

The Relationship Between Body Mass Index and Upper Body Endurance in Physiotherapists

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Abstract

Background: Endurance is a basic element essential for better performance. Higher fat mass can decrease the work output and increase fatigability. The purpose of this study was to assess a correlation between Body mass index (BMI) and upper muscular endurance measure among physiotherapy students.

Methods: A cross-sectional study was conducted on 150 Bachelor of Physiotherapy students without any upper limb pain. BMI was assessed using height and weight measures. Upper muscular endurance was assessed with push up test. Relationships were explored using Pearson's correlation coefficient test[®]. Chi square test was used for comparing upper muscular endurance among various BMI categories.

Results: Mean age of the subjects was 17-24 (19±1.93) years. No linear correlation was found between BMI and upper muscular endurance ($r = -0.13$). Statistically significant ($p < 0.05$) difference in upper muscular endurance of the subjects was found as per their BMI categories.

Conclusion: Obesity lowers down the endurance component of fitness by abating overall performance level among physiotherapy students.

Keywords: Push-up test; Fitness; Body fat.

Introduction

Prolonged guarded postures and repetitive tasks of physiotherapy students exposes them to various musculoskeletal injuries [1-3]. Various types of lifts and controlling the sudden movements of patients make their work physically demanding [4]. A study relates postural risk factors and transferring patients to great deal of neck, upper and lower back problems. Among physiotherapists work related musculoskeletal disorders are prevailing highest with low back region [5].

Endurance, a component of physical fitness, is defined as the ability of a muscle to maintain its function for maximum amount of time or maximum repetitions [6, 7]. In physiotherapists also their several day to day activities demand for a continuous muscular effort over a wider period of time. Therefore, assessment of their musculoskeletal functions has endurance as the vital component [8]. Higher fat mass in physiotherapists results in their decreased performance on fitness tests such as back endurance tests, workout act and increased fatigability [9, 10].

Push-up test is a reliable and valid field method to assess upper body endurance [11]. Electromyography shows activity in Pectoralis major, Serratus Anterior along with scapula stabilizers during

standard push-up [12]. Endurance is a basic element essential for better performance. The studies aimed to find its relation with BMI are very few [13, 14].

Most of the BMI based correlation studies have significant results with lower limb and respiratory fitness measures [15, 16, 17]. But the literature regarding BMI correlation with upper limb fitness measures such as endurance and strength tests are very few. Physiotherapy students are involved with treating large number of patients per day involving repetitive tasks and within same constrained postures [4]. Their endurance assessment is important.

This study was undertaken to assess any BMI and upper muscular endurance correlation among physiotherapy students. Also, the study determined the impact of obesity on the muscular endurance of upper limb among physiotherapy students.

Material and Methods

After ethical approval from college committee, a cross-sectional study was done on 150 Bachelor of physiotherapy male and female students. Based on purposive sampling students who gave written informed consent with no upper limb pain and age group 17-24 years (19± 1.93) were included. Students with any acute trauma, upper limb surgeries were excluded. The principal investigator recorded weight using body fat analyzer and height was measured using stadiometer. Body mass index was calculated using weight and height measures. Subjects were categorized among various BMI categories based on Asian classification.

Then they were asked to perform pushups with shoes on were on flat, stable surface. Hands were placed slightly wider than shoulder-width

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apart, and fingers pointed forward. Participants were instructed to maintain a neutral spine and feet together position throughout the entire movement [18]. The participants were allowed to do as many repetitions as possible. No modified push up position was used for females. Mean no. of push-ups for each category of BMI was taken as an outcome variable [19].

Data analysis was done using SPSS 15 software.

Results

Table 1 shows distribution of 150 physiotherapists among various BMI categories and the mean number of push-ups per category.

Table 2 reported statistically significant results with $p < 0.05$ (using chi square test) for comparison of among various BMI categories with respect to upper muscular endurance (n=150)

Graph 1 shows no linear correlation between BMI and upper body endurance with $r = -0.13$

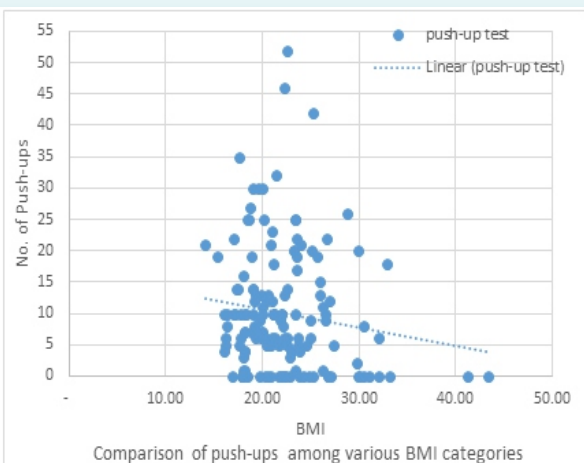
Table 1 : Comparison of Push-ups among various BMI categories

BMI	Sample Size N (150)	Push-ups (Mean±SD)
Underweight	32	9.28±8.17
Normal or Overweight	104	10.93±10.37
Obese	14	5.71±8.97

Table 2 : Comparison of BMI categories and upper body endurance performance.

BMI	Push Up	
	V. POOR(n=36)	GOOD(n=114)
U	6	26
N	22	82
OB	8	6
Total	36	114

The chi-square statistic is 9.3765. The p-value is .009203. The result is significant at $p < .05$.



Graph 1 : Correlation between BMI and upper body endurance measure



Figure 1 : Starting position for push-ups

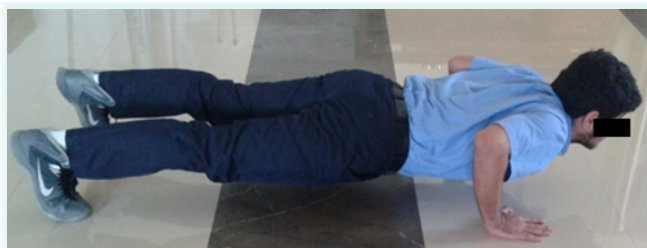


Figure 2 : Finishing position for push-ups

Discussion

Push-ups is a multi-joint closed chain exercise for upper limb that require maintaining neutral position of lumbar spine throughout the maneuver [20]. It facilitates muscle co-contraction along with dynamic joint stability [21]. The performance of physiotherapists depends on physical fitness level though gender variations also exist. Among females depending on age differences zero to one is categorized as very poor which in males is less than four [19]. It is important to begin with the movement. As the performance continues the subject finds it relatively easy.

BMI is an important measure used in various health settings. As fitness is essential for all, many studies investigating its relationship with BMI are present.

A 2015 study of 212 healthy participants on the upper limb pushing and pulling strength found no linear correlation between anthropometric parameters and strength measures [22]. Umesh et al (2012) found no significant relationship between BMI and handgrip strength or endurance [14]. Our results are very much in agreement with this study.

They further concluded that increase in body fat percentage might decrease handgrip endurance but not strength, though there are studies with variable results. A school based survey found the underweight and overweight group with lower grip strength and endurance [23]. Subjects with healthy BMIs have the highest level of fitness. High BMI groups report low speed, agility, and muscular strength. This results in exercise intolerance because of early overtiredness. Push-ups like endurance tasks are designed in such a way that continuous muscle work is required till exhaustion. Gouvali et al determined the relative load in pushup position during elbow extension and flexion 66 and 75 % respectively [24].

The gravitational pull exerted during pushups is affected by body weight and the way it is sustained on ground. Reduced Myocardial work efficiency as reported by maximal oxygen uptake and catecholamine levels lessens the overall performance in obese [25, 26, 27].

Other intrinsic and extrinsic factors like age, gender, motivation, and

training also do influence gains with upper body muscular endurance [28]. Future studies can further explore these variables and compare how significantly they improve various fitness components.

Future scope

1. Physiotherapy students are involved in repetitive tasks and manual handling of patients. Studies finding importance of endurance and strength training programs are suggested.
2. Future studies comparing different upper endurance tests and performance variation among males and females are further suggested.

Conclusion

There is no linear correlation between BMI and upper body endurance. Obesity has a negative impact on performance levels of physiotherapy students.

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