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A COMPARATIVE STUDY ON DIFFERENT BMI CATEGORY AND PHYSICAL FITNESS HEALTH RELATED COMPONENT OF SEDENTARY MALE YOUTH IN TERENGGANU

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ABSTRACT

This study aims to compare the physical fitness health related component on three different BMI category (underweight-UG; normal-NG and obese-OG) of sedentary male youth in Terengganu. 223 sedentary male youth of Terengganu (age 17.4±1.9) categorize into three groups based on BMI index value. Five physical fitness health related component (VO_2max, one minute sit up and push up, V sit and reach and 20 meter speed) are measured in all groups. Multivariate Analysis of variance revealed that there is significant different between three BMI groups on physical fitness health related components $F(10, 434) = 6.24$, $P < 0.0001$. Thus, the current study shows an evidence to improve health, enhancement in each physical fitness health related components must be concentrated instead of correcting BMI alone.

Keywords: BMI; physical fitness health related; obesity.

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1. INTRODUCTION

The high incidence of youth obesity is one of the great public health concerns [16] and comparatively low incidence of underweight in Western youth, discoveries on the health concerns of underweight including physical fitness are limited. But in Asia, the aspiration to be skinny is common among youth [12]. Many Asian countries for example China have the twin problem of underweight and overweight together [10]. The rise in overweight is linked with a simultaneous decline in physical fitness [20]. Physical fitness can be categorized into health-related and skill-related fitness. Health-related fitness is crucial for everyday activities. It has the benefit that it can be measured non-invasively. There are some fitness tests that can be used to estimate the components of health-related fitness.

Link among weight category and health-related physical fitness has been witnessed by [5]. Studies describe the health-related fitness comprise morphological and metabolic components [4]. The morphological indicator is more concern about body mass index. Body mass index (BMI) is broadly used in scrutiny of overweight and obesity across youth. The amount of body weight and height is contribute to find the BMI (BMI = kg/m^2).

The BMI taxonomy is resulting from cut points gained from the general population and may not be particular to subgroups such as athletes and young adult and non-athletes. Compared with the general youth population, the impact of large muscle mass on BMI in athletes and youth may misclassify these populations as overweight and obese. Because BMI generally overemphasizes fattiness, on person with more lean body mass and undervalues more fattiness, on person with less lean body mass [15].

Studies investigating the correlation amongst weight status and health-related physical fitness in youth have stated that a decline in fitness with increasing BMI [17]. But, the specific impact of fat mass and fat-free mass remains uncertain [21]. Even though the studies exist that standards for a healthy BMI should be based on health-related fitness tests [7], focusing in BMI alone is used for an indicator of health enhancement by youth population in Malaysia.

Recent studies found that people categorized as obese by BMI do not face any risk of early death. However, interaction was found between BMI and fitness, but all health related physical fitness components interaction with BMI is unclear. Though, to our understanding,

the interactive relationships between health related physical fitness components and BMI category have rarely been studied systematically. So, this study aims to compare the physical fitness health related component on three different BMI category (underweight-UG; normal-NG and obese-OG) of sedentary male youth in Terengganu.

2. METHODOLOGY

2.1. Participants

After getting the ethical approval from university ethical committee, 250 sedentary youth males (17.38 ± 1.92 years) were randomly recruited from the nine different province in Terengganu of 27 each using stratified random sampling technique. The written inform concern were obtained from all 223 youths of 25 each from nine province who accepted to participate in this study after notifying that the participants are allowed to withdraw at any time from the study, it would not produce any health related consequences. Ranges of age are based on the recommendation of WHO from 13 to 19 years old.

2.2. Anthropometric Measurement

Typical anthropometric testing was carried out which constitutes of height and weight with the participants wearing light apparel. Height was measured with a wall-mounted wooden stadiometer to the closest 0.5 cm. Physique weight used to be evaluated with a standardized electronic digital scale to the nearest 0.1 kg. BMI was once measured as physique mass in kilograms divided with the stature in meters squared (kg/m^2). The measurements had been acquired twice, and the mean worth was generated as the final value. The entire measurements have been done in accordance to ISAK protocol [14].

2.3. Muscular Strength Measurement

The test was performed according to the suggested method for physical fitness tests [18]. Participants performed the sit-up test with knees bent at 90 degrees and feet flat on the floor and performed push up test with extended legs. The number of completed routine of sit-ups and push-ups in one minute was measured.

2.4. Flexibility Measurement

As proposed by prior study, the flexibility of the lower back and hamstrings was measured by the V sit and reach test [2]. The athletes performed two trials and the best one was recorded for further analysis [8].

2.5. Speed Measurement

Timing gate (Brower timing system) were allocated at the starting point and at 20m at a height of around 0.5 m off the ground to record the timing [19]. Participant started the test from a standing start at a distance of 0.3 m behind the initial timing gate before starting the test taking (to avoid the reaction time) after a countdown from the tester. The subjects were told to keep running at maximal velocity and verbal encouragement provided by the tester to avoid a reduction in sprint speed until passing the final timing gate. Participant performed two trial (five minute rest interval) with the fastest times utilized for further analysis.

2.6. Endurance Capacity Measurement

The multistage 20-m shuttle run test was employed to obtain the participant's predicted aerobic capacity uptake [17]. Every participant kept running for whatever distance of time they could afford until could no more keep pace with the velocity of the tape. Test results for every participant were expressed as predicted VO_2max consummate by checking the last level and shuttle number when the participant voluntarily resigned from the test.

2.7. Data analysis

In prior of the main data analysis, all the missing data, data error, outlier and normality data were checked [1, 27-30]. Furthermore, an appropriateness of a MANOVA also was test by applying sequences of Pearson correlations were test between all of the dependent variables in order to test the assumption that the dependent variables would be correlated with each other, at least in the moderate range [23-26]. Additionally, covariance matrices were test to homogeneity for the purpose of the MANOVA. As show in Equation (1) and (2), multivariate Pillais' Trace test was used to test the hypothesis that there would be one or more mean differences between BMI levels (underweight, normal and obese) and physical fitness health related.

Based on the current research, follow up test via Tukey HSD test was applied to examine BMI group mean differences comparisons across all five levels of physical fitness related health.

$$T = \sum_{i=1}^{s} \lambda_i \quad (1)$$

where HSD is honestly significant difference, M_1 and M_2 is reflect to the mean values, MSw is for mean square width and finally n is the number per mean.

$$HSD = \frac{M_1 - M_2}{\sqrt{MS_W\left[\frac{1}{n}\right]}} \quad (2)$$

3. RESULTS AND DISCUSSION

The purpose of the current study is to compare the physical fitness health related component on three different BMI category (underweight-UG, normal-NG and obese-OG) of sedentary male youth in Terengganu. To achieve the purpose of this study, 223 sedentary male youth of Terengganu (age 17.4 ± 1.9) categorize into three groups (underweight-UG, normal-NG and obese-OG) based on BMI index value. Then, the five physical fitness health related component (VO_2max, one minute sit up and push up, V sit and reach and 20 meter speed) are measured in all the three groups. Based on the Table 1, it is projected the tabulation of each groups, the minimum, maximum, mean as well as standard deviation for age, weight, height and BMI.

Table 1. Descriptive statistics of the participants for three groups

Statistic	Group	Age	Weight (Kg)	Height (M)	BMI
Sample	UG	43.00	43.00	43.00	43.00
	NG	142.00	142.00	142.00	142.00
	OB	38.00	38.00	38.00	38.00
Minimum	UG	13.00	23.00	126.70	14.33
	NG	13.00	42.90	148.60	18.54
	OB	15.00	59.20	132.30	25.02
Maximum	UG	21.00	61.50	184.50	18.44
	NG	21.00	77.40	187.00	24.81
	OB	21.00	122.00	182.90	36.47
Mean	UG	16.26	45.83	162.10	17.29
	NG	17.55	59.29	167.94	20.97

	OB	18.00	80.37	168.47	28.27
	UG	2.19	7.50	11.71	0.94
Standard Deviation	NG	1.76	7.18	6.65	1.74
	OB	1.71	11.96	8.01	3.11

The outcomes for the Multivariate Analysis of variance of all the three group comparison shows P value of less than 0.05, $F(10, 434) = 6.24$, $P < 0.0001$ ($P > 0.05$), which indicate that there is significant difference between three BMI groups on physical fitness health related components (see Table 2). These result display that the three different BMI category youths has considerably different fitness level in health related physical fitness component (see Fig. 1). The outcomes of this study are reliable with the prior studies where they found that the relation between BMI and health-related physical fitness was non-linear [13, 5].

Table 2. Multivariate Pillai's test

	BMI Category
Lambda	0.251
F (Observed values)	6.242
DF1	10
DF2	434
F (Observed values)	1.853
p-value	< 0.0001

Tukey (HSD) follow up test (see Table 3) of analysis of variance for the performance of the groups in flexibility test indicated only NG and UG revealed a significant difference, $p = 0.023$, $p < 0.05$, which is the obese BMI category people flexibility is as good as normal weight BMI category people, this is may be due to non-weight bearing nature of the test. The result is matched with two Taiwanese studies [7]. But, the underweight BMI category youths flexibility is very poor when compare with normal weight BMI category youth. Finding from this study is parallel with the previous study which found that sit-and-reach results in underweight youths are poorer compare with obese youths [13]. It is uncertain why underweight BMI category youth have poorer performance in flexibility test.

Table 3. Summary of all pairwise comparisons for BMI category Tukey (HSD)

	S&R	Speed	P. Up	S. Up	VO_2max
NG	52.84	3.43	38.16	26.96	43.56
OG	49.60	3.48	32.66	24.26	36.57
UG	48.81	3.52	32.19	23.02	43.07
Pr > F	0.01	0.18	0.01	0.000	0.00
Sig.	Yes	No	Yes	Yes	Yes

*Note: S&R = Sit and Reach; Speed = speed; P. Up = Push Up; S. Up = Sit Up; VO_2max = aerobic capacity.

Similarly, upper muscle strength test, only NG and UG shows significant difference, $p = 0.028$, $p < 0.05$. This result indicates that the underweight BMI category youths upper limb muscle strength is poor when compare with normal weight BMI category youth. It is not in line with the previous study which stated that an obese BMI category peoples in upper limb muscle strength is poor when compare with normal weight BMI category people even though weight lifting nature of this test [13]. So, UG have to focus on the enhancement of upper limb muscle strength through improving their upper limb muscle.

Hence, core muscle strength test indicated significant difference between NG and UG, $p = 0.000$, $p < 0.01$; and also between NG and OG, $p = 0.021$, $p < 0.05$ respectively. This outcome too point out that the underweight BMI category as well obese BMI category youths, core muscle strength is poor when compare with normal weight BMI category youth. This result is supported by the earlier study which found that obese subjects had poorer performances on weight-bearing tasks [9], as well as in line with the study that says underweight youth has poor sit up performance due to their weak abdominal muscles as a result both the category need to put effort to improve their core muscle strength [13].

Henceforth, aerobic capacity test revealed significant difference between NG and OG, $p = 0.0001$, $p < 0.01$; and between UG and OG, $p = 0.0001$, $p < 0.05$ respectively. This findings denote that the underweight BMI category people aerobic capacity is almost like normal weight BMI category people is due to less mass on their body. On the other hand, the obese BMI category youths aerobic capacity is deprived when compare with normal weight BMI

category youth, which is in contrast with the previous study [11]. Thus, OG have to concentrate more on the improvement of aerobic capacity.

On the other hand speed test revealed that there is no significant difference among the groups, $p = 0.183$, $p > 0.05$. It indicates that all the three BMI category youths speed is almost the same.

Thus, the current study shows evidence that youth should concentrate on each health related physical fitness components to enhance their health, not only focus on correcting their BMI index level.

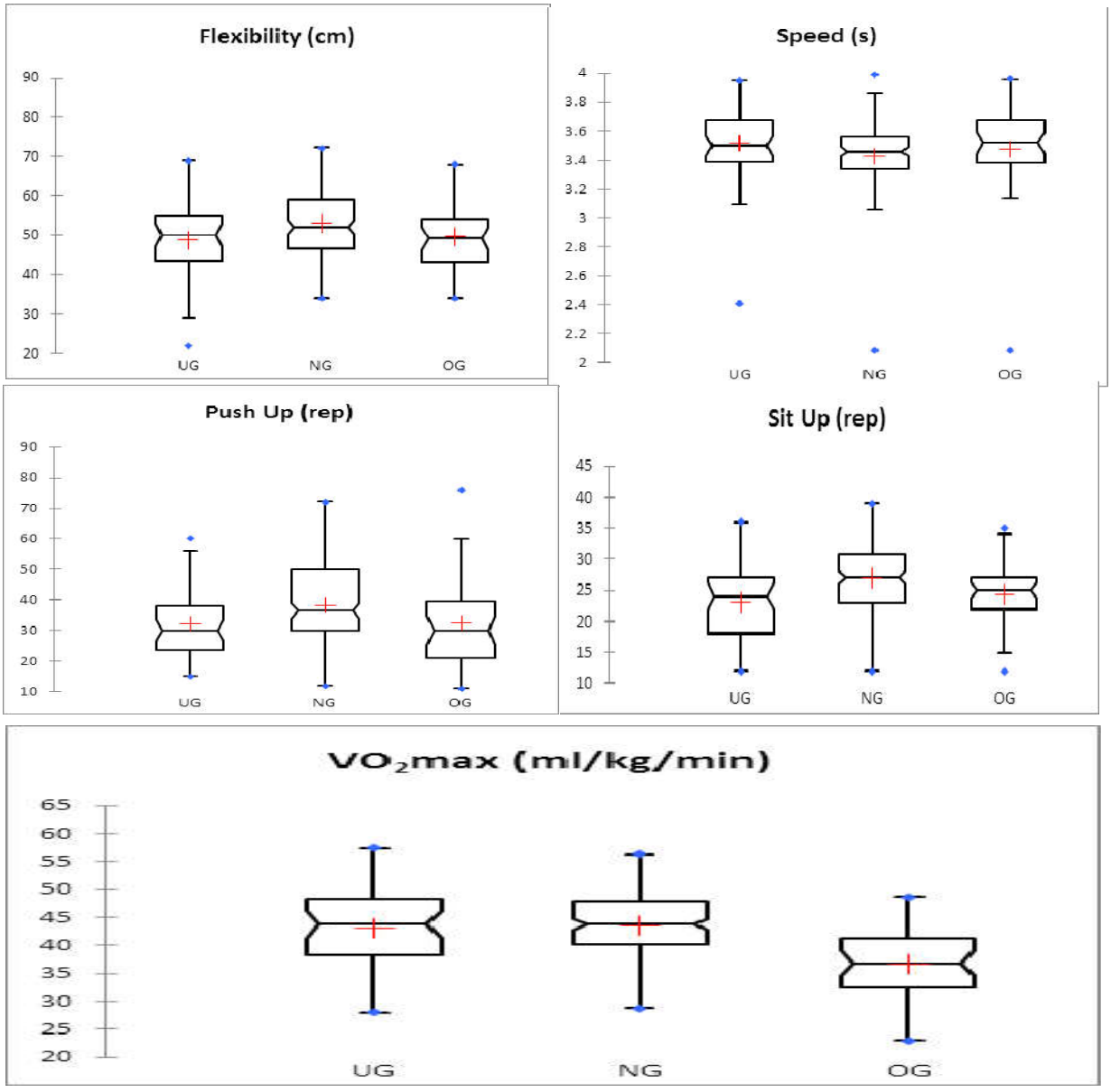

Fig.1. Summary plot of BMI category for all physical fitness variables

4. CONCLUSION

The comparison between the physical fitness health related component on three different BMI category proves that three different BMI category youths has considerably different fitness level in health related physical fitness component and the obese BMI category youths flexibility, upper limb muscle strength, speed are as good as like normal weight BMI category people but the aerobic capacity and core muscle strength components are poor when compare with normal weight BMI category youths, so OG need to improve aerobic capacity and core muscle strength. On the other hand, underweight BMI category youth aerobic capacity and speed are almost like normal weight BMI category youth but the flexibility, upper limb muscle strength and core muscle strength components are poor when compare with normal weight BMI category youths, hence UG have to concentrate on the improvement of flexibility, upper muscle strength and core muscle strength components. Therefore, to improve health, enhancement in each physical fitness health related components must be concentrated instead of correcting BMI alone.

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