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Original Article

The Impact of Spinning on Individuals in Menopause with Metabolic Syndrome

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Abstract

This study aims to analyze the effects of spinning on menopausal women suffering from metabolic syndrome. Metabolic syndrome, characterized by a combination of conditions such as hypertension, hyperglycemia, excess abdominal fat, and abnormal cholesterol levels, is exacerbated by the hormonal and physiological changes associated with menopause. The study seeks to determine whether a structured and consistent spinning program can provide significant benefits in managing metabolic syndrome in menopausal women, thereby contributing to improved quality of life and reducing the risk of cardiovascular diseases and type 2 diabetes Research Objectives: Assess changes in functional and metabolic parameters; Evaluate body composition modifications; Identify the impact on cardiovascular health. Two groups of 10 participants each, aged between 50 and 60, will take part in a three-month spinning program. The training will consist of 50-minute sessions, twice per week. Participants will undergo initial and final evaluations of metabolic and cardiovascular parameters.

1. Introduction

Spinning, also known as indoor cycling, is an extremely popular form of exercise, especially among women. However, its effects on affect have not yet been thoroughly investigated (Szabo, Gáspár, Kiss, & Radványi, 2015). Metabolic syndrome is a cluster of risk factors for cardiovascular disease, and menopause is correlated with an increased prevalence of this syndrome (Jouyandeh, Nayebzadeh, Qorbani, & Asadi, 2013). Spinning is a fitness training method performed indoors on stationary bikes, where participants pedal in synchronization, guided by the

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rhythm of the music and the motivational instructions of an instructor. Although this recreational activity is extremely popular worldwide, scientific research on its effects on metabolic, respiratory, and cardiovascular functions remains limited, with most existing studies being exploratory in nature (Caria, Tangianu, Concu, Crisafulli, & Mameli, 2007). According to (Witkoś & Dąbrowska-Galas, 2012), spinning training sessions are structured based on specific heart rate percentage intervals, leading to five types of spinning workouts: recovery (50–65% HRmax), endurance (65–75% HRmax), strength (75–85% HRmax), interval (65–92% HRmax), and competition day (80–92% HRmax). The authors of the study (Rendos, Musto, Signorile & Joseph, 2015) consider Spinning to be a widely practiced group workout, conducted in fitness centers and health clubs worldwide. During a spinning session, intensity varies and is regulated through body positioning on the stationary bike and perceived resistance level. During a 50-minute Spinning session, the authors of the study (Cvenić, Macan & Staković, 2022) did not observe significant differences in functional abilities between high school students and university students. Boys exhibited a lower maximum heart rate than girls, indicating higher physical capacity. While the time spent in different intensity zones was similar for both genders, boys burned significantly more calories than girls.

The authors of the study (Piacentini, Gianfelici, Faina, Figura & Capranica, 2009) concluded that Spinning should be considered a "very high-intensity" exercise, and new or untrained participants should receive special attention, as no real-time feedback is provided during the session to adjust effort intensity. Spinning is a guided workout that combines endurance, strength, and interval training on a stationary bike. A one-hour session increases troponin T levels in healthy and well-trained individuals, while NT-ProBNP and CKMB levels remain unchanged. These findings are clinically relevant given the increasing popularity of spinning (Duttaroy, Thorell, Karlsson, & Börjesson, 2012).

Spinning training can be an effective and safe intervention for middle-aged and older adults who present multiple cardiovascular risk factors (Verrusio et al., 2016). Indoor cycling and stationary bike workouts are effective strategies for preventing metabolic diseases by increasing CTRP-3 levels, an anti-inflammatory marker that influences metabolism, liver function, and adipose tissue (Safarpour, Nayebifar, & Nikoofar, 2020). Low HDL cholesterol levels and abdominal obesity are the most frequent characteristics compared to other metabolic components. The study by the authors (Marjani, & Moghasemi, 2012) also identified several factors associated with metabolic syndrome in postmenopausal women, which may increase cardiovascular risk in this group. The studies conducted by the authors (Marchi et al., 2017) show that found that the predominant components of metabolic syndrome in postmenopausal women were low HDL-C levels (<50 mg/dL), hypertension (SBP ≥130 mmHg or DBP ≥85 mmHg), and elevated fasting glucose levels (≥100 mg/dL). Metabolic syndrome is highly prevalent among postmenopausal women, highlighting the need for preventive measures to reduce the risk of developing diabetes and cardiovascular diseases (Sapkota, Sapkota, Acharya, Raut, & Jha, 2015), furthermore (Lee et al., 2012) emphasize that menopause symptoms are a significant concern for postmenopausal women. Metabolic syndrome (MetS) is a major risk factor for cardiovascular diseases, and menopause is associated with a higher prevalence of this condition. Excess visceral fat is well known to be closely linked to an increased risk of coronary artery disease, metabolic lipid disorders, hypertension, and type 2 diabetes (Okura et al., 2007).

Menopause induces significant changes in women's quality of life, including hormonal fluctuations that increase BMI, promote visceral fat accumulation, and lead to loss of lean mass, bone density, and protein reserves (Iancu, et al., 2018). The study by (Lima et al., 2012) shows that a 12-week aerobic training program can improve components of metabolic syndrome without significant effects on blood pressure. Although blood glucose levels decreased in active women, it remains unclear whether menopause influences cardiometabolic responses to exercise. Another study (Wiklund et al., 2014) shows that a small amount of weight loss does not bring significant benefits; however, short-term aerobic exercise can improve glucose and lipid metabolism even without weight loss in overweight and sedentary obese women. According to the author (Silișteanu, 2022), regular physical activity reduces inflammation, oxidative stress, and visceral fat accumulation, contributing to maintaining a healthy weight.

2. Material and Methods

The aim of this study is to evaluate the effects of a spinning program on metabolic parameters, body composition, and cardiovascular health in menopausal women suffering from metabolic syndrome.

Research Hypothesis. It is assumed that participation in a three-month spinning program, conducted twice per week, will lead to significant improvements in metabolic and cardiovascular parameters, as well as a reduction in body fat in menopausal women with metabolic syndrome. Research Objectives: Assess changes in functional and metabolic parameters; Determine body composition modifications; Identify the impact on cardiovascular health; Evaluate improvements in quality of life.

Research Methods sed: scientific documentation method, observation method experimental method, mathematical-statistical method, testing method, survey and graphical method. Applied Tests: body mass index (BMI), waist circumference, maximum heart rate (HRmax), blood pressure measurement, 6-minute walk test, 6-minute elliptical bike test, muscular endurance test, anaerobic endurance test, blood glucose level, total cholesterol level.

Experiment organization and implementation. The experiment was conducted at the "Wender Gym" in Suceava between April and June 2024, over a period of three months. Spinning sessions were held twice per week, each lasting 50 minutes. Participants were divided into two groups: morning group – sessions at 10:00 AM and evening group – sessions at 8:00 PM.

The spinning program, with variable intensity cycles, was implemented to achieve the proposed objectives.

Table 1. *Spinning Program Model for Women Aged 50-60 with Grade I Obesity and Hypertension*

General Objectives: weight control, improvement of cardiovascular function, reduction of the risk of complications associated with hypertension and obesity, and enhancement of bone density.

Period	Experimental Group Spinning
3 months (April-June 2024)	**Duration: 2 sessions/week (40-50 min/session)**
Weeks 1-2	**Objectives:** Adaptation to movement, improvement of cardiorespiratory endurance. Enhancement of flexibility and blood pressure control. **Warm-up:** 5 min of light cycling, no resistance, steady pace. Controlled breathing. **Main Phase:** 30 min at low intensity, without major rhythm variations. 1-2 min breaks every 10 min. **Cooldown:** 5 min of light cycling, gradual reduction of pace. 10 min of stretching for legs and back.
Weeks 3-4	**Objectives**: Improvement of cardiovascular function, calorie burning, weight reduction. **Warm-up:** - 5 min of cycling at moderate intensity, low resistance. **Main Phase:** - 30 min with 4 cycles of 4 minutes at moderate intensity (60 70% of capacity) - 1 min breaks between cycles. **Cooldown:** - 5 min of slow cycling, relaxation. - 10 min of stretching for flexibility.
Weeks 5-6	**Objectives:** Increase endurance and muscle toning. Reduce cardiovascular risk and improve metabolism. **Warm-up:** 7 min of cycling at moderate intensity, low resistance. **Main Phase:** 35 min with 5 cycles of 4 minutes at moderate intensity (60-70% of capacity). - 30 sec breaks between cycle. **Cooldown:** 5 min of slow cycling, relaxation. - 10 min of stretching, focusing on flexibility and muscle relaxation.
Weeks 7-8	**Objectives:** Increase work capacity, reduce stress, and improve cardiovascular endurance. Continue weight loss. **Warm-up:** 10 min of cycling at moderate intensity, medium resistance. **Main Phase:** 35 min with 6 cycles of 4 minutes at moderate intensity (60-70% of capacity), with slightly increased resistance. -30 sec breaks between cycles. **Cooldown**: 5 min of slow cycling and controlled breathing. - 10 min of stretching, focusing on back and legs.
Weeks 9-10	**Objectives:** Increase physical performance, muscle toning, improve cardiovascular function, and continue weight reduction. **Warm-up:** 10 min of cycling at moderate intensity, medium resistance. **Main Phase:** 40 min with 6 cycles of 5 minutes at moderate intensity (70-80% of capacity), with medium resistance. - 30 sec breaks between cycles. **Cooldown:** 5 min of slow cycling, relaxation. -10 min of stretching for flexibility, focusing on legs and back.
Weeks 11-12	**Objectives:** Improve muscular and cardiovascular endurance, increase exercise intensity, optimize metabolism, and maintain weight. **Warm-up:** 10 min of cycling at moderate intensity, medium to high resistance. **Main Phase:** 40 min with 7 cycles of 5 minutes at high intensity (80-90% of capacity), with high resistance. - 30 sec breaks between cycles. **Cooldown:** 5 min of slow cycling, complete relaxation. - 10 min of stretching for flexibility, focusing on the entire body (legs, back, arms).

Inclusion Criteria. The inclusion criteria for the study were age between 50 and 60 years postmenopausal status for at least one year grade I obesity or Grade I hypertension low level of physical activity. Out of the 44 women initially evaluated, only 20 met the inclusion criteria and were divided into two groups: one group participated in spinning sessions at 10:00 AM and the other group trained at 8:00 PM. Each group consisted of 10 women (6 with Grade I obesity and 4 with Grade I hypertension). The participants self-selected their preferred training schedule (morning or evening) based on their work commitments, energy levels, and individual availability. Exclusion criteria were: presence of severe cardiovascular diseases, type 2 diabetes, severe musculoskeletal disorders, use of medications that could significantly influence the response to physical exercise, failure to attend a sufficient number of sessions (at least 75% of the sessions), and specific medical contraindications for moderate physical exercise, as determined by a specialist.

Before the experiment began, all 20 women included in the study signed an informed consent form, confirming their understanding and acceptance of its conditions and objectives. Materials and equipment used in the experiment: adjustable spinning bikes, heart rate measurement devices, and performance monitoring tools.

3. Results and Discussions

The study analyzed the impact of a 12-week spinning program on anthropometric and functional parameters in two groups of participants:

- Group A (morning - 10:00 AM)
- Group B (evening - 8:00 PM)

The study monitored changes in BMI, waist circumference (WC), heart rate (BPM), and blood pressure (BP) by comparing initial values (IT) with final values (FT).

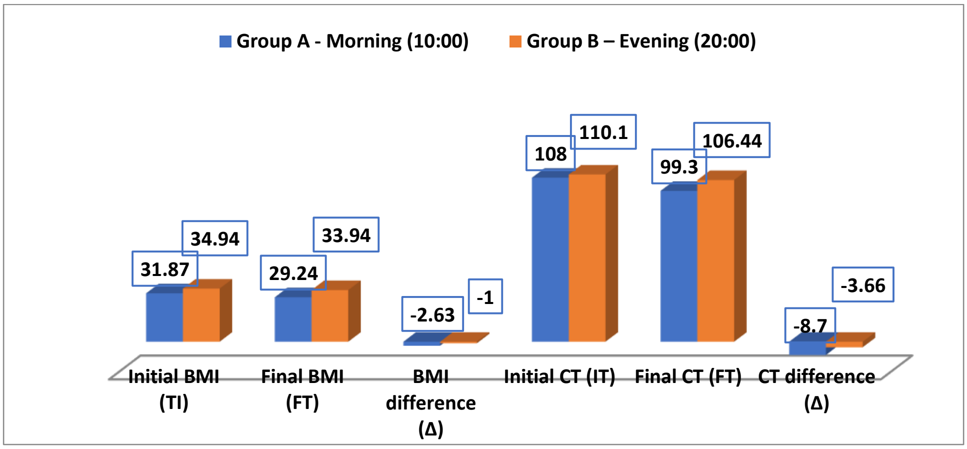

Figure 1. *Analysis of anthropometric parameters*

Group A experienced a greater reduction in BMI compared to Group B (-2.63 vs. -1.00). It was observed that morning exercises may contribute more effectively to weight loss. The reduction in waist circumference was significantly greater in Group A (-8.7 cm) compared to Group B (-3.66 cm). This result may indicate more efficient visceral fat burning in the morning.

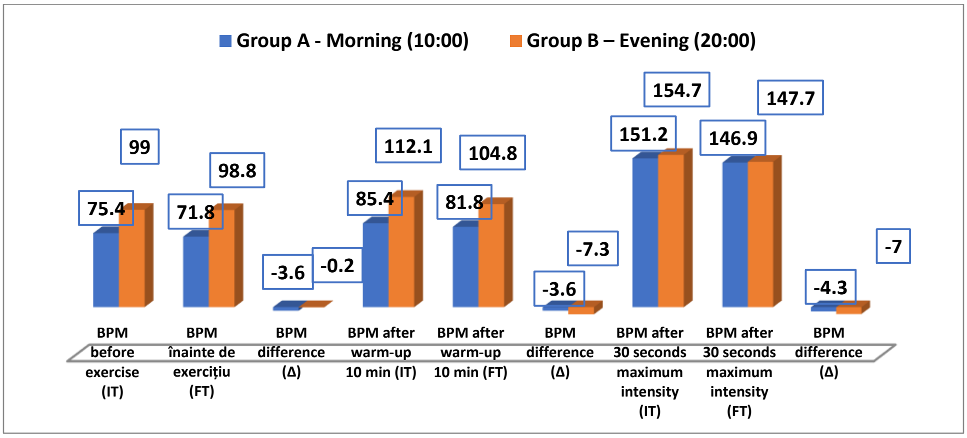

Figure 2. *Heart rate analysis (BPM)*

The rate of decrease in heart rate before exercise was higher in Group A, suggesting better cardiovascular adaptation to effort. Both groups showed a decrease in BPM after warm-up, but Group B had a greater reduction, which may suggest better effort tolerance during evening workouts. The reduction in BPM after maximal effort was greater in Group B (-7.0 bpm), indicating a better recovery capacity after evening workouts.

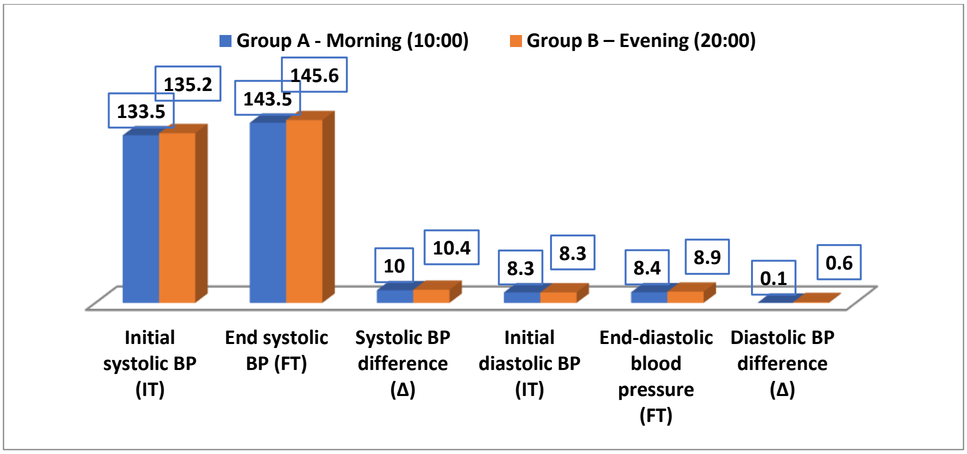

Figure 3. *Blood pressure (BP) analysis*

We note that the slight increase in systolic blood pressure after exercise is physiological and normal during moderate-to-high intensity training. No significant changes in diastolic blood pressure were observed, indicating vascular stability in both groups.

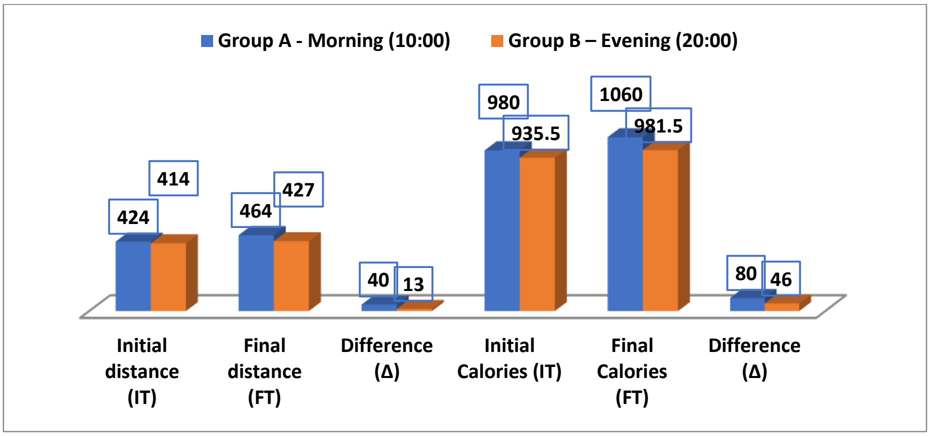

Figure 4. *Analysis of the 6-minute walk test and Analysis of the elliptical test (6 minutes)*

Group A recorded a greater increase in the distance covered (+40 m vs. +13 m), suggesting a more significant improvement in aerobic capacity and cardiovascular endurance. The increase in caloric expenditure was higher in Group A (+80 kcal vs. +46 kcal), indicating better aerobic metabolism efficiency and more effective fat burning for energy.

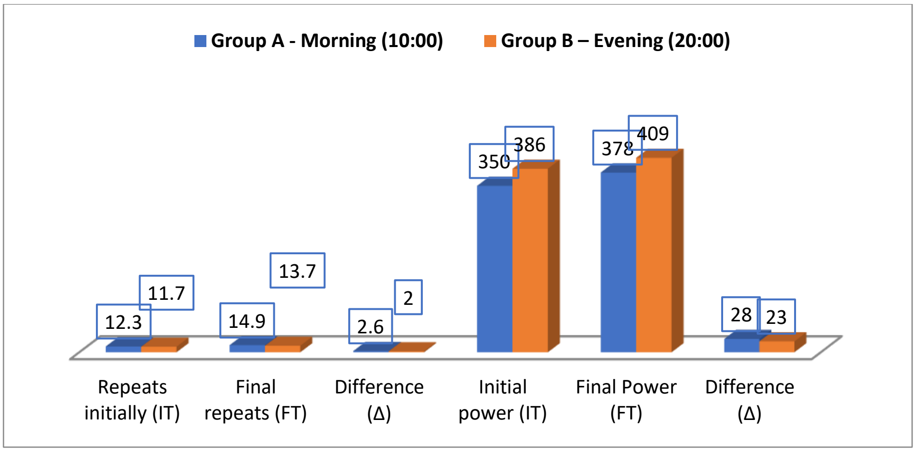

Figure 5. *Analysis of muscular endurance and Statistical analysis of anaerobic resistance*

Both groups recorded an improvement in muscular endurance, but Group A showed a slightly greater increase (+2.6 vs. +2.0 repetitions), which may suggest a better response to morning workouts. Both groups improved their anaerobic capacity, but Group A had a greater increase in power (+28 W vs. +23 W), suggesting that morning exercises may better support the development of muscular explosiveness.

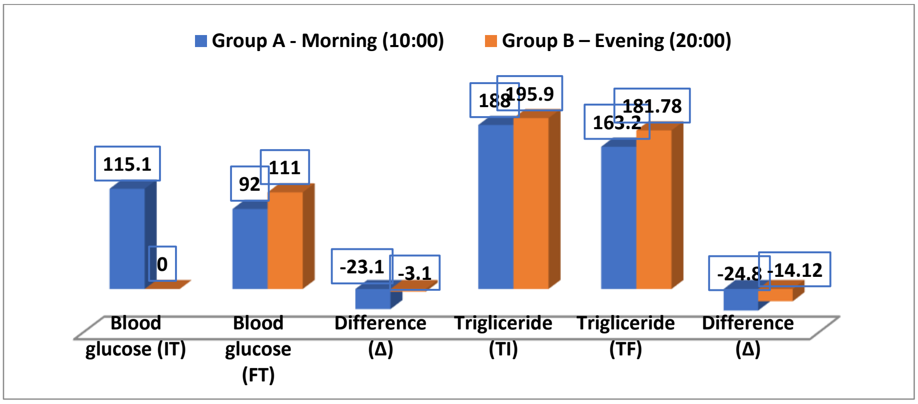

Figure 6. *Statistical analysis of blood glucose and Statistical analysis of Triglycerides*

Group A (morning) recorded a significant reduction in blood glucose levels of -23.1 mg/dl, while Group B (evening) had a much smaller decrease of -3.1 mg/dl. This result suggests that morning workouts may contribute more effectively to blood glucose regulation. Group A (morning) experienced a greater reduction in triglycerides (-24.8 mg/dl) compared to Group B (evening), which had a smaller decrease of -14.12 mg/dl. This result suggests that morning workouts may be more effective in reducing triglyceride levels.

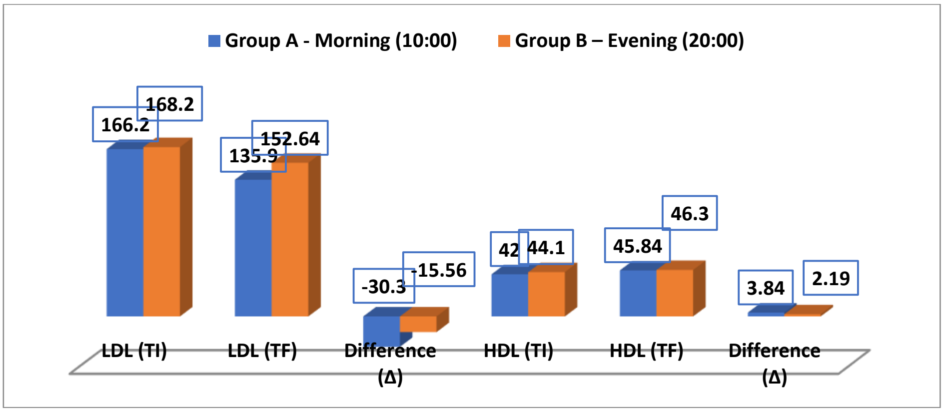

Figure 7. *Statistical analysis of LDL ('bad' cholesterol) and Statistical analysis HDL (good cholesterol)*

Group A (morning) experienced a significant decrease in LDL levels (-30.3 mg/dl) compared to Group B (evening), which had a smaller reduction of -15.56 mg/dl. This result suggests that morning workouts may have a greater impact on reducing "bad" cholesterol (LDL). Both groups recorded an increase in HDL, with Group A showing a greater increase (+3.84 mg/dl vs. +2.19 mg/dl). This suggests that morning workouts may contribute more to the increase in "good" cholesterol.

In Group A, the correlations between BMI and blood glucose before the program (r = 0.76) result in a strong relationship, indicating that a higher BMI tends to be associated with higher initial blood glucose levels. The 6-minute walk test and final heart rate (r = -0.81) result in a strong inverse relationship, suggesting that participants who walked more significantly improved their cardiac function.

The initial cholesterol and initial blood glucose (r = 0.72) result in a positive correlation, indicating that individuals with higher cholesterol levels tend to have higher blood glucose levels. In Group B, the correlations between BMI and initial heart rate (r = 0.83) result in a strong relationship, suggesting that a higher BMI is associated with a higher initial heart rate. The initial blood glucose and initial cholesterol (r = 0.77) result in a strong relationship, indicating an increased risk of metabolic complications. The walking test distance and final cholesterol (r = -0.74) result in the finding that participants who improved their walking capacity experienced greater reductions in cholesterol levels.

Comparative Analysis Between Group A – Morning (10:00 AM) and Group B – Evening (8:00 PM): Group A (morning) experienced a greater reduction in weight and BMI than Group B. Participants who trained in the morning lost, on average, more kilograms than those who exercised in the evening. Morning exercise can activate metabolism for the entire day, leading to better fat oxidation. Group A showed a greater improvement in the distance covered in the 6-minute walk test. Group B achieved better performance on the elliptical bike (possibly due to better muscle activation in the evening). In the evening, body temperature is higher, which may improve muscle performance. Both groups experienced a reduction in blood pressure, but Group A had a more pronounced decrease in systolic pressure. The correlation between weight loss and blood pressure was higher in Group A than in Group B. Group A recorded a greater reduction in blood glucose after 3 months. Group B had a better reduction in triglycerides and a more significant increase in HDL (good cholesterol). Evening spinning sessions may improve lipid metabolism, while morning sessions help more with blood glucose control. Group B showed a greater improvement in anaerobic endurance (cycling sprint test). Group A showed a greater improvement in muscular endurance (chair rise test). Anaerobic performance is favored in the evening due to a higher body temperature.

Discussions

In analyzing the results of the three studies, a significant impact of Spinning on cardiovascular and metabolic function is observed, compared to other forms of exercise such as the stationary bike. The study conducted by (Caria, Tangianu, Concu, Crisafulli, & Mameli, 2007) suggests that Spinning, due to its variable intensity exercises, has a considerable effect on oxygen consumption and can stimulate post-exercise energy expenditure without increasing the perceived effort. This can be beneficial for improving physical fitness, but it is not recommended for sedentary individuals or older adults, who may experience difficulties in adapting to the exercise intensity. The study conducted by (Nakhaei, Nayebifar & Fanaei, 2023) highlights that both Spinning and stationary bike exercises were effective in reducing body weight and triglycerides while increasing high-density lipoproteins (HDL).

Spinning and stationary bike exercises were also found to be effective in improving the lipid profile, having a positive impact on cardiovascular health. This study suggests that Spinning may offer additional benefits in terms of reducing total cholesterol and LDL levels. Spinning and stationary bike exercises are effective in improving cardiovascular and metabolic health, reducing body weight, and enhancing lipid profiles. Variable intensity exercises stimulate energy expenditure without increasing perceived exertion, making them useful for improving physical fitness. However, it is essential to adjust exercise intensity according to the needs of sedentary individuals or older adults.

Our study highlights the positive impact of a spinning program on the physiological parameters of the participants, both in terms of weight control and the improvement of cardiovascular and metabolic function. Special attention was given to the influence of the time of day when the training was performed (morning vs. evening), and the comparative analysis between the two groups provides valuable insights into optimizing spinning programs for individuals with obesity or metabolic syndrome.

The results of this study indicate that morning training was more effective for weight loss, BMI reduction, and blood pressure improvement, while evening training had a more pronounced impact on anaerobic endurance and triglyceride level reduction. These findings align with the specialized literature, which suggests that morning physical exercises may have a superior metabolic effect on fat oxidation, while evening workouts may enhance anaerobic performance and muscle adaptations.

4. Conclusions

The reduction in BMI and waist circumference was greater in Group A (morning), suggesting a superior metabolic effect of morning exercises on body composition. Heart rate before exercise and after warm-up improved significantly in both groups, reflecting good cardiovascular adaptation. Systolic blood pressure (SBP) increased moderately after exercise, which is normal and physiological, with no negative effects on diastolic blood pressure (DBP). Group B (evening) demonstrated better BPM recovery after maximal effort, indicating greater tolerance to high-intensity exercises.

Group A (morning - 10:00 AM) recorded significantly greater reductions in blood glucose, LDL, and triglyceride levels compared to Group B (evening), suggesting that morning workouts may have a stronger impact on improving the lipid profile and regulating blood glucose. HDL ("good" cholesterol) increased in both groups, but the morning sessions were more effective in stimulating HDL growth.

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