5	7	91,5	89,9	1,6	26,2	25,7	0,5
8	60,7	57,9	2,8	21,3	20,3	1	8	80,8	79	1,8	23,6	23,1	0,5
9	65	62,2	2,8	22,5	21,5	1	9	66,3	63,4	2,9	22,9	21,9	1
10	59,3	57	2,3	21,5	20,7	0,8	10	77,6	75	2,6	22,2	21,4	0,8
11	61,9	60,2	1,7	21,4	20,8	0,6	11	79,1	76	3,1	25	24	1
12	55	53,3	1,7	20,2	19,6	0,6	12	86,9	84,3	2,6	25,4	24,6	0,8
13	62,7	60,2	2,5	23	22,1	0,9	13	77,2	74,8	2,4	22,1	21,4	0,7
14	60,6	57,8	2,8	22,5	21,5	1	14	73,5	72,3	1,2	24,6	24,2	0,4
15	49,3	46,5	2,8	20,3	19,1	1,2	15	65,3	63,4	1,9	23,1	22,5	0,6
16	52,7	50,1	2,6	21,4	20,3	1,1	16	73,8	72,1	1,7	25,2	24,7	0,5
17	59,7	57,4	2,3	24,5	23,6	0,9	17	70,8	69,2	1,6	22,9	22,3	0,6
18	59,8	58,6	1,2	21,2	20,8	0,4	18	87,1	83,7	3,4	25,4	24,5	0,9
19	53,7	52,4	1,3	20,7	20,2	0,5	19	83,7	81,7	2	23,9	23,4	0,5
20	61,1	58,3	2,8	22,4	21,4	1	20	72,6	69,4	3,2	26,7	25,5	1,2
21	74,6	72,4	2,2	24,9	24,2	0,7	21	71,9	69,3	2,6	22,7	21,9	0,8
22	54,3	53,3	1	21,2	20,8	0,4	22	72,6	69,6	3	23,7	22,7	1
23	62,1	60,9	1,2	23,4	22,9	0,5	23	66	63,7	2,3	22,6	21,8	0,8
24	68,8	66,5	2,3	23,8	23	0,8	24	75,1	72,7	2,4	26,6	25,8	0,8
25	54,2	53,2	1	21,2	20,8	0,4	25	79	76,8	2,2	26,4	25,7	0,7
X̄ (m)	60,9	58,8	2,024	22,5	21,7	0,744		76,5	74,2	2,32	24,3	23,6	0,74
Amplitude – W (m)	32,8	32,3	0,403	2,25	2,38	0,057		53,5	53,8	0,36	2,12	2,14	0,04
Standard deviation – S	5,73	5,68	0,63	1,50	1,54	0,24		7,31	7,33	0,60	1,46	1,46	0,21
The coefficient of variability CV	9,41	9,66	31,35	6,68	7,11	32,01		9,56	9,89	25,89	5,99	6,21	28,27

a) Cooper test results

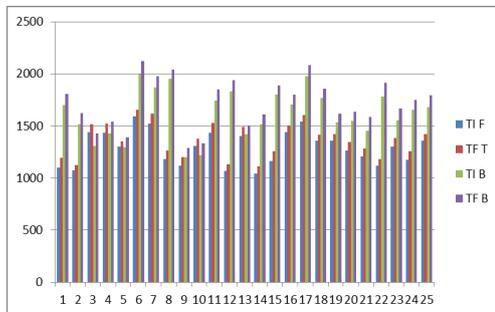


Fig. 1. Values obtained between initial testing (TI) and final testing (TF) for men and women

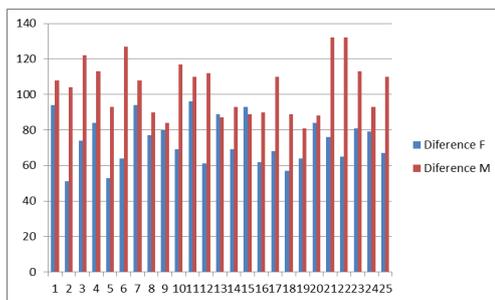


Fig. 2. Differences obtained between initial testing (TI) and final testing (TF) for men and women

Notable differences between men and women can be observed through the application of the Cooper test. For women, the largest difference was 96, and the smallest was 51, while for men, the largest difference was 132, and the smallest was 81 (Figures 1, 2).

b) Ruffier-Dickson Test

The largest differences between initial testing (TI) and final testing (TF) for the experimental group of women were 5 for pulse at rest, 14 for pulse after 30 squats, and 9 for pulse after one minute of rest (Figure 3).

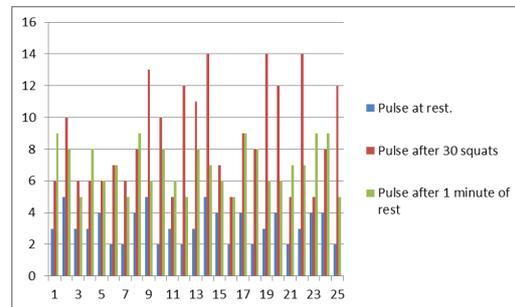


Fig. 3. Differences obtained between initial testing (TI) and final testing (TF) for women at Ruffier-Dickson test

In contrast, for the experimental group of men, by applying the Ruffier-Dickson test, the largest differences between resting heart rate (TI) and recovery heart rate (TF) were 6 beats at rest, 15 beats after 30 squats, and 11 beats after a one-minute pause (Figure 4).



Fig. 4. Differences obtained between initial testing (TI) and final testing (TF) for men at Ruffier-Dickson test

This suggests that men had higher heart rate responses compared to women following the testing exercises. These differences may reflect different fitness levels, physiological responses, or even exercise behaviors between the two groups. By analyzing this data, researchers can draw conclusions regarding the effectiveness of the exercises or the physical adaptations specific to each gender.

c) Six Minute Walk Test

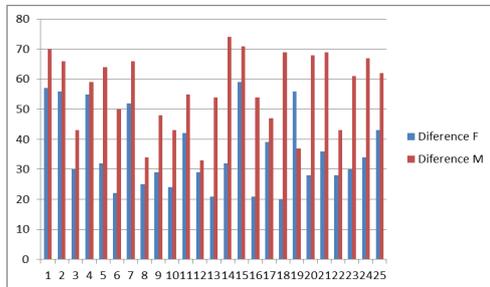


Fig. 5. Differences obtained between initial testing (TI) and final testing (TF) for female and man at Six Minute Walk Test.

Based on the measurements taken at initial testing (TI) and final testing (TF), the application of the Six Minute Walk Test resulted in a maximum difference of 59 m for the women's group and 74 m for the men's group (Fig. 5). This statement indicates that when assessing the performance of the two groups (women and men) using the Six Minute Walk Test, there was a measurable improvement in distance covered or performance between the initial testing (TI) and final testing (TF). These differences suggest that both groups improved their walking performance over the testing period, with men showing a greater increase in distance covered compared to women. This could imply variations in physical conditioning, response to the intervention of exercise, or other factors affecting endurance between the two groups. Analyzing these results can help researchers understand the effectiveness of the exercise program and its impact on different sexes.

d) Wingate Test

As we can see in Figure 6, notable differences were obtained between initial

testing (TI) and final testing (TF) for both women and men, indicating that after 8 weeks, conclusive results can be achieved.

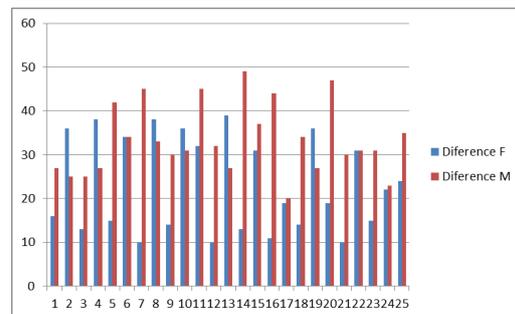


Fig. 6. Differences obtained between initial testing (TI) and final testing (TF) for female and man at Wingate Test

The largest difference in the experimental group of women was 39, while for men it was 49. This indicates that the developed strength and anaerobic capacity improved significantly, with higher values observed in men. The fact that men showed greater improvements compared to women indicates that, on average, men in the study developed more strength and had higher anaerobic capacity gains over the 8 weeks.

Overall, this suggests that the training program was effective in enhancing physical fitness levels in both groups, particularly in men. Researchers can use this information to draw conclusions about exercise effectiveness and gender differences in response to training.

e) Heart Rate Recovery Test

To measure the efficiency of the cardiovascular system, the difference between initial values and recovery values is assessed.

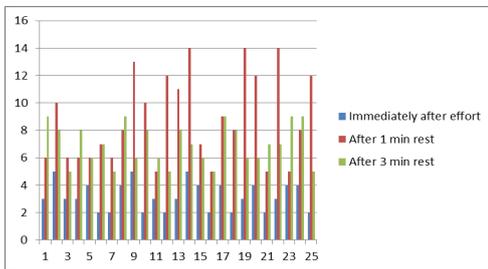


Fig. 7. Differences obtained between initial testing (TI) and final testing (TF) for women at Heart Rate Recovery test.

In the case of the women's group, the minimum obtained was 2 seconds and the maximum was 5 seconds for heart rate measurement immediately after effort, a minimum of 5 seconds and a maximum of 14 seconds after one minute of rest, and a minimum of 5 seconds and a maximum of 9 seconds at 3 minutes of rest.

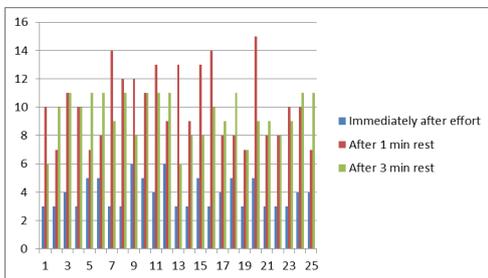


Fig. 8. Differences obtained between initial testing (TI) and final testing (TF) for men at Heart Rate Recovery test.

In the case of men, the minimum obtained was 3 seconds and the maximum was 6 seconds for heart rate measurement immediately after effort, a minimum of 7 seconds and a maximum of 15 seconds after one minute of rest, and a minimum of 6 seconds and a maximum of 11 seconds at 3 minutes of rest.

The results indicate how quickly each group's heart rate returns to baseline after exercise.

Shorter recovery times typically signify better cardiovascular efficiency and fitness levels.

The data suggest that both groups improve in recovery ability, but men show slightly longer recovery times immediately after effort compared to women, while women take longer to recover after one minute of rest.

Overall, these observations provide insight into the cardiovascular fitness of each group and how well their bodies recover from physical exertion.

5. Conclusions

The hypothesis proposed that men and women would exhibit different cardiovascular responses to moderate-intensity exercise due to physiological gender differences. The data supports this hypothesis, as significant differences in heart rate recovery, blood pressure changes, and other cardiovascular parameters were observed between the two groups. For instance:

Men showed greater improvements in anaerobic capacity and overall strength, indicating a different physiological response.

Women had varied heart rate recovery times after different exercise phases, reflecting unique adaptations.

Analyzing Changes in Cardiovascular Functions: The study aimed to analyze changes in cardiovascular functions by measuring parameters such as heart rate, blood pressure, and cardiorespiratory capacity. The results showcased measurable improvements in these areas over the 8-week spinning program for both groups, indicating fulfillment of this objective.

Weight loss and changes in body mass index (IMC) were recorded, showing positive outcomes related to cardiovascular fitness improvements.

Observing Recovery and Adaptation Differences: The objectives also included observing differences between men and women in terms of recovery and adaptation to training. The results revealed:

- Men and women responded differently in terms of heart rate recovery during exercises. Heart rate recovery after exertion was generally quicker for women, whereas men had higher overall gains in anaerobic performance.

- These findings illustrate the varied ways both sexes adapt to spinning training, confirming the objective's fulfillment.

The study effectively addressed its objectives and fulfilled its hypothesis by demonstrating that men and women exhibit distinct cardiovascular responses to moderate-intensity exercise, particularly in aspects such as heart rate recovery, anaerobic capacity, and overall physical fitness adaptations following spinning training. The significant differences noted in both physiological responses and performance improvements align with the intended goals of the research, offering valuable insights into gender differences in exercise response and adaptation.

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