The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
18(4): 07-13, 2023 www.thebioscan.com

# Physiological Adaptations to Structured Aerobic and Resistance Exercise Among Sedentary Young Adults

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**DOI: 10.63001/tbs.2023.v18.i04.pp07-13**

**Keywords**
aerobic exercise, resistance training, physiological adaptations, sedentary young adults, university wellness programs

**Received on:**
**29-10-2023**

**Accepted on:**
**24-11-2023**

**Published on:**
**23-12-2023**

## ABSTRACT

This study examined the physiological adaptations to structured aerobic and resistance exercise among sedentary young adults at Isabela State University–Echague Campus. The increasing prevalence of sedentary behavior among university students poses significant health risks, including reduced cardiovascular fitness, poor muscular strength, and unfavorable body composition. Using a quantitative quasi-experimental pretest–posttest design, the study investigated the effects of two eight-week supervised exercise interventions on selected physiological variables. Participants were purposively selected sedentary young adults aged 18–25 years and were assigned to either an aerobic exercise group or a resistance exercise group. Physiological measures assessed before and after the intervention included cardiovascular endurance, resting heart rate, muscular strength, muscular endurance, and body fat percentage. Data were analyzed using descriptive and inferential statistics to determine within-group and between-group changes at a 0.05 level of significance. Results showed that both exercise modalities produced significant physiological improvements. The aerobic exercise group demonstrated greater gains in cardiovascular endurance and significant reductions in resting heart rate, indicating improved cardiorespiratory efficiency. In contrast, the resistance exercise group exhibited more pronounced increases in muscular strength and muscular endurance, reflecting neuromuscular and muscular adaptations. Both groups showed significant reductions in body fat percentage, suggesting improved metabolic efficiency. The study concludes that structured aerobic and resistance exercise programs are effective in improving key physiological indicators among sedentary young adults. The findings highlight the importance of incorporating both exercise modalities into university wellness and physical activity programs to address sedentary lifestyles and promote long-term health among young adults.

## Introduction

Physical inactivity among young adults has become a growing public health concern, particularly with the increasing prevalence of sedentary lifestyles associated with academic demands, technology use, and limited physical activity engagement. Sedentary behavior has been linked to adverse physiological outcomes such as reduced cardiovascular fitness, increased body fat, poor muscular strength, and heightened risk for non-communicable diseases. Universities, as critical environments for shaping lifelong health behaviors, play a key role in addressing physical inactivity among young adults through evidence-based exercise interventions.

Aerobic and resistance exercises are two widely recommended forms of physical activity known to produce distinct yet complementary physiological adaptations. Aerobic exercise primarily enhances cardiovascular endurance and metabolic efficiency, while resistance exercise improves muscular strength, endurance, and body composition. Despite extensive research on these exercise modalities, there remains a need for localized, institution-based studies that examine their comparative physiological effects among sedentary young adults. This study therefore aimed to investigate the physiological adaptations resulting from structured aerobic and resistance exercise programs among sedentary young adults at Isabela State University – Echague Campus.

Aerobic exercise has been consistently shown to improve cardiovascular endurance, reduce resting heart rate, and enhance oxygen utilization efficiency. According to American College of Sports Medicine (2022), regular moderate-intensity aerobic exercise leads to significant improvements in cardiorespiratory fitness and metabolic health. Warburton, Nicol, and Bredin (2006) reported that aerobic training reduces cardiovascular risk factors and improves overall physiological functioning, particularly among inactive individuals.

Resistance training is associated with increases in muscular strength, muscular endurance, lean muscle mass, and bone density. Kraemer and Ratamess (2004) emphasized that structured resistance training produces neuromuscular adaptations that enhance functional strength and metabolic rate. Similarly, Westcott (2012) found that resistance exercise improves body composition and physical performance, even among previously sedentary populations.

Comparative studies suggest that aerobic and resistance exercises produce distinct physiological benefits. While aerobic exercise is more effective in improving cardiovascular parameters, resistance training yields greater improvements in muscular strength and body composition (Strasser & Schobersberger, 2011). However, most studies have been conducted in clinical or athletic populations, with limited focus on sedentary university students in developing country contexts.

Although existing literature supports the physiological benefits of aerobic and resistance exercise, limited empirical studies have examined their comparative effects among sedentary young adults in Philippine university settings. Moreover, few studies provide institution-based evidence that may inform campus wellness and physical education programs. This study addresses this gap by examining physiological adaptations to structured exercise interventions among sedentary young adults at Isabela State University – Echague Campus.

**Research Objectives**

This study aimed to examine the physiological adaptations resulting from structured aerobic and resistance exercise among sedentary young adults. Specifically, it sought to determine the effects of a structured aerobic exercise program on selected physiological variables such as cardiovascular endurance, resting heart rate, body composition, and muscular endurance. It also aimed to assess the effects of a structured resistance exercise program on muscular strength, muscular endurance,

and body composition among sedentary participants. Furthermore, the study intended to compare the physiological adaptations produced by aerobic exercise and resistance exercise interventions. Lastly, the study aimed to determine whether significant changes in physiological indicators occurred after participation in the structured exercise programs, thereby providing empirical evidence on the effectiveness of planned physical activity interventions for sedentary young adults.

**Methodology**

This study employed a **quantitative quasi-experimental research design** using a **pretest–posttest approach** to examine physiological adaptations to structured aerobic and resistance exercise among sedentary young adults. The design was appropriate for determining changes in physiological variables following controlled exercise interventions without random assignment to groups.

The **participants of the study** consisted of sedentary young adults aged 18–25 years enrolled at Isabela State University – Echague Campus. Participants were purposively selected based on inclusion criteria such as absence of regular physical exercise for at least six months prior to the study and medical clearance to engage in physical activity. Participants were assigned to either an aerobic exercise group or a resistance exercise group.

The **exercise intervention** lasted for eight weeks. The aerobic exercise group participated in structured activities such as brisk walking, jogging, and cycling at moderate intensity, while the resistance exercise group engaged in structured strength training exercises targeting major muscle groups using bodyweight and resistance equipment. Both programs were conducted three times per week under supervised conditions to ensure safety and adherence.

**Data collection** involved physiological measurements taken before and after the intervention. These included resting heart rate, blood pressure, body mass index, body fat percentage, cardiovascular endurance, and muscular strength and endurance. Standardized testing procedures and calibrated instruments were used to ensure accuracy and reliability of measurements.

**Data analysis** utilized descriptive statistics to summarize participants' physiological profiles and inferential statistics, such as paired t-tests and independent t-tests, to determine significant differences within and between groups at a 0.05 level of significance. Ethical considerations, including informed consent, confidentiality, and participants' right to withdraw, were strictly observed throughout the study.

**Results and Findings of the Study**

**Table 1. Pretest and Posttest Physiological Measures of Participants by Exercise Group**

| Physiological Variables | Group | Pretest Mean | Posttest Mean | Mean Difference | Statistical Result | Interpretation |
|---|---|---|---|---|---|---|
| Cardiovascular Endurance ($VO_2max$) | Aerobic | 32.40 | 38.75 | +6.35 | $p < .05$ | Significant improvement |
| | Resistance | 32.10 | 34.20 | +2.10 | $p < .05$ | Moderate improvement |
| Resting Heart Rate (bpm) | Aerobic | 78.60 | 70.15 | −8.45 | $p < .05$ | Significant reduction |
| | Resistance | 77.90 | 74.80 | −3.10 | $p < .05$ | Slight reduction |
| Muscular Strength (kg) | Aerobic | 28.35 | 32.10 | +3.75 | $p < .05$ | Moderate improvement |
| | Resistance | 28.40 | 38.60 | +10.20 | $p < .05$ | Significant improvement |
| Muscular Endurance (repetitions) | Aerobic | 18.25 | 23.10 | +4.85 | $p < .05$ | Significant improvement |
| | Resistance | 18.40 | 27.35 | +8.95 | $p < .05$ | Significant improvement |
| Body Fat Percentage (%) | Aerobic | 26.40 | 23.15 | −3.25 | $p < .05$ | Significant reduction |
| | Resistance | 26.35 | 24.10 | −2.25 | $p < .05$ | Moderate reduction |

**Explanation of Results**

Table 1 presents the pretest and posttest physiological measurements of sedentary young adults who participated in structured aerobic and resistance exercise programs. Results show that both exercise modalities produced statistically significant improvements across all measured physiological variables. Participants in the aerobic exercise group demonstrated marked improvements in cardiovascular endurance and resting heart rate, indicating enhanced cardiorespiratory efficiency following the intervention. Meanwhile, the resistance exercise group exhibited substantial gains in muscular strength and muscular endurance, reflecting neuromuscular and muscular adaptations associated with structured resistance training. Both groups experienced reductions in body fat percentage, with the aerobic group showing a slightly greater decrease.

Overall, the findings indicate that structured exercise interventions effectively improved physiological functioning among sedentary young adults, with each exercise modality producing distinct adaptation patterns.

**Interpretation of Findings**

The findings indicate that structured aerobic and resistance exercise programs elicit meaningful physiological adaptations among sedentary young adults, confirming the effectiveness of planned physical activity interventions in a university setting. Aerobic exercise proved more effective in improving cardiovascular-related variables, such as $VO_2$max and resting heart rate, suggesting enhanced oxygen utilization and cardiovascular efficiency. In contrast, resistance exercise resulted in greater improvements in muscular strength and endurance, reflecting adaptations in muscle fiber recruitment, neuromuscular coordination, and muscular hypertrophy. The reduction in body fat percentage across both groups suggests improved metabolic efficiency regardless of exercise modality. These results imply that while both aerobic and resistance exercises are beneficial, the specific physiological outcomes depend on the nature of the exercise program. Consequently, exercise prescriptions for sedentary young adults should be goal-oriented, incorporating aerobic training for cardiovascular health and resistance training for muscular development and body composition improvement.

**Discussion**

The present study examined the physiological adaptations resulting from structured aerobic and resistance exercise among sedentary young adults, and the findings provide clear evidence that both exercise modalities produce significant health-related benefits. The results demonstrated that aerobic exercise led to greater improvements in cardiovascular endurance and resting heart rate, confirming its effectiveness in enhancing cardiorespiratory efficiency. These findings are consistent with previous research indicating that aerobic training increases maximal oxygen uptake ($VO_2$max) through improved stroke volume, capillary density, and mitochondrial function (Warburton et al., 2006; American College of Sports Medicine [ACSM], 2022).

Conversely, resistance exercise produced more pronounced gains in muscular strength and muscular endurance compared to aerobic training. The substantial increase observed in strength-related variables among the resistance group supports earlier studies that attribute these improvements to neuromuscular adaptations, increased motor unit recruitment, and muscle hypertrophy resulting from progressive overload (Kraemer & Ratamess, 2004; Westcott, 2012). While aerobic exercise also contributed to moderate improvements in muscular endurance, its effects were secondary to those achieved through resistance training.

Both exercise groups demonstrated significant reductions in body fat percentage, indicating improved metabolic efficiency and energy expenditure. The slightly greater fat reduction in the aerobic group aligns with evidence suggesting that continuous moderate-intensity aerobic activity enhances lipid oxidation and caloric expenditure (Strasser & Schobersberger, 2011). However, the

meaningful reductions observed in the resistance group further support literature emphasizing the role of resistance training in increasing resting metabolic rate through lean mass gains.

Overall, the findings reinforce the principle that exercise modality selection should be guided by targeted physiological outcomes. Aerobic and resistance training offer distinct yet complementary benefits, highlighting the importance of integrating both forms of exercise in programs designed to address sedentary behavior among young adults in university settings.

**Conclusions**

Based on the results of the study, it is concluded that structured aerobic and resistance exercise programs significantly improve key physiological indicators among sedentary young adults. Aerobic exercise was more effective in enhancing cardiovascular endurance and reducing resting heart rate, while resistance exercise produced greater improvements in muscular strength and endurance. Both exercise modalities contributed to favorable changes in body composition, particularly in reducing body fat percentage. The study confirms that structured, supervised exercise interventions are effective strategies for improving physiological health and mitigating the adverse effects of sedentary lifestyles among young adults.

**Practical Implications for Isabela State University and University Wellness Programs**

The findings of this study have important implications for health promotion and physical activity programming at Isabela State University and similar higher education institutions. University wellness programs may incorporate structured aerobic exercise to improve students' cardiovascular health and resistance training to enhance muscular fitness and body composition. Developing integrated exercise programs that combine aerobic and resistance components may maximize overall physiological benefits.

Additionally, the results support the inclusion of structured exercise interventions within physical education courses, student wellness initiatives, and campus health campaigns, particularly targeting sedentary students. Providing supervised, evidence-based exercise programs can help foster long-term physical activity habits and contribute to improved student health and academic performance. University administrators and health practitioners may use these findings to design inclusive, sustainable fitness programs aligned with institutional wellness goals.

**References**

American College of Sports Medicine. (2022). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.

Brillantes, A. B., Jr., & Fernandez, M. T. F. (2011). Restoring trust and building integrity in government: Issues and concerns in the Philippines and areas for reform. *International Public Management Review, 12*(2), 55–80.

Cuenca, J. S. (2018). Basic education reforms in the Philippines: Key issues, challenges, and prospects. *Philippine Institute for Development Studies Discussion Paper Series*.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education, 18*(2), 1–8. https://doi.org/10.1080/00958964.1987.9943482

Kraemer, W. J., & Ratamess, N. A. (2004). Fundamentals of resistance training: Progression and exercise prescription. *Medicine & Science in Sports & Exercise, 36*(4), 674–688. https://doi.org/10.1249/01.MSS.0000121945.36635.61

Lewis, B. D., & Pettersson, G. (2009). Governance in education: Raising performance. *World Bank Policy Research Working Paper No. 4930*.

Manasan, R. G. (2015). *Assessment of the implementation of the K to 12 program*. Philippine Institute for Development Studies.

OECD. (2016). *Education governance in action: Lessons from case studies*. OECD Publishing.

Strasser, B., & Schobersberger, W. (2011). Evidence for resistance training as a treatment therapy in obesity. *Journal of Obesity, 2011*, 482564. https://doi.org/10.1155/2011/482564

Tapales, P. D., Padilla, E. J., & Joaquin, M. E. (2017). *Public administration in the Philippines: A reader* (3rd ed.). University of the Philippines Press.

UNESCO. (2017). *Education for sustainable development goals: Learning objectives*. UNESCO Publishing.

UNICEF. (2019). *Every child learns: UNICEF education strategy 2019–2030*. UNICEF.

Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal, 174*(6), 801–809. https://doi.org/10.1503/cmaj.051351

Westcott, W. L. (2012). Resistance training is medicine: Effects of strength training on health. *Current Sports Medicine Reports, 11*(4), 209–216. https://doi.org/10.1249/JSR.0b013e31825dabb8

World Bank. (2018). *World development report 2018: Learning to realize education's promise*. World Bank.