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Physical Activity, Sedentary Behavior, and Fitness: A Cross-Sectional Study

Stefiona Gabriela Liem[1*], Hamisah[2]

[1]Physiotherapy Professional Program, Faculty of Nursing, Hasanuddin University, Makassar
[2]Lecturer, Undergraduate Physiotherapy Program, Faculty of Nursing, Hasanuddin University, Makassar, South Sulawesi

*Corresponding author:
E-mail: liemstefiona.23@gmail.com

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Abstract

Introduction: Sedentary behavior has become increasingly prevalent among young adults and may contribute to declining physical fitness. Despite engagement in regular physical activity, high sedentary time may attenuate fitness outcomes. This study aimed to examine the association between physical activity, sedentary behavior, and physical fitness among undergraduate physiotherapy students at Hasanuddin University.

Methods: This cross-sectional descriptive-analytic study included 67 physiotherapy students selected through purposive sampling. Physical activity levels were measured using the International Physical Activity Questionnaire (IPAQ), sedentary behavior using the Sedentary Behavior Questionnaire (SBQ), and physical fitness using the American College of Sports Medicine Physical Fitness Test (ACSM-PFT). Univariate analysis was applied to describe variable distributions, and Somers' D correlation test was used to examine associations.

Results: The majority of respondents reported high physical activity (69.9%) and high sedentary behavior (50.7%), yet 50.7% demonstrated low physical fitness. No statistically significant relationship was found between physical activity and physical fitness ($p = 0.595$; $r = 0.046$), nor between sedentary behavior and physical fitness ($p = 0.153$; $r = 0.107$).

Conclusion: This study found no significant association between physical activity or sedentary behavior and physical fitness among undergraduate physiotherapy students. These findings indicate that physical fitness may be influenced by multiple factors beyond activity levels and sedentary time. Future studies should explore additional physiological and behavioral determinants in larger and more diverse populations.

Keywords

physical activity, sedentary behavior, physical fitness, students, cross-sectional studies

Introduction

The rapid advancement of technology has simplified human tasks in various aspects of daily life. Activities that once required considerable physical effort can now be performed more easily and with minimal energy expenditure, leading to increased physical inactivity and a tendency toward sedentary behavior.[1] The term "mager," a colloquial acronym for "malas gerak" (too lazy to move), has gained popularity among youth in Indonesia to describe the growing trend of low physical activity.[2] According to the 2022 Physical Activity Report Cards issued by the Active Healthy Kids Global Alliance (AHKGA), which assessed physical activity levels among children and adolescents in 57 countries, Indonesia received a grade of F. This indicates that fewer than 20% of Indonesian children and adolescents meet the global physical activity recommendations.[3]

Physical activity is defined as any body movement involving skeletal muscles that requires energy expenditure. Regular engagement in physical activity has been shown to improve overall health and reduce the risk of various non-communicable diseases.[5] However, research by Hariyanto et al. reported that 41% of 2,698 university students exhibited low levels of physical activity.[5] This widespread inactivity contributes to a shift from a healthy lifestyle to a sedentary one. The World Health Organization (WHO), as cited by Sagita et al., has stated that 60–85% of people in both developed and developing countries currently live sedentary lifestyles, which can lead to serious health problems.[6]

Sedentary behavior differs from physical inactivity or lack of exercise. It refers to waking behaviors predominantly performed in sitting or reclining positions, which involve very low energy expenditure and are often associated with poor dietary habits.[7] Prolonged sedentary behavior may disrupt metabolic processes, increase fat accumulation, and decrease muscle function, ultimately resulting in reduced physical fitness.[6] This type of behavior can occur in multiple settings—at home, at school, in the workplace, or while commuting—and can significantly impact physical fitness levels.

Physical fitness is the ability to perform physical tasks or activities without excessive fatigue.[8] It also refers to the capacity to reserve energy for unplanned physical demands and leisure activities.[8] Among the factors that influence physical fitness are physical activity and lifestyle habits. A combination of low physical activity and prolonged sedentary

behavior can negatively affect physiological functions, leading to fat accumulation, increased body fat percentage, and obesity, all of which may reduce overall physical performance and health.[9]

The phrase “remajajompo,” or “elderly youth,” has emerged as a cultural term to describe younger individuals experiencing symptoms of poor physical fitness, such as fatigue and muscle soreness, even after minimal physical exertion.[2] These individuals often exhibit physical weakness and insufficient movement or exercise, making them more prone to exhaustion and frequent rest, which further indicates low physical fitness.[8]

This growing concern regarding the physical fitness of young people has gained attention from health professionals, including physiotherapists. As outlined in the Regulation of the Minister of Health of the Republic of Indonesia No. 65 of 2015, physiotherapists play a critical role in improving physical function, fitness, and quality of life through movement-based health interventions. They help prevent impairments, functional limitations, and disabilities resulting from illnesses, disorders, or injuries.[6]

Preliminary observations based on interviews with 10 undergraduate students at Hasanuddin University revealed that 9 of them had sedentary lifestyles and frequently reported muscle fatigue and soreness during moderate to vigorous physical activity. These findings are consistent with research by Etika et al., who found that approximately 49.7% of health science students reported high levels of sedentary behavior.[10] Supporting this, Wenni et al. reported that most health students at the Muslim University of Indonesia in Makassar exhibited moderate levels of sedentary lifestyle.[11] Additionally, Supriyanto et al. conducted a study on the relationship between physical activity, physical fitness, and academic performance among students at STKIP PGRI Sumenep, finding a significant correlation between physical activity and physical fitness.[12] In contrast, a study by Hartanti and Mawarni found no significant relationship between sedentary behavior and physical fitness.[9]

To date, studies exploring the combined relationship of physical activity and sedentary lifestyle with physical fitness in university student populations remain limited. Based on this background, the present study aims to investigate the relationship between physical activity and sedentary lifestyle with physical fitness among undergraduate physiotherapy students at the Faculty of Nursing, Hasanuddin University.

Methods

This research employed a descriptive-analytic quantitative design using a cross-sectional approach. The study was conducted in March 2024 at the Undergraduate Physiotherapy Program, Faculty of Nursing, Hasanuddin University. Data collection occurred over a three-month period from February to April 2024.

The study population consisted of all undergraduate physiotherapy students at the Faculty of Nursing, Hasanuddin University. Participants were selected using purposive sampling, based on predefined inclusion and exclusion criteria. Inclusion criteria required that participants be active undergraduate students aged 18 to 22 years, in good health, not undergoing any medical treatment, and willing to participate in the study. Exclusion criteria included individuals diagnosed with or having a history of cardiovascular or pulmonary disorders that may affect general health. From a total population of 229 students, the sample size was calculated using Slovin’s formula with a margin of error (e) of 5%, resulting in a final sample of 146 respondents:

$n = N / (1 + N(e^2))$

$n = 229 / (1 + 229(0.05^2)) = 146$ respondents

Data were collected using three primary instruments. Physical activity levels were assessed using the International Physical Activity Questionnaire (IPAQ), which has been shown to have a validity of 0.30 and reliability of 0.80, based on a study by Dharmansyah and Budiana.[13] In this instrument, activity scores are expressed in MET-minutes/week, with walking equivalent to 3.3 METs, moderate-intensity activity equivalent to 4.0 METs, and vigorous-intensity activity equivalent to 8.0 METs. These values are multiplied by duration (in minutes) and frequency (in days), then summed to calculate the total physical activity score. Based on IPAQ scoring guidelines, physical activity is categorized as light (<600 MET-minutes/week), moderate (≥600 MET-minutes/week), and vigorous (≥1500–3000 MET-minutes/week).[13]

Sedentary behavior was measured using the Sedentary Behaviour Questionnaire (SBQ), with a validity of 0.35 and a reliability range of 0.44–0.91 as reported by Marconcin et al.[14] Total sedentary time during weekdays was multiplied by five, while sedentary time on weekends was multiplied by two; these values were then summed to calculate total weekly sedentary time. Sedentary behavior was classified into three levels: low (≤38.5 to <60 hours/week), moderate (60 to <81.5 hours/week), and high (≥81.5 to ≥102.75 hours/week).[15]

Physical fitness was assessed using the Asian Committee on the Standardization of Physical Fitness Test (ACSPFT), which is internationally recognized and standardized across Asia.[16] The ACSPFT consists of seven components: a 50-meter sprint, standing broad jump, flexed arm hang for males and bent-arm hang for females, 4 × 10-meter shuttle run, 30-second sit-ups, forward trunk flexion, and long-distance running (1000 meters for males and 800 meters for females).[17] The total score is calculated by summing the results from all test items and is categorized into five levels: very good (females ≥441, males ≥431), good (females 361–440, males 376–430), moderate (females 281–360, males 311–375), poor (females 201–280, males 251–310), and very poor (females ≤200, males ≤250).[17] While this study did not account for confounding genetic factors, several variables such as age, sex, and body mass index (BMI) were controlled.

Data collection procedures involved the direct administration of the IPAQ and SBQ questionnaires in classroom settings, while ACSPFT testing was conducted on the university sports field. To reduce information bias, participants were provided with written instructions and briefed directly by the researcher prior to completing the questionnaires. All data were collected anonymously to minimize social desirability bias.

Data analysis began with normality testing, followed by univariate and bivariate analyses. Univariate analysis was conducted to determine the frequency distribution of each variable, while bivariate analysis examined relationships between variables to test the study hypotheses. Somers' d test was employed to analyze ordinal data and assess the direction and strength of associations between variables, using IBM SPSS Statistics version 26.0.0.0. Missing data were addressed using listwise deletion. This study was approved by the Research Ethics Committee of the Faculty of Nursing, Hasanuddin University, under protocol number UH2403009.

Results

From a total population of 229 undergraduate students, 146 respondents were selected for inclusion in this study using the Slovin formula with a 5% margin of error and based on the established inclusion criteria.

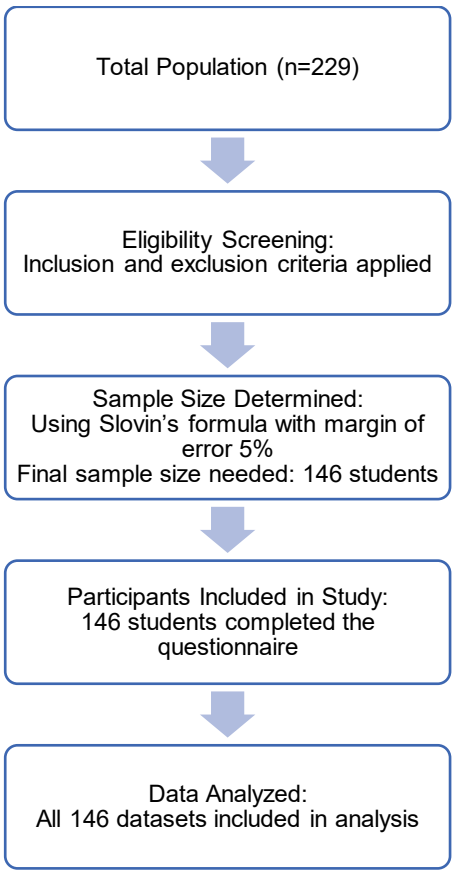

Figure 1. presents the flowchart of respondent selection.

Table 1 outlines the demographic characteristics of respondents, including age, gender, and body mass index (BMI).

Table 1. Characteristics of Respondents

Characteristic	Frequency (n)	Percentage (%)
Age		
18 years	43	29.5
19 years	50	34.2
20 years	28	19.2
21 years	13	8.9
22 years	12	8.2
Total	146	100
Gender		
Female	124	84.9
Male	22	15.1
Total	146	100
BMI		
Underweight	33	22.6
Normal	72	49.3
Overweight	14	9.6
Obese I	18	12.3
Obese II	9	6.2
Total	146	100

As shown in Table 1, the mean age of respondents was 19.32 years, encompassing four academic cohorts (2020–2023). Female participants dominated the sample. The average BMI was 21.56 ± 4.29 kg/m². BMI was recorded for descriptive purposes but was not included as a confounding or predictor variable. No missing data were found for the analyzed variables. Table 2 summarizes the distribution of physical activity levels based on the IPAQ classifications.

Table 2. Distribution of Physical Activity Levels

Physical Activity Level	Frequency (n)	Percentage (%)
Low	15	10.3
Moderate	29	19.3
High	102	69.9
Total	146	100

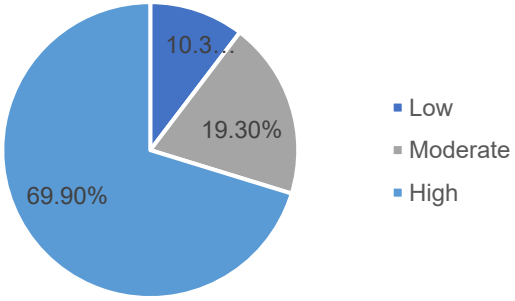

Figure 2. Diagrammatic distribution of physical activity levels.

According to Table 2, physical activity was categorized based on MET-minutes/week as low (<600), moderate (≥600), and high (≥1500–3000). A majority of respondents (69.9%) fell into the high physical activity category. Table 3 presents the distribution of sedentary lifestyle based on SBQ criteria.

Table 3. Distribution of Sedentary Lifestyle

Sedentary Level	Frequency (n)	Percentage (%)
Low	45	30.8
Moderate	27	18.5
High	74	50.7
Total	146	100

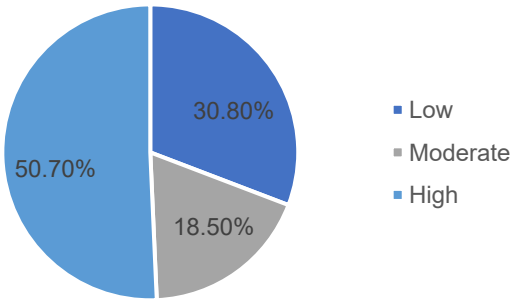

Figure 3. Provides a visual representation of sedentary behavior levels.

As indicated in Table 3, sedentary behavior was classified as low (≤38.5–<60 hours/week), moderate (60–<81.5 hours/week), and high (≥81.5–≥102.75 hours/week). A total of 50.7% of respondents exhibited high sedentary behavior, mainly characterized by extended screen time during weekdays and weekends. Table 4 details the distribution of physical fitness levels according to ACSPFT scores.

Table 4. Distribution of Physical Fitness

Fitness Level	Frequency (n)	Percentage (%)
Excellent	1	0.7
Good	3	2.1
Fair	56	38.4
Poor	74	50.7
Very Poor	12	8.2
Total	146	100

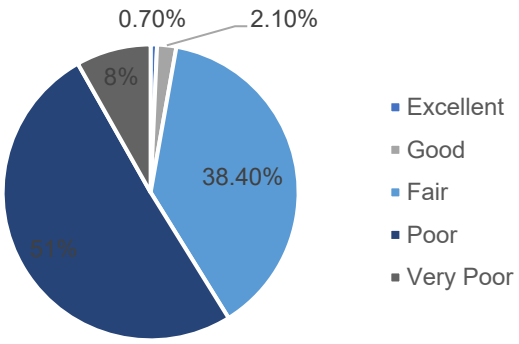

Figure 4. Bar chart of the physical fitness level distribution.

As seen in Table 4, physical fitness levels were classified into five categories: excellent, good, fair, poor, and very poor. Overall, the average fitness score was 272.62, which falls into the "poor" category based on the ACSPFT scoring standards.

The bivariate relationship between physical activity and physical fitness was analyzed using Somers' d test, as shown in Table 5.

Table 5. Association Between Physical Activity and Physical Fitness

Variable	n	r	p
Physical Activity	146	0.046	0.595

Table 5 shows that the association between physical activity and physical fitness yielded a p-value of 0.595 (>0.05), indicating no statistically significant relationship. The correlation coefficient (r = 0.046) suggests a very weak positive association, with a 95% confidence interval ranging from –0.10 to 0.19. Confounder adjustments were not performed, given that this was an exploratory descriptive-analytic study. Subgroup analyses were also not conducted due to limited sample sizes within each category. The relationship between sedentary lifestyle and physical fitness was likewise examined using Somers' d test, as displayed in Table 6.

Table 6. Association Between Sedentary Lifestyle and Physical Fitness

Variable	n	r	p
Sedentary Lifestyle	146	0.107	0.153

As shown in Table 6, the correlation between sedentary lifestyle and physical fitness yielded a p-value of 0.153 (>0.05), indicating no significant relationship. The correlation coefficient was 0.107, representing a very weak positive correlation with a 95% confidence interval of –0.04 to 0.27. No adjustments for confounding variables or subgroup analyses were performed for reasons previously stated.

Discussion

This study aimed to examine the relationship between physical activity and sedentary lifestyle with physical fitness among undergraduate physiotherapy students at the Faculty of Nursing, Hasanuddin University. In this study, the number of female respondents was significantly higher than that of male respondents, as the Physiotherapy Program at the Faculty of Nursing is predominantly attended by female students. This finding aligns with the study by Riskiana et al., which noted that the majority of students in health-related faculties are female, likely due to social perceptions that women are more inclined toward health professions.[18]

In terms of age, the majority of respondents were 19 years old (n=50), likely due to the higher availability and willingness of students in this age group to participate in the study. Regarding body mass index (BMI), most respondents fell within the normal category (n=72), followed by the underweight (n=33) and obese I (n=18) categories. This pattern is consistent with findings by Astuti et al., who reported that the BMI of university students aged 18–25 years was predominantly within the normal category (72.2%), followed by underweight (18.5%) and overweight (9.25%).[19]

Physical Activity Profile

The high level of physical activity observed among these physiotherapy students is likely attributable to the demands of the curriculum and the practical, physically engaging nature of the profession. This aligns with the findings of Charerina et al., who reported that 36.7% of health students engaged in vigorous physical activity.[20] Physical activity is a fundamental human function and fulfills essential daily needs.[21] As university students typically have a busy schedule that extends beyond classroom activities, they often engage in a wide range of physical tasks. Moreover, students in health disciplines tend to possess adequate knowledge and positive perceptions about the health benefits of physical activity.[22] The demands of the physiotherapy program, which requires substantial physical effort during both learning and future practice, further reinforce the need for a physically active lifestyle among these students.

Sedentary Lifestyle Profile

The high prevalence of sedentary behavior among physiotherapy students reflects a broader trend among health students, who often spend significant time sitting due to academic activities and frequent use of technology.[12] This phenomenon is driven by rapid technological advancement, which encourages prolonged screen time and contributes to increased sedentary behaviors. A study by Etika et al. reported a strong association between sedentary behavior and social media usage, with nearly half of students (42%) having more than four social media accounts and almost all (90.7%) using social media daily.[10]

Physical Fitness Profile

The generally low physical fitness observed among students in this study highlights potential challenges in maintaining adequate levels of physical health. Contributing factors may include low frequency of structured exercise and persistent sedentary habits. Similar findings were reported by Arsyad and Rozi, who found that most students fell into the low fitness category (79.6%).[23] Other influencing factors could include age, gender, and BMI.

Relationship Between Physical Activity and Physical Fitness

Although physical activity is a vital component of physical fitness, it does not always translate directly into fitness improvements if not accompanied by appropriate intensity, quality, and duration. This was evident in the present study, which found no significant relationship between physical activity and physical fitness (p=0.595). Similar results were reported by Albab and Simarmata & Jesmar. [24,25] Factors such as individual motivation, habitual exercise, and environmental influences may also play roles. Several researchers emphasize that frequency of physical activity alone, without adequate exercise quality and load, may not significantly impact fitness levels. This suggests that even though most respondents reported engaging in vigorous physical activity, it did not correlate significantly with fitness outcomes as initially hypothesized.

Contrarily, Dewi and Rohmah reported a significant relationship between physical activity and physical fitness.[26] This discrepancy could stem from differences in methodology and fitness assessment instruments. Studies that demonstrate significant associations often use cardiovascular-based tests such as the Harvard Step Test, which primarily assesses cardiorespiratory fitness. In contrast, this study employed the ACSPFT (Asian Committee on the Standardization of Physical Fitness Test), which measures multiple components including muscular strength, muscular endurance, power, speed, agility, flexibility, coordination, and balance.

Furthermore, Majid stated that maintaining physical fitness requires more than physical activity alone; it also involves healthy dietary habits, good nutrition, and consistent exercise.[27] Exercise intensity should reach 70–80% of maximum heart rate, performed 3–5 times per week, with aerobic sessions lasting 20–60 minutes involving major muscle groups.[28] Wu et al. also emphasized that high-intensity physical activity significantly enhances muscle power, endurance, and strength.[29] While no significant association was found in this study, results should be interpreted with caution due to potential self-reporting bias and uncontrolled confounding variables.

Relationship Between Sedentary Lifestyle and Physical Fitness

Statistical analysis using Somers'd correlation showed no significant association between sedentary behavior and physical fitness (p=0.153). This finding is consistent with studies by Laksono & Hidayat1 and Hartanti & Mawarni, who also reported non-significant associations.[9] In contrast, Sagita et al. reported a significant relationship between sedentary behavior and physical fitness.[6] Such discrepancies may arise due to differences in fitness assessment tools, sample characteristics, and the extent of physical activity engagement among respondents. Studies using cardiovascular-based fitness tests tend to show stronger associations compared to those using multi-dimensional assessments like ACSPFT.

It is important to note that sedentary behavior is not synonymous with physical inactivity. An individual may engage in prolonged sedentary activities yet still maintain regular exercise routines, thus producing different effects on physical fitness.[30] In this context, structured physical exercise appears to contribute more significantly to fitness enhancement than sedentary time alone.[31]

Study Limitations

This study has several limitations. The cross-sectional design limits causal inference. Physical activity and sedentary behavior were measured using self-reported questionnaires, which are susceptible to reporting bias. There was an imbalance in gender distribution, with a predominance of female participants, which may affect the generalizability of findings. Additionally, potential confounding variables that may influence physical fitness were not assessed.

Recommendations

The findings suggest that physical fitness among university students is influenced not only by physical activity levels but also by other factors such as training intensity, dietary patterns, and genetic predispositions. It is recommended that students adopt a healthy lifestyle, allocating time for physical exercise or sports for at least 150–300 minutes per week at moderate intensity. Future studies should consider additional influencing variables, employ larger and more gender-balanced samples, utilize longitudinal designs, and incorporate objective measurement tools such as wearable devices to enhance data accuracy and generalizability.

Conclusion

Based on the results and discussion above, it can be concluded that the majority of undergraduate physiotherapy students at the Faculty of Health Sciences, Universitas Hasanuddin, engage in vigorous physical activity on a weekly basis according to the IPAQ scoring standard. However, they also exhibit high levels of sedentary behavior as measured by the SBQ, and low physical fitness levels as assessed by the ACSPFT. Statistical analysis revealed no significant association between physical activity and physical fitness ($p > 0.05$), nor between sedentary behavior and physical fitness ($p > 0.05$), with both correlations classified as very weak.

These findings indicate that improving students' physical fitness requires an approach that not only emphasizes increasing physical activity but also focuses on reducing sedentary behavior and considering other potentially influential factors. Limitations of this study include the use of self-reported questionnaires, which may introduce bias, and an unbalanced gender distribution among respondents. Future studies are recommended to employ a longitudinal design with a larger and more gender-balanced sample, as well as more objective measurement tools.

Author Contribution

Stefiona Gabriela Liem designed the study, collected the data, and performed the initial analysis. Hamisah supervised the research process, provided methodological guidance, and verified the analytical procedures. Both authors contributed to the interpretation of results, manuscript preparation, and critical revision. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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Ethics Statement

This study was approved by the Research Ethics Committee of the Faculty of Nursing, Hasanuddin University (Protocol No. UH2403009). Participation was voluntary, and written informed consent was obtained from all participants prior to their inclusion. All personal data were handled confidentially in accordance with ethical research principles and the Declaration of Helsinki.

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