ORIGINAL ARTICLE

The Association of Physical Activity Against Depression Among Universiti Putra Malaysia Undergraduate Medical Students-A Cross Sectional Study

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ABSTRACT

Introduction: The crossroads of mental health and academia particularly in higher education have drawn considerable attention. Research explores how physical activity impacts depression among medical students in higher education where mental health challenges are prevalent due to academic stress. **Materials and methods:** In an observational cross-sectional study, 251 undergraduate medical students participated by completing questionnaires assessing physical activity and depressive symptoms. The study utilized the International Physical Activity Questionnaire-Long Form and Centre for Epidemiologic Studies Depression Scale. **Results:** In a study of 251 medical students split into pre-clinical and clinical groups, the latter were older (23.2 vs 20.3 years) and generally had lower physical activity levels, especially in transport, domestic and leisure activities. Pre-clinical students showed higher overall activity. Depression levels differed significantly between groups with clinical student scoring higher (20.2 vs 18.7). Relationships were noted between depression and physical activity, particularly in transport-related activities, walking and total physical activity-higher activity linked to lower depression. However, no significant correlation was found for moderate or vigorous physical activity levels. **Conclusion:** Study suggest promoting activities like walking and transportation to mitigate depression among medical students, offering strategies to enhance the mental well-being of future healthcare professionals.
Malaysian Journal of Medicine and Health Sciences (2024) 20(5): 226-236. doi:10.47836/mjmhs20.5.29

Keywords: Medical students, Depression, Physical activity, Level of intensity, Cross-sectional

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INTRODUCTION

In recent years, the crossroads between mental health and academia has reaped noteworthy attention, especially within the realm of higher education [1]. Medical students, within diverse cohorts, stand out as a unique group. Their challenging academic journey exposes them to numerous factors, leading to a notably higher depression rate, about one-third more prevalent than the general population [2, 3]. This prevalence is notably higher in Asia [4] and among female students due to the stressful environment [3, 5]. Depression is a multifaceted mental health state marked by enduring sadness, reduced interest or pleasure and various cognitive and physical symptoms [6]. About 4.4% of the population is living with depression globally [7]. The World Health Organization projected that by 2020, depression would rank second to heart diseases as a prevalent global health issue [8].

It's widely recognized that the occurrence of depression among medical students is more prevalent compared to both the general population and peers of similar age [5, 9]. The frequency of depression amongst medical students ranges from 6.1 to 38.2% [2, 10-11]. Amidst these challenges, mental health trepidations especially depression have arose as pressing issues with implications for both the individual's well-being and their academic competence [12]. Depression significantly hampers academic and professional success, causing issues like poor academic performance, substance abuse and even suicidal thoughts [7, 13]. There are various factors that can contribute to the deterioration of the state of their mental health such as workload, sleep deprivation, academic pressure, financial concerns, exposure to patient's suffering and death [14, 15].

The relationship between physical activity (physical activity refers to any bodily movement that elevates energy expenditure beyond resting levels) [16] and depression have been a subject of growing interest as it holds promise of a non-pharmacological intervention to alleviate mental health challenges. Regular physical activity has the capability to diminish the

intensity of depressive states, subsequently leading to a multitude of positive effects [8]. If a causal relationship were established, adhering to current health recommendations for physical activity could potentially prevent approximately 1 in 9 cases of depression within the population [17]. Elevated physical activity levels have shown a correlation with reduced symptoms of depression. However, the majority of medical students fail to meet the recommended physical activity guidelines [18], dedicating approximately 7-8 hours daily to sedentary activities (sedentary behavior is describes as any waking activity where energy expenditure remains at or below 1.5 metabolic equivalents while in a seated, reclines or lying position) [16].

Recent studies suggest that lifestyle choices, like the lack of physical activity could be pivotal areas to focus on when devising strategies to prevent depression. This research aims to shed light on how physical activity correlates with preventing depression. This research aims to highlight the significance of exercise within the community, emphasizing its role not just in enhancing health outcomes, supporting the mental well-being of future healthcare professionals but also as a complement to prevent depression. The findings will directly link exercise to an enhanced quality of life. The lack of comprehensive research addressing the level of physical activity on depression among medical students leaves a critical gap in understanding the risk of depression in this population.

This study aims to explore two key aspects among undergraduate medical students at Universiti Putra Malaysia. Firstly, it seeks to establish the correlation between overall physical activity and depression. Secondly, it intends to investigate how varying levels of physical activity intensity are associated with depression. By delving into these facets, this research endeavors to shed light on the nuanced relationship between physical activity and depression within this specific demographic.

MATERIALS AND METHODS

An observational cross-sectional study design was used to examine the association between physical activity against depression among medical students from a Malaysian public university. The sample size was determined using a 2-proportion calculation, accounting for a 30% dropout rate in an email survey using the university database. Questionnaires were distributed to Year 1 to Year 5 students from May 9th to June 22nd, 2023, accompanied by information sheets and consent forms. Inclusion and exclusion criteria were specified in the email. A total of 251 medical students were recruited with a favorable response rate and no missing values.

Inclusion criteria

The study includes registered undergraduate medical students from Year 1 to Year 5 who consented to participate.

Exclusion criteria

Students with physical conditions preventing movement or independent walking as well as those who withdrew consent are excluded from the study.

The study employed a self-made questionnaire capturing socio-demographic details, assessed physical activity using International Physical Activity Questionnaire-Long Form (IPAQ-LF) and measured depressive symptoms using Centre for Epidemiologic Studies Depression Scale (CESD). Permission for this research was granted by the Ethics Committee for Research Involving Human Subjects at Universiti Putra Malaysia, with the reference number JKEUPM-2023-067.

International Physical Activity Questionnaire- Long Form (IPAQ-LF)

IPAQ was designed for adults ages 18-65 and is a widely used self-reported tool assessing physical activity levels over the past 7 days [19]. IPAQ-LF comprehensively assesses daily activities, measuring time spent on walking, moderate and vigorous activities across work, transportation, household chores, gardening, and leisure pursuits [20]. The cleaned questionnaire data were grouped by different physical activity domains to calculate total time spent in occupational, transport, household, and leisure activities. This was used to assess weekly physical activity, considering metabolic equivalent task (MET) levels for each activity category. METs were assigned based on standardized guidelines with moderate activities between 3-6 METs and vigorous activities above 6 METs. Calculations involved duration, frequency per week and MET intensity [21]. Physical activities lasting at least 10 minutes were considered. Using the IPAQ scoring, activities were categorized into low, moderate (600 MET-min/week) and high (3000 MET-min/week) distinctions [22]. The IPAQ's measurement settings demonstrated comparable reliability and validity to established self-report physical activity tools. Typically, IPAQ shows reliability correlations of 0.80 and validity correlations of 0.30 [19, 23].

Centre for Epidemiologic Studies Depression Scale (CESD)

The Center for Epidemiological Studies Depression Scale, created by Radloff in 1977, comprises 20 self-reported items scoring from 0 to 60. It gauges the presence and severity of depressive symptoms across various populations, with higher scores indicating increased propensity for such symptoms. Widely used in epidemiological and clinical settings, this scale evaluates feelings and behaviors over 7 days using a four-point scale from 0 (rarely or none) to 3 (most or all of the time) [24]. Four of the 20 items in the scale are positively worded and scored inversely. A total score of 16 or higher indicates subthreshold depression [25]. CES-D is shown to have high internal consistency with a

Cronbach's alpha of 0.85-0.90 [24, 26].

Statistical analyses

IBM SPSS Statistics version 29 was used for data analysis to explore sociodemographic characteristics of medical students from Year 1 to Year 5 at Universiti Putra Malaysia. The findings were illustrated by displaying means and standard deviations for continuous variables and percentages for categorical variables, with a significance level determined at $p<0.05$. The study used chi-square and t-test to compare socio-demographic variables between pre-clinical and clinical groups. Linear regression analyzed associations between socio-demographic and depression, with significant factors further explored in a multiple regression model. ANOVA checked differences in physical activity and depression levels; intensity of physical activity was also linked to depression. Post-hoc Tukey HSD tests followed significant ANOVA results, controlling for multiple comparisons.

RESULTS

Table I shows the socio-demographic distribution of the participants that are divided into preclinical and clinical groups, consisting of 251 medical students. The pre-clinical constituted of 50.6% (127 individuals) while the clinical group comprised of 49.4% (124 individuals). The table outlines participants characteristics. Clinical participants are older (23.2 years vs 20.3 years pre-clinical) and more likely to have a BMI less than 25 kg/m2 (66.9% vs 82.7%). Females dominate both groups, slightly more in pre-clinical (75.6%) than clinical (62.9%). Bumiputera showed more predominance in the pre-clinical group (62.2%) as compared to clinical being 58.9%. Few reports smoking or alcohol use, slightly more in the clinical group. Mental illness rates are low but slightly higher in the clinical group (7.3% vs 1.6%).

Table I: Characteristics of participants.

Socio demographic	Pre-clinical N= 127 (50.6%)	Clinical N= 124 (49.4%)	Total N= 251 (100.0%)
Age			
Mean ± SD	20.3 ± 0.6	23.2 ± 1.0	21.7 ± 1.7
BMI			
≤ 25 kg/m²	105 (82.7%)	83 (66.9%)	188 (74.9%)
> 25 kg/m²	22 (17.3%)	41 (33.1%)	63 (25.1%)
Gender			
Male	31 (24.4%)	46 (37.1%)	77 (30.7%)
Female	96 (75.6%)	78 (62.9%)	174 (69.3%)
Ethnic			
Bumiputera	79 (62.2%)	73 (58.9%)	152 (60.6%)
Non-bumiputra	48 (37.8%)	51 (41.1%)	99 (39.4%)
Marital status			
Single	126 (99.2%)	119 (96.0%)	245 (97.6%)
Married	1 (0.8%)	5 (4.0%)	6 (2.4%)
Religions			
Muslim	80 (63.0%)	72 (58.1%)	152 (60.6%)
Buddhist	17 (13.4%)	22 (17.7%)	39 (15.5%)
Hindu	25 (19.7%)	17 (3.7%)	42 (16.7%)
Christian	5 (3.9%)	12 (9.7%)	17 (6.8%)
Others		1 (0.8%)	1 (0.4%)
Smoking cigarettes			
No	127 (100.0%)	121 (97.6%)	248 (98.8%)
Yes		3 (2.4%)	3 (1.2%)
Alcohol consumption			
No	127 (100.0%)	116 (93.5%)	243 (96.8%)
Yes		8 (6.5%)	8 (3.2%)
Mental illness			
No	125 (98.4%)	115 (92.7%)	240 (95.6%)
Yes	2 (1.6%)	9 (7.3%)	11 (4.4%)

Table II compares depression levels between pre-clinical and clinical group. On average, the clinical group scored slightly higher in depression (20.2) than the pre-clinical group (18.7).

Table II: Mental health status of participants (depression).

	Pre-clinical (n=127)	Clinical (n= 124)	Total (n= 251)
Depression	18.7 ± 9.7	20.2 ± 13.1	19.5 ± 11.5

Table III shows physical activity levels between pre-clinical group and clinical group across various categories. In most categories, the clinical group showed lower mean activity in transport (968.4 vs 1299.7), domestic and garden (554.3 vs 1334.8) and leisure time (902.5 vs 2097.8). However, the mean activity for work were slightly lower for work in both pre-clinical and clinical group (34.0 vs 91.1). It is further divided into level of intensity of physical activity across the domains. Across all areas, most participants, around 97% exhibited low activity in work. In transport, more clinical participants (60.5%) had low activity compared to clinical (39.4%). Similarly, higher percentages of clinical participants showed low activity in domestic task and leisure compared to pre-clinical. Fewer participants in both groups engaged in moderate or high activity levels.

Table III: Physical activity levels of participants.

	Pre-clinical (n=127)	Clinical (n= 124)	Total (n= 251)
Work (MET-minute/week)	34.0 ± 227.8	91.1±566.0	62.2 ± 429.6
Low	124 (97.6%)	120 (96.8%)	244 (97.2%)
Moderate	3 (2.4%)	2 (1.6%)	5 (2.0%)
High	0 (0)	2 (1.6%)	2 (0.8%)

CONTINUE

Table III: Physical activity levels of participants. (CONT.)

	Pre-clinical (n=127)	Clinical (n= 124)	Total (n= 251)
Transport (MET-minute/week)	1299.7±1422.7	968.4±1141.4	1136.0 ± 1299.5
Low	50 (39.4%)	75 (60.5%)	125 (49.8%)
Moderate	63 (49.6%)	40 (32.3%)	103 (41.0%)
High	14 (11.0%)	9 (7.3%)	23 (9.2%)
Domestic and garden (MET-minute/week)	1334.8 ± 1776.9	554.3 ± 1164.3	949.2 ± 1552.8
Low	68 (53.5%)	94 (75.8%)	162 (64.5%)
Moderate	55 (43.3%)	29 (23.4%)	84 (33.5%)
High	4 (3.1%)	1 (0.8%)	5 (2.0%)
Leisure time (MET-minute/week)	2097.8±2678.5	902.5±1516.2	1507.3 ± 2259.6
Low	56 (44.1%)	86 (69.4%)	142 (56.6%)
Moderate	39 (30.7%)	25 (20.2%)	64 (25.5%)
High	32 (25.2%)	13 (10.5%)	45 (17.9%)

Table IV compares level of intensity of physical activity of participants in which across walking, moderate, vigorous, and total overall activity, the pre-clinical group showed higher mean compared to the clinical group. In walking and moderate categories, more pre-clinical participants showed higher activity levels while more clinical participants exhibited low activity. Across all categories, the pre-clinical group generally displayed higher levels of moderate to high activity compared to the clinical groups.

Table IV: Level of intensity of physical activity of participants.

	Pre-clinical (n=127)	Clinical (n= 124)	Total (n= 251)
Walking (MET-minute/week)	1678.6 ± 1616.9	1309.9 ± 1449.1	1496.5 ± 1544.3
Low	37 (29.1%)	57 (46.0%)	94 (37.5%)
Moderate	66 (52.0%)	51 (41.1%)	117 (46.6%)
High	24 (18.9%)	16 (12.9%)	40 (15.9%)
Moderate (MET-minute/week)	1790.6 ± 2259.4	704.9 ± 1216.7	1254.2 ± 1896.6
Low	58 (45.7%)	81 (65.3%)	139 (55.4%)
Moderate	42 (33.1%)	38 (30.6%)	80 (31.9%)
High	27 (21.3%)	5 (4.0%)	32 (12.7%)
Vigorous (MET-minute/week)	1302.4 ± 2245.6	488.1 ± 1118.0	900.1 ± 1822.9
Low	83 (65.4%)	99 (79.8%)	182 (72.5%)
Moderate	34 (26.8%)	25 (20.2%)	59 (23.5%)
High	10 (7.9%)	0(0)	10 (4.0%)

CONTINUE

Table IV: Level of intensity of physical activity of participants. (CONT.)

	Pre-clinical (n=127)	Clinical (n= 124)	Total (n= 251)
Physical activity (MET-minute/week)	4902.9 ± 4415.8	2516.1 ± 2581.6	3723.8 ± 3812.6
Low	7 (5.5%)	29 (23.4%)	36 (14.3%)
Moderate	51 (40.2%)	54 (43.5%)	105 (41.8%)
High	69 (54.3%)	41 (33.1%)	110 (43.8%)

Low: Less than 600 MET-minute/week.
Moderate: At least 600 MET-minute/week but less than 3000 MET-minute/week.
High: 3000 MET-minute/week or more

Based on the results in Table V, age (p= <0.001), BMI (p= 0.004), gender (p= 0.029), alcohol intake (p= 0.004) and mental illness (p= 0.028) shows significant difference between pre-clinical and clinical groups. However, ethnicity, marital status, religion, and smoking cigarettes did not exhibit significant differences. Linear regression was subsequently done to determine the association in which the results shows that gender and ethnicity exhibit statistically significant associations with depression. Beta coefficient of 4.550 suggest that females tend to have higher levels of depression compared to males whereas the beta coefficient of -3.085 indicated that Bumiputera students tends to have a higher level of depression. Significant factors (gender and ethnic) identified in the initial linear regression analysis were subsequently included in a multiple linear regression model to further examine their combined impact on depression. Based on multiple linear regression results, both factors also show a significant difference with depression with result p value 0.003 and 0.007 respectively.

Table V: Association between socio-demographic factors and depression among undergraduate medical students in Universiti Putra Malaysia (by year of study).

Socio demographic	Pre-clinical N= 127 (50.6%)	Clinical N= 124 (49.4%)	p-value; decision
Age			
Mean ± SD	20.3 ± 0.6	23.2 ± 1.0	< 0.001*
BMI			
≤ 25 kg/m^2	105 (82.7%)	83 (66.9%)	0.004*
> 25 kg/m^2	22 (17.3%)	41 (33.1%)	
Gender			
Male	31 (24.4%)	46 (37.1%)	0.029*
Female	96 (75.6%)	78 (62.9%)	
Ethnic			
Bumiputera	79 (62.2%)	73 (58.9%)	0.589
Non-bumiputra	48 (37.8%)	51 (41.1%)	
Marital status			
Single	126 (99.2%)	119 (96.0%)	0.092
Married	1 (0.8%)	5 (4.0%)	

CONTINUE

Table V: Association between socio-demographic factors and depression among undergraduate medical students in Universiti Putra Malaysia (by year of study). (CONT.)

Socio demographic	Pre-clinical N= 127 (50.6%)	Clinical N= 124 (49.4%)	p-value; decision
Religions			
Muslim	80 (63.0%)	72 (58.1%)	
Buddhist	17 (13.4%)	22 (17.7%)	0.169
Hindu	25 (19.7%)	17 (3.7%)	
Christian	5 (3.9%)	12 (9.7%)	
Others		1 (0.8%)	
Smoking cigarettes			
No	127 (100.0%)	121 (97.6%)	0.078
Yes		3 (2.4%)	
Alcohol consumption			
No		116 (93.5%)	0.004*
Yes	127 (100.0%)	8 (6.5%)	
Mental illness			
No	2 (1.6%)	9 (7.3%)	0.028*
Yes	125 (98.4%)	115 (92.7%)	

*. Correlation is significant at the 0.05 level (2-tailed).

In Table VI, a one-way ANOVA analysis demonstrated a notable variance in average transport between at least two groups, indicating statistical significance (F (2, 248) = [5.951], p = 0.003). Tukey's Honest Significant Difference (HSD) Test for multiple comparisons detected a significant distinction in the mean transport values between the low and moderate levels (p = 0.006, 95% C.I. for the difference in means = [1.10, 8.19]) also between moderate and high level (p = 0.041, 95% C.I. for the difference in means = [-12.48, -0.20]). However, there was no statistically significant difference in mean transport between low and high level (p = 0.786, 95% C.I. for the difference in means = [-4.35, 7.74]).

Table VI: Association between physical activity and depression among undergraduate medical students in Universiti Putra Malaysia.

Physical Activity	Sum of Squares	df	Mean squares	F statistics	P value	Post Hoc Comparison (for transport)
Work	Between groups: 301.458	2	150.729	1.138	0.322	-
	Within groups: 32855.004	248	132.480			
	Total: 33156.462	250				

CONTINUE

Table VI: Association between physical activity and depression among undergraduate medical students in Universiti Putra Malaysia. (CONT.)

Physical Activity	Sum of Squares	df	Mean squares	F statistics	P value	Post Hoc Comparison (for transport)
Transport	Between groups: 1518.264	2	759.132	5.951	0.003*	Low-Moderate: 4.643 (0.006*) Low-High: -1.697 (0.786) Moderate-Low: -4.643 (0.006*) Moderate-High: -6.340 (0.041*) High-Low: 1.697 (0.786) High-Moderate: 6.340 (0.041*)
	Within groups: 31638.198	248	127.573			
	Total: 33156.462	250				
Domestic and Garden	Between groups: 23.623	2	11.811	0.088	0.915	-
	Within groups: 33132.839	248	133.600			
	Total: 33156.462	250				
Leisure time	Between groups: 549.381	2	274.690	2.089	0.126	-
	Within groups: 32607.081	248	131.480			
	Total: 33156.462	250				

*. Correlation is significant at the 0.05 level (2-tailed).

A one-way ANOVA in Table VII, revealed that there was a statistically significant difference in mean walking between at least two groups (F(2, 248) = [6.904], p = 0.001). Also, there was a statistically significant difference in mean for total physical activity between at least two groups (F(2, 248) = [6.187], p = 0.002).

Tukey's HSD Test for multiple comparisons found that the mean value of walking was significantly different between low and moderate level (p = 0.001, 95% C.I. for the difference in means = [2.06, 9.41]). However, there was no statistically significant difference in mean walking between low and high level (p = 0.558, 95% C.I. for the difference in means = [-2.82, 7.20]) and also between moderate and high (p = 0.199, 95% C.I. for the difference in means = [-8.41, 1.31]). Similarly, Tukey's HSD Test for multiple comparisons found that the mean value of total physical activity was significantly different between low and moderate level (p = 0.002, 95% C.I. for the difference in means = [2.48, 12.76]) and also between low and high level (p = 0.012, 95% C.I. for the difference in means = [1.13, 11.35]). However, there was no statistically significant difference in mean total physical activity between moderate and high level (p = 0.646, 95% C.I. for the difference in means = [-5.00, 2.26]).

Table VII: Association between level of intensity of physical activity and depression among undergraduate medical students in Universiti Putra Malaysia.

Level of intensity	Sum of Squares	df	Mean Squares	F statistics	P value	Post Hoc Comparison
Walking	Between groups: 1748.761	2	874.380	6.904	0.001*	Low - Moderate: 5.737 (0.001*) Low - High: 2.189 (0.558) Moderate - Low: -5.737 (0.001*) Moderate - High: -3.548 (0.199) High - Low: -2.189 (0.558) High - Moderate: 3.548 (0.199)
	Within groups: 31407.701	248	126.644			
	Total: 33156.462	250				
Moderate	Between groups: 179.187	2	89.593	0.674	0.511	-
	Within groups: 32977.275	248	132.973			
	Total: 33156.462	250				
Vigorous	Between groups: 230.974	2	115.487	0.870	0.420	-
	Within groups: 32925.489	248	132.764			
	Total: 33156.462	250				
Total physical activity	Between groups: 1575.720	2	748.860	6.187	0.002*	Low - Moderate: 7.617 (0.002*) Low - High: 6.243 (0.012*) Moderate - Low: -7.617 (0.002*) Moderate - High: -1.374 (0.646) High - Low: -6.243 (0.012*) High - Moderate: 1.374 (0.646)
	Within groups: 31580.743	248	127.342			
	Total: 33156.462	250				

*. Correlation is significant at the 0.05 level (2-tailed).

Kendall's tau analysis examined the correlation between physical activity and depression. Results showed varying correlations, notably a significant negative link between depression and transportation activities, suggesting more of these activities relates to lower depression. Additionally, intensity level analysis revealed a significant negative correlation between depression and walking, as well as total physical activity, indicating more walking and overall activity relate to reduced depression. However, no significant correlations were found for moderate or vigorous physical activity levels.

DISCUSSION

The study aimed to unravel the intricate association between physical activity and depression among medical students, recognizing the heightened prevalence of depression within this academic cohort [7]. The results unearthed noteworthy correlations and variations between physical activity levels, intensity, and depressive symptoms, shedding light on potential intervention strategies to address mental health challenges among future healthcare professionals.

The study identified several socio-demographic factors associated with depression among medical students. Significant differences were observed in age, BMI, gender, alcohol intake and mental illness between pre-clinical and clinical groups. These findings are consistent with another study by Suraj et al. that highlighted similar socio-demographic factors as significant contributors [27]. The subsequent liner regression analysis highlighted gender and ethnicity as statistically significant factors associated with depression mirroring findings from other study by Minhat et al. that also indicated a significant association between depression onset and being female or of Malay ethnicity [28]. Women is found to experience higher rates of depression earlier in life compared to men, contributing in part to the higher prevalence of depression among adult females [27, 29]. However, the significance may be attributed to the higher participation from Bumiputera medical student and females in this study, leading to a notable correlation between these socio-demographic factors and depression.

The findings from this research underscore a meaningful association between physical activity and the prevalence of depression among medical students, consistent with previous studies which indicated that increased physical activity is linked to a reduced likelihood of experiencing depression in the future [30-33]. Additionally, a study by Schuch et al. highlights a notable correlation linking sedentary behavior to an increased incidence of depression [30], particularly evident within the clinical groups exhibiting a more sedentary lifestyle. Remarkably, the pre-clinical group demonstrated substantially higher levels of physical activity compared to their clinical counterparts. Furthermore, the clinical group exhibited higher depression scores compared to the pre-clinical cohort, further emphasizing disparity. Despite this, both the pre-clinical and clinical groups scored above the threshold considered clinically relevant for depression (≥16, CES-D scale) [34]. The heightened risk of depression among the clinical group in this study aligns with findings from another study in Nigeria by Suraj et al., which revealed higher rates of depression among medical students during their clinical years [27]. The sedentary lifestyle observed among clinical students may stem from their demanding schedules, comprising of long study hours and hospital duties, leaving limited time for physical activity. The high stress levels associated with clinical studies, coupled with responsibilities in patient care, might prioritize academics over exercise.

Significantly, involvement in transportation related activities such as cycling and walking as stated in the questionnaire showed a negative association with depression, suggesting that students who engaged more in these activities experienced lower levels of depressive symptom. Achieving an activity threshold equivalent to 2.5 hours of brisk walking weekly showed a correlation with a 25% decrease in the likelihood of experiencing depression. Even at half that amount, the risk was lowered by 18% compared to individuals engaging in no activity [16]. Given that medical students predominantly commute via walking or cycling, these activities may contribute to reduced depressive symptoms. Additionally, Guo et al.'s research in China emphasized a notable inverse relationship between higher overall physical activity and increased low-intensity physical activity. This connection suggested a reduced occurrence of depressive symptoms among individuals engaging in higher levels of total physical activity [35]. This implies that an increased in physical activity, particularly walking and cycling could potentially act as a protective factor against depressive symptoms among medical students. Evidence from a study indicated that individuals who use cycling as a mode of transportation reported decreased psychological distress and increased life satisfaction. The act of cycling potentially influences mental well-being by allowing cyclists to engage closely with nature and the external environment. This interaction might positively impact mood, providing a refreshing break from stress and fatigue [36].

Recreational activity typically shows a positive link to improved mood in depression. While any form of recreational physical activity is generally recommended for mental health benefits [33], this analysis did not find a substantial association between leisure driven physical activity and mood improvements in its results. The absence of notable association concerning work related, domestic and leisure driven physical activities among the surveyed medical students might be attributed to various underlying circumstances. Primarily, these students, engrossed in full time medical studies, prioritize their academic pursuits and clinical responsibilities, leaving minimal time for extensive engagement in work related

physical activities. Moreover, the majority of these students reside within the confines of the campus, limiting opportunities for domestic chores or gardening related tasks due to the restricted living environment. This lack of physical space and time allocation could hinder their involvement in such activities potentially impacting the observed correlations. Similarly, the insignificance observed in the relationship with leisure activities might stem from the wide array of leisure pursuits available to these medical students, spanning from passive forms of entertainment to more actively engaging hobbies. The diverse nature of these leisure activities and individual preferences in engagement might dilute any discernible correlation with depressive symptoms due to the subjective and varied nature of their participation.

All levels of physical activity intensity are effective, yet moderate to high intensities tend to yield greater efficacy compared to low-intensity activities [31]. Numerous studies support the reverse connection between higher physical activity levels and depressive symptoms. This study stands out by uniquely showcasing that even low-intensity activities, such as walking, can provide protective effects against depression. This finding aligns with previous research indicating that low intensity activity correlates with reduced risk of depression [31, 35, 37-38].

Motl et al. found that low-intensity exercise effectively alleviates depressive symptoms in sedentary older adults [39]. This finding elucidates why a significant portion of medical students in this university experiences improvement through low-intensity activity, given their predominantly sedentary lifestyles. Considering the duration and frequency of physical activity in this study in assessment of activity intensity enhances the objectivity and comprehensiveness [35] of this evaluation. This discrepancy in results between this study and others can be attributed to the nuanced approach in assessing physical activity intensity. The lack of significant findings in this study regarding moderate and vigorous activity levels concerning depressive symptoms mirrors a study carried out by Dillon et al. [40] among surveyed medical students. This similarity in outcomes might be attributed to various underlying factors. Medical students might engage in burst of intense activities intermittently rather than sustaining a consistent level of moderate or vigorous activity, making it challenging to capture these fluctuations accurately through self- reported assessment. Furthermore, the demanding nature of their academic curriculum and clinical rotations could result in time constraint, potentially limiting opportunities for sustained moderate or vigorous physical activities. Low-intensity activity appeared to be widespread among medical students, likely due to its association with daily functional and social routines [41]. Within this sample, low intensity walking activities encompassed actions like strolling from dorms to lecture halls or walking to catch a bus.

This study primary focuses on exploring the relationship between physical activity and depression; however, it's important to acknowledge that there are additional lifestyle factors that can influence depression. Roldбn et.al's study underscores the significance of implementing lifestyle interventions to promote enduring healthy habits. Their research emphasizes the importance of adhering to lifestyle interventions for effective depression management. Maintaining healthy sleep patterns and cultivating supportive relationships are highlighted as protective factors against depression [42].

Furthermore, Ghali et.al's study illustrated the positive impact of adopting a healthy lifestyle, including habits such as consuming nutritious food, refraining from smoking, avoiding alcohol and other illicit substances. Their findings also suggested that individuals who engage in regular physical activity and practice effective stress management tend to experience better mental health outcomes [43].

These conclusions align with those of another study by Sarris et.al, which includes a narrative examination of evidence-backed strategies like engaging in physical activity or exercise, making dietary adjustments, ensuring sufficient relaxation and sleep, fostering social interaction, practicing mindfulness meditation techniques and minimizing the use of recreational substances like nicotine, drugs and alcohol [44].

The study's findings hold significant implications for mental health interventions among medical students. Implementing targeted programs promoting increased physical activity, particularly in transportation and walking, might serve as a potential strategy to mitigate depression. Furthermore, future research should delve deeper into the causal relationship between physical activity and depression, considering longitudinal studies or intervention-based research to gauge the effectiveness of physical activity interventions in preventing or reducing depression among medical students.

Limitations

The study encountered several limitations. Firstly, the sample was exclusively drawn from a single public medical university, failing to encompass the diverse sociodemographic profiles of medical students in Malaysia across private and government sectors. Moreover, the crosssectional study design prohibits establishing causation; instead, it solely examines association between variables. Additionally, the sampling method's potential for unequal representation might result in certain groups being overrepresented or underrepresented due to chance, thereby affecting the uniform distribution of population characteristic and the representativeness of the sample. Furthermore, the

measurement tools also pose potential limitations. Primarily, the self-rated nature of the questionnaire introduces the likelihood of inherent bias. Secondly, gauging the intensity of physical activities can be challenging since individuals might misinterpret activity levels. Compounded by the fact that the surveyed population comprises students, not the working adults as ideally required by the questionnaire's activity spectrum, this adds further complexity to the assessment. Moreover, the inclusion of participants with mental health issues may significantly influence their level of physical activity or their experience of depression, potentially confounding the results. This could pose challenges in isolating the precise relationship between physical activity and depression. Another limitation of this study is related to the timing and method of data collection. Although efforts were made to ensure consistency in the data collection process, the questionnaire were not filled out simultaneously; however, students completed them within one setting. Medical students, being a unique population, undergo continuous examinations and may experience varying levels of depression due to factors such as academic stress, personal circumstances, and the timing of assignments. Therefore, different cohorts of students could indeed exhibit differing levels of depression depending on these contextual factors. This variability could potentially introduce confounding variables and limit the generalizability of the findings.

CONCLUSION

In conclusion, this study underscores the significance of physical activity in potentially mitigating depression among medical students. The findings suggest a promising avenue for preventive interventions targeting increased physical activity, particularly walking and transport related activities, to bolster the mental health and well-being of future healthcare professionals.

ACKNOWLEDGEMENT

The authors extend their gratitude to the Department of Psychiatry at Universiti Putra Malaysia for their support, as well as to the medical students who willingly participated in this study.

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