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Correlation between handgrip strength and depressive symptoms in medical students

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Abstract

Medical students are at higher risk of stress. This puts medical students vulnerable to depression and higher cortisol levels. Cortisol is suggested to reduce muscle mass, which decreases muscle mass and low hand grip strength. This study aims to investigate the correlation between hand grip strength and symptoms of depression among medical students. This is a cross-sectional study involving 90 medical students. Hand grip strength data was evaluated using a digital dynamometer. Depression was assessed using Indonesian DASS-42. Significance was set at $p < 0.05$. Most of the participants (62.2%) had low hand grip strength, while 16.7% of participants had symptoms of mild to very severe depression. Gender was associated with handgrip strength ($p=0.047$), but not depression ($p=0.32$). A significant correlation was found between hand grip strength and depressive symptoms in males and overall ($r=-0.5$ and 0.3 , respectively, $p < 0.05$). Hand grip strength has a negative weak-moderate correlation with depression among medical students.

Keywords: Medical students, hand grip strength, depressive symptoms, cytokine, gender difference

1. Introduction

It is estimated that many medical students have low physical activity and high stress levels [1, 2]. A meta-analysis study reported that almost a third of medical students suffer from psychological stress and anxiety [3]. Medical students are supposed to have higher stress due to academic burden, long study periods, dissatisfaction with lectures, and family and financial problems [4-6]. These put medical students at risk of experiencing burnout, reduced quality of life, and depression [7]. It was estimated that 30% of medical students experienced depression, and 11% had suicidal ideas [8]. There were approximately more than half of medical students in Jakarta have symptoms of depression [9, 10].

Hand grip strength is a reliable clinical parameter to assess nutritional conditions and physical fitness [11-14]. In addition, hand grip strength is also linked with depression [15]. Weaker hand grip strength is associated with increased inflammatory cytokines, a chemical mediator that plays a role in the pathogenesis of depression [16-20]. Several previous studies reported the association between handgrip strength and depression. A previous study reported that people without depression had stronger hand grip strength [17]. Lee et al. demonstrated that people aged 19–80 years with the lowest quartile of hand grip strength were at greater risk of experiencing symptoms of depression [21]. This finding was also supported by Cao et al., who found that female students with lower hand grip strength were at greater risk of experiencing depressive symptoms [17].

Previous studies regarding the relationship between hand grip strength and depression have been conducted previously. However, based on the meta-analysis, most studies involved older adults [22]. Only a few studies have evaluated the association between depression and handgrip strength among medical students. This study investigated the correlation between handgrip strength and depression among medical students.

2. Material & Methods

2.1 Study design and subjects

This cross-sectional study with a correlative analytical observational design was conducted in

October-December 2023. The sample comprised ninety medical faculty students (50% girls), obtained using the systemic random sampling method. Exclusion criteria were students currently experiencing hand injuries, old injuries that have not healed completely, neurological deficits in the hand or arm on one hand, conditions or illness affecting handgrip performance, taking medicine affecting depression and handgrip strength. Participants approved their participation by signing the written consent. Ethical clearance was approved by the Ethical Committee of Atma Jaya Catholic University of Indonesia (No 04/09/KEP-FKIKUAI/2023).

2.2 Handgrip measurements

Handgrip strength was examined using a digital hand dynamometer (Camry dynamometer, Model EH101, China). The subjects were encouraged to do a trial prior to the examination. The handgrip examination was conducted according to the standard procedure. The subject was in a standing position with shoulder-width apart. The subjects held the dynamometer with their dominant hand. At the command, the subject squeezed the dynamometer as hard as possible. The handgrip examination was carried out three times, with the highest value recorded as the result. The measurement results were then averaged. A score under average was classified as 'weak', and a score above as 'normal'.

2.3 Depression assessment

Depression was evaluated using an Indonesian version of Depression Anxiety Stress Scales 42 (DASS-42) in the form of a questionnaire [23, 24]. Subjects were requested to complete a depressive symptoms questionnaire using the Indonesian version of DASS-42 via Google Form. The depressive symptom scores obtained through questionnaires were then classified into: normal (scores 0–9), mild (scores 10–13), moderate (14–20), severe (21–27), and very severe (scores 28–42) [25].

2.4 Statistical analysis

Categorical data was presented in numbers and percentages, while numerical data was presented in mean and standard

deviation (SD). The normality of numeric data distribution was assessed using Kolmogorov-Smirnov. An Independent t-test or Mann-Whitney was applied to test the differences in numerical variables between the two groups. A chi-square test was performed to evaluate the association of categorical variables between groups. Spearman test was used to evaluate the correlation between handgrip strength and depression score.

Results

Characteristics of the subjects are presented in Table 1. The average age falls into the teenage category. The number of males and females is equal. Most of the subjects had a dominant right hand. The mean DASS score meets with the normal category.

Table 1: Characteristic of subjects

Variables	Overall	
	x±SD	n (%)
Age (years)	19.7±0.9	-
Gender (n)		
Male	-	45 (50%)
Female	-	45 (50%)
Dominant hands		
Right	-	87 (96.7%)
Left	-	3 (3.3%)
Handgrip strength (kg)	26.3±8.3	-
DASS-42 (score)	5.6±7.2	-

The comparison of handgrip strength and depression between genders was demonstrated in Table 2. Most subjects had normal handgrip strength (62.2%). Males had significantly greater handgrip strength than females ($p < 0.001$). There was an association between handgrip strength and gender ($p = 0.047$), with women having a risk of lower handgrip strength of 2.6 (OR 2.6 CI 95% 2.2 - 3.0). Most subjects were within the normal category based on the DASS-42 score (83.3%). The number of subjects who experienced depression in men was the same as in women. No association was found between gender and depression symptoms ($p = 0.32$).

Table 2: Comparison of handgrip strength and depression between genders

Variables	Gender		Total	p (OR, CI 95%)
	Male	Female		
Handgrip strength (kg)	31.9±7.3	20.6±4.5	-	<0.001
Weak	12 (26.7%)	22 (48.9%)	34 (37.8%)	0.039 (2.6, 2.2-3.0)
Normal	33 (73.3%)	23 (51.1%)	56 (62.2%)	
DASS 42 score	5.64±7.4	5.56±7.1		0.63
Normal	37 (82.2%)	38 (84.4%)	75 (83.3%)	0.32
Mild	2 (4.4%)	1 (2.2%)	3 (3.3%)	
Moderate	4 (9.0%)	4 (9.0%)	8 (9.0%)	
Severe/very severe	2 (4.4%)	2 (4.4%)	4 (4.4%)	

The correlation between handgrip strength and depression is presented in Table 3. In males, the significant correlation was confirmed ($p = 0.041$); handgrip strength had a negative moderate correlation with depression ($r = -0.57$). In females,

no significant correlation was found. Overall, handgrip strength was weakly and negatively correlated with depression ($r = -0.30$, $p = 0.047$)

Table 3: The correlation between handgrip strength and depression

Handgrip strength	Depression	
	r	p
Male	-0.57	0.041
Female	-0.22	0.163
Overall	-0.30	0.047

Discussion

Many previous studies have been conducted on the relationship between depression and grip strength [26-29]. Even though different research methods and statistical tests were performed, all of those studies concluded that handgrip strength had an association and correlation with depression and degree of depression. Those previous studies involved older adults but rarely involved young people, particularly college students. Our study attempted to fill the information gap regarding the correlation between handgrip strength and depression in medical students. Our findings demonstrated that handgrip strength correlated with depression. However, this correlation was only in males and overall gender, not females.

Our findings revealed that depression among medical students was not prevalent. However, some studies reported conflicting results. A systematic review study estimated the prevalence of depression among university students at around 30.6% [30]. A meta-analytic study reporting the prevalence of depression in various regions reported that prevalence in Asia was 30.1% [31]. A recent systematic review and meta-analysis estimated the global prevalence of depression and its manifestations in medical students as around 27.2% [9]. Several factors might influence a prominent gap in the prevalence of depression between studies. In addition, although some studies reported the influence of gender differences on depression, our findings indicated that the frequency of depression did not differ significantly between genders. Methodology, research design, sample size, country of origin, subjects, and campus environment might contribute to this difference.

This recent study found that male students had significantly greater handgrip strength than females. Several studies also support this. A study involving older adults showed that men had higher grip strength than women [31]. Men having stronger handgrip strength is considered common because men have greater muscle mass compared to women. Differences in muscle handgrip strength due to gender differences are also found in those with diabetes mellitus [32].

Our findings demonstrated that handgrip was negatively correlated with depression in males but not in females. However, the direction of the correlation for both genders was negative. This means that the stronger the handgrip, the lower the score and incidence of depression, and vice versa. Lower handgrip strength indicates an increase in pro-inflammatory cytokines [20, 33]. An increase in cytokines can contribute to depressive symptoms because cytokines can interfere with synthesizing serotonin, glutamate, and dopamine, monoamine neurotransmitters, which are important for mood regulation, especially for creating pleasure and joy [34].

We documented some limitations of this study. First, the sample size might need to be bigger to be representative of the larger population and have an impact on the statistical results. Second, this study has not included factors, such as existing diseases, body mass index, sleep quality, and social economy status that might influence depression, handgrip strength, and cytokine release. Third, this study did not examine other parameters such as muscle and fat mass and biochemistry to see the causes of differences.

We conclude that handgrip strength had a negative correlation with depression among male medical students. Females had a 2.6 more significant risk of having weaker handgrip. Gender had no association with depression. It is recommended that further studies should include larger sample size and influencing factors that affect depression, handgrip strength,

and cytokine level.

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Conflict of interest

None to declare

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