The Associations Between Physical Activity and Mental Health Problems in Middle-aged Indonesians

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Objectives: Mental health issues have become a growing concern worldwide. Research has shown that regular physical activity (PA) can positively affect mental health. This study investigated the associations between PA and mental health problems (MHPs) in middle-aged Indonesians.

Methods: The study utilized data from the 2018 Indonesian Basic Health Research Survey and used a cross-sectional approach. The participants included individuals aged 40-60 years who completed the 20-question Self-Reporting Questionnaire. A logistic regression was performed to analyze a sample of 263 930 data points.

Results: Nearly 10.4% of the participants suffered from mental health issues. Notably, among those who did not engage in moderate and vigorous PA, a sign of MHPs was found in 12.5% of participants. Those who met World Health Organization standards for PA were less likely to experience MHPs (10.1%). This study found a significant association between PA and mental health. After adjusting for smoking, alcohol consumption, non-communicable diseases, and socio-demographic variables like age, sex, education, occupation, marital status, and residence, the connection between PA and mental health became even stronger (adjusted odds ratio, 0.81; 95% confidence interval, 0.78 to 0.85; $p < 0.001$).

Conclusions: Regular PA has been shown to affect mental health positively. Therefore, it is important to improve health education and efforts to raise awareness among middle-aged Indonesians about the importance of PA in maintaining good mental health.

Key words: Physical activity, Mental health, Middle-aged, Indonesia

INTRODUCTION

Mental health is a critical issue that affects people worldwide. From 1990 to 2019, the global burden of diseases related to mental disorders increased significantly from 80.8 million disability-adjusted life years (DALYs) to 125.3 million DALYs. Additionally, the percentage of global DALYs attributed to mental disorders rose from 3.1% to 4.9% [1].

According to the 2018 Indonesian Basic Health Research Survey (Riskesdas 2018), about 6.1% of the population in Indonesia aged >15 years suffered from depression, and about 9.8% suffered from mental health problems (MHPs) [2]. These figures are prone to underestimation due to a significant proportion of the Indonesian population refraining from seeking assistance or lacking awareness regarding their mental health status.

Over the past few years, an increasing amount of research

has confirmed that engaging in physical activity (PA) can benefit mental health and overall well-being. PA has been acknowledged to alleviate symptoms of anxiety, stress, and depression. It is considered a potential alternative method for reducing the negative impact of mental illness [3]. A study in Poland has shown that PA improved the self-esteem and mental health of middle-aged females [4]. Furthermore, a longitudinal study in Canada has expressed concerns about poor mental health in middle-aged individuals with limited socioeconomic resources [5].

Insufficient research focusing on middle-aged individuals has been conducted on the relationship between PA and mental health in Indonesia. One study highlighted health and well-being concerns but did not specifically discuss the relationship between mental health and PA [6]. Studies on the link between PA and mental health in Indonesia have centered on specific regional populations, such as the study about PA patterns and their influence on health risks and life satisfaction in Surabaya City [7]. Therefore, this study aimed to investigate the association between PA and MHPs among middle-aged Indonesians, utilizing big data from Riskesdas 2018.

Among the potential benefits of the current study is better support for aging individuals. In Indonesia, the older population (>60 years old) is projected to increase from 9.0% (23.0 million) in 2015 to 19.8% (63.3 million) in 2045 [8]. As a result, it is imperative to encourage healthy lifestyles, including PA, among the middle-aged population in Indonesia in preparation for their continued aging as of 2045. Middle-aged individuals (40-60 years old) often experience a significant impact on their mental health due to visible signs of aging, physical deterioration, increased health issues, and loss of peers [9].

METHODS

Data Sources

The study utilized nationally representative data from Riskesdas 2018, which encompassed the entirety of Indonesia's provinces, districts, and cities: 1 091 528 individuals across 34 provinces and 514 districts and cities [10]. The participants represented a range of age groups, with a particular focus on middle age (40-60 years old). Figure 1 illustrates the participant selection process. Data were sourced from the Health Development Policy Agency following the guidelines at https://www.badankebijakan.kemkes.go.id/.
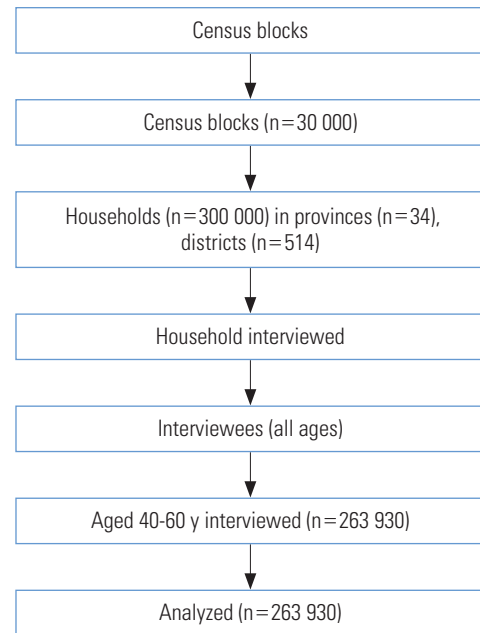
Figure 1. Flow diagram for sampling selection response. Modified from report of Indonesian Basic Health Research 2018 [2].

Variables
Outcome variable

The study's dependent variable was participants' MHPs. MHPs were measured using the 20-question Self-Reporting Questionnaire 20 (SRQ-20) developed by the World Health Organization (WHO) in 1994. The SRQ-20 is widely used for assessing MHPs and has proven effective in identifying indicative symptoms. However, while valuable, it should not be regarded as a substitute for professional diagnosis and should be used as a supplementary resource by mental health professionals [11].

Each SRQ-20 question prompted a binary response (yes or no). Affirmative responses were coded as "1" and negative responses as "0." The individual classification was based on the sum of scores. A cumulative score exceeding 5 indicated the presence of MHPs, while a score of 5 or below indicated the absence of MHPs. The Indonesian version demonstrated a 70% positive predictive value and a 92% negative predictive value [12].

Exposure variable

The study's exposure variable was PA. Data collection involved presenting the participants with vignettes featuring pictures of rigorous and moderate activities. The participants identified each activity, reported the duration in minutes, and

specified the frequency per week. The WHO guidelines for PA recommend that adults engage each week in aerobic PA at moderate intensity for a minimum of 150 minutes to 300 minutes or at vigorous intensity for at least 75 minutes to 150 minutes [13].

PA was computed using the WHO formula (metabolic equivalents), with total duration in minutes multiplied by 8 and total moderate activities multiplied by 4. The level of PA categorized based on whether it met or exceeded WHO standards (≥600 minutes), fell below WHO standards (<600 minutes), or involved no moderate or vigorous PA. The PA classification was as follows: 0, no moderate or vigorous PA; 1, ≥WHO standard PA; and 2, <WHO standard PA.

Confounding Factors

The variables considered were sex (male or female), age (40-44, 45-54, 55-59 years), educational level (low, without a high school certificate; high, with at least a high school certificate), marital status (single, divorced, widowed, or married), employment status (unemployed or employed), and type of residential area (urban or rural). Individual risk behaviors included alcohol consumption and smoking (categorized as smoking daily, sometimes, or never).

Statistical Analysis

We conducted a univariate analysis to examine the distributions of sample characteristics based on the independent and dependent variables. To evaluate the strength of the associations, a multivariable logistic regression was used, with the results presented as odds ratios (ORs) and 95% confidence intervals (CIs). All analyses were performed using SPSS version 25 (IBM Corp., Armonk, NY, USA). Three models were presented: model 1 demonstrated the association of PA with mental health without confounding factors; model 2 explored the influence of this association of non-communicable diseases (NCDs), smoking, and alcohol consumption; and model 3 investigated the impact of demographic factors on the association of PA, NCDs, smoking, and alcohol consumption with mental health.

Ethics Statement

The National Ethics Committee granted ethical approval for this research under reference No. LB.02.01/2/KE.024/2018, and all participants provided informed consent before participating in the study.

RESULTS

Data cleaning yielded a total of 263 930 participants whose data were to be analyzed. Table 1 presents the participants' general characteristics. The study sample was 52.0% female, and 49.4% of the total participants were aged 45-54 years. Most participants were married (87.6%), had lower levels of education (53.8%), resided in rural areas (56.3%), and were employed (77.3%). In addition, 90.8% of the participants reported having no NCDs. As many as 61.8% of participants were non-smokers, and 95.8% abstained from consuming alcohol. Notably, 9.9% of the participants did not engage in moderate or vigorous PA, 85.3% adhered to the WHO PA standard, and the remainder pursued PA not in accordance with this standard.

The bivariate analysis revealed a significant correlation between PA and MHPs. The incidence of MHPs was higher among female, rural residents, those with lower educational attainment, and unemployed individuals. Individuals who were divorced or widowed had a higher likelihood of experiencing MHPs compared to their married or single counterparts.

Additionally, the prevalence of mental disorders exhibited an upward trend in concurrence with advancing age. Those individuals afflicted by more than 1 NCD and those who consumed alcohol were more likely to develop MHPs. Intriguingly, individuals who abstained from smoking had a higher risk of experiencing MHPs than those who smoked on a daily or occasional basis. Moreover, individuals who did not engage in moderate or vigorous PA were more likely to develop MHPs than those who integrated PA into their routine, even if their activity levels did not adhere to the WHO standards.

Table 2 depicts the associations between PA and MHPs in models 1, 2, and 3. The multivariate logistic regression analysis demonstrated a significant positive association between PA and MHPs among middle-aged Indonesians. Model 1 showed that middle-aged adults engaging in PAs as per the WHO recommendations had a lower likelihood of developing MHPs than those who did not participate in moderate or vigorous PA. Conversely, in middle-aged people, engaging in PA not aligned with WHO guidelines was correlated to a higher probability of suffering MHPs.

Model 2 added smoking, alcohol consumption, and NCDs to the analysis. The results indicated that the impact of adhering to WHO-standard PA was less pronounced than in model 1. Moreover, in model 2, those adhering to WHO PA guidelines had a smaller chance of developing MHPs than inactive indi-

Table 1. Distribution of MHPs with independent variables (n=263 930)

Variables	All respondents	MHPs		p-value
		No	Yes	
PA				<0.001
No moderate or vigorous PA	26 029 (9.9)	22 785 (87.5)	3244 (12.5)	
≥WHO standard	225 106 (85.3)	202 446 (89.9)	22 660 (10.1)	
<WHO standard	12 795 (4.8)	11 376 (88.9)	1419 (11.1)	
Smoking status				<0.001
Daily	81 076 (30.7)	74 128 (91.4)	6948 (8.6)	
Sometimes	19 820 (7.5)	17 732 (89.5)	2088 (10.5)	
Never	163 034 (61.8)	144 747 (88.8)	18 287 (11.2)	
Alcohol consumption				<0.001
Yes	10 985 (4.2)	9502 (86.5)	1483 (13.5)	
No	252 945 (95.8)	227 105 (89.8)	25 840 (10.2)	
Non-communicable diseases				<0.001
None	239 661 (90.8)	217 292 (90.7)	22 369 (9.3)	
1	21 851 (8.3)	17 699 (81.0)	4152 (19.0)	
>1	2418 (0.9)	1616 (66.8)	802 (33.2)	
Sex				<0.001
Male	126 554 (47.9)	117 115 (92.5)	9439 (7.5)	
Female	137 376 (52.0)	119 492 (87.0)	17 884 (13.0)	
Age (y)				<0.001
40-44	74 649 (28.3)	67 400 (90.3)	7249 (9.7)	
45-54	130 423 (49.4)	116 988 (89.7)	13 435 (10.3)	
55-59	58 858 (22.3)	52 219 (88.7)	6639 (11.3)	
Marital status				<0.001
Single	7006 (2.6)	6249 (89.2)	757 (10.8)	
Divorced	7140 (2.7)	6002 (84.1)	1138 (15.9)	
Widowed	18 478 (7.0)	15 560 (84.2)	2918 (15.8)	
Married	231 306 (87.6)	208 796 (90.3)	22 510 (9.7)	
Education				<0.001
Lower	141 932 (53.8)	123 810 (87.2)	18 122 (12.8)	
Higher	121 998 (46.2)	112 797 (92.5)	9201 (7.5)	
Type of residential area				<0.001
Urban	115 440 (43.7)	105 103 (91.0)	10 337 (9.0)	
Rural	148 490 (56.3)	131 504 (88.6)	16 986 (11.4)	
Employment status				<0.001
Unemployed	59 835 (22.7)	51 194 (85.6)	8641 (14.4)	
Employed	204 095 (77.3)	185 413 (90.8)	18 682 (9.2)	
Total	263 930 (100)	236 607 (89.6)	27 323 (10.4)	

Values are presented as number (%).
MHP, mental health problem; PA, physical activity; WHO, World Health Organization.

viduals. Surprisingly, model 2 indicated that smoking was associated with a lower risk of MHPs. Daily smokers had a lower probability of experiencing MHPs than non-smokers. In contrast, those who consumed alcohol were more susceptible to developing MHPs than those who abstained. Individuals grap-

pling with multiple NCDs also had a greater risk of experiencing MHPs relative to those without NCDs.

In model 3, we incorporated socio-demographic factors such as age, sex, marital status, employment status, and type of residential area. Compared to model 2, model 3 showed a

Table 2. Results of the multivariate regression analysis

Determinants	β	Model 1 OR (95% CI)	β	Model 2 aOR (95% CI)	β	Model 3 aOR (95% CI)
PA						
No moderate or vigorous PA		1.00 (reference)		1.00 (reference)		1.00 (reference)
≥WHO standard	-0.241	0.79 (0.76, 0.82)***	-0.149	0.86 (0.83, 0.90)***	-0.208	0.81 (0.78, 0.85)***
<WHO standard	-0.132	0.88 (0.82, 0.94)***	-0.112	0.89 (0.84, 0.96)***	-0.082	0.92 (0.86, 0.99)*
Smoking status						
Never		-		1.00 (reference)		1.00 (reference)
Daily		-	-0.310	0.73 (0.71, 0.75)***	0.453	1.57 (1.50, 1.65)***
Sometimes		-	-0.114	0.89 (0.85, 0.94)***	0.558	1.75 (1.65, 1.85)***
Alcohol consumption						
No		-		1.00 (reference)		1.00 (reference)
Yes		-	0.501	1.65 (1.56, 1.75)***	0.618	1.85 (1.75, 1.97)***
Non-communicable diseases						
None		-		1.00 (reference)		1.00 (reference)
1		-	0.798	2.22 (2.14, 2.30)***	0.816	2.26 (2.18, 2.35)***
>1		-	1.533	4.63 (4.25, 5.05)***	1.559	4.75 (4.35, 5.20)***
Sex						
Male		-		-		1.00 (reference)
Female		-		-	0.834	2.30 (2.20, 2.41)***
Education						
Higher		-		-		1.00 (reference)
Lower		-		-	0.481	1.62 (1.57, 1.66)***
Employment status						
Employed		-		-		1.00 (reference)
Unemployed		-		-	0.241	1.27 (1.23, 1.31)***
Marital status						
Married		-		-		1.00 (reference)
Single		-		-	0.201	1.22 (1.13, 1.32)***
Divorced		-		-	0.481	1.62 (1.51, 1.73)***
Widowed		-		-	0.309	1.36 (1.30, 1.42)***
Age (y)						
40-44		-		-		1.00 (reference)
45-54		-		-	-0.014	0.99 (0.96, 1.02)
55-59		-		-	-0.086	0.92 (0.88, 0.95)***
Type of residential area						
Urban		-		-		1.00 (reference)
Rural		-		-	0.221	1.25 (1.21, 1.28)***

OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; PA, physical activity; WHO, World Health Organization.
*p<0.05, ***p<0.001.

stronger effect from adhering to WHO-standard PA. In model 3, daily smokers had a higher likelihood of developing MHPs than those who refrained from smoking. Moreover, individuals who consumed alcohol were at a higher risk of experiencing MHPs than those who abstained. Individuals with multiple NCDs also had a higher likelihood of developing MHPs. Likewise, female, unemployed individuals, divorced individuals, rural residents, and those with lower educational levels had a higher risk of developing MHPs. Regarding age groups, the older participants (aged 55-59 years) were less likely to report experiencing MHPs than those aged 40-54 years.

DISCUSSION

The logistic regression results indicated that PA significantly reduced the risk of mental health issues in middle-aged Indonesians. This finding aligns with previous studies in China and India [14,15]. PA can enhance emotional well-being and quality of life and alleviate certain psychotic symptoms. It can also help manage medical conditions often linked to psychotic disorders [15]. In contrast, WHO health surveys in Bangladesh, India, Nepal, and Sri Lanka found an insignificant association between PA and mental health among participants with self-reported depression [16]. However, our study found a significant association between PA and MHPs in self-reporting participants, suggesting a discrepancy with the WHO health survey. The differences in the results could be due to the bias and potential inaccuracy of self-reported mental health data.

Our findings also indicated that other factors, such as sociodemographic factors, may confound the causal link between PA and MHPs. One study has asserted that establishing a definitive cause-effect relationship between PA and mental health remains challenging due to other potential contributing factors that cannot be disregarded, such as social interaction [17]. Another study stated that social environmental factors, such as an individual's social support, sense of connection, and social networks, contributed to the association between PA and mental health status [18].

Regarding smoking behavior, the regression analysis in model 2 indicated that daily smokers had a lower probability of developing MHPs than non-smokers. Similarly, a study in Iran showed that smoking can be an emotionally focused strategy for smokers for stress relief. People who use an emotionally focused strategy seek short-term stress relief and may shift the stress to another situation, which may lead to a reduced sense of control [19]. However, after we controlled for sociodemographic factors in model 3, we found that smokers had a higher likelihood of experiencing MHPs than non-smokers. Our findings agree with a retrospective study conducted in the Czech Republic that found a marked rise in mental health issues among smokers [20].

Our study also confirmed a positive association between alcohol use and MHPs. This finding is in line with research in Ethiopia that asserted a positive association between drinking alcohol and having mental health disorders [21]. The prevalence of MHPs among alcohol drinkers is related to several variables, such as social isolation and interpersonal difficulties

[22]. Moreover, this study supports the idea that the relationship between alcohol intake and mental health is complex; it is influenced by several factors and may emerge in a variety of ways.

The results of logistic regression in models 2 and 3 indicated a significant association between MHPs and NCDs. This finding corroborates the results of earlier research in India and China [23,24]. Although our result was anticipated, the mechanism underlying the association between NCDs and mental disorders is complex. Mental illnesses frequently coexist with other NCDs and share numerous risk factors [23]. People with chronic physical diseases are more likely to suffer from MHPs [25]. Furthermore, several NCDs can directly impact the brain and cause mental health issues. A stroke, for example, might lead to despair and anxiety, while Alzheimer's disease can result in mood swings and personality changes [26].

This study also found that among the middle-aged participants, females were more likely to experience MHPs than males. This finding confirms the results of a cohort study in Germany, which stated that females report more MHPs than males [27]. Previous studies found that females often experience feelings of loneliness and perceive a deficiency in social support compared to males. Additionally, females are more likely to develop MHPs than males due to the female roles as homemakers and the experiences associated with maternity leave [28].

In terms of education, this study found that people with lower levels of education had a higher likelihood of experiencing MHPs. This finding is in line with a study in China that determined that having higher educational levels led to a significant improvement in mental health [29]. Similarly, a study in Portugal [30] found that educated older adults were shown to have better psychological well-being and more positive leisure attitudes. Empirical evidence also supports the notion that more highly educated people are better equipped to manage stressful life circumstances, seek positive adaptation, and mitigate symptoms of depression [31].

This study also revealed an association between MHPs and unemployment. The finding is consistent with research undertaken in Bosnia and Herzegovina, which indicated the negative impacts of unemployment on mental health [32]. Unemployment is linked to lower self-esteem and is associated with an increase in depression symptoms [33]. Moreover, the financial strain resulting from unemployment may exacerbate its impact on mental health [34].

Regarding marital status, the current study demonstrated

that individuals who have been divorced or widowed were at higher risk of developing MHPs. Similarly, a study in Korea found that being divorced or widowed was accompanied by a higher risk of experiencing mental health issues [35]. The elevated risk was attributed to the potential loss of social support previously provided by a partner [36]. Additionally, social stigma, particularly against divorced female, may exacerbate MHPs. In Indonesia, traditional expectations of female to be obedient housewives and loving mothers contribute to the stigmatization of divorced female, unfairly labeling them as morally deficient [37].

Our study also indicated that individuals aged 55-59 years were less likely to experience mental health issues than those aged 40-54 years. This finding is in line with a study conducted in the United States, which revealed that older adults had a smaller chance of developing depression than younger adults due to well-developed coping strategies, such as emotional regulation, self-reflection, compassion, acceptance of different views, and decisiveness [38].

Furthermore, this study found that rural residents were more likely to develop MHPs than urban residents. This finding is consistent with a study among middle-aged individuals in Iran, which also found that rural residents had a higher likelihood of developing mental health disorders than urban residents [39]. This phenomenon might well be explained by the limited job opportunities in rural areas, which led to a higher likelihood of unemployment [40].

A significant strength of this study lies in its utilization of a large dataset from a national public health survey, which has enabled an exploration of the broader associations between PA and MHPs. This study fills a crucial gap in understanding these connections regarding middle-aged individuals in Indonesia, where research on this topic has been scarce.

On the other hand, one limitation of this study stems from its cross-sectional design, which has prevented the determination of causality regarding PA and MHPs. Additionally, reliance on self-reporting via the SRQ-20 may have introduced response bias or inaccuracies regarding participants' mental health status. The self-reported responses to PA questions were also a limitation of this study. The assessment of PA did not utilize more accurate tools, such as mobile apps designed to monitor PA. The absence of details regarding the types and intensities of physical activities undertaken by participants also limited the depth of the analysis. These limitations should be addressed in future studies.

The current study observed significant associations between PA and MHPs in middle-aged Indonesians. Those who engaged in less PA had a higher prevalence of MHPs than those who met the WHO PA standards. Daily smokers and alcohol users were more likely to experience MHPs than those who abstained. Middle-aged people with multiple chronic NCDs were more likely to have MHPs than those without NCDs. MHPs were more strongly associated with female, unemployed individuals, divorced individuals, rural residents, and those with lower levels of education. Older adults (aged 55-59 years) were less susceptible to MHPs than those in the 40-year to 54-year age range. In conclusion, PA has a protective effect on mental health in middle-aged Indonesians. Therefore, health education should be encouraged, and general awareness of the significance of PA on mental health should be increased.

NOTES

Data Availability

All data generated or analyzed during this study are included in this published article. Other data may be requested through the corresponding author.

Conflict of Interest

The authors have no conflicts of interest associated with the material presented in this paper.

Author Contributions

Conceptualization: Handayani S, Isfandari S. Formal analysis: Handayani S, Isfandari S, Agustiya RI. Funding acquisition: None. Methodology: Isfandari S, Agustiya RI. Writing - original draft: Handayani S, Isfandari S, Effendi DE, Agustiya RI, Ardani I, Nugroho AP, Fitrianti Y. Writing - review & editing: Handayani S, Isfandari S, Effendi DE, Agustiya RI, Ardani I, Nugroho AP, Fitrianti Y.

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