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The Relationship Between the Jakarta Cardiovascular Score and Physical Activity: Screening of Cardiovascular Risk Factors in Older Adults

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Abstract

Background: Cardiovascular disease (CVD) remains a leading cause of morbidity and mortality worldwide, including in Indonesia, where low physical activity is a major modifiable risk factor. The Jakarta Cardiovascular Score (JAKVAS) was developed as a local modification of the Framingham Risk Score to better represent Indonesian populations by including physical activity as a variable. However, the quantitative relationship between physical activity level and JAKVAS has not been well established.
Methods: This cross-sectional analytical study involved 21 adult participants who took part in a community health screening. Data were collected through structured questionnaires covering JAKVAS components and the International Physical Activity Questionnaire (IPAQ). Physical activity was classified into low–moderate and high categories. Data were analyzed using independent t-test or Mann–Whitney test according to data distribution, with a significance level of $p < 0.05$.
Results: Participants with high physical activity were predominantly male (83.3%; $p = 0.003$). No significant differences were observed in body mass index, blood pressure, or blood glucose levels. Smoking status ($p = 0.003$) and menopausal status ($p = 0.003$) were significantly associated with physical activity, whereas hypertension and diabetes mellitus were not. The median JAKVAS score was higher in the low–light activity group (median = 6; range 0–15) than in the moderate–vigorous group (median = 4; range 1–8; $p = 0.066$), indicating a trend toward lower cardiovascular risk with higher physical activity levels.
Conclusion: Higher physical activity levels tended to correlate with lower cardiovascular risk scores based on JAKVAS, though not statistically significant. Promoting physical activity remains a key preventive strategy against cardiovascular disease in the community.

Keywords: *physical activity; jakarta cardiovascular score; cardiovascular risk; sedentary lifestyle; cardiovascular disease*

Introduction

Cardiovascular disease (CVD) remains the leading cause of global morbidity and mortality, including in Indonesia. Data from the Global Burden of Disease indicate that CVD accounts for more than 30% of global deaths, with a substantial increase in disease burden in developing countries driven by sedentary lifestyles and low levels of physical activity. [1] An analysis of the Indonesian population demonstrated that the proportion of individuals with low physical activity increased from 18.2% in 2007 to 39.6% in 2014, and this group had a 2.11-fold higher likelihood of having a high 10-year CVD risk compared with physically active individuals.[2] These findings highlight the critical role of physical activity as a major determinant in primary prevention strategies for cardiovascular disease in Indonesia.

To assess cardiovascular risk in the local population, the Jakarta Cardiovascular Score (JAKVAS) was originally introduced as a modification of the Framingham Risk Score, designed as a simple and practical method for cardiovascular risk stratification in developing countries, including Indonesia.[3] This scoring system incorporates variables that better reflect population-specific characteristics and resource-limited settings. JAKVAS evaluates key components such as age, sex, blood pressure, smoking status, diabetes mellitus, body mass index, and physical activity. However, despite its conceptual relevance, the quantitative relationship between physical activity parameters (frequency, duration, and intensity) and JAKVAS values has not been extensively explored, underscoring the need for further validation and optimization of this score as a cardiovascular screening tool in the general population.[4]

This study aimed to investigate the impact of physical activity on JAKVAS values among the Indonesian population, with the specific objective of identifying the optimal physical activity level associated with reduced cardiovascular risk. The findings are expected to provide an evidence-based foundation for population-level health promotion policies and primary prevention strategies. Given the high prevalence of cardiovascular risk and the low national level of physical activity, this research is both important and timely to strengthen evidence-based cardiovascular prevention approaches in Indonesia. [1]

Methods

Study Design and Setting

This study employed an analytical cross-sectional design. The research was conducted in Bungus Village, West Sumatra, during a community health screening program organized by the Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Andalas.

Ethical Considerations

All participants provided written informed consent prior to enrollment, and the study protocol was approved by the institutional Health Research Ethics Committee. (No. DP.04.03/D.XVI.10.2/290/2026)

Sample Size

The target population comprised residents of Bungus Village aged >60 years who participated in the health screening program. Sampling was performed using a consecutive sampling technique, in which all eligible participants meeting the inclusion criteria during the survey period were recruited until the minimum required sample size was achieved (n = 21). The inclusion criteria were: (1) age ≥60 years, (2) residence in Bungus Village for at least six months, (3) ability to read and understand the questionnaire, and (4) willingness to participate. Exclusion criteria included pregnancy, acute illness interfering with questionnaire completion, or severe physical or neurological disability limiting activity without assistive devices.

Outcome Measures

The primary variables were cardiovascular risk score, assessed using the Jakarta Cardiovascular Score (JAKVAS), and physical activity level. JAKVAS consists of seven components: sex, age, blood pressure, smoking status, diabetes mellitus, body mass index (BMI), and weekly physical activity. Cardiovascular risk categories were defined as low (−7 to 1; <10%), moderate (2–4; 10–20%), and high (≥5; >20%). Physical activity was classified as low, moderate, or high based on frequency, duration, and total metabolic equivalent (MET)-minutes per week, in accordance with established guidelines.

Data collection was conducted through structured interviews using a demographic questionnaire and JAKVAS components. Blood pressure was measured using a validated oscillometric device following the 2019 American Heart Association recommendations, after 3–5 minutes of rest in the seated position[5]. Two measurements were obtained at 1–2 minute intervals, and the average value was recorded. Body weight and height were measured using calibrated scales and a stadiometer to calculate BMI. Histories of hypertension and diabetes mellitus were confirmed through prior diagnoses by healthcare professionals or current use of related medications.

Statistical Analysis

Continuous variables were summarized as mean ± standard deviation or median with range, according to data distribution, while categorical variables were presented as frequencies and percentages. Data normality was assessed using the Shapiro–Wilk test. Differences in JAKVAS score across physical activity levels were analyzed using the Kruskal–Wallis test. A p-value <0.05 was considered statistically significant. All analyses were performed using SPSS version 26, with results reported alongside 95% confidence intervals where appropriate.

Results

A total of 21 participants were included in the analysis. The majority of respondents in the high physical activity group were male (83.3%), whereas the low–moderate physical activity group was predominantly female (67.9%). This difference was statistically significant (p = 0.003). The mean age of participants in the high physical activity group was slightly higher (66.05 ± 5.81 years) compared with the low–moderate physical activity group (60.90 ± 9.74 years), although this difference did not reach statistical significance (p = 0.052). Systolic blood pressure tended to be higher in the high physical activity group (149.10 ± 22.36 mmHg) than in the low–moderate activity group (136.47 ± 17.33 mmHg), with a p-value of 0.052, indicating a trend toward statistical significance. No significant differences were observed in body mass index [median 24 (range 16–37) vs. 21 (range 17–32); p = 0.105] or blood glucose levels [median 107 (range 83–366) vs. 122 (range 91–441); p = 0.236] between the two groups.

Table 1 Respondent Characteristic

Variable	Low to Moderate level Activity	High level Activity	P-value
Sex			
Male	2 (16.7%)	10 (83.3%)	0.003[a]
Female	19 (67.9%)	9 (32.1%)	
Body Mass Index	24 (16.37)	21 (17-32)	0.105[c]
Age	60,90 (±9.74)	66,05 (±5.81)	0.052[b]
Systolic Blood Pressure	136,47 (±17.33)	149,10 (±22.36)	0.052[b]
Blood Glucose	107 (83-366)	122 (91-441)	0.236[c]

a. Chi-square. b. Independent t-test. c. Mann–Whitney test.

Overall, most respondents without hypertension tended to have low–moderate physical activity, whereas individuals with hypertension were more frequently observed in the high physical activity group. However, this difference was not statistically significant (p = 0.342), indicating no significant association between hypertension status and physical activity level in this population. Similarly, respondents with diabetes mellitus appeared to have a higher proportion of high physical activity compared with non-diabetic participants, but this difference was also not statistically significant (p = 0.226). These findings suggest that diabetes status in the study population did not directly influence physical activity levels.

Table 2. Comorbid and Risk Factors

Variable	Low to Moderate level Activity	High level Activity	P-value
Hypertension			
No Hypertension	12 (60.0%)	8 (40.0%)	0.342[a]
Hypertension	9 (45.0%)	11 (55.0%)	
Diabetes Mellitus			
No Diabetes Mellitus	19 (57.6%)	14 (42.4%)	0.226[b]
Diabetes Mellitus	2 (28.6%)	5 (71.4%)	
Smoking			

Non-Smoker	20 (66.6%)	10 (33.3%)	0.003[b]
Smoker	1 (10.0%)	9 (90.0%)	
Menopause			
No Menopause	5 (71.4%)	2 (28.6%)	0.003[b]
Menopause	14 (66.7%)	7 (33.3%)	

a. *Chi-square,* b. *Fisher exact-test*

In contrast, statistically significant associations were observed between smoking status (p = 0.003) and menopausal status (p = 0.003) with physical activity level. Smokers were proportionally more likely to have high physical activity compared with non-smokers. Regarding menopausal status, premenopausal respondents were more frequently categorized in the low–moderate physical activity group.

Table 3. JAKVAS Score Difference Between Activity Level

Physical Activity	Median	Minimum-Maximum	P-value
Low to Moderate level Activity	6	0-15	0.066
High level Activity	4	1-8	

The analysis demonstrated that the median JAKVAS score was higher in the low–light physical activity group (median = 6; range 0–15) compared with the moderate–vigorous activity group (median = 4; range 1–8). Although this difference did not reach statistical significance (p = 0.066), a clinically relevant trend was observed, suggesting that higher levels of physical activity were associated with lower cardiovascular risk scores as assessed by JAKVAS.

Discussion

Cardiovascular disease (CVD) remains the leading cause of global morbidity and mortality, including in Indonesia. Global Burden of Disease data indicate that CVD accounts for more than 30% of deaths worldwide, and the burden is rising in developing countries, partly driven by sedentary lifestyles and insufficient physical activity.[1] In Indonesia, low physical activity is increasingly prevalent and is associated with higher estimated 10-year CVD risk.[6] From a prevention standpoint, contemporary major guidelines consistently position regular physical activity and reduction of sedentary time as core lifestyle targets for primary prevention and risk reduction.[7,8]

To assess CVD risk in local populations, the Jakarta Cardiovascular Score (JAKVAS) was originally introduced as a modified Framingham-based approach intended to be practical for risk stratification in developing-country settings.[3] In this study, the median JAKVAS score was higher in participants with low–light physical activity than in those with moderate–vigorous activity, indicating a negative trend between activity level and estimated risk (p = 0.066). This direction is concordant with large prospective evidence showing lower cardiovascular events and mortality among more physically active individuals across diverse settings[6] and with global surveillance demonstrating persistent sex differences in activity patterns that may influence risk distributions.[9] Physical activity increases laminar shear stress on vascular endothelium, a key stimulus for improved endothelial signaling and vasodilator capacity. In hypertensive populations, exercise interventions have been associated with improved endothelial-related markers (e.g., nitric oxide and endothelin-1 dynamics) and better vascular function, supporting a mechanistic link between activity and lower vascular risk.[10] This matters clinically because endothelial dysfunction promotes vasoconstriction, inflammation, platelet activation, and early atherogenesis, processes that elevate cardiovascular risk.[11]

Exercise lowers blood pressure through integrated mechanisms: reduced sympathetic tone, improved endothelial-dependent vasodilation, and favorable vascular remodeling. These mechanisms are consistent with guideline frameworks emphasizing lifestyle interventions for risk reduction.[7,12] Importantly, multi-country evidence indicates that strengthening physical activity can meaningfully reduce blood pressure at the population level, including in low- and middle-income contexts.[13] Because systolic blood pressure is a direct component of JAKVAS, this pathway is a biologically coherent route by which higher activity could translate into a lower score.

Regular exercise is associated with reductions in systemic inflammatory burden, including CRP, a marker linked to vascular risk. A systematic review/meta-analysis found exercise training associated with decreased CRP levels,[14] and more recent evidence syntheses continue to support exercise-related improvement in chronic systemic inflammatory biomarkers.[15] Lower inflammation reduces endothelial activation, plaque vulnerability, and thrombogenic milieu, all of which are mechanistic bridges between activity and lower cardiovascular risk estimates.

Physical activity also reduces cardiometabolic risk by improving body composition and lipid profile, factors closely related to BMI-based risk scoring approaches. A systematic review/meta-analysis in individuals with obesity found that exercise improved BMI/waist circumference and multiple lipid parameters.[16] In parallel, resistance training stimulates myokine signaling with anti-inflammatory and metabolic effects, providing a mechanistic framework for how exercise supports cardiometabolic health.[17] These pathways are particularly relevant because BMI and diabetes status are JAKVAS components, and insulin resistance mechanistically links inactivity to atherosclerosis progression.

The findings of this study have several implications for healthcare services, policy, and clinical practice. In healthcare services, cardiovascular risk assessment using tools such as JAKVAS may help identify individuals who require early lifestyle intervention, particularly in primary care and community-based screening programs. Physical activity counseling should not be delivered as a stand-alone message, but should be integrated with smoking cessation, reduction of sedentary behavior, blood pressure control, diabetes prevention, and weight management. From a policy perspective, these findings support the need for population-based strategies that promote active living environments, reduce prolonged sitting time, and strengthen smoking prevention programs. In clinical practice, healthcare providers should assess not only whether patients exercise, but also their total sedentary time, smoking status, menopausal status, and other cardiometabolic risk factors, because higher physical activity may not fully offset the adverse vascular effects of smoking or prolonged sedentary behavior.[18]

This study has several strengths. First, it evaluated cardiovascular risk using JAKVAS, a risk assessment tool developed for the Indonesian population, making the findings more contextually relevant for local cardiovascular prevention strategies. Second, the study addressed an important lifestyle-related factor, physical activity, which is modifiable and highly relevant for primary prevention. Third, the analysis considered clinically important factors such as smoking and menopausal status, which may influence the relationship between physical activity and cardiovascular risk.

However, this study also has limitations. The small sample size may have limited the statistical power to detect significant associations. The cross-sectional design prevents causal inference between physical activity level and JAKVAS score. Reverse causality is also possible, as individuals with known hypertension, diabetes, or higher cardiovascular risk may have increased their physical activity after diagnosis. In addition, sedentary time, smoking intensity, dietary pattern, occupational activity, and duration of menopausal status were not fully explored, although these factors may influence cardiovascular risk. Therefore, the findings should be interpreted as exploratory and hypothesis-generating.

Further studies with larger sample sizes and multicenter recruitment are recommended to confirm these findings in a broader Indonesian population. Prospective cohort studies are needed to clarify the temporal relationship between physical activity and changes in JAKVAS score over time. Future research should also measure sedentary behavior, smoking exposure, diet, occupational activity, and physical activity intensity more comprehensively. Objective tools such as accelerometers may provide more accurate assessment of physical activity and sedentary time. In addition, subgroup analyses based on sex, menopausal status, smoking status, hypertension, diabetes, and age group may help identify populations that benefit most from targeted lifestyle interventions.

Smoking clustered in the higher-activity group is clinically important: smoking induces endothelial dysfunction and pro-atherogenic, procoagulant changes. Cohort evidence also suggests additive harm when smoking coexists with physical inactivity, increasing mortality risk substantially.[19] Thus, higher activity may not fully offset smoking-related vascular injury; risk reduction is optimized when physical activity promotion is paired with smoking cessation.

Menopausal status can also influence risk via hormonal changes that affect vascular function and cardiometabolic profile. In postmenopausal women, higher physical activity has been associated with a more favorable cardiovascular risk profile in cross-sectional evidence. This supports targeted lifestyle strategies in older women, a group where risk accelerates after menopause.[20]

Given the sample size of 21 participants and the cross-sectional design, a lack of statistical significance is expected even with a real effect; reverse causality is also possible (e.g., those diagnosed with hypertension/diabetes becoming more active). This is why guidelines emphasize sustained lifestyle adoption across the life course and why dose–response evidence shows the largest relative benefit occurs when moving from inactive to minimally active.[20]

Conclusions

Higher levels of physical activity tended to be associated with lower cardiovascular risk scores based on the Jakarta Cardiovascular Score (JAKVAS), although the association did not reach statistical significance. These findings underscore the importance of promoting physical activity as a preventive strategy against cardiovascular disease at the community level.

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Declaration concerning generative AI and AI-augmented technologies in the compositional process

In the course of preparing this paper, the authors utilized ChatGPT to enhance readability and linguistic quality. Subsequent to utilizing this tool/service, the authors assessed and amended the information as necessary and assume complete accountability for the publication's content.

Declarations of competing interest

No potential competing interest was reported in this research.

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