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ASSOCIATION BETWEEN STRESS LEVEL, SLEEP QUALITY, PHYSICAL ACTIVITY WITH CARDIORESPIRATORY FITNESS IN MEDICAL STUDENTS: A CROSS SECTIONAL STUDY

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A b s t r a c t

Introduction *Modern life style and high burden of academic tasks contribute to the upsurge of stress, poor sleep quality, lack of sufficient physical activity in medical student society nowadays. The unhealthy life style act as one cardiovascular risk factor which can be predicted using Cardiorespiratory Fitness (CRF) examination.* ***Objectives*** *to identify the association between stress, sleep quality, physical activity with CRF level among medical students.* ***Design*** *The cross-sectional data was collected between September until November 2021. A total of 38 male and 73 female students of Faculty of Medicine and Health Sciences UIN Maulana Malik Ibrahim Malang were participated in this study. Stress level was assessed with DASS-21, sleep quality with PSQI, physical activity with GPAQ questionnaire. The level of CRF was measured using the Harvard Step Test. Statistical analysis for bivariate correlation ordinal scale was tested using Spearman Rank.* ***Results*** *80 participants (72.1%) had very low and low CRF. Meanwhile, 76 participants (68.5%) experienced no stress. In addition, 75 participants (67.6%) had poor sleep quality. A total number of 79 participants (71%) had low physical activity. There was no significant correlation between stress level, sleep quality, physical activity with CRF (p=0.962; 0.772; 0.114, respectively). The participants who had low physical activity and low CRF was found in 56 participants (50.45%).* ***Conclusions*** *There was no association between stress level, sleep quality, physical activity with CRF among medical students.*

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INTRODUCTION

Medical students are populations with high academic burden.[1] Moreover, most of times spent by medical students are for studying and completing tasks.[2] Therefore, many studies reported the significant association between the overload task and the high levels of stress among medical students.[1,3] Several studies have shown that the levels of anxiety, depression, and stress of medical students are highest compared to other majors.[4]

Additionally, previous research showed that many medical students experienced poor sleep quality.[5] In Asia, epidemiological data on sleep disorders among medical students have been widely reported. A large survey study in Malaysia revealed that 35.5% of 799 medical students felt sleepy during the day. Research on 244 students in Iran reported that 40.6% of them had poor sleep quality.[6] This is supported by a study Almojali and colleagues in 2017 on 756 medical students at King Saud bin Abdul Aziz University which showed 76% of respondents had poor sleep quality and 53% experienced symptoms of stress.[7] Similar research in Indonesia was conducted by Fitri in 2020 at the Faculty of Medicine, Andalas University, which showed that 65.32% of 222 students had sleep disturbances.[8] According to research conducted by Sutrisno, Faisal and Huda in 2017 at the Faculty of Medicine University of Padjadjaran, the majority of students only slept for less than five hours at night.[9]

Other consequences of the academic load experienced by medical students are the low level of physical activity. Previous study stated that medical students did not reach the level of activity recommended by WHO.[10] There were reports described that medical students had a low level of physical activity due to high workload and less leisure time.[11] Overall, 197 of 244 (80.7%) medical students did not exercise and the average time spent working on a computer was 420 minutes a day.

The modern lifestyles characterized by low physical inactivity, high levels of stress, poor sleep quality contribute to the increasing prevalence of cardiovascular disease that shifted to younger age.[12,13] Numerous studies showed that risk factor of cardiovascular disease has significant correlation with cardiorespiratory fitness (CRF). Many reports confirmed that low CRF can facilitate the development of atherosclerosis, Congestive Heart Failure (CHF), stroke, and atrial fibrillation.[14,15,16] Based on the description above, this study aimed to investigate the association between stress level, sleep quality, physical activity with CRF level in medical students.

METHODS

Study Design and Population

A cross-sectional study was performed in Faculty of Medicine and Health Science at Islamic State University Maulana Malik Ibrahim Malang during the academic year from September to November 2021. This study had been approved by the Ethics and Research Committee Faculty of Medicine and Health Science at Islamic State University Maulana Malik Ibrahim Malang No. 048/EC/KEPK-FKIK/2021. The category variables were comprising into four main groups as follows: level of stress; sleep quality; physical activity, and CRF.

Sample Determination

A total of 111 participant were recruited for this study based in calculation using Slovin formula. Samples were obtained through stratified random sampling technique. The participants were selected by inclusion as follow: the active students of first until third year of medical faculty at Islamic State University Maulana Malik Ibrahim Malang. The students who had cardio-pulmonary disease and movement limitation were excluded from this study. All students that fulfill the criteria were enrolled in this study.

Sociodemographic Measurements

The variables were consisting of age, gender, academic degree study, and Body Mass Index (BMI).

Stress Level Assay

The Depression, Anxiety and Stress Scale - 21 (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression, anxiety, and stress. Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content. The stress scale is sensitive to levels of chronic nonspecific arousal. It assesses difficulty relaxing, nervous arousal, and being easily agitated, irritable or over-reactive and impatient. Scores for depression, anxiety and stress are calculated by summing the scores for the relevant item.[17]

Sleep Quality Assay

The Pittsburgh Sleep Quality Index (PSQI) contains 19 self-rated questions. The 19 self-rated items are combined to form seven "component" scores, each has a range of 0-3 points. In all cases, a score of "0" indicates no difficulty, while a score of "3" indicates severe difficulty. The seven component scores are then added to yield one "global" score, with a range of 0-21 points, "0" indicating no difficulty and "21" indicating severe difficulties in all areas. Final step was categorization of global scores into poor (<5) or good sleep quality (≥5).[18]

Physical Activity Measurement

Global Physical Activity Questionnaire (GPAQ) comprised into three domain and each domain had several questions. Instrument questions contain P1-P6 for activity at work, P7-P9 for travel places, P10-P15 for recreational activities. all the questions must be asked. Skips of questions only if P1, P4, P7, P10, or P13 have been answered negatively. Subsequently, the score converted into MET minute/week.[19]

The physical activity categorized as 1. High, if: total MET ≥ 3000; 2. Moderate, if ≥ 600 to < 3000; 3. Low if: the MET value is <600 or the MET value does not meet the criteria for moderate or high levels of physical activity.

Cardiorespiratory Fitness Measurement

Harvard step test was selected to measure the CRF. All of the Respondents were directed to stand facing a bench with a height of 50 cm (men) and 45 cm (women). The respondent went up and down the bench starting with the same foot and the footsteps match the sound of the metronome beat which was set 120 times per minute. After 5 minutes or the respondent felt no longer enough to continue, the Harvard step up was stop. The next step was collection of the recovery pulse within one, two, and three minutes and followed by calculation of CRF using formula as follow: Physical Fitness Index = Test duration in seconds x 100: 2 (First pulse + Second pulse + Third pulse). The score than classified into 5 criteria of CRF level.[20]

Statistical Analysis

All statistical analysis were performed using IBM SPSS 24.0 for Windows. The socio-demographic profile presented using frequency and percentage table. The Spearman rank test was used to determine the correlation between stress level, sleep quality, and physical activity with CRF, due to all the data in ordinal scale. p value<0.05 was considered statistically significant.

RESULT

Sociodemographic Characteristic of the Participants

The medical students who participated in the study were 111 participants. The proportion of student's academic degree were distributed almost equally with 33.3% from first year students, 31.5% from second year, and 35.1% from third year students. Of these students,

65.8% were female and 34.2% were male. The profile of socio-demographic data of the respondents were presented in table 1.

Table 1. Respondents' characteristics of the study

Variable	n	(%)
Gender		
Male	38	(34.2)
Female	73	(65.8)
Year of study		
3rd year	39	(35.1)
2nd year	35	(31.5)
1st year	37	(33.3)
Age		
18-19	25	(22.5)
20-21	76	(68.4)
22-23	9	(8.1)
24-25	1	(0.9)
BMI		
Underweight	23	(21)
Normal	58	(52)
Obese	30	(27)

Life Style Factors Profile of the Respondents

Profile of risk factors associated with cardiorespiratory fitness were presented in Table 2. Majority of the respondents did not suffer from stress (68%). Interestingly, most of students (82%) experienced poor sleep quality. The medical students had low physical activity (71%). 66.7 % of the respondent had very low CRF. The low physical activity level found greater in female (82%) than men students (50%). Additional result showed that low and very low CRF level was obtained higher in female students (80%) than men (58%).

Table 2. Distribution of stress level, sleep quality, physical activity among medical students

Variables	n	(%)
Stress Level		
Normal	76	(68)
Mild	17	(15)
Moderate	13	(12)
Severe	5	(5)
Extremely Severe	0	(0)
Sleep Quality		
Good	20	(18)
Poor	91	(82)
Physical Activity		
Low	79	(71)
Moderate	18	(16)
High	14	(13)
CRF		
Very Low	74	(66.7)
Low	6	(5.4)
Regular	10	(9)
Good	10	(9)
Excellent	11	(9.9)

CRF, Cardiorespiratory fitness

The stress experienced by 24 (32.8%) female students which is higher than 11 (28,9%) male students. The similar pattern was obtained in sleep quality. Female students who categorized as poor sleep quality (71.2%) were greater than men students (55,2%). There was only slight difference of all parameters which identified from year level of study.

Association of Sleep Life Style Factors with CRF

Table 3 displays the cross-tabulation table and correlational analysis between sleep quality, stress level, physical activity, with CRF in medical students. None of the correlation in categorical variables were significant after bivariate analysis.

Table 3. Cross tabulation and correlation between stress level, sleep quality, physical activity and CRF in participants

Stress level \ **CRF**	Very low	Low	Reguler	Good	excellent	p
Normal	51	5	7	4	9	0.962
mild	10	1	3	3	0	
Moderate	9	0	0	2	2	
Severe	4	0	0	1	0	
Very severe	0	0	0	0	0	
Sleep quality						
Good	24	1	7	3	1	0.772
Poor	50	5	3	7	10	
Physical activity						
Low	56	4	5	8	6	0.114
Moderate	11	1	4	0	2	
High	7	1	1	2	3	

Although there were no significant results found in bivariate analysis, the cross-tabulation data showed some important features. The participant who had low physical activity and low CRF was found in 56 participants. Furthermore, 64 subjects in all categories of BMI either undernutrition, normal, or overweight and obesity were also had low CRF. In addition, 64 subjects who experienced good and poor sleep quality also classified low CR. The same pattern was also found in stress level parameters. Thus, it can be concluded in the table that among others, physical activity might become an important role and might associate with CRF compare to other parameters.

DISCUSSION

College years have been deemed as one of the most stressful and busiest times in a person's life.[2,21] Thus, it affects their life including the stress, the sleep, and the motivation to perform physical activity or exercise. Furthermore, the high stress level, poor sleep quality and sedentary life are element that act as risk factor of cardiovascular disease which can be represent earlier in CRF level.

Majority of participants in this study were classified into poor sleep quality. Previous study also reported the similar data.[22] Thus, it can be concluded that the academic load in this faculty high in all

degree program. Our findings showed there was no significant correlation between sleep quality and the CRF. Lindegård *et al.* in 2019 demonstrated no relationship could not be found between the level of CRF over time and sleep disturbances (p=0.12).[23] Sleep quality is an accumulated score of several indicators including hours of starting sleep at night, duration of sleep at night, the use of sleeping pills, the presence of sleep latency, insomnia, daytime sleepiness which might have a significant correlation with CRF, but was not examined in this study.

The new social environment, plenty of tasks, and difficult subjects of medicine creates pressure not only to make friends and build meaningful relationships, but also to survive and pass the exams. All of these academic expectations combined with the student's search for identity, autonomy, and purpose, creates an incredible amount of pressure and stress. It was stated that any type of stress elicits the same biological response, called the General Adaptation Syndrome (GAS). At this condition, the sympathetic is activated and thus the heart rate increases, breathing quickens because the adrenaline is released. The chronic activation of sympathetic results in lower CRF.[24] Our findings showed that there was no significant correlation between the stress level and CRF. We assumed that medicine students had good coping stress mechanism.[1] Hence, it called stress tolerance.[25] Unfortunately, we did not make either coping stress or stress tolerance as parameter of our study.

Although the physical activity did not associate significantly with CRF, the majority of respondent who had low physical activity also had low CRF. The measurement of physical activity behavior and CRF using questionnaire was complicated because of memory bias and misclassification, unlike the objective measurement using laboratory techniques. This could explain the relationship between physical activity and CRF became relatively weak.[26] Interestingly, the number of participants with low physical activity and low CRF in this study higher than students with high physical activity and superior CRF. According to research by Chaput *et al*. (2008), lack of physical activity due to sedentary lifestyle will induce biological stress lead to HPA (hypothalamus – pituitary – adrenal) hyperactivity, cortisol release, and increase energy intake due to hyperphagia, so that a positive energy balance occurs. The energy enters the body more than needed. This process will increase the risk of overweight and obesity. Obesity can lead to changes in fat enzyme work, inflammation, and an increase in blood sugar that leads to decreased insulin sensitivity in peripheral organs, one of which is the lungs, heart, and blood vessels. This results in decreased pulmonary ventilation, decreased oxygen diffusion, increased cardiac workload, and increased peripheral resistance. These four factors will cause a decrease in CRF.[27]

It seemed that gender was associated with stress, sleep quality, and physical activity in our findings although the statistical analysis was not conducted. However, this study has several limitations. Many factors that affect CRF like smoking habit and dietary pattern did not assess in this study.[20,28] These factors could greatly affect the results of the study. Second, the cross-sectional study and the small size of the sample also become the reason that could affect the result. Third, the questionnaire tools for defining parameters should be replaced by the measurement of biological marker that really represent the stress, sleep quality, physical activity, and CRF. We suggest to measure stress level using cortisol and catecholamine assay; polysomnography for sleep pattern; calorimetry for physical activity; and treadmill test or spirometry direct assessment of VO2 max for CRF.

Future research needs to explore the association of the parameters and CRF using case control design and utilize more participants for better results. Additionally,

the coping mechanisms and also biological marker should be measured.

CONCLUSION

Assessment of CRF and lifestyle factors hold an important strategy as an early screening to lower the prevalence of cardiovascular disease. The data in this research showed that stress levels, sleep quality, physical activity was not significantly correlated with CRF in medical students of FKIK UIN Maulana Malik Ibrahim Malang. Compared to other lifestyle parameters in this study, the physical activity tends to have association with CRF.

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