

## ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND DEPRESSION AMONG OLDER ADULT WITH DIABETES IN INDONESIA: ANALYSIS OF THE 2023 HEALTH SURVEY

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### ABSTRACT

**Introduction:** Depression is a common mental health problem among older adults with chronic diseases, including diabetes mellitus (DM). Physical activity has been shown to improve psychological well-being; however, evidence among Indonesian elderly with DM remains limited. **Methods:** This cross-sectional study utilized secondary data from the 2023 Indonesian Health Survey. A total of 4,130 respondents aged  $\geq 60$  years diagnosed with DM were included. Depression status was recorded based on the mental health indicators available in the national survey dataset. Physical activity was categorized into vigorous and moderate activity. Additional variables included age, sex, marital status, education level, employment status, place of residence, and diabetes type. Weighted chi-square tests were used to assess the association between variables, with a significance level of  $p < 0.05$ . **Results:** Depression prevalence was 6.8%. Significant associations were observed between depression and vigorous activity ( $p < 0.001$ ) and moderate activity ( $p < 0.001$ ). Older adults not engaging in vigorous activity had higher depression (6.3%) than active individuals (0.5%). Similarly, those without moderate activity reported higher depression (4.3%) compared with active respondents (2.4%). Depression was also significantly associated with sex, age, marital status, education, employment, and residence (all  $p < 0.05$ ). Diabetes type showed no significant relationship ( $p = 0.151$ ). **Conclusion:** Physical activity demonstrates a protective effect against depression among Indonesian elderly with diabetes. Integrating regular physical activity into community-based elderly health programs may support promotive and preventive mental health interventions.

**Keywords:** diabetes mellitus, depression, elderly, physical activity, Indonesian Health Survey.

### *HUBUNGAN ANTARA AKTIVITAS FISIK DAN DEPRESI PADA LANSIA DENGAN DIABETES DI INDONESIA: ANALISIS SURVEI KESEHATAN INDONESIA TAHUN 2023*

#### *ABSTRAK*

**Pendahuluan:** Depresi merupakan salah satu masalah kesehatan mental yang umum terjadi pada lansia dengan penyakit kronis, termasuk diabetes melitus (DM). Aktivitas fisik diketahui dapat meningkatkan kesejahteraan psikologis, namun bukti mengenai hal tersebut pada lansia dengan DM di Indonesia masih terbatas. **Metode:** Penelitian cross-sectional ini menggunakan data sekunder dari Survei Kesehatan Indonesia tahun 2023. Sebanyak 4.130 responden berusia  $\geq 60$  tahun yang terdiagnosis DM diikutsertakan dalam penelitian. Status depresi dicatat berdasarkan indikator kesehatan mental yang tersedia dalam dataset survei nasional. Aktivitas fisik dikategorikan menjadi aktivitas berat dan aktivitas sedang. Variabel tambahan

meliputi usia, jenis kelamin, status perkawinan, tingkat pendidikan, status pekerjaan, tempat tinggal, dan tipe diabetes. Uji chi-square berbobot digunakan untuk menganalisis hubungan antarvariabel dengan tingkat signifikansi  $p < 0,05$ . **Hasil:** Prevalensi depresi sebesar 6,8%. Hubungan yang signifikan ditemukan antara depresi dengan aktivitas berat ( $p < 0,001$ ) dan aktivitas sedang ( $p < 0,001$ ). Lansia yang tidak melakukan aktivitas berat memiliki prevalensi depresi lebih tinggi (6,3%) dibandingkan individu yang aktif (0,5%). Demikian pula, responden yang tidak melakukan aktivitas sedang menunjukkan prevalensi depresi lebih tinggi (4,3%) dibandingkan responden yang aktif (2,4%). Depresi juga berhubungan signifikan dengan jenis kelamin, usia, status perkawinan, pendidikan, pekerjaan, dan tempat tinggal (seluruhnya  $p < 0,05$ ). Tipe diabetes tidak menunjukkan hubungan yang signifikan ( $p = 0,151$ ). **Kesimpulan:** Aktivitas fisik menunjukkan efek protektif terhadap depresi pada lansia dengan diabetes di Indonesia. Integrasi aktivitas fisik rutin dalam program kesehatan lansia berbasis komunitas dapat mendukung intervensi promotif dan preventif kesehatan mental. **Kesimpulan:** Temuan ini menegaskan pentingnya skrining insomnia dan kecemasan dalam pengelolaan hipertensi pada lansia.

**Kata Kunci:** aktivitas fisik, depresi, diabetes melitus, lansia, Survei Kesehatan Indonesia.

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#### ARTICLE INFORMATION

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## INTRODUCTION

Diabetes mellitus (DM) is one of the most common chronic conditions affecting the elderly. Beyond its physical complications, DM has a significant psychological impact, particularly among older adults.(Hossain et al., 2024);(Sapra & Bhandari, 2025);(Bellary et al., 2021) Elderly individuals with DM face numerous challenges, including long-term disease management, limited mobility, lifestyle restrictions, and dependence on medications (Pandya et al., 2020; Leung et al., 2018). These burdens often lead to emotional stress, which can develop into mental health disorders such as depression

(Baloh, 2022). Depression in elderly individuals with DM may worsen glycemic control, reduce treatment adherence, and accelerate the onset of complications (Wojujutari Ajele & Sunday Idemudia, 2025a; Wojujutari Ajele & Sunday Idemudia, 2025b). Although depression is a common issue among elderly individuals with chronic illnesses, the relationship between physical activity and depression in elderly diabetics in Indonesia remains underexplored (Idaiani & Indrawati, 2021; Ronzon et al., 2025). While physical activity is believed to help maintain mental health, there is a lack of nationally representative data examining this

relationship specifically in elderly individuals with diabetes. This gap in the literature poses challenges for developing evidence-based health policies, particularly those aimed at promotive and preventive interventions targeting the elderly population (Ibáñez Román et al., 2023). Previous research has shown that physical activity whether vigorous or moderate can improve mental well-being and reduce the risk of depression (White et al., 2024; Mahindru et al., 2023a). Physical activity influences the central nervous system by increasing the production of neurotransmitters such as endorphins and serotonin, which regulate mood. In addition, physical activity helps control blood glucose levels, improves sleep quality, and boosts self-esteem in elderly individuals with DM (Asri et al., 2025). However, few studies in Indonesia have quantitatively evaluated these benefits using large-scale national data. This study aims to analyze the relationship between physical activity and depression in elderly individuals with diabetes mellitus in Indonesia, using secondary data from the 2023 Indonesian Health Survey (Yang et al., 2025).

## **METHODS**

### **Data Sources and Study Design**

This study employed a cross-sectional design using secondary data

obtained from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia 2023). This study was designed to explore the association between physical activity and depression among older adults diagnosed with diabetes mellitus in Indonesia.

### **Study Population**

The study population consisted of elderly individuals (aged  $\geq 60$  years) who had been diagnosed with diabetes mellitus and were recorded in the 2023 Indonesian Health Survey dataset. A total of 4,130 respondents met the criteria and were included in the final analyses.

### **Inclusion Criteria And Exclusion Criteria**

Inclusion and exclusion criteria were used to ensure data compliance with the research objectives. Respondents meeting the inclusion criteria were all individuals aged 60 years or older who were diagnosed with diabetes mellitus in the 2023 Indonesian Health Survey (SKI) and had complete data on depression status, physical activity, and required sociodemographic variables. Only respondents with complete data were included in the analysis to maintain the validity of the results.

Exclusion criteria were applied to respondents who lacked complete data on primary or supporting variables, potentially introducing analysis bias. Furthermore, respondents identified in the survey as

having a severe mental disorder other than depression were excluded, as this condition could influence the interpretation of depression status. Elderly individuals with severe physical limitations, which, according to the survey classification, could hinder their ability to accurately report physical activity, were also excluded. Through this selection process, the study ensured that the analyzed sample truly represented the population of older adults with diabetes, whose information could be comprehensively assessed.

### **Variables and Measurements**

This study used depression status as the dependent variable, determined based on the mental health module in the 2023 Indonesian Health Survey (SKI). Respondents were categorized as having depression if they reported depressive symptoms according to the indicators established in the survey, and the results were coded dichotomously as "yes" or "no." The primary independent variable was physical activity, assessed using vigorous and moderate activity. Vigorous activity includes activities that significantly increase heart rate, such as intensive physical labor or brisk cycling, and respondents were considered active if they performed them at least three days per week. Moderate activity includes activities such as brisk walking or household chores that moderately increase physical activity,

and was categorized as active if they performed them at least five days per week. In addition, several sociodemographic variables were used to describe respondent characteristics, including age (60–69, 70–79, and  $\geq 80$  years), gender, marital status, education level, employment status, residential area (urban or rural), and diabetes type (type 1 or type 2). All these variables were analyzed to understand the distribution and factors associated with depression in older adults with diabetes.

### **Statistical Analysis**

Data analysis was performed using SPSS version 27.0.1 software. The associations between physical activity and depression and between other independent variables and depression were examined using the chi-square test. To ensure more accurate and representative estimates, sampling weights from the dataset were applied to account for the intricate survey design, which included stratification, clustering, and unequal likelihoods of selection. A p-value of less than 0.05 was considered to indicate statistical significance.

### **Ethics Approval**

This study utilized anonymized secondary data from the 2023 Indonesian Health Survey (SKI) and did not involve direct interactions with human subjects. The use of SKI 2023 microdata was conducted under a data-sharing agreement

through the Confidentiality Agreement No. FRM/SMKI-PUSDATIN/70/0108/2024.

The study protocol was approved and registered under the Ticket No number. 240675B7CC9C4327. All procedures were performed in accordance with research ethics standards and national regulations governing the use of human data for research. Data access and application procedures are publicly available at the following link: <https://www.badankebijakan.kemkes.go.id/data-mikro-ski/>.

## RESULTS

Table 1. The largest age group was 60–69 years (74.3%), followed by 70–79 years (22.3%), and ≥80 years (3.4%). Women dominated the sample (56.5%). Most respondents were married (69.8%). In terms of education, almost half of the respondents had primary education (48.6%), followed by secondary education (35.9%) and higher education (15.5%). A total of 57.8% of respondents were still working, and 72.2% lived in urban areas. The majority of respondents had type 2 diabetes (73.7%). Only 11.5% engaged in vigorous physical activity, while 52.3% engaged in moderate physical activity. The overall prevalence of depression was 6.8%.

**Table 1. Frequency Distribution of Characteristics Among Elderly with Diabetes Mellitus (n=4130)**

Variable	Frequency (n)	Percentage (%)
<b>Age Group (Years)</b>		
60–69	308	74,3
70–79	922	22,3
≥80	140	3,4
<b>Gender</b>		
Male	1.795	43,5
Female	2.335	56,5
<b>Marital Status</b>		
Single	35	0,8
Married	2.883	69,8
Divorced	1212	29,3
<b>Education Level</b>		
Primary Education	2.007	48,6
Secondary Education	1.481	35,9
Higher Education	642	15,5
<b>Employment</b>		
Unemployed	1.741	42,2
Employed	2.389	57,8
<b>Area of Residence</b>		
Urban	2.980	72,2
Rural	1.150	27,8
<b>Diabetes Mellitus Type</b>		
Type 1	1.086	26,3
Type 2	3.044	73,7
<b>Heavy Activity</b>		
Yes	477	11,5
No	3.653	88,5
<b>Moderate Activity</b>		
Yes	2.160	52,3
No	1.970	47,7
<b>Depression</b>		
Yes	280	6,8
No	3.850	93,2

Table 2. There is a significant relationship between physical activity and depression. Respondents who did not engage in strenuous activity showed a higher prevalence of depression (6.3%) compared to those who were active (0.5%) with a p value < 0.001. Similarly, not engaging in moderate activity was

associated with higher depression (4.3%) compared to active respondents (2.4%) ( $p < 0.001$ ). Factors such as age, gender, marital status, education, occupation, and area of residence also showed a significant relationship with depression ( $p < 0.05$ ). Type 1 and type 2 diabetes did not show a significant difference in the prevalence of depression ( $p = 0.151$ ).

**Table 2. Relationship Between Depression Among Elderly with Diabetes Mellitus Using Chi-Square Analysis (n=4130)**

Variable	Depression		p-value
	Yes [n (%)]	No [n (%)]	
<b>Age Group (Years)</b>			
60–69	178 (4,3)	2.890 (70,0)	0,001*
70–79	84 (2,0)	838 (20,3)	
≥80	18 (0,4)	122 (3,0)	
<b>Gender</b>			
Male	117 (2,8)	1.687 (40,6)	0,001*
Female	163 (3,9)	2.172 (52,6)	
<b>Marital Status</b>			
Single	4 (0,1)	31 (0,8)	0,001*
Married	194 (4,7)	2.689 (65,1)	
Divorced	82 (2,0)	1.130 (27,4)	
<b>Education Level</b>			
Primary Education	141 (3,4)	1.866 (45,2)	0,001*
Secondary Education	101 (2,4)	1.380 (33,4)	
Higher Education	38 (0,9)	604 (14,6)	
<b>Employment</b>			
Unemployed	145 (3,5)	1.596 (38,6)	0,001*
Employed	135 (3,3)	2.254 (54,6)	
<b>Area of Residence</b>			
Urban	200 (4,8)	2.780 (67,3)	0,001*
Rural	80 (1,9)	1.070 (25,9)	
<b>Diabetes Mellitus Type</b>			
Type 1	65 (1,6)	1.021 (24,7)	0,001*
Type 2	215 (5,2)	2.829 (68,5)	
<b>Heavy Activity</b>			
Yes	20 (0,5)	457 (11,1)	0,001*
No	260 (6,3)	3.393 (82,2)	
<b>Moderate Activity</b>			
Yes	101 (2,4)	2.059 (49,9)	0,001*
No	179 (4,3)	1.791 (43,4)	

## DISCUSSION

This study revealed a significant association between physical activity and depression among older adults with diabetes mellitus in Indonesia. Elderly individuals who did not engage in moderate or vigorous physical activity had a considerably higher prevalence of depression than those who were physically active. Based on the analysis of data from the 2023 Indonesian Health Survey, 6.3% of older adults who did not perform vigorous physical activity experienced depression, while only 0.5% of those who did were affected. Similarly, among those who did not engage in moderate activity, the prevalence of depression was 4.3%, compared with 2.4% among those who were moderately active. These findings confirm the important role of physical activity in protecting mental health, particularly in older adults with chronic conditions such as diabetes (Wang et al., 2017). Physical activity contributes to mental well-being by reducing stress, improving blood circulation, and stimulating the production of endorphins natural mood enhancers. It also promotes better sleep, increases self-confidence, and encourages social interactions. For elderly individuals, these benefits can significantly reduce feelings of isolation, helplessness, and anxiety, which are common triggers of depressive

symptoms (Mahindru et al., 2023b; Schuch et al., 2018). In addition to physical activity, several sociodemographic factors were also found to be significantly associated with depression in elderly individuals with diabetes. Age was one such factor, with those aged 60–69 showing the highest prevalence of depression compared to older age groups (Zenebe et al., 2021). This may be explained by the transition into old age, which often involves retirement, the emergence of chronic illnesses, and changes in family or social roles. In contrast, older individuals may have better psychological resilience or coping strategies owing to their life experiences. Gender was also significantly related to depression, with women experiencing higher rates than men. This could be influenced by a variety of factors, including caregiving burdens, higher rates of widowhood, and biological changes that can affect emotional stability (Dang et al., 2022). Marital status played a protective role against depression. Elderly individuals who were married had lower rates of depression compared to those who were single or divorced (Bulloch et al., 2017). A partner can serve as a key source of emotional and social support, which is essential in coping with both aging and chronic illness. Education level was another factor related to depression (Shin & Park, 2022). Older adults with only primary

education experienced the highest rates of depression compared to those with secondary or higher education (Li et al., 2022). Lower educational attainment may limit access to health information, reduce the ability to manage stress, and restrict health-related decision-making. Employment status was also linked to depression (Suiter & Meadows, 2023). Unemployed elderly individuals showed higher rates of depression than those who were still working or were involved in meaningful activities. Being active through work or social engagement helps maintain a structured routine, sense of purpose, and social connections, all of which are critical to mental health (Runge et al., 2020). Place of residence was another significant factor. Elderly individuals living in urban areas had higher rates of depression than those in rural areas (Muhammad, 2023). Urban environments, although often offering better healthcare access, may expose individuals to higher levels of stress, social isolation, and a faster-paced lifestyle, all of which can contribute to mental health issues. Interestingly, the study found no significant association between the type of diabetes mellitus (type 1 or type 2) and depression (Cacciatore et al., 2025; Preston & Biddell, 2021). This suggests that the psychological burden experienced by elderly individuals with diabetes is influenced more by social, behavioral, and

emotional factors than by the medical classification of the disease (Daniel, 2025). In conclusion, this study highlights the importance of physical activity as a preventive measure against depression in elderly individuals with diabetes (Amin et al., 2025). The findings also emphasize the impact of broader social and demographic factors such as age, gender, marital status, education, employment, and place of residence on mental health. Effective health interventions should not only encourage regular physical activity but also address the specific needs of high-risk groups, such as the unemployed, socially isolated, and urban-dwelling older adults. Community-based, holistic programs that integrate both physical and mental health components are essential to improving the quality of life for older adults with diabetes in Indonesia (Nutakor et al., 2023). Limitations: Despite its valuable contributions, this study is not without limitations. First, the quasi-experimental design lacks a control group, limiting causal inferences. Second, although adequately powered, the sample size may not be representative of the broader population of older adults with T2DM. Third, the study was conducted at a single institution in Egypt, which may limit its generalizability to other cultural or healthcare settings. Finally, self-reported data on anxiety and depression, although based on validated scales, may be subject to

response biases. Implications: This study highlights the critical role of structured physical activity programs in managing both physical and psychological complications associated with T2DM in older adults. Health practitioners, particularly gerontological nurses and physiotherapists, should advocate regular exercise as an essential component of diabetes management. Tailored interventions that consider individual preferences, comorbidities, and socioeconomic factors may enhance participation and adherence. Public health policies should also incorporate exercise promotion in community health programs targeting the elderly population.

The results of this study indicate that physical activity is significantly associated with depression status in older adults with diabetes mellitus. Elderly individuals who engage in neither vigorous nor moderate physical activity tend to have a higher proportion of depression than those who are active (Meawad Elsayed et al., 2023). This finding aligns with previous research reporting that physical activity engagement is associated with better psychological well-being in both older adults and populations with chronic diseases. Possible mechanisms explaining this association include improved neurotransmitter regulation, improved sleep quality, and increased social

engagement that accompanies physical activity, although this study was not designed to directly assess these mechanisms (De Sousa et al., 2021).

In addition to physical activity, several sociodemographic variables also showed significant associations with depression. Gender emerged as an important factor, with women showing a higher proportion of depression. This is consistent with literature suggesting that older women are more vulnerable to psychological distress due to role burdens and social changes experienced during the aging process. Education was also significantly associated with depression, with respondents with lower levels of education having a higher prevalence of depression. Higher levels of education may contribute to access to health information, the ability to cope with stress, and access to social support (Zhao et al., 2024).

Marital and employment status were also found to be associated with depression. Older adults who are unmarried or unemployed show a higher prevalence of depression. Social support from a spouse or work environment can play a role in maintaining psychological well-being, so the lack of such support may be associated with higher rates of depression in certain groups. Furthermore, residence showed a significant association, with older adults in urban areas having a higher proportion of

depression than those living in rural areas. Environmental factors such as population density, social pressure, and isolation may contribute to this condition, as has also been shown in other studies (Kim et al., 2023).

Interestingly, this study found no significant association between diabetes type (type 1 or type 2) and depression. This suggests that social and behavioral factors may play a greater role than the clinical classification of diabetes itself in influencing the psychological well-being of older adults. However, this interpretation requires caution because the survey data did not capture diabetes severity, disease duration, or complications that may contribute to psychological burden (Farooqi et al., 2022).

The findings of this study have important implications for promotive and preventive efforts in elderly healthcare. Although the cross-sectional design does not allow for determining the direction of the relationship, these results underscore the importance of physical activity as a factor potentially associated with mental well-being in older adults with diabetes. Community-based interventions that encourage regular physical activity can be a strategic component of older adult health programs. However, longitudinal research is needed to understand the temporal relationships between physical activity, sociodemographic factors, and depression.

## CONCLUSION

Depression is common among older Indonesians with diabetes (6.8%). Physical activity showed a clear protective association: no vigorous or moderate activity was linked to higher depression (6.3% and 4.3%) versus active peers (0.5% and 2.4%, respectively). Depression was also more frequent in women, those who were unmarried, those with lower education, those who were unemployed, and urban residents, while diabetes type was not associated with depression. Programs for older adults with diabetes should prioritize tailored physical activity promotion alongside psychosocial support that addresses these sociodemographic vulnerabilities.

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## DATA AVAILABILITY STATEMENT

The dataset utilized in this research can be accessed by requesting it from the Ministry of Health of the Republic of Indonesia through this link: <https://www.badankebijakan.kemkes.go.id/data-mikro-ski/>

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