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ORIGINAL PAPERS

The Short-term Effect of Regular Physical Activity on the Women's Cardiorespiratory Status and Body Composition – a Pilot Study

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Abstract

Physical activity (PA) demonstrates its positive long-term effects on physical and mental health and on preventing the onset of non-communicable diseases. However, the short-term effects remain insufficiently studied, particularly in women. Apart from their unique anatomical structure, women exhibit physiological specificities. This study aimed to determine the short-term effects of regular PA on the cardiorespiratory status of women.

The study included 24 participants with an average age of 42.54 years. They participated in a two-month organized program of regular physical activity. Measurements were taken before and after exercise, including oxygen saturation, a six-minute walk test, and body mass index.

Statistical analysis revealed no significant differences in the BMI of participants between the first and second measurements (p=0.422). The study found significant differences in oxygen saturation before and after exercise (p=0.003). Participants achieved significantly better results in the six-minute walk test (p<0.001).

The study shows that a two-month PA program improves the cardiovascular status of women and increases endurance and functional capacity. At the same time, the impact on BMI and body weight is insignificant. The results can emphasize the short-term benefits of exercise and motivate women to exercise by defining the short- and long-term health effects.

Keywords: body mass index, cardiorespiratory status, oxygen saturation, physical activity, women

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INTRODUCTION

According to the WHO, health is a comprehensive state of well-being, and achieving optimal health is a global priority[1]. Regular physical activity (PA) promotes better physical health and supports cognitive development[2]. It significantly reduces the risk of non-communicable diseases[3]. PA can undeniably lower the risk of type 2 diabetes, high blood pressure, and metabolic syndrome, and significantly reduce the risk of ischemic heart disease, colon cancer, and breast cancer[4,5,6,7]. Adequate physical activity is crucial for young people. However, 81% of young people do not meet the activity guidelines[8]. Aerobic exercises such as dancing, swimming, and running improve cardiovascular function through oxygen intake. In contrast, anaerobic exercises, such as weightlifting, focus on increasing muscle fitness[9]. PA has a significant impact on hormone balance, especially in women who are subject to hormonal fluctuations[10]. The endorphins from PA reduce the level of depression, improve mood, and relieve anxiety[11]. They also act as a natural painkiller, decreasing the sensation of pain and triggering euphoria alongside the release of noradrenaline, dopamine, and acetylcholine[12]. Although cortisol, the most important stress hormone, may temporarily increase during exercise, consistent PA lowers cortisol levels. This hormone regulates numerous physiological processes, including metabolism and inflammation[13]. Consequently, lowering cortisol levels through PA positively affects mood, energy, sleep quality, and insulin sensitivity in patients with type 2 diabetes[14]. Patients with osteoarthritis require PA to maintain functional capacity[15]. Regular PA significantly improves motor and cognitive skills, personality development, quality of life, and social interactions[15]. PA increases cardiac output, and with increasing intensity and duration, heart muscle mass and the thickness of the heart wall increase[16]. The WHO recommends at least 150 minutes of PA per week[17]. A lack of PA leads to a 20% to 30% increased risk of death[17]. Nevertheless, today's lifestyle is characterized by insufficient PA, leading to muscle wasting, reduced strength, and musculoskeletal changes[18,19]. In addition, fast-paced lifestyles increase people's expectations and make the speed and efficiency of any activity, including regular PA, a prerequisite for maintaining motivation to exercise. Adherence to WHO guidelines is alarmingly low among European men and women. Eurobarometer data shows that 45% of EU citizens are inactive, exacerbating non-communicable diseases and putting a strain on healthcare systems[20]. Women are particularly at risk due to societal pressures that prevent them from focusing on their health, as Short et al. emphasize in their article[21]. Medical research has, therefore, begun to focus increasingly on women. Apart from their unique anatomical structure, women have physiological peculiarities at certain stages of life, such as adolescence, pregnancy, the postpartum period, and menopause[22,23]. Women balance family, career, and social engagement, contribute to the development of the community, and shape the future[24]. However, in this significant life dynamic, they often neglect their health and look for quick ways to achieve positive health effects. However, the short-term effects that could contribute to a better motivation for PA have not yet been sufficiently investigated in women. This study aimed to determine the short-term effects of regular PA on the cardiorespiratory status of women through easily accessible measurements, which could improve endurance and motivation for regular PA in women.

PARTICIPANTS AND METHODS

Participants

The study involved 24 participants with an average age of 42.54 years, ranging from 23 to 63 years old, who participated in a two-month organized regular PA program from September 1, 2014, to October 31, 2024. The inclusion criteria were: female participants over 18 years old, individuals with no known history of cardiovascular, respiratory, or metabolic disease, participants leading a sedentary lifestyle at the beginning of the study, and those willing and able to participate in a structured exercise program before signing an informed consent form. The exclusion criteria were the presence of chronic or acute medical conditions precluding PA (e.g., heart disease, uncontrolled hypertension, severe asthma, diabetes), pregnant or breastfeeding women, taking medication that could impair cardiorespiratory status or physical performance (e.g. beta blockers, corticosteroids), any physical disability or injury that restricts participation in regular PA, inability to adhere to the study schedule or participate in regular PA, participants who have regularly participated in the exercise program in the past six months, and individuals participating in other clinical trials or studies during the study period. The participants were divided into three age groups: up to 35 years, between 36 and 45 years, and over 45 years.

Methods

Patients participated in a two-month program of regular PA according to World Health Organization (WHO) guidelines, which recommend at least 150–300 minutes of moderate-intensity aerobic PA or 75–150 minutes of vigorous-intensity aerobic activity per week for adults[17]. The program included three days per week of moderate-intensity exercise, two days for moderate-intensity aerobic activity, and one day for strength training. The training intensity was controlled using heart rate monitoring. Each session lasted 45–60 minutes. Aerobic exercises include walking/jogging, cycling, and group aerobic dance. Strength training consisted of squats, lunges, push-ups, and planks. Participants performed only bodyweight exercises targeting the major muscle groups and completed 2–3 sets of 8–12 repetitions for each exercise. Dynamic stretching exercises were performed before training for flexibility and after recovery training. Comprehensive measurements were taken at the beginning and end of the two-month program, including height, weight, and body mass index (BMI) calculations to track physical changes over time. In addition, oxygen saturation (SpO_2) was measured at the beginning of the program before and after an exercise session to assess the immediate physiological responses to exercise. To assess the participants' endurance and overall physical fitness, a six-minute walk test (6MWT) was performed both at the beginning and at the end of the program. This test is used in people with various illnesses, especially during rehabilitation, and has proven its worth in assessing the functional capacity of patients. However, due to its simplicity, it is also often used to monitor the effectiveness of exercise in recreational athletes[24].

Ethical considerations

The study received approval from the Faculty of Health Studies at the University of Rijeka, Croatia (602-04/24-01/41) on 06.12.2023. The study complied with the Act on the Protection of Patients' Rights (Official Gazette 169/04, 37/08) and the Act on the Protection of Personal Data (Official Gazette 103/03-106/12) to protect the rights and data of the participants. In addition, the principles of the Declaration of Helsinki were observed. Participation in the survey was voluntary. Participants were informed in advance about the aims of the study. All participants signed a consent form.

Statistical analysis

After data collection, the data were processed using appropriate statistical methods in Statistica 13.3.0. software (TIBCO Software Inc.). Descriptive statistics were calculated for age, height, weight, BMI, SpO_2, and 6MWT. Nonparametric tests were used because the Kolmogorov-Smirnov test showed that the data were not distributed according to a normal distribution. Differences between the results of the first and second measurements were assessed using the Wilcoxon matched pairs test and Fisher's exact test. The Friedman ANOVA test was used to investigate whether there were differences in oxygen saturation values between the measurements. Statistical significance was set at a value of $p < 0.05$.

RESULTS

The study included 24 participants with an average age of 42.54 ± 10.16 years. Table 1 lists descriptive data for height, weight, and BMI for all 24 subjects.

Table 1. Presentation of height, body weight, and BMI in the first and second measurement

	M ± SD	Median	Mode	Range
Height/ cm				
1st measurement	170.58 ± 6.76	170	170	159-190
2nd measurement	170.58 ± 6.76	170	170	159-190
Body mass/ kg				
1st measurement	69.42 ± 11.21	67.50	Multiple	56-99
2nd measurement	69.06 ± 10.82	65.50	60	55-99
Body mass Index/kg/m^2				
1st measurement	23.83 ± 3.39	22.75	Multiple	18.90-32.30
2nd measurement	23.74 ± 3.48	22.90	Multiple	18.90-32.30

M - arithmetic mean, SD - standard deviation

Statistical analysis using the Wilcoxon matched pairs test revealed no significant difference in height (p=1), body mass (p=0.422), and BMI (p=0.422) between the first and second measurements.

Distribution of participants by BMI category

The difference in the frequency of participants with normal and overweight body mass at the first and second measurements was not statistically significant, as confirmed by Fisher's exact test, p = 0.999 (Figure 1).

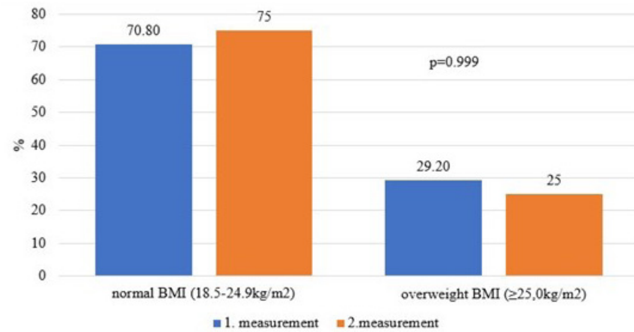

Figure 1. Distribution of participants (%) according to BMI category

BMI distribution by age group of participants

The Wilcoxon test showed no significant differences between the first and second measurements in participants younger than 35 (p = 0.180). (Figure 2). Participants aged 36 to 45 also had no significant differences between the first and second measurements (p = 0.281). Although there was an increase in BMI in the second measurement in subjects over 46 years old, the Wilcoxon test did not show a significant difference, p = 0.917.

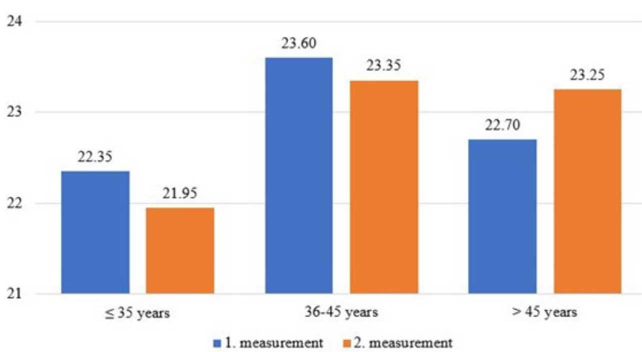

Figure 2. Display of the median BMI values (kg/m^2) for the 1st and 2nd measurement by age group of the participants

Oxygen saturation

Statistical analysis revealed significant differences in SpO_2 before and after exercise in the first and second measurements.

Table 2. Presentation of SpO2 values in the first and second measurement

SpO_2 (%)	M ± SD	Median	Mode	Range	p*
1st measurement					0.003
Before training	95.71 ± 2.63	96.50	97	90-99	
After training	97.17 ± 1.32	97	Multiple	95-99	
2nd measurement					
Before training	96.54 ± 1.32	97	97	94-99	
After training	97.58 ± 0.83	98	98	96-99	

*Friedman ANOVA test
M - arithmetic mean, SD - standard deviation, % - percentage

Oxygen saturation by age group of participants

Statistical analysis revealed that there were no significant differences in SpO2 before and after exercise at the first and second measurements in all age groups (Figures 3 and 4).

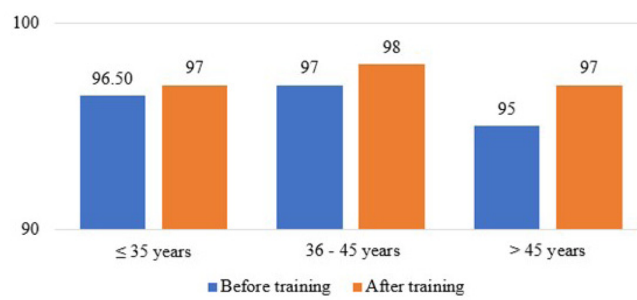

Figure 3. Display of the median SpO2 (%) for the 1st measurement by age group of the participants (years)

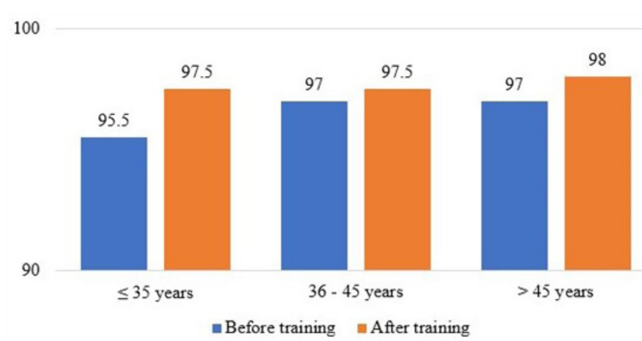

Figure 4. Display of the median SpO2 (%) for the 2nd measurement by age group of the participants (years)

The participants achieved significantly better results in the second measurement, which was confirmed by the Wilcoxon test, $p < 0.001$ (Table 3).

Table 3. Presentation of the Wilcoxon Matched Pairs Test for the 6MWT

6MWT (m)	M ± SD	Median	Mod	Range	p*
1. measurement	461.22 ± 117.09	471.90	Multiple	217-636	<0.001
2. measurement	544.18 ± 144.20	518.10	636	230-984	

*Wilcoxon Matched Pairs Test
6MWT – Six-minute Walk test, M - arithmetic mean, SD - standard deviation

Six-minute Walk test by age group of participants

Based on the data obtained, differences in the medians of the first and second measurements of the 6MWT can be identified within each age group (Figure 5). Participants younger than 35 years had a median of 579 meters for the first measurement and 627 meters for the second measurement. However, the Wilcoxon test showed no significant differences between the first and second measurements, $p = 0.059$. Participants aged 36 to 45 years had a median of 487.30 meters at the first measurement and 518.10 meters at the second measurement. The Wilcoxon test showed significant differences between the first and second measurements, $p = 0.012$. Participants older than 45 years had a median of 382.80 meters in the first measurement and 469.80 meters in the second measurement. The Wilcoxon test showed significant differences between the first and second measurements, $p = 0.007$.

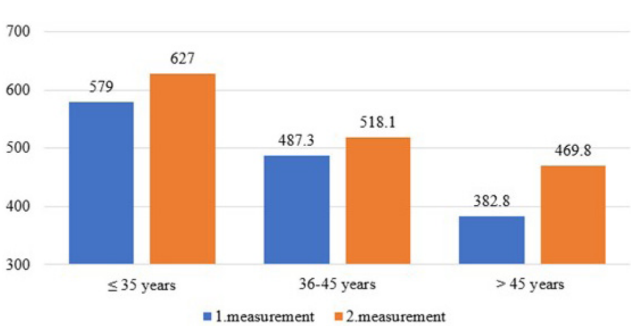

Figure 5. Display of the median values for the 6MWT (m) for the 1st and 2nd measurement by age group of the participants (years)

DISCUSSION

This study aimed to investigate the effects of a two-month organized program of regular PA on the cardiorespiratory status and body composition of women. Previous research has clearly shown that regular PA plays a key role in maintaining heart and lung health, as stated in the research by Isath et al.[26]. It helps to lower blood pressure, improve cholesterol levels, and increase tissue oxygenation[27]. These changes reduce the risk of numerous chronic, non-communicable diseases and improve the quality of life and the feeling of vitality, as numerous studies show, e.g., the study by Marquez et al.[28,29]. In addition to the physical benefits, exercise also has a significant positive impact on mental health. In their review, Mahindru and colleagues emphasize that regular exercise reduces stress, improves mood, and contributes to a general sense of well-being[30]. However, finding time to exercise remains a challenge, especially in the fast-paced rhythm of modern life where women have to juggle work commitments, family care, and household duties. Even though men are increasingly contributing to family responsibilities, much of the burden still falls on women. In this context, the short-term effects of regular PA become extremely important. If women notice improvements quickly, this can significantly increase their motivation to continue exercising. The most important element is intrinsic motivation, such as the desire for better health, more energy, or less stress, as Teixeira et al. emphasize in their research article[31]. Given today's fast-paced lifestyle and the dominance of unhealthy diets, many women have a complex relationship with body weight, exercise, and motivation for a healthy lifestyle, as the study by Homan et al. shows[32]. Social pressure and the idealization of the "perfect body" often create feelings of dissatisfaction that can lead to sporadic and short-lived attempts to exercise, as recent studies such as those by Arigo et al, Festino et al., and Pedalino et al. show[33,34,35].

Our study involved 24 participants with a mean age of 42.54 years. The age of the participants ranged from 23 to 63 years. The results showed no statistically significant difference in height, body weight, or BMI between the first and second measurements. These results indicate that the two-month program had no significant effect on these parameters in the entire sample. The study by Ho et al. showed that a 12-week exercise regimen leads to an improvement in the cardiovascular risk profile in overweight and obese participants[36]. Our research also showed a trend towards a reduction in BMI, but this was not statistically significant, which could be due to the lower intensity of the training. Nevertheless, this result suggests that longer-term training is required to achieve significant changes in body weight. A study of similar training intensity was conducted by Miller and colleagues, who found a significant improvement in work capacity in sedentary obese men after only 6 hours of total training[37]. This confirms the short-term effects of exercise, but the study was conducted exclusively with obese men. These studies also show a lack of targeted research on women. Segar et al. highlight that cognitive-behavioral, empowerment-based interventions that address the unique sociopsychological constraints of women can increase physical activity in middle-aged white women[38]. One of the most important motivations for women to exercise is appearance and weight loss, as Mroz et al. emphasize in their study[39]. To lose weight, it is recommended to create a calorie deficit in addition to healthy eating habits and regular PA. A weight loss of 0.5-1 kg per week can be achieved by combining a moderate calorie reduction (about 500 calories less per day) with activities such as aerobic exercise and strength training, as emphasized in the study by Garthe et al. on athletes[40]. Motivation is further enhanced when women notice positive changes, which encourages a long-term commitment to a healthy lifestyle.

When analyzing BMI changes by age group, a slight decrease in BMI was observed in the younger age groups, although this was not statistically significant. Conversely, a slight increase in BMI was observed in participants over the age of 45, but this change was also not statistically significant. These results suggest that age may play a role in the dynamics of BMI changes. Similar results were reported in the study by Macek et al. [41]. However, due to the lack of statistical significance, further research with larger samples or longer durations is needed to define the potential impact of the program on different age groups. Nonetheless, these results emphasize the need for a comprehensive and multidisciplinary approach to PA that includes the importance of lifestyle changes, such as a balanced diet with controlled calorie intake, stress reduction through relaxation techniques, and the adoption of healthy habits. The research conducted by Dalle Grave et al. emphasizes the importance of an integrated approach that includes both dietary changes and PA to achieve sustainable weight loss[42]. Similarly, Swift et al. concluded that aerobic exercise and dietary modification in combination lead to better weight loss results than isolated exercise[43]. However, most studies agree that long-term changes in combination with regular PA led to better results than short-term programs. Raising awareness of the importance of integrating all of these factors can help women achieve sustainable results in weight loss and improved overall health.

Our analysis showed significant differences in pre- and post-exercise SpO2 levels during the first and second measurements. These results indicate a potential improvement in blood oxygenation through exercise. Short-term programs such as this two-month program may produce a slight positive change in blood oxygen saturation, while long-term training has a greater potential for significant improvements[44]. According to research by Kodama et al., prolonged aerobic exercise significantly improves cardiovascular function, which can contribute to optimal tissue oxygenation[45]. When analyzing the results by age group, no significant difference in SpO2 was found in either the first or second measurement.

The results of the 6MWT showed an improvement in all participants on the second measurement. These results suggest that participants, regardless of age, showed progress in functional capacity. However, when the results were analyzed by age group, a different pattern of progress emerged. Participants under the age of 35 increased their median distance from 579 to 627 meters, but this difference was not statistically significant, possibly due to higher baseline aerobic capacity. For participants aged 36–45 years, the mean distance was 487.30 meters at the first measurement and 518.10 meters at the second measurement, and the difference was significant ($p = 0.012$). For participants over 45 years of age, the mean distance increased from 382.80 to 469.80 meters, also with a statistically significant difference ($p = 0.007$). These results suggest that women benefit particularly from regular PA with increasing age. According to a study by Pinto et al., a six-week strength training program in sedentary older women led to a significant increase in muscle quality and an improvement in functional capacity[46]. Our study confirms that even short-term exercise has a remarkable positive impact on women's functional capacity, which can significantly increase their motivation to engage in PA. In short-term programs, participants often notice quick results, such as increased distance in the walking test, which can be crucial for motivation. Visible changes promote a sense of achievement and confirm the value of exercise. However, to achieve a long-term commitment to exercise, it is important to emphasize the lasting benefits of regular PA aimed at improving quality of life and maintaining functional capacity, especially in older age.

Limitations of the study

The limitations of this study include the relatively small sample size (24 women), which restricts the generalizability of the results to a larger population. In addition, the research duration of two months may be too short to observe longer-term changes in body weight, BMI, or other parameters, so further studies with a longer program duration are needed. The absence of a control group restricts the interpretation of the results. Other factors that could influence the results, such as dietary habits, lifestyle, or genetics, were not taken into account. The different ages of the participants could also influence the results, so future studies could better address the specific needs of different age groups. Finally, the study was based on only one type of exercise.

CONCLUSIONS

The results of this study show that a two-month program of regular physical activity has a positive effect on the cardiorespiratory status of women, especially on the improvement of blood oxygenation and functional capacity. Although no significant changes in BMI or weight were observed, the program had a positive effect on physical endurance. An analysis of the results by age group suggests that younger women may not notice major changes in their body weight, while older women may notice a more significant improvement in their functional capacity. For future research, it is necessary to increase the sample size and extend the duration of the program.

Ethics Statement and Conflict of Interest Disclosures

Financial support and sponsorship: All authors have declared that no financial support was received from any organization for the submitted work.

Ethics Consideration: The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national laws. Written informed consent was provided by the patient participant in this study.

This study was approved by the Institutional Research Board and Ethics Committee.

Conflict of interest: No known conflict of interest correlated with this publication.

Availability of data and materials: The data used and/or analyzed throughout this study are available from the corresponding authors upon reasonable request.

Competing interests: The authors declared that they have no competing interests.

The use of generative AI and AI-assisted technologies: The authors did not use in this article generative AI and AI-assisted technologies.

REFERENCES

1. Schramme T. Health as Complete Well-Being: The WHO Definition and Beyond. Public Health Ethics. 2023;16(3):210–8.
2. Kohl HW, Cook HD. Physical Activity and Physical Education: Relationship to Growth, Development, and Health. In: Educating the Student Body: Taking Physical Activity and Physical Education to School. National Academies Press (US). 2013.
3. Saqib ZA, Dai J, Menhas R, Mahmood S, Karim M, Sang X, et al. Physical Activity is a Medicine for Non-Communicable Diseases: A Survey Study Regarding the Perception of Physical Activity Impact on Health Wellbeing. Risk Manag Health Policy. 2020;13:2949–62.
4. Trica A, Cotel A, Golu F, David I, Licu M. Attitudes Towards Aging - an Explanatory Mechanism for the Relationship Between Perceived Age Discrimination and Successful Aging. Modern Medicine. 2023;30(4):315–322.
5. Dhuli K, Nusreen Z, Medori MC, Fioretti F, Carus P, Perrone MA, et al. Physical activity for health. J Prev Med Hyg. 2022;63(2 Suppl 3):E150–9.
6. Radu-Valentin Coltuc[1], Victor Stoica. Metabolic Syndrome - Cardiovascular and Metabolic, Complex, Difficult to Quantify Risk Factor. Modern Medicine. 2016;23(1):54-59.
7. Souisa NF, Santosa B, Limijad EKS. Correlation of Hba1c, Triglyceride, HDL with the Degree of Stenosis in Coronary Heart Patients with Type 2 Diabetes Mellitus. Medicina Moderna - Modern Medicine. 2024;31(2):117–122. DOI: 10.31689/rmm.2024.31.2.117
8. Physical activity. https://www.who.int/news-room/fact-sheets/detail/physical-activity. (Accessed March 25, 2025)
9. Patel H, Alkhawam H, Madanieh R, Shah N, Kosmas CE, Vittorio TJ. Aerobic vs anaerobic exercise training effects on the cardiovascular system. World J Cardiol. 2017;9(2):134–8.
10. Ennour-Idrissi K, Maunsell E, Diorio C. Effect of physical activity on sex hormones in women: a systematic review and meta-analysis of randomized controlled trials. Breast Cancer Res BCR. 2015;17:139.
11. Hossain MN, Lee J, Choi H, Kwak YS, Kim J. The impact of exercise on depression: how moving makes your brain and body feel

better. Phys Act Nutr. 2024;28(2):43–51.
12. De Nys L, Anderson K, Ofosu EF, Ryde GC, Connelly J, Whittaker AC. The effects of physical activity on cortisol and sleep: A systematic review and meta-analysis. Psychoneuroendocrinology. 2022;143:105843.
13. Jones C, Gwenin C. Cortisol level dysregulation and its prevalence-Is it nature's alarm clock? Physiol Rep. 2021;8(24):e14644.
14. Shi P, Feng X. Motor skills and cognitive benefits in children and adolescents: Relationship, mechanism and perspectives. Front Psychol. 2022;13:1017825.
15. Kraus VB, Sprow K, Powell KE, Buchner D, Bloodgood B, Piercy K, et al. Effects of Physical Activity in Knee and Hip Osteoarthritis: A Systematic Umbrella Review. Med Sci Sports Exerc. 2019;51(6):1324–39.
16. Pinckard K, Baskin KK, Stanford KI. Effects of Exercise to Improve Cardiovascular Health. Front Cardiovasc Med. 2019;6:69.
17. WHO guidelines on physical activity and sedentary behaviour. https://www.who.int/publications/i/item/9789240015128. (Accessed March 25, 2025)
18. Białkowski A, Soszyński P, Stencel D, Religioni U. Consequences of Insufficient Physical Activity: A Comparative Analysis of Poland and Europe. Med Sci Monit Int Med J Exp Clin Res. 2024;30:e942552.
19. Pišot R. Physical Inactivity – the Human Health's Greatest Enemy. Slov J Public Health. 2022;61(1):1–5.
20. Health-enhancing physical activity statistics. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Health-enhancing_physical_activity_statistics. (Accessed March 25, 2025)
21. Short SE, Zacher M. Women's Health: Population Patterns and Social Determinants. Annu Rev Sociol. 2022;48:277–98.
22.McKinney JL, Clinton SC, Keyser LE. Women's Health Across the Lifespan: A Sex- and Gender-Focused Perspective. Phys Ther. 2024;104(10):pzae121.
23.Peng B, Ng JYY, Ha AS. Barriers and facilitators to physical activity for young adult women: a systematic review and thematic synthesis of qualitative literature. Int J Behav Nutr Phys Act. 2023;20(1):23.
24. Pace F, Sciotto G. Gender Differences in the Relationship between Work–Life Balance, Career Opportunities and General Health Perception. Sustainability. 2022;14(1):357.
25.Agarwala P, Salzman SH. Six-Minute Walk Test. Chest. 2020;157(3):603–11.
26.Isath A, Koziol KJ, Martinez MW, Garber CE, Martinez MN, Emery MS, et al. Exercise and cardiovascular health: A state-of-the-art review. Prog Cardiovasc Dis. 2023;79:44–52.
27. Nystoriak MA, Bhatnagar A. Cardiovascular Effects and Benefits of Exercise. Front Cardiovasc Med. 2018;5:135.
28. Marquez DX, Aguiñaga S, Vásquez PM, Conroy DE, Erickson KI, Hillman C, et al. A systematic review of physical activity and quality of life and well-being. Transl Behav Med. 2020;10(5):1098–109.
29. Hariyadi D, Puspita WL, Anwar T, Wardoyo S. A Path Model of Factors Associated with Hypertension and Disease: Analysis of Indonesian Basic Health Survey Year 2018. Medica Moderna - Modern Medicine. 2024;31(2):135-142. DOI: 10.31689/rmm.2024.31.2.135
30. Mahindru A, Patil P, Agrawal V. Role of Physical Activity on Mental Health and Well-Being: A Review. Cureus. 2023;15(1):e33475.
31.Teixeira PJ, Carraça EV, Markland D, Silva MN, Ryan RM. Exercise, physical activity, nd self-determination theory: a systematic review. Int J Behav Nutr Phys Act. 2012;9:78.
32. Homan KJ, Tylka TL. Appearance-based exercise motivation moderates the relationship between exercise frequency and positive body image. Body Image. 2014;11(2):101–8.
33. Arigo D, Hevel D, Bittel K, Maher JP. Within-person examination of the exercise intention-behavior gap among women in midlife with elevated cardiovascular disease risk. Psychol Sport Exerc. 2022;60:102138.
34. Festino E, Papale O, Di Rocco F, De Maio M, Cortis C, Fusco A. Effect of Physical Activity Behaviors, Team Sports, and Sitting Time on Body Image and Exercise Dependence. Sports Basel Switz. 2024;12(9):260.
35. Pedalino F, Camerini AL. Instagram Use and Body Dissatisfaction: The Mediating Role of Upward Social Comparison with Peers and Influencers among Young Females. Int J Environ Res Public Health. 2022;19(3):1543.
36. Ho SS, Dhaliwal SS, Hills AP, Pal S. The effect of 12 weeks of aerobic, resistance or combination exercise training on cardiovascular risk factors in the overweight and obese in a randomized trial. BMC Public Health. 2012;12:704.
37. Miller MB, Pearcey GEP, Cahill F, McCarthy H, Stratton SBD, Noftall JC, et al. The effect of a short-term high-intensity circuit training program on work capacity, body composition, and blood profiles in sedentary obese men: a pilot study. BioMed Res Int. 2014;2014:191797.
38.Segar M, Jayaratne T, Hanlon J, Richardson CR. Fitting Fitness into Women's Lives: Effects of a Gender-tailored Physical Activity Intervention. Womens Health Issues Off Publ Jacobs Inst Womens Health. 2002;12(6):338–47.
39.Mroz JE, Pullen CH, Hageman PA. Health and appearance reasons for weight loss as predictors of long-term weight change. Health Psychol Open. 2018;5(2):2055102918816606.
40 Garthe I, Raastad T, Refsnes PE, Koivisto A, Sundgot-Borgen J. Effect of two different weight-loss rates on body composition and strength and power-related performance in elite athletes. Int J Sport Nutr Exerc Metab. 2011;21(2):97-104.
41. Macek P, Terek-Derszniak M, Biskup M, Krol H, Smok-Kalwat J, Gozdz S, et al. Assessment of Age-Induced Changes in Body Fat Percentage and BMI Aided by Bayesian Modelling: A Cross-Sectional Cohort Study in Middle-Aged and Older Adults. Clin Interv Aging. 2020;15:2301–11.
42. Dalle Grave R, Calugi S, El Ghoch M. Lifestyle modification in the management of obesity: achievements and challenges. Eat Weight Disord EWD. 2013;18(4):339–49.
43.Swift DL, Johannsen NM, Lavie CJ, Earnest CP, Church TS. The role of exercise and physical activity in weight loss and maintenance. Prog Cardiovasc Dis. 2014;56(4):441–7.
44. Sepriadi E, Pratiwi MD, Sepriani R. The effect of physical exercise on oxygen saturation in college students. J Phys Educ Sport. 2023; 23(12): 3178-82.
45.Kodama S, Saito K, Tanaka S, Maki M, Yachi Y, Asumi M, etr al. Cardiorespiratory fitness as a quantitative predictor of all-cause mortality and cardiovascular events in healthy men and women: a meta-analysis. JAMA. 2009;301(19):2024–35.
46. Pinto RS, Correa CS, Radaelli R, Cadore EL, Brown LE, Bottaro M. Short-term strength training improves muscle quality and functional capacity of elderly women. Age Dordr Neth. 2014;36(1):365–72.