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Research Article

Relationship Between Stress, Physical Activity Level and Body Mass Index Among School Adolescents in Penang, Malaysia

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Abstract

Background and Objective: Studies on the relationship between stress, physical activity levels and body mass index (BMI) among secondary school students are limited in Malaysia and information describing each factor is scarce. This study was conducted to determine the stress and physical activity levels among adolescent secondary school students in the state of Penang and to identify the relationship between stress, physical activity levels and BMI. **Materials and Methods:** A total of 420 adolescents from four different schools in Penang were randomly selected as subjects for this study. Data collection was carried out through anthropometric measurements, the depression, anxiety and stress scale (DASS-21) and the international physical activity level questionnaires (IPAQ). The anthropometric measurements included weight and height. **Results:** DASS-21 results showed that the subjects experienced a normal depression level (8.50 ± 6.78), a moderate anxiety level (10.0 ± 6.96) and a normal stress level (11.95 ± 7.00). The condition with the highest prevalence among the subjects was anxiety (60.0%) followed by depression (40.0%) and stress (29.5%). The level of physical activity among the subjects was high with mean of metabolic equivalent (MET) scores of 4207.6 ± 3606.4 for total physical activity. The DASS-21 showed a significant but weak negative correlation between depression scores and MET scores for male subjects ($r = -0.154, p < 0.05$) and overall subjects ($r = -0.145, p < 0.01$). There was no correlation between BMI and all DASS components but a negative correlation with BMI was observed for high intensity physical activity ($r = 0.214, p < 0.01$) and total MET scores ($r = -0.174, p < 0.05$) for male subjects. **Conclusion:** The depression and stress levels were found to be at normal levels whereas the level of anxiety was found to be moderate. The level of physical activity was high. A significant negative correlation of depression with DASS and MET scores was observed for male and overall subjects.

Key words: Adolescents, body mass index (BMI), physical activity, stress, Malaysia

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Stress is defined as a form of restlessness, anxiousness or tension due to mental or physical stress. Stress occurs when feelings of unease or discomfort arise from something that has happened to the individual involved¹. Adolescence is a phase full of obstacles and stress². Stress among students is often caused by academics³. The national health and morbidity survey⁴ conducted by the ministry of health (MOH) has shown that the prevalence of mental health problems in Malaysia is highest (14.4%) among 16-19 year olds and the majority of those are from low-income groups. In Malaysia, several studies have reported that the estimated prevalence of stress is from 40-100% among Malaysian adolescents⁵⁻⁸. The study conducted by Akande *et al.*⁹ showed that high school students in Nigeria have moderate levels of stress and that the causative factors of stress are academic, intrapersonal and environmental. The study by Watode *et al.*¹⁰ involving 397 adolescents in Delhi showed that 87.6% tested positive for stress.

Physical activity is suggested as a therapy to improve psychological health problems. Physical activity refers to daily activity that involves movement and muscle power to reduce or maintain body weight¹¹. Physical activity has the potential to provide health benefits to adolescents. Adequate levels of physical activity and maintaining a normal weight are the most effective ways to prevent chronic diseases, including cardiovascular disease and diabetes¹². Nevertheless, despite the many benefits of exercise, most adolescents still maintain an inactive lifestyle. Stress can be reduced by performing physical activities such as sports, exercise and meditation. Stress and physical activity are believed to be reciprocal¹³.

Stults-Kolehmainen and Sinha¹⁴ examined the influence of stress on physical activity and exercise. The majority of studies have shown that stress reduces physical activity and exercise while increasing sedentary behaviours. Individuals who exercise, have low levels of depression, anxiety and stress¹⁵. Studies indicate that an individual's experience of stress may be an important barrier to achieve a healthy level of physical activity¹⁶. This indicates that stress is associated with low levels of physical activity and can contribute to the risk sedentary lifestyle-related diseases¹⁷. The studies by Giammattei *et al.*¹⁸ and Lasheras *et al.*¹⁹ found that children and adolescents who are overweight have low levels of physical activity and insufficient regular exercises.

In general, studies on the relationship between stress, physical activity level and body mass index (BMI) of secondary school adolescents are rarely carried out in Malaysia. Some studies in Malaysia have focused mainly on the stress

parameters faced by secondary school adolescents^{7,20}. Therefore, the objective of this study was to determine the association between stress, physical activity level and BMI among secondary school adolescents in the state of Penang.

MATERIALS AND METHODS

Ethical approval: Written permission was received to conduct this study from the ministry of education Malaysia (MOE) [reference number KPM.600-3/2/3-eras (1246)] and the Penang state department of education [JPNPP reference number (PER) 100-4/2J.11(31)]. An approval letter to conduct this study was also obtained from the Medical Research and Innovation, Secretariat Committee, Counsellor Tuanku Mukhriz Hospital (reference UKM PPI/111/8 /JEP- 2018-490).

Subjects and study location: This cross-sectional study was carried out involving 420 students from four national secondary schools in Penang that were randomly selected from a list of secondary schools obtained from the Penang state education department. The subjects were selected based on systematic random sampling. The subjects include male and female students consisting of the three main races, namely Malay, Chinese and Indian. The subjects chosen were required to be healthy and not suffering from any chronic illnesses and all participated in this study voluntarily. The sample size was determined according to the method proposed by Krejcie and Morgan²¹. A total of 420 adolescents from four different schools in Penang were randomly selected as subjects for this study. Prior to commencing the study, the subjects were briefed on the purpose and the procedure involved in this study. The duration of the study was eight weeks from June 2018 to January 2019.

Sociodemographic information: A set of questionnaires were used to collect data regarding the sociodemographic information such as age, form, gender and race.

Anthropometric measurements: All anthropometric measurements were performed according to the standard procedure. Height was measured while the subject was standing upright without wearing shoes using a SECA Body Meter 208 (SECA, Germany) to the closest 0.1 cm. TANITA Digital Lithium Scale (HD319; TANITA Corporation, Tokyo, Japan) was used to measure weight to the nearest 0.1 kg. Respondents were measured in light clothing and bare feet. Body weight and height was required to determine the BMI and was calculated based on weight (kg)/height (m)².

Questionnaires: The questionnaire comprised three main areas, namely sociodemographic information, depression, anxiety and stress scale (DASS-21) and international physical activity questionnaire (IPAQ).

Depression, anxiety and stress scale (DASS-21) questionnaire: The DASS-21 questionnaire consisted of 21 questions composing of three main scales of self-esteem: depression (D), anxiety (A) and stress (S). Each of these key scales has seven questions that were answered based on the subject's experiences over the past seven days. The DASS-21 questionnaire employs a Likert scale for response options: zero (does not describe my situation), one (rarely or seldom describes my situation), two (always or frequently describes my situation) and three (many times or very frequently describes my situation). The sum of the scores was calculated, multiplied by two and compared to the DASS -21 score²² in Table 1.

International physical activity questionnaires (IPAQ): The IPAQ was used to determine the level of physical activity of the respondents. The respondents were required to estimate the frequency and time spent on physical activity during the last seven days. Recorded physical activities included physical activity at work, home and leisure activities, transportation to and from work, exercise or sports activities during leisure time and time spent on sitting.

The metabolic equivalent (MET) was used to analyse IPAQ data. The IPAQ²³ formula for calculating physical activity scores was used. Scores for each type of activity were calculated by multiplying the corresponding MET values by the time (minutes) and the frequency (days) of the specific physical activity. The score is expressed as a MET-minutes/week. Total physical activity was calculated by summing the total MET-minutes/week score for all activities.

MET score <600 min week⁻¹ indicated low physical activity; MET score ≥600 min week⁻¹ indicated moderate physical activity; MET score ≥3000 min week⁻¹ indicated high physical activity.

Data analysis: The data collected were analysed using statistical package of social sciences (SPSS) version 21.0 software (Inc, Chicago, IL, USA). Descriptive tests including mean, standard deviation and percentage were used for the socio-demographic data, anthropometric measurement, depression, anxiety and stress scales and physical activity levels. The independent t-test was used to determine the differences in the mean scores of anthropometric measurements, depression, anxiety and stress scales as well as

Table 1: Score classification of DASS-21

Category	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Very severe	28+	20+	34+

Lovibond and Lovibond²²

physical activity levels by gender group. Associations between BMI categories, levels of depression, anxiety and stress as well as physical activity levels category in male and female subjects were evaluated using chi-square test. Pearson correlation test was used to determine the relationship between stress, physical activity level and BMI. For all data analyses, significant levels were set at p<0.05.

RESULTS AND DISCUSSION

Subject profile: A total of 420 students (50.0% male and 50.0% female) from four schools in Penang participated in this study. The subjects involved were 16 (80.0%) to 17 (20.0%) years old. The majority of the subjects involved were Malays (61.4%), followed by Chinese(31.9%) and Indians (6.7%).

Anthropometric data: The anthropometric characteristics of the subjects are reported in Table 2. Comparisons between the genders showed that the mean weights of male subjects (61.9±12.1 kg) was significantly higher than that of the female subjects (53.3±12.0 kg) (p<0.001). The height of male (1.7±0.1 m) was significantly higher than that of the female subjects (1.6±0.1 m) (p<0.001). This result is consistent with the findings of the study on high school adolescents in Kajang, Selangor by Rezali *et al.*²⁴, who reported that there was a significant difference in weight and height between male and female subjects with mean body weight of 50.0±13.1 kg (male: 52.1±13.2 kg, female: 48.1±12.8 kg) whereas mean height of subjects was 1.59±0.08 m (male: 1.62±0.08 m, female: 1.56±0.06 m). Furthermore, the mean BMI for male subjects was slightly higher than that of the female subjects but there was no significant difference (p>0.05). The results of this study are not consistent with a previous study on high school adolescents in the state of Terengganu conducted by Ahmad *et al.*²⁵ which reported that BMI of female subjects was significantly higher than that of male subjects (p<0.05).

Table 3 shows the gender wise classification of body weight status based on the BMI-for-age classification proposed by the WHO²⁶ for individuals aged 5-19 years. The comparisons between genders showed that the majority of male and female subjects were classified as having normal

Table 2: Mean of anthropometric characteristics of subjects

Anthropometric profile	Mean \pm standard deviation			p-value
	Male (n = 210)	Female (n = 210)	Total (N = 420)	
Weight (kg)	61.9 \pm 12.1	53.3 \pm 12.0	57.0 \pm 12.9	<0.001*
Height (m)	1.7 \pm 0.1	1.6 \pm 0.1	1.6 \pm 0.1	<0.001*
Body mass index (kg m ⁻²)	21.8 \pm 4.1	21.0 \pm 4.5	21.4 \pm 4.3	0.081

*Significant difference between male and female (p<0.001)

Table 3: Gender wise classification of body weight status

BMI classification-for-age	Number (%)			χ^2	p
	Male (n = 210)	Female (n = 210)	Total (N = 420)		
Chronic underweight	11 (5.3)	25 (11.9)	36 (8.6)	7.246	0.123
Underweight	29 (13.8)	24 (11.4)	53 (12.6)		
Normal	118 (56.2)	119 (56.7)	237 (56.4)		
Overweight	32 (15.2)	28 (13.3)	60 (14.3)		
Obese	20 (9.5)	14 (6.7)	34 (8.1)		

No significant differences between male and female for BMI classification-for-age (p>0.05)

Table 4: Gender wise mean score of DASS

DASS scales	Mean \pm standard deviation			p-value
	Male (n = 210)	Female (n = 210)	Total (N = 420)	
Depression	8.05 \pm 6.85	8.95 \pm 6.71	8.50 \pm 6.78	0.172
Anxiety	9.26 \pm 7.03	10.77 \pm 6.82	10.01 \pm 6.96	0.026*
Stress	11.27 \pm 6.62	12.63 \pm 7.30	11.95 \pm 7.00	0.046*

*Significant difference between male and female for BMI classification-for-age (p>0.05)

weight (56.7 and 56.2%, respectively). Furthermore, the female subjects classified as having underweight (23.3%) was higher than that of male subjects (19.2%). On the other hand, the proportion of male subjects classified as overweight or obese was higher with a prevalence of 24.7%, than that of female subjects (20.0%). The study by Ochiai *et al.*²⁷ on adolescents in Japan is consistent with this study which showed that the prevalence of underweight for female adolescents was higher (11.2%) than that of the male adolescents (8.2%), whereas overweight or obesity prevalence was higher among male adolescents (14.8%) than that of the female adolescents (11.4%).

Overall, the majority of the subjects (56.4%) involved in this study had normal weight followed by overweight (14.3%), underweight (12.6%), chronic underweight (8.6%) and obese (8.1%). The study by Othman and Sedek²⁸ on high school adolescents in the state of Penang showed that 12.9% of the subjects were underweight, 55.2% were normal weight, 17.5% were overweight and 14.4% were classified as obese. Comparison of the study by Othman and Sedek²⁸ with the findings of this study showed a decrease in over weight (3.2%) and obesity (6.3%) from 2014-2018.

Mean depression, anxiety and stress scale (DASS) Score: The mean DASS score by gender is reported in Table 4. Comparison between genders found that mean score for

depression of female subjects (8.95 \pm 6.71) was higher than that of male subjects (8.05 \pm 6.85), however, there was no significant difference between both groups (p>0.05). The depression level of the male and female subjects was at the normal level (range of 0-9) based on the DASS score classification indicated by Lovibond and Lovibond²².

Subsequently for the anxiety scale, there were significant differences between male and female subjects with mean scores of 9.26 \pm 7.03 and 10.77 \pm 6.82, respectively (p<0.05). Based on DASS score classification proposed by Lovibond and Lovibond²², male subjects had a low level of anxiety as the mean score ranged from 8-9, whereas female subjects had moderate levels of anxiety as mean score was in the range of 10-14.

The mean stress score for male subjects (11.27 \pm 6.62) was significantly lower than that for female subjects (12.63 \pm 7.30) (p<0.05). The combined mean score for both genders ranged from 0-14 indicating that overall stress level was normal. The results of this study are consistent with the findings of Ivanović and Ivanović²⁹ who reported that there were significant differences in mean anxiety and stress scales scores between male and female adolescents but no significant differences for the depression scale.

The overall DASS mean score of the subjects indicated that the depression level of the subjects was normal (8.50 \pm 6.78), the anxiety scale was moderate (10.01 \pm 6.96) and the stress scale was normal (11.95 \pm 7.00). The mean scores for

all the DASS scales in this study were higher than those reported by Mellor *et al.*³⁰ who conducted a study on high school adolescents from four countries namely Malaysia, Chile, China and Australia.

Classification of subjects by depression, anxiety and stress levels:

Levels of depression, anxiety and stress were categorized into five categories as proposed by Lovibond and Lovibond²². Table 5 shows the classification of subjects according to their levels of depression, anxiety and stress by gender. Overall, 60% (male: 59.0%, female: 61.0%) of the subjects involved in this study had normal level of depression. Forty percent of subjects either had mild, moderate, severe, or very severe depression levels.

The NHMS⁴ survey showed that among adolescents, the prevalence of depression in Penang is 21.0%. This indicates an increase in the percentage of adolescents who suffer from depression by 19% from 2017-2018. Furthermore, the overall subjects categorized as having normal level of anxiety was 40 and 60% of subjects either had mild, moderate, severe or very severe levels of anxiety. There was a 22.4% increase in the prevalence of depression when compared to the findings of the NHMS⁴.

In addition, the subjects with a normal level of stress was 70.5% indicating that the proportion of adolescents in Penang who experienced stress was less than those who experienced depression and anxiety. A total of 29.5% of subjects experienced either mild, moderate, severe, or very severe depression levels. Comparison of this study with NHMS⁴ showed that the prevalence of stress in Penang increased by 20.3% from 9.2-29.5%.

Physical activity level: The mean MET-min week⁻¹ score by gender is reported in Table 6. Comparison between genders found that mean MET score for high-intensity activity for male subjects was significantly higher (2504.8±2748.6) than that for female subjects (1150.3±1672.7). The significant differences in these MET scores indicate that male subjects performed more intense physical activity. A study by Kamis *et al.*,³¹ on high school adolescents in the Felda area in Negeri Sembilan showed that the mean score for high-intensity activity for male subjects (540.42±324.81) was higher than the mean score for female subjects (453.97±364.81) but the difference was not significant. (p>0.05). Furthermore, the mean score of moderate-intensity activity for male subjects (1183.9±1340.5) and female subjects (834.3±1072.5) in this study was also significantly different (p<0.05). However, there was no significant

Table 5: Gender wise classification of subjects according to their levels of depression, anxiety and stress

Category	Depression				Anxiety				Stress						
	M (n = 210)	F (n = 210)	Total (N = 420)	χ^2	p	M (n = 210)	F (n = 210)	Total (N = 420)	χ^2	p	M (n = 210)	F (n = 210)	Total (N = 420)	χ^2	p
Normal	124 (59.0)	128 (61.0)	252 (60.0)	3.917	0.417	96 (45.7)	72 (34.3)	168 (40.0)	3.912	0.042*	157 (74.8)	139 (66.2)	296 (70.5)	10.581	0.032*
Mild	48 (22.9)	37 (17.6)	85 (20.2)			20 (9.5)	25 (11.9)	45 (10.7)			29 (13.8)	31 (14.8)	60 (14.3)		
Severe	28 (13.3)	30 (14.3)	58 (13.8)			57 (27.2)	53 (25.2)	110 (26.2)			19 (9.0)	26 (12.4)	45 (10.7)		
Very severe	5 (2.4)	11 (5.2)	16 (3.8)			22 (10.4)	32 (15.2)	54 (12.9)			2 (1.0)	11 (5.2)	12 (3.1)		
	5 (2.4)	4 (1.9)	9 (2.2)			15 (7.2)	28 (13.4)	43 (10.2)			3 (1.4)	3 (1.4)	6 (1.4)		

*Significant difference between male and female for levels of anxiety and stress (p<0.05)

Table 6: Gender wise mean score of physical activity intensity

	Mean \pm standard deviation			p-value
	Male (n = 210)	Female (n = 210)	Total (N = 420)	
Physical activity (MET-min week ⁻¹)				
High intensity	2504.8 \pm 2748.6	1150.3 \pm 1672.7	1827.5 \pm 2371.4	<0.001*
Moderate intensity	1183.9 \pm 1340.5	834.3 \pm 1072.5	1009.1 \pm 1225.1	0.003*
Walking intensity	1482.5 \pm 1457.2	1259.3 \pm 1480.1	1371.0 \pm 1471.2	0.120
Total of physical activity	5171.2 \pm 3969.2	3244.0 \pm 2907.7	4207.6 \pm 3606.4	<0.001*

*Significant difference between male and female for physical activity intensity at p<0.05

Table 7: The physical activity level of both gender

Physical activity level category	Number (%)			χ^2 value	p-value
	Male (n = 210)	Female (n = 210)	Total (N = 420)		
Low	14 (6.7)	33 (15.7)	47 (11.2)	17.705	p<0.001***
Moderate	60 (28.6)	81 (38.6)	141 (33.6)		
High	136 (64.7)	96 (45.7)	232 (55.2)		

***Significant difference between male and female for physical activity level category at p<0.001

Table 8: Gender wise correlation between DASS and MET score of physical activity

DASS scales	Male		Female		Total	
	r-value	p-value	r-value	p-value	r-value	p-value
Depression	-0.154	0.026**	-0.105	0.128	-0.145	0.003**
Anxiety	-0.006	0.935	0.033	0.637	0.019	0.692
Stress	-0.026	0.707	0.029	0.678	-0.028	0.574

**Significantly correlated between DASS scales and MET score of physical activity at p<0.01

difference in the mean score for walking between male (1482.5 \pm 1457.2) and female subjects (1259.3 \pm 1480.1) (p>0.05). The mean score for total physical activity was significantly higher (5171.2 \pm 3969.2) in male subjects than that of the female subjects (3244.0 \pm 2907.7) (p<0.001). This number exceeds 3000 MET-min week⁻¹ based on IPAQ²³, indicating that male and female subjects had a high level of physical activity.

Table 7 shows the physical activity level of both gender. The results showed that the physical activity level of male was higher (64.7%) than that of female subjects (45.7%). Chi-square tests showed a significant difference in the physical activity level of male and female subjects and this result is supported by a previous study on high school adolescents in Petaling, Selangor by Ismail and Fairuz³² (p<0.001). Overall, 55.2% of subjects had high levels of physical activity followed by moderate (33.6%) and low (11.2%) levels of activity. The results of this study are not consistent with the study of Hashim *et al.*³³ who reported that 50.0% of adolescents had moderate level of physical activity and only 20.0% of adolescents had high level of physical activity in South Malaysia.

Relationship between the DASS and MET physical activity scores: Correlations between the DASS and MET-min week⁻¹ by gender are reported in Table 8. The results showed no

significant correlation of anxiety and stress scores with MET physical activity scores in either genders and in the subjects overall. (p>0.05). However, there was a significant but weak negative correlation between depression scores and MET physical activity scores for male subjects (r = -0.154, p<0.05) and overall (r = -0.145, p<0.01). Depression scores showed no correlation with MET physical activity scores for female adolescents (p>0.05).

This finding explains that as the physical activity of adolescents increases, the rate of depression may decrease. Many studies have been conducted on the relationship of depression, anxiety and stress with the level of individual physical activity. Physical activity is said to be a therapy for mental disorders³⁴⁻³⁶. The findings of this study are in consistent with the study on adolescents from six secondary schools in the state of Johor conducted by Tajik *et al.*³⁶, who found that physical activity levels are significantly correlated with anxiety and stress (p<0.001). This study also contradicts with the findings of Ganz³⁷ who reported no significant correlation between depression and physical activity levels among high school adolescents in Mankato, United States (p>0.05).

Relationship between BMI and depression, anxiety and stress scale (DASS) scores: Correlations between BMI and DASS scores are reported in Table 9. The results showed

Table 9: Gender wise correlation between BMI and DASS

DASS scales	Male		Female		Total	
	r-value	p-value	r-value	p-value	r-value	p-value
Depression	0.088	0.203	-0.004	0.958	0.032	0.519
Anxiety	0.079	0.255	-0.025	0.711	0.016	0.747
Stress	0.010	0.889	0.038	0.889	0.016	0.738

No significantly correlated between BMI and DASS scales at $p > 0.05$

Table 10: Gender wise correlation between BMI and MET score of physical activity intensity

Physical activity (MET-min week ⁻¹)	r-value (p)		
	Male	Female	Total
Walking	-0.046 (0.509)	0.027 (0.695)	-0.004 (0.927)
Moderate intensity	-0.026 (0.712)	0.035 (0.618)	0.014 (0.767)
High intensity	-0.214** (0.002)	0.027 (0.695)	-0.084 (0.086)
Total score	-0.174* (0.012)	0.039 (0.575)	-0.052 (0.287)

*Significant correlation between BMI and MET score of physical activity at $p < 0.05$, **Highly significant correlation between BMI and MET score of physical activity at $p < 0.01$

no correlation between BMI and all components of DASS for male, females and all subjects ($p > 0.05$). A study by Javadi *et al.*³⁸ on high school adolescents in Iran found that there was a significant and positive correlation between BMI and depression ($r = 0.333$, $p < 0.001$). Some evidence-based studies showed that obese adolescents have greater mental health problems such as depression, anxiety and lack of confidence than those of non-obese adolescents³⁹. BMI is the most common factor associated with obesity and dissatisfaction with weight is seen as a contributing factor for depression⁴⁰.

Relationship between BMI and MET-min week⁻¹ scores:

Correlations between BMI and MET min week⁻¹ are reported in Table 10. The results showed that there was a significant negative correlation between BMI and high intensity physical activity score ($r = -0.214$, $p < 0.01$) and total MET scores ($r = -0.174$, $p < 0.05$) for male subjects. This negative correlation suggests that increasing MET scores may reduce BMI as well as the risk of overweight and obesity among adolescents. This finding is in line with a previous study conducted by Lateef *et al.*⁴¹ that showed a negative but weak correlation between BMI and the level of physical activity of high school adolescents in Nigeria ($r = -0.015$, $p < 0.01$). No correlation between BMI and MET scores was observed in either female subjects or all subjects ($p > 0.05$).

CONCLUSION

The depression and stress levels in this study were found to be at normal levels. Meanwhile, the level of anxiety was found to be moderate. The mean scores on the anxiety and stress scales showed significant differences between male and

female subjects. Furthermore, the level of physical activity among these subjects was high. There was a significant negative correlation of depression with DASS and MET scores for male and overall subjects. There was no correlation between BMI and DASS scores but a significant negative correlation of BMI with high intensity score and total MET scores was observed for male subjects. The outcomes of this study can increase awareness among high school adolescents on the importance of stress control and its influence on physical activity level.

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REFERENCES

1. Myers, D., 2005. Myers' 'Exploring Psychology'. 6th Edn., Worth Publisher, New York, Pages: 581.
2. Jensen, A.J. and C. Hamilton, 2006. G. stanley hall's adolescence: A centennial reappraisal: introduction. His. Psychol., 9: 165-171.
3. Sagar, P. and B. Singh, 2017. A study of academic stress among higher secondary school students. Int. J. Creative Res. Thoughts, 5: 1864-1869.
4. Institute for Public Health, 2015. National Health and Morbidity Survey 2015 (NHMS 2015). Vol. II: Non-Communicable Diseases, Risk Factors & Other Health Problems; 2015. Ministry of Health, Malaysia. Putrajaya, Malaysia. Pages: 291.

5. Musa, R. and M.A. Fadzil and Z. Zaini, 2007. Translation, validation and psychometric properties of Bahasa Malaysia version of the Depression, Anxiety and Stress Scale (DASS). *ASEAN J. Psychiatr*, 8: 82-89.
6. Tajularipin, S., H. Aminuddin, M.S. Vizata and A.S. Kumar, 2009. The level of stress among students in urban and rural secondary schools in Malaysia. *Eur. J. Soc. Sci.*, 10: 179-184.
7. Yaacob, S.N., R. Juhari, M.A. Talib and I. Uba, 2009. Loneliness, stress, self esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan*, 7: 87-95.
8. Yusoff, M.S.B., A.H.A. Hamid, N.R. Rosli, N.A. Zakaria and N.A.C. Rameli *et al.*, 2011. Prevalence of stress, stressors and coping strategies among secondary school students in Kota Bharu, Kelantan, Malaysia. *Int. J. Students Res.*, 1: 23-28.
9. Akande, J.A., A.O. Olowonirejuaro and C.E. Okwara-Kalu, 2014. A study of level and sources of stress among secondary school students. *IOSR J. Res. Method Educ.*, 4: 32-36.
10. Watode, B.K., J. Kishore and C. Kohli, 2015. Prevalence of stress among school adolescents in Delhi. *Indian J. Youth Adolesc. Health*, 2: 4-9.
11. Dayi, A., A. Acikgoz, G. Guvendi, L. Bayrak, B. Ersoy, C. Gur and O. Ozmen, 2017. Determination of factors affecting physical activity status of university students on a health sciences campus. *Med. Sci. Monit.*, 23: 325-334.
12. WHO., 2002. Physical Activity. <https://www.who.int/health-topics/physical-activity>
13. Jerstad, S.J., K.N. Boutelle, K.K. Ness and E. Stice, 2010. Prospective reciprocal relations between physical activity and depression in female adolescents. *J. Consulting Clin. Psychol.*, 78: 268-272.
14. Stults-Kolehmainen, M.A. and R. Sinha, 2014. The effects of stress on physical activity and exercise. *Sports Med.*, 44: 81-121.
15. Wipfli, B.M., C.D. Rethorst and D.M. Landers, 2008. The anxiolytic effects of exercise: a meta-analysis of randomized trials and dose-response analysis. *J. Sport and Exercise Psychol.*, 30: 392-410.
16. Lutz, R.S., P. Karoly and M.A. Okun, 2008. The why and the how of goal pursuit: Self-determination, goal process cognition and participation in physical exercise. *Psychol. Sport Exercise*, 9: 559-575.
17. Nabkasorn, C., N. Miyai, A. Sootmongkol, S. Junprasert, H. Yamamoto, M. Arita and K. Miyashita, 2006. Effects of physical exercise on depression, neuroendocrine stress hormones and physiological fitness in adolescent females with depressive symptoms. *Eur. J. Public Health*, 16: 179-184.
18. Giammattei, J., G. Blix, H.H. Marshak, A.O. Wollitzer and D.J. Pettitt, 2003. Television watching and soft drink consumption: Association with obesity in 11 to 13 year old schoolchildren. *Arch. Pediatr. Adolescent Med.*, 157: 882-886.
19. Lasheras, L., S. Aznar, B. Merino and E.G. López, 2001. Factors associated with physical activity among Spanish youth through the national health survey. *Preventive Med.*, 32: 455-464.
20. Yusoff, M.S.B., A.F.A. Rahim and M.J. Yaacob, 2010. Prevalence and sources of stress among university students Malaysia medical students. *Malays. J. Med. Sci.*, 17: 30-37.
21. Krejcie, R.V. and D.W. Morgan, 1970. Determining sample size for research activities. *Educ. Psychol. Meas.*, 30: 607-610.
22. Lovibond, P.F. and S.H. Lovibond, 1995. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck depression and anxiety inventories. *Behav. Res. Therapy*, 33: 335-343.
23. IPAQ Research Committee, 2005. Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)-short and long forms. IPAQ Research Committee, pp: 17.
24. Rezali, F.W., Y.S. Chin, M. Yusof and B. Nisak, 2012. Obesity-related behaviors of Malaysian adolescents: A sample from Kajang district of Selangor state. *Nutr. Res. Pract.*, 6: 458-465.
25. Ahmad, A., N. Zulaily, N.S.A. Manan, M.R. Shahril and S.W.W.S.S.T. Wafa *et al.*, 2017. Body weight status of school adolescents in Terengganu, Malaysia: a population baseline study. *BMC Public Health*, Vol. 17, No. 9 10.1186/s12889-016-3911-2
26. WHO., 2007. BMI-for-age, boys and girls (5 to 19) years. World Health Organization, Geneva, Switzerland.
27. Ochiai, H., T. Shirasawa, H. Nanri, R. Nishimura, S. Nomoto, H. Hoshino and A. Kokaze, 2017. Lifestyle factors associated with underweight among Japanese adolescents: a cross-sectional study. *Arch. Public Health*, Vol. 75, No. 45 10.1186/s13690-017-0213-9
28. Nur Hanisah Othman, Razalee Sedek 2014. Body Weight Perception and Weight Control Behaviors among School Adolescents in Pulau Pinang *Pak. J. Nutr.*, 13: 760-767.
29. Ivanović, M. and U. Ivanović, 2018. Gender differences during adolescence in the motives for physical exercise, depression, anxiety and stress. *Exercise Qual. Life*, 10: 17-27.
30. Mellor, D., E.V. Vinet, X. Xu, N.H.B. Mamat, B. Richardson and F. Román, 2015. Factorial invariance of the DASS-21 among adolescents in four countries. *Eur. J. Psychol. Assess.*, 31: 138-142.
31. Kamis, H., A.A. Tajri, E. Ismail, M.R.A. Razak, 2017. Corak aktiviti fizikal dan hubungannya dengan obesiti dalam kalangan murid sekolah menengah di felda [physical activity patterns and relationship with obesity among high school students in felda]. *J. Educ. Social Sci.*, 6: 309-317.
32. Aniza, I. and M.R. Fairuz, 2009. Factors influencing physical activity level among secondary school adolescents in petaling district, selangor. *Med. J. Malaysia*, 64: 228-232.

33. Hashim, H.A., F. Golok and R. Ali, 2011. Profiles of exercise motivation, physical activity, exercise habit and academic performance in Malaysian adolescents: A cluster analysis. *Int. J. Collab. Res. Internal Med. Public Health*, 3: 416-428.
34. Salmon, P., 2001. Effects of physical exercise on anxiety, depression and sensitivity to stress: a unifying theory. *Clin. Psychol. Rev.*, 21: 33-61.
35. Shokrvash, B., F. Majlessi, A. Montazeri, S. Nedjat, A. Rahimi, A. Djazayeri and D. Shojaezadeh 2013. Correlates of physical activity in adolescence: a study from a developing country. *Global Health Action*, 10.3402/gha.v6i0.20327
36. Tajik, E., M. Javadi and M. Mohammadzadeh, 2017. Diet and mental health: what should be done for Malaysian adolescents. *Iran J. Public Health*, 46: 992-994.
37. Ganz, J., 2012. Relationship Between Physical Activity and Depressive Symptoms in Adolescents. Master Thesis, Minnesota State University, Mankato.
38. Javadi, M., Z. Jourabchi, A.A. Shafikhani and E. Tajik, 2017. Prevalence of depression and anxiety and their association with body mass index among high school students in Qazvin, Iran, 2013-2014. *Electron. Physician*, 9: 4655-4660.
39. Melnyk, B.M., L. Small, D. Morrison-Beedy, A. Strasser and L. Spath *et al.*, 2006. Mental health correlates of healthy lifestyle attitudes, beliefs, choices and behaviors in overweight adolescents. *J. Pediatr. Health Care*, 20: 401-406.
40. Cash, T. F., Morrow, J.A., Hrabosky, J.I. and A.A. Perry, 2004. How has body image changed? A cross-sectional investigation of college women and men from 1983 to 2001. *J. Consulting Clin. Psychol.*, 72: 1081-1089.
41. Lateef, O.J., E. Njogu, F. Kiplamai, U.S. Haruna and R.A. Lawal, 2016. Determinants of overweight and obesity among adolescent students in public secondary schools in Kwara state, Nigeria. *Curr. Res. Nutr. Food Sci. J.*, 4: 96-106.