

## THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND THE PREVALENCE OF ACUTE CORONARY SYNDROME

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### ABSTRACT

**Introduction:** Acute Coronary Syndrome (ACS) is a major cause of morbidity and mortality worldwide, and physical activity is a key modifiable factor associated with cardiovascular risk. This study aims to determine the relationship between physical activity levels and the prevalence of ACS.

**Methods:** This study employed an analytical observational case-control design. A total of 39 respondents were included using a consecutive sampling method, consisting of 23 patients diagnosed with Acute Coronary Syndrome (cases) and 16 non-ACS patients (controls). Physical activity levels were assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF), and ACS status was determined based on medical diagnoses listed in medical records.

**Results:** The results of the Pearson Chi-Square test, the *p*-value obtained was 0.131 ( $p > 0.05$ ), indicating no statistically significant relationship between physical activity level and the prevalence of ACS.

**Conclusions:** There was no significant association between physical activity level and the prevalence of Acute Coronary Syndrome (ACS). Physical activity is not the dominant factor in determining the prevalence of ACS in the respondents of this study, considering that ACS is a multifactorial disease that is influenced by various other risk factors.

## Introduction

Physical activity is one of the main components of lifestyle that plays an important role in efforts to prevent cardiovascular disease or CVD (Cardiovascular disease), according to the definition of the World Health Organization (WHO, 2024). A systematic meta-analysis found that regular physical activity can significantly reduce the risk of CVD (Cardiovascular disease) through improved endothelial function, blood pressure control, increased insulin sensitivity, and decreased lipid and inflammatory levels (Li et al., 2021). Despite the known benefits of physical activity, physical inactivity remains prevalent, particularly in modern urban lifestyles and demanding work environments that limit regular physical activity, contributing to the burden of Acute Coronary Syndrome (ACS). Therefore, investigating the relationship between physical activity levels and ACS prevalence is urgently needed to support effective prevention strategies.

According to the *Survei Kesehatan Indonesia (SKI) 2023* reported by the Indonesian Ministry of Health, the national prevalence of physician-diagnosed heart disease was 0.85%. Several provinces exceeded this national average, with Daerah Istimewa Yogyakarta reporting the highest prevalence at 1.67%, followed by Papua Tengah (1.65%), DKI Jakarta (1.56%), Jawa



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Barat (1.18%), and Kalimantan Timur (1.08%), indicating geographic disparities in the burden of heart disease across Indonesia. These updated figures highlight the continued public health challenge posed by cardiovascular conditions and underline the need for targeted prevention and control strategies in high-risk areas (Kementerian Kesehatan RI, 2023)

The World Health Organization (WHO) advises adults to do moderate-intensity physical activity for 150–300 minutes per week or strenuous-intensity activity for 75–150 minutes per week. The implementation of these recommendations has been proven to be effective in lowering blood pressure, improving lipid profiles, and reducing the risk of cardiovascular disease overall (WHO, 2020). According to LaVie et al. (2019), explained that activities such as regular exercise and moderate to vigorous physical activity has been shown to provide protective effects against major cardiovascular risk factors through improvements in metabolic and vascular function.

Physical activity influences metabolic processes by enhancing fatty acid oxidation and insulin sensitivity, which contribute to improved microvascular perfusion and vascular health and reduced insulin resistance key mechanisms in the pathophysiology of cardiovascular disease (Anderson et al., 2025). Thus, physical activity interventions are an effective non-pharmacological strategy in the prevention and control of CVD risk factors through improved vascular function, blood pressure regulation, and metabolic improvement in healthy individuals and with chronic conditions (Hei & Xie, 2025).

ACS encompasses a spectrum of conditions such as ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina, in which blood flow to the myocardial is acutely reduced causing ischemia due to thrombosis-inducing atherosclerosis plaque rupture and its primary pathophysiology involves an oxygen supply-demand mismatch due to sudden coronary obstruction (Singh et al., 2023). The ongoing ischemic process can decrease myocardial contractility and lead to a decrease in cardiac output, which risks worsening the patient's hemodynamic condition (Byrne et al, 2024).

According to Yandrapalli et al. (2019), among various risk factors, lack of physical activity, smoking, hypertension, diabetes, dyslipidemia, and dietary changes are important modifiable risk factors in young adults. Early examination of various risk factors for cardiovascular disease in asymptomatic conditions allows the application of risk factor modification therapies that will have the potential to reduce morbidity and mortality (PERKI, 2022). Therefore, this study aims to examine the relationship between physical activity levels and the prevalence of Acute Coronary Syndrome (ACS), with the hypothesis that physical activity levels are associated with ACS prevalence.

## Methods

This study employed a quantitative analytical observational case-control design. In a case-control study, subjects are classified into two groups, namely cases and controls, to examine the association between exposure variables and outcomes through observation without any intervention from the researcher.

In the case-control design, the research subjects were divided into two groups, namely the case group of patients with ACS (Acute Coronary Syndrome) and the control group (non-ACS cardiovascular patients) who came from the same population source. Each study subject was then evaluated based on their history of exposure to risk factors, in this case physical activity, to determine whether there was a difference in the proportion of exposure between the case and control groups. This design is suitable for assessing disease risk factors quickly, especially when cases are already available in hospitals (Hamsi et al., 2022). Physical activity was measured using the International Physical Activity Questionnaire-Short Form (IPAQ-SF). The instrument has demonstrated acceptable validity and reliability. An Indonesian adaptation study conducted



by Dharmansyah and Budiana (2021) reported an internal consistency value with a Cronbach's alpha of 0.884, indicating good reliability. The sampling technique uses consecutive sampling, all patients who meet the inclusion criteria during the study period are included sequentially until the number of samples is reached (Sugiyono, 2022).

Data were collected from eligible participants after obtaining written informed consent. All respondents were informed about the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without consequences. Data collection was conducted using structured questionnaires and medical record review in accordance with ethical research principles. Data collection was conducted over a one-month period at Lavalette Hospital, Malang City, after obtaining institutional permission. Participants were recruited using consecutive sampling. Inclusion criteria were patients with full consciousness (compos mentis, GCS 15) who were able to communicate effectively. Exclusion criteria included patients with cognitive impairment or altered consciousness that prevented questionnaire completion, as well as those who refused to participate. During the study period, a total of 39 respondents were enrolled, consisting of 23 patients with Acute Coronary Syndrome (ACS) and 16 non-ACS cardiovascular patients..

The data used in this study consisted of general and specific data. General data included respondent characteristics such as age, gender, education level, and occupation. Specific data included physical activity levels measured using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) and ACS status (ACS and non-ACS) based on medical records. Data were collected through structured interviews and medical record review. The association between physical activity level and ACS incidence was analyzed using the Chi-square test, with a significance level of  $p < 0.05$ .

## Results

Table 1. Demographic Data

Characteristics		Frekuensi	Percentage (%)
<b>Gender</b>	Men	22	55,4
	Women	17	43,6
<b>Age</b>	26-40yo	2	5,1
	41-60yo	16	41
	>60yo	21	53,8
<b>Education</b>	Not in school yet	5	12,8
	Elementary school	10	25,6
	Junior High School	3	7,7
	Senior High School	11	28,2
	College/university	10	25,6
<b>Job</b>	Not Working	19	48,7
	Laborer	2	5,1
	Farmer	6	15,4
	Self-employed	7	17,9
	Private Employees	4	10,3
	civil servants	1	2,6
	TNI/Polri	0	0

(source: primary data, 2025)

Based on Table 1 Respondent characteristics are an overview of the research subject which includes gender, age, education level, and occupation. The presentation of respondent characteristics aims to provide information about the respondents' background that can affect the results of the research. The number of respondents in this study was 39 people. Based on



gender, most of the respondents were male, namely 22 respondents (56.4%), while the respondents were female as many as 17 respondents (43.6%). This shows that the respondents

Characteristics		Frequency/Respondents		Percentage (%)
Diagnose	ACS	23		59.0 %
	Non-ACS	16		41.1 %
Physical activity	ACS			Total (%)
	Non-ACS			
<b>Total</b>		<b>39</b>		<b>100 %</b>
Physical activity	Low	10	3	13 (33,33)
	Moderate	7	4	11 (28,21)
	Vigorous	6	9	15 (38,46)
<b>Total</b>		<b>23</b>	<b>16</b>	<b>39 (100%)</b>

in this study are more dominated by men.

Table 2. Frequency Distribution of Physical Activity

(source: primary data, 2025)

Based on table 2. Physical activity level is a description of respondents' physical activity behavior which is classified based on physical activity categories, including low, moderate, and

Characteristics		Frequency/Respondents		Percentage (%)
Physical Activity	Low	13		33,43
	Moderate	11		28,21
	Vigorous	15		38,46
<b>Total</b>		<b>39</b>		<b>100</b>

high physical activity. This physical activity level grouping is based on the results of the calculation of the MET-minute/week score using the International Physical Activity Questionnaire–Short Form (IPAQ-SF) questionnaire.

Based on the results of the study on 39 respondents, it was found that 13 respondents (33.43%) had low levels of physical activity. Respondents with moderate levels of physical activity amounted to 11 respondents (28.21%), while respondents with high levels of physical activity were 15 respondents (38.46%).

Table 3. Distribution of Diagnosis Frequencies

(source: primary data, 2025)

Based on table 3 the results of the study on 39 respondents, most of the respondents were diagnosed with ACS (Aqute Coronary Syndrome), namely 23 respondents (59.0%), while respondents with a Non-ACS diagnosis were 16 respondents (41.1%).

These results show that the number of respondents with ACS diagnosis is more than non-ACS respondents, so that the majority of study subjects are patients with ACS (Aqute Coronary Syndrome) conditions.

Table 4. Distribution of Physical Activity Based on ACS Prevalence

(source: primary data, 2025)

Based on the table 4 results of the analysis, respondents with low levels of physical activity amounted to 13 people (33.33%), with a distribution of 10 respondents (76.9%) experiencing ACS and 3 respondents (23.1%) non-ACS. In the moderate physical activity category, there were 11 respondents (28.21%), consisting of 7 respondents (63.6%) with ACS and 4 respondents (36.4%) non-ACS. Furthermore, in the category of high physical activity, the number of respondents was 15 people (38.46%), with a distribution of 6 respondents (40.0%) experiencing ACS and 9 respondents (60.0%) non-ACS.



These results show that descriptively the proportion of ACS incidence is higher in respondents with low levels of physical activity, and tends to decrease as physical activity levels increase. However, these differences in distribution were then statistically tested to determine whether there was a meaningful relationship between physical activity levels and ACS events.

Table 5. The Relationship of Physical Activity with the Prevalence of Acute Coronary Syndrome

Var independent	n	p Value	Var dependent
Physical Activity	39	0,131	Prevalence of ACS

*Chi-square*

(source: primary data, 2025)

Based on the analysis using the Chi-square test, the relationship between physical activity level and the prevalence of Acute Coronary Syndrome (ACS) in this study was not statistically significant ( $p = 0.131$ ,  $p > 0.05$ ). This indicates that variations in physical activity levels contributed only minimally to differences in ACS prevalence among the participants.

## Discussion

### 1. Physical Activity Level

The physical activity level of respondents in this study was measured using the International Physical Activity Questionnaire–Short Form (IPAQ-SF) and categorized into low, medium, and high based on MET-minute/week scores (IPAQ, 2005). The univariate analysis showed that high physical activity was the most common category with 15 respondents (38.46%), followed by low physical activity with 13 respondents (33.33%), and moderate activity with 11 respondents (28.21%). Regarding ACS status, 23 respondents were diagnosed with ACS while 16 were non-ACS.

Physical activity is widely recognized as a protective factor against cardiovascular diseases, including ACS. Higher levels of physical activity are thought to improve cardiovascular function, reduce risk factors such as obesity and hypertension, and contribute to overall heart health

Results of physical activity levels based on ACS and Non-ACS diagnoses showed a specific pattern. Respondents with an overall ACS diagnosis were 23 people, while non-ACS were 16 people. In this study, although the majority of respondents had high physical activity, ACS was still observed in a considerable portion of participants. This suggests that other factors besides physical activity, such as genetics, comorbidities, or lifestyle behaviors, may also play a role in ACS prevalence.

Based on data from the low physical activity category, as many as 10 respondents experienced ACS, while 3 non-ACS respondents were also included. Therefore, the highest proportion of ACS cases was observed among individuals with low physical activity levels. In the moderate physical activity category, there were 7 respondents with ACS and 4 non-ACS respondents, indicating that the incidence of ACS was still dominant in this group, but the percentage was smaller compared to the low level. In the high physical activity category, as many as 6 respondents experienced ACS, while 9 respondents did not experience ACS. High levels of physical activity tend to be more common in the Non-ACS group.

ACS.

### 2. Prevalensi Acute Coronary Syndrome

Acute Coronary Syndrome remains a major cardiovascular problem and is influenced by multiple risk factors such as age, hypertension, diabetes mellitus, dyslipidemia, smoking, and



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genetic predisposition. In the present study, ACS was still observed among respondents, reflecting the multifactorial nature of the disease and suggesting that ACS occurrence cannot be explained by a single risk factor alone.

The diagnosis of the respondents in this study was obtained from the doctor's diagnosis or data listed in the Medical Record. The prevalence of ACS in this study was higher than that of non-ACS, namely as many as 23 respondents (59.0%) experienced ACS and 16 respondents (41.0%) did not experience ACS. The high prevalence of ACS in respondents indicates that the study population is a group with a fairly high cardiovascular risk.

ACS is an acute manifestation of coronary heart disease that is influenced by various risk factors, such as old age, hypertension, diabetes mellitus, dyslipidemia, smoking, and other lifestyle factors. Therefore, although physical activity has a protective role against cardiovascular disease, the presence of other risk factors that were not specifically studied in this study may affect the high prevalence of ACS in respondents.

### **3. The Relationship of Physical Activity with the Prevalence of Acute Coronary Syndrome**

The relationship between physical activity level and the prevalence of Acute Coronary Syndrome (ACS) in this study was analyzed using the Chi-square test. The results showed that the association between physical activity level and ACS prevalence was not statistically significant ( $p = 0.131$ ,  $p > 0.05$ ). These findings indicate that physical activity level was not significantly associated with the prevalence of ACS in the study population.

These findings suggest that although there are descriptive differences in the distribution of physical activity levels between ACS and non-ACS groups, these differences are not strong enough to suggest a meaningful relationship. The weak Chi-square value indicates that physical activity is not a dominant factor in determining the prevalence of ACS in this study population.

Thus, based on the results of the Chi-square test, it can be concluded that the level of physical activity is not significantly related to the prevalence of ACS, so physical activity cannot be used as the main predictor factor of ACS incidence in this study. As reported by Priasmoro (2023), physical activity levels are strongly influenced by sociodemographic factors such as age, gender, academic workload, and living arrangements, which shape a tendency toward a passive or sedentary lifestyle.

Although the results of this study showed the absence of a statistically significant relationship, physical activity remains one of the risk factors for cardiovascular disease, including ACS (Malla, 2019). Low physical activity can contribute to atherosclerosis, metabolic disorders, as well as an increase in other risk factors such as obesity, hypertension, and diabetes mellitus, which can indirectly increase the risk of ACS (Dimitriadis et al., 2025). Therefore, theoretically, lack of physical activity has the potential to be one of the causes of ACS, although in this study this effect was not significantly visible (Oseni et al., 2024; Kazemi et al., 2024), although in this study this influence was not seen significantly. This finding is consistent with the study by Priasmoro & Lestari (2023), which reported a high prevalence of sedentary lifestyles in the general population and demonstrated that low physical activity is more strongly associated with chronic disease risk and elevated stress levels rather than with a single acute cardiovascular event. Their study emphasizes that physical inactivity often contributes indirectly to cardiovascular risk through intermediate pathways such as metabolic disorders, psychological stress, and unhealthy lifestyle clustering, which may not be immediately reflected in ACS incidence when analyzed cross-sectionally.

The insignificance of the relationship between physical activity level and the prevalence of ACS in this study may be because ACS is a multifactorial disease. According to Utami et al (2025), various other risk factors such as age, gender, history of hypertension, diabetes mellitus, dyslipidemia, smoking habits, stress, and genetic factors can cause Acute Coronary Syndrome. The presence of these risk factors, which were not analyzed simultaneously in this study, likely

has a more dominant influence on the occurrence of ACS compared to physical activity level alone.

Thus, the results of the Chi-Square test in this study do not negate the role of physical activity as a risk factor for ACS, but rather show that physical activity is not a single factor or dominant factor in determining the prevalence of ACS in the study population. Therefore, ACS prevention efforts need to be carried out through a multifactorial comprehensive approach while still paying attention to increasing physical activity as part of a healthy lifestyle (Sangadji, 2021).

Furthermore, the research conducted by Matthias et al (2018), which aimed to assess the level of physical activity of patients before the occurrence of Acute Coronary Syndrome (ACS) using the IPAQ questionnaire that was in. The study involved more than 500 patients with a diagnosis of ACS and analyzed the relationship of physical activity with a variety of clinical parameters, including the type of ACS and the severity of the disease.

The study showed that of the 504 patients, 128 (25.1%) were very active, 87 (17.1%) were minimally active, and 289 (56.7%) were found to be inactive. When considering mets per week, 134 (26.3%) spent less than 1000 mets/week. The physical activity levels of men and women were similar ( $p = 0.06$ ). that there was no significant relationship between physical activity levels and types of ACS (STEMI, NSTEMI, and unstable angina), with a value of  $p = 0.36$ . In addition, physical activity was also not significantly related to the severity of ACS as measured using TIMI scores, both in the STEMI ( $p = 0.10$ ) and NSTEMI/UA ( $p = 0.24$ ) groups. In multivariate regression analysis, total physical activity scores (MET-minutes/week) were not a significant predictor of ACS severity ( $p = 0.724$ ).

These findings indicate that although physical activity is often considered a cardiovascular protective factor, the level of physical activity prior to the occurrence of ACS is not always directly and significantly related to the incidence or clinical characteristics of ACS. These results support the findings of the current study which also show the absence of a significant association between physical activity and the prevalence of ACS.

## Conclusion

This study has several limitations. First, the case-control design limits the ability to establish a causal relationship between physical activity level and the prevalence of Acute Coronary Syndrome (ACS). Second, physical activity data were collected using a self-reported questionnaire (IPAQ-SF), which may be subject to recall bias and reporting inaccuracies, particularly in retrospectively assessing past physical activity. Third, other important risk factors for ACS, such as dietary patterns, genetic predisposition, and the severity of comorbid conditions, were not analyzed in detail. These limitations should be considered when interpreting the findings, and future studies using larger sample sizes and prospective or longitudinal designs are recommended.

Based on the results of this study, it can be concluded that the physical activity level of respondents is generally divided into low, medium, and high categories, with the highest level of physical activity in respondents with high MET-minute/week scores. The prevalence of Acute Coronary Syndrome (ACS) among respondents reached 59%, while non-ACS was 41%. Although descriptively it was seen that the proportion of ACS incidence was higher in the group with low physical activity levels and decreased as physical activity levels increased, the results of statistical analysis using the Chi-square test showed that there was no statistically significant relationship between physical activity level and ACS prevalence ( $p > 0.05$ ).

These results indicate that physical activity levels cannot be used as the main predictor factor in determining the incidence of ACS in the study population. However, distribution



patterns and existing theories suggest that increased physical activity remains an important aspect of overall cardiovascular disease prevention efforts. Other multifactorial risk factors may have a greater influence on the incidence of ACS than physical activity alone. Therefore, the approach to prevention and management of cardiovascular diseases should be carried out comprehensively, not only focusing on one risk factor, but considering all contributing factors. Further research with a larger sample and more complete variables is needed to strengthen the understanding of the relationship between physical activity and ACS events.

### Ethics approval and consent to participate

This study obtained ethical approval under the registration number KEPK-EC / 397 / XI / 2025 from the Health Research Ethics Committee of ITSK RS dr. Soepraen Malang.

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