Journal of Physical Exercise Research
https://journal.sainspenapublisher.com/jpers E-ISSN: XXXX-XXXX

ORIGINAL ARTICLE

The Relationship between Walking Activity and Cardiorespiratory Endurance Using the Six Minute Walking Test in Female Students of the Physiotherapy Study Program, Airlangga University

Olga Norberta Wicaksono[1]
[1]D-IV Physiotherapy Study Program, Faculty of Vocational Studies, Universitas Airlangga, Surabaya
Corresponding author: Olga Norberta Wicaksono - olga.norberta.wicaksono-2021@vokasi.unair.ac.id

Received: 16 November 2025
Accepted: 17 November 2025

Abstract:
Background: Walking is a simple physical activity that plays an important role in improving fitness and cardiorespiratory endurance. College students are a group at risk of decreased physical activity due to a sedentary lifestyle. Objective: To determine the relationship between walking activity and cardiorespiratory endurance using the Six Minute Walking Test (6MWT) in female Physiotherapy students at Airlangga University. Methods: This study used an observational analytical design with a cross-sectional approach. The sample consisted of 25 female students aged 18–22 years who were selected using random sampling. Walking activity was measured using the International Physical Activity Questionnaire – Short Form (IPAQ-SF), while cardiorespiratory endurance was measured using the Six Minute Walking Test (6MWT) to calculate VO_2Max. Data analysis used the Spearman's rho test with a significance level of $p < 0.05$. Results: The average VO_2Max value of the respondents was 30.74 ± 6.18 mL/kg/min. The Spearman test results showed an r value of 0.59 with a p value of 0.002, indicating a positive and significant relationship between walking activity and cardiorespiratory endurance. Conclusion: There is a significant relationship between walking activity and cardiorespiratory endurance. Regular walking activity can improve the fitness and cardiorespiratory capacity of female physiotherapy students.
Keywords: walking activity; cardiorespiratory endurance; VO_2Max; six-minute; walking test; physiotherapy.

1. Introduction

The development of society with a modern lifestyle like today is not always beneficial but can be detrimental to human life, causing many individuals to suffer from infectious and non-infectious diseases (Anggraeni & Trisnawati, 2025). Physical activity in the form of walking is an activity that plays an important role in increasing metabolism and energy as well as maintaining physical and mental health (Pashar & Wendikbo, 2024). According to Kaki et al., 2022 Walking is a physical activity that can improve physical fitness, as it strengthens the body's muscles and bones, increases cardiorespiratory endurance, and reduces mortality due to lack of physical activity. Public awareness in Indonesia, especially among those aged >15 years, regarding the implementation of physical activity of at least 30 minutes per day is still relatively low, even though walking has many benefits (Pashar & Wendikbo, 2024).

Physical inactivity is one of the most significant sedentary behaviors, with significant implications for public health and the global economy. Regular physical activity (PA) can significantly reduce the risk of cardiovascular disease, stroke, sarcopenic obesity, malignancy, and diabetes, as well as improve mental health problems such as depression and anxiety. Furthermore, PA helps maintain and mitigate physiological aging, which is dependent on the decline of the musculoskeletal system (Grigoletto & Mauro, 2023). Walking has long been recognized as one of the best ways to maintain overall aerobic and neuromuscular fitness. However, over the past 10 years, walking, a variation of conventional walking, has become popular as an aerobic exercise (Shah et al., 2025).

Data from the 2018 Basic Health Research (RISK Kesehatan Dasar) indicates that 35% of Indonesians are physically inactive, increasing the risk of death by 20% to 30%. Currently, clinical practice guidelines recommend at least 150 minutes per week of moderate-intensity aerobic exercise or 75 minutes per week of high-intensity aerobic exercise (Yang et al., 2025). Lifestyle changes, particularly among individuals who prefer to consume more food and spend time sedentary with minimal physical activity, are common. The decline in physical activity is particularly pronounced among college students. This is due to the monotonous routine of sitting still while studying and limited opportunities for active physical activity. This decrease in physical activity can lead to a decline in physical health in students.

Data from The World Health Organization in 2018 stated that 34.3% of students never exercised with a prevalence of 25% of male students and 43% of female students, with students participating in physical activity being 32.5% but these students did physical activity less than three times a week (WHO, 2018). Cardiorespiratory endurance is related to endurance and heart health, allowing individuals to perform activities without fatigue. Several factors influence an individual's cardiorespiratory endurance, including genetics, age, ethnicity, and gender. Factors affecting cardiorespiratory endurance that individuals can modify depending on their lifestyle and patterns include body mass index and physical activity (Takken, 2020). This study aims to analyze the relationship between walking activity and cardiorespiratory endurance using the Six Minute Walking Test in female students of the Physiotherapy Study Program, Airlangga University.

2. Materials and Methods

Research Design and Location

This study used an observational analytical design with a cross-sectional approach and was conducted at the Old Pharmacy Building Field, Airlangga University, Surabaya, in March 2025.

Population and Sample

The population consisted of all 181 active female students of the Diploma IV Physiotherapy Program at Airlangga University, graduating in the 2022–2024 intake. A sample of 25 students was selected using a random sampling technique, using the Slovin formula with a 20% margin of error.

Research Instruments

Walking activity was measured using the International Physical Activity Questionnaire – Short Form (IPAQ-SF), which assesses the duration and frequency of walking activity over the past 7 days.

Cardiorespiratory endurance was measured using the Six-Minute Walking Test (6MWT). VO_2Max is calculated using the formula:

$$VO_2Max=12.701+(0.06\times\text{distance traveled})-(0.732\times BMI)$$

Interpretation of results refers to the VO_2Max standard for women aged 20–29 years.

Data Analysis

Data analysis was performed using SPSS 23. Shapiro–Wilk's test for normality was used, while relationships between variables were tested using Spearman's rho correlation with a significance level of $p < 0.05$.

Research Ethics

This study has obtained ethical approval from the Health Research Ethics Committee, Faculty of Public Health, Airlangga University (Number: 55/EA/KEPK/2025).

3. Results

A total of 25 female students participated with an age range of 18–22 years (average 20.68 ± 1.07 years). Most respondents had normal nutritional status (44%) and reported walking for 30–60 minutes per day, 7 days a week. The average VO_2Max value of respondents was 30.74 ± 6.18 mL/kg/min, which is included in the fair–good category. The Spearman correlation test showed r = 0.59 and p = 0.002, indicating a positive and significant relationship between walking activity and cardiorespiratory endurance.

4. Discussion

The results of this study indicate that the more frequently and for longer a person walks, the better their cardiorespiratory endurance. Walking repeatedly exercises skeletal muscles, increases oxygen supply, and stimulates physiological adaptations in the heart and lungs. Moderate aerobic activity such as walking can increase stroke volume, cardiac output, and the efficiency of gas exchange in the alveoli, ultimately increasing VO_2Max. Additionally, other factors such as body mass index (BMI) and healthy lifestyle habits also contribute to cardiorespiratory endurance (Takken, 2020). However, this study was limited to a female population and the sample size was small, so generalization of the results needs to be done with caution.

Regular walking improves blood circulation and myocardial blood flow, delivering more oxygen and nutrients to the heart. This increased energy metabolism in myocardial cells improves the efficiency of heart function and facilitates left ventricular remodeling (Chen et al., 2025). In addition, walking exercise has a beneficial impact on vascular endothelial function (Maupoint et al., 2016). Endothelial cells, an integral component of the blood vessel wall, secrete various bioactive substances that regulate vascular tone. However, walking can increase the shear force of blood flow, stimulating endothelial cells to release relaxing factors such as nitric oxide. This response increases cellular oxidase activity, improves vascular endothelial function, decreases vascular resistance, increases cardiac preload, and supports cardiac pumping efficiency (Chen et al., 2025). Furthermore, the integration of breathing exercises strengthens the strength and endurance of the respiratory muscles, increases lung capacity, and improves the efficiency of gas exchange, thereby reducing pulmonary congestion and alleviating the symptoms of dyspnea (Duarte et al., 2017).

Healthy walking, defined as moderate aerobic exercise with a stride frequency of 100 steps per minute, is comfortable and feasible for most people, especially older adults (Dafna et al., 2012). Several studies have explored the health benefits of walking, including its benefits for work. For example, previous research has shown that walking has a direct positive effect on the cardio-ankle vascular index, particularly in men (Alonso-domínguez et al., 2019). Similarly, other studies have found a correlation between walking and body weight and muscle strength (Bu et al., 2023). The 10,000 steps a day program, launched by the Centers for Chronic Disease Control and Prevention in 2016, encourages workers to take brisk walks (Xia et al., 2025). Indeed, walking has very good benefits in improving health so it is highly recommended for anyone to do.

Research Limitations

This study has limitations because the number of respondents is small and it is limited to walking interventions only in its review of cardiorespiratory.

Directions for Future Research

Further research could investigate the effects of walking exercise on molecular biomarkers for laboratory testing.

5. Conclusions

A positive and significant correlation was found between walking activity and cardiorespiratory endurance using the Six-Minute Walking Test in Airlangga University Physiotherapy students. The higher the walking activity, the better the cardiorespiratory endurance, as indicated by an increase in VO_2Max values.

Acknowledgement

We would like to express our gratitude to the many parties involved in this research and the success of this research so that the results of this research can be published in this manuscript.

Conflict of Interest

The authors declare no conflict of interest.

6. References

Alonso-domínguez, R., Recio-rodríguez, J. I., & Patino-alonso, M. C. (2019). *Acute effect of healthy walking on arterial stiffness in patients with type 2 diabetes and differences by age and sex : a pre-post intervention study*. 1–9.

Anggraeni, S., & Trisnawati, S. N. (2025). The Effect Of Brisk Walking Exercise On Reducing High Blood Pressure In Hypertension Patients. *Journal Of Health Science Community*, *5*(4), 311–317.

Bu, A., Maclean, M. K., & Ferris, D. P. (2023). EMG-informed neuromuscular model assesses the effects of varied bodyweight support on muscles during overground walking. *Journal of Biomechanics*, *151*(March), 111532. https://doi.org/10.1016/j.jbiomech.2023.111532

Chen, Q., Jiang, W., Li, Y., Su, X., Wen, N., Zhao, W., Cui, X., Li, W., & Wang, C. (2025). *Impact of Walking and Respiratory Training on Cardiopulmonary Function and Activity Endurance in Patients With Chronic Heart Failure*. https://doi.org/10.1002/clc.70123

Dafna, M., Carmen, C., Kamalesh, V., & Adrian, B. (2012). How diverse was the leisure time physical activity of older Australians over the past decade ? *Journal of Science and Medicine in Sport*, *15*(3), 213–219. https://doi.org/10.1016/j.jsams.2011.10.009

Duarte, C. S., Vilacortta-junior, H., & Nóbrega, A. C. L. (2017). Inspiratory muscle. *Journal of Cardiac Failure*. https://doi.org/10.1016/j.cardfail.2017.05.003

Grigoletto, A., & Mauro, M. (2023). *Evaluation of the Effectiveness of a Nordic Walking and a Resistance Indoor Training Program : Anthropometric , Body Composition , and Functional Parameters in the Middle-Aged Population*.

Kaki, P., Daya, T., Babang, V. M. M. F., Jawa, K., Jasmani, P., & Rekreasi, K. (2022). *PENGARUHJALAN KAKI TERHADAP DAYA TAHAN CARDIOVASCULAR SISWA KELAS V YANG BERJALAN KAKI KESEKOLAH DI SD BOKONG TAKARI*. *1*(1).

Maupoint, J., Besnier, M., Gomez, E., Bouhzam, N., Henry, J., Boyer, O., Nicol, L., Mulder,

P., Martinet, J., & Richard, V. (2016). *Selective Vascular Endothelial Protection Reduces Cardiac Dysfunction in Chronic Heart Failure*. 1–10. https://doi.org/10.1161/CIRCHEARTFAILURE.115.002895

Pashar, I., & Wendikbo, L. (2024). *Hubungan Pola Makan Dan Aktivitas Fisik Dengan Penyakit Jantung Koroner Di Rsud Labuang Baji Makassar*. *02*(1), 31–42.

Shah, Y., Deshmukh, M., & Rathi, M. (2025). *Stepping toward Better Health : A Scoping Review of Nordic Walking Benefits*. 246–251. https://doi.org/10.4103/amhs.amhs

Takken, T. (2020). *Cardiorespiratory Fitness in Youth : An Important Marker of Health*. 101–118. https://doi.org/10.1161/CIR.0000000000000866

Xia, W., Zheng, D., Yu, L., Jiang, X., Fan, M., & Zou, H. (2025). *The association between healthy walking and COVID-19 symptom severity : A cross- sectional study on the first peak following China ' s prevention policy change*.

Yang, Z., Liang, Y., He, L., Zhou, L., Peng, X., & Lai, Y. (2025). International Journal of Cardiology Cardiovascular Risk and Prevention Walking as a viable alternative to moderate-to-vigorous physical activity for improving cardiovascular outcomes in coronary artery disease patients. *International Journal of Cardiology Cardiovascular Risk and Prevention*, *26*(June), 200452. https://doi.org/10.1016/j.ijcrp.2025.200452

Alonso-domínguez, R., Recio-rodríguez, J. I., & Patino-alonso, M. C. (2019). *Acute effect of healthy walking on arterial stiffness in patients with type 2 diabetes and differences by age and sex : a pre-post intervention study*. 1–9.

Anggraeni, S., & Trisnawati, S. N. (2025). The Effect Of Brisk Walking Exercise On Reducing High Blood Pressure In Hypertension Patients. *Journal Of Health Science Community*, *5*(4), 311–317.

Bu, A., Maclean, M. K., & Ferris, D. P. (2023). EMG-informed neuromuscular model assesses the effects of varied bodyweight support on muscles during overground walking. *Journal of Biomechanics*, *151*(March), 111532. https://doi.org/10.1016/j.jbiomech.2023.111532

Chen, Q., Jiang, W., Li, Y., Su, X., Wen, N., Zhao, W., Cui, X., Li, W., & Wang, C. (2025). *Impact of Walking and Respiratory Training on Cardiopulmonary Function and Activity Endurance in Patients With Chronic Heart Failure*. https://doi.org/10.1002/clc.70123

Dafna, M., Carmen, C., Kamalesh, V., & Adrian, B. (2012). How diverse was the leisure time physical activity of older Australians over the past decade ? *Journal of Science and Medicine in Sport*, *15*(3), 213–219. https://doi.org/10.1016/j.jsams.2011.10.009

Duarte, C. S., Vilacortta-junior, H., & Nóbrega, A. C. L. (2017). Inspiratory muscle. *Journal of Cardiac Failure*. https://doi.org/10.1016/j.cardfail.2017.05.003

Grigoletto, A., & Mauro, M. (2023). *Evaluation of the Effectiveness of a Nordic Walking and a Resistance Indoor Training Program : Anthropometric , Body Composition , and Functional Parameters in the Middle-Aged Population*.

Kaki, P., Daya, T., Babang, V. M. M. F., Jawa, K., Jasmani, P., & Rekreasi, K. (2022). *PENGARUHJALAN KAKI TERHADAP DAYA TAHAN CARDIOVASCULAR SISWA KELAS V YANG BERJALAN KAKI KESEKOLAH DI SD BOKONG TAKARI*. *1*(1).

Maupoint, J., Besnier, M., Gomez, E., Bouhzam, N., Henry, J., Boyer, O., Nicol, L., Mulder, P., Martinet, J., & Richard, V. (2016). *Selective Vascular Endothelial Protection Reduces Cardiac Dysfunction in Chronic Heart Failure*. 1–10. https://doi.org/10.1161/CIRCHEARTFAILURE.115.002895

Pashar, I., & Wendikbo, L. (2024). *Hubungan Pola Makan Dan Aktivitas Fisik Dengan Penyakit Jantung Koroner Di Rsud Labuang Baji Makassar*. *02*(1), 31–42.

Shah, Y., Deshmukh, M., & Rathi, M. (2025). *Stepping toward Better Health : A Scoping Review of Nordic Walking Benefits*. 246–251. https://doi.org/10.4103/amhs.amhs

Takken, T. (2020). *Cardiorespiratory Fitness in Youth : An Important Marker of Health*.

101–118. https://doi.org/10.1161/CIR.0000000000000866

Xia, W., Zheng, D., Yu, L., Jiang, X., Fan, M., & Zou, H. (2025). *The association between healthy walking and COVID-19 symptom severity : A cross- sectional study on the first peak following China ' s prevention policy change*.

Yang, Z., Liang, Y., He, L., Zhou, L., Peng, X., & Lai, Y. (2025). International Journal of Cardiology Cardiovascular Risk and Prevention Walking as a viable alternative to moderate-to-vigorous physical activity for improving cardiovascular outcomes in coronary artery disease patients. *International Journal of Cardiology Cardiovascular Risk and Prevention*, *26*(June), 200452. https://doi.org/10.1016/j.ijcrp.2025.200452