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Original Article

A STUDY TO DETERMINE THE ASSOCIATION OF BODY MASS INDEX WITH PERFORMANCE-BASED MEASURES OF BALANCE AND MOBILITY IN YOUNG ADULTS

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ABSTRACT

Background: The incidence of obesity is increasing in younger adults, with associated worsening of disability. Little is known about the impact of body mass index (BMI) on performance-based balance and mobility measures in younger adults.

Objective: The purpose of this study was to examine the association of BMI with measures of balance and mobility.

Methods: Young adults who participated in the study (N=50) were classified as normal weight, overweight, moderately obese, or severely obese. Mobility and balance were assessed by performance-based measures. Pearson correlation test was used to examine the association among BMI, mobility, and balance after controlling for potential confounding variables.

Results: There is a significant correlation between mobility and BMI at 0.01 levels. There is also a significant correlation between balance and BMI, though there was no correlation found between standing with narrow base balance and BMI.

Conclusions: Higher BMI levels are associated with poorer mobility and balance. Furthermore, individuals classified as being of normal weight and those classified as overweight were similar in mobility and balance, whereas individuals with obesity had greater impairments in mobility and balance.

KEY WORDS: Balance, Mobility, Body Mass Index (BMI), Weight, Obesity, Impairment.

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INTRODUCTION

Obesity is a major public health problem around the world. There has been a substantial increase in the prevalence of obesity globally, even in developing countries [1]. The prevalence of obesity is increasing rapidly in young adults (18-22 yrs) and adults (23-64 yrs). This increasing prevalence is of great concern because the health and economic burdens of obesity are vast. Numerous chronic diseases, including hypertension, cardiovascular disease, type 2 diabetes, osteoarthritis, and certain forms of cancer, are strongly associated with excess body weight [2,3].

Obesity has been suggested to lead to an increased risk of disability through a range of mechanisms, including skeletal stress and atherogenesis. The increased prevalence of obesity in adults is especially concerning given the association between obesity and impaired physical function [4,5]. Physical function refers to a person's ability to perform basic and

instrumental activities of daily living and mobility tasks. Impairments in physical function, such as the components of mobility and balance, have been linked to the development of disability.

The 6-Minute Walk Test has been used as a measure of mobility and aerobic endurance in older adults with and without disease and has shown to be a reliable measure. The 6MWT is a practical simple test that requires a 100-ft hallway but no exercise equipment or advanced training for technicians. Walking is an activity performed daily by all but the most severely impaired patients. This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes.

Single leg stance measures static standing ability (balance with feet fixed). This test helps to assess standing balance. Tandem stance assesses static balance with narrow base of support. For clients who cannot perform the single leg stance, use the TS test for an outcome measure.

The BMI is the most common method to quantify weight across a range of body sizes in adults. Using the BMI, individuals can be classified as:

Normal Weight:	BMI 18.5 – 24.9
Overweight:	BMI 25 – 29.9
Obese:	BMI 30 – 34.9
Moderate Obese:	BMI 35 – 39.9
Severe Obese:	BMI ≥40

The BMI is an inexpensive and easy-to-use clinical measure that can be administered with minimal training [6]. Health care professionals, such as physical therapists, may utilize this simple measure to screen patients and determine risks for diseases associated with obesity.

Studies investigating the relationship between BMI and mobility have focused on individuals with severe obesity [7,8] and few studies have examined the relationship between BMI and balance [9].

The purposes of this study were to describe how mobility and balance measures are affected by BMI and to examine other factors that might explain the association between BMI and mobility and balance.

MATERIALS AND METHODS

Present study conducted with 50 young adults having age between 18-24 years from the Rajkot City, India, and excluded the subjects with Neuromuscular disorders, Cancer, Major surgery in the previous 6 months, Severe pulmonary disease, chest pain with activity, A cardiac event such as a heart attack in the previous 6 months.

Procedure:

BMI: Height and weight were measured while wearing indoor clothing and without shoes.

The BMI classifications used in this study were based on the World Health Organization's definitions of

Normal weight (BMI 18.5 to <25 kg/m^2)

Overweight (BMIe"25 to <30 kg/m^2)

Class I obesity (BMIe"30 to<35 kg/m^2)

Mobility measure: Six-Minute Walk Test, Each participant was asked to walk as far as possible in 6 minutes, taking standing rest periods as needed. A straight path of 12.18 m was used. The total distance walked back and forth in 6 minutes was recorded.

Balance measures: Timed balance measures, Participants were asked to maintain their balance for up to 30 seconds under each of the following conditions: with eyes closed:

Standing while the feet were positioned as close together as possible

Tandem stand

Single-leg stance

Statistical Analysis: Data was analyzed by using Pearson Correlation Test and interpreted with the available literature.

RESULTS

Fig. 1: Showing correlation between BMI and the Mobility (6 MWT).

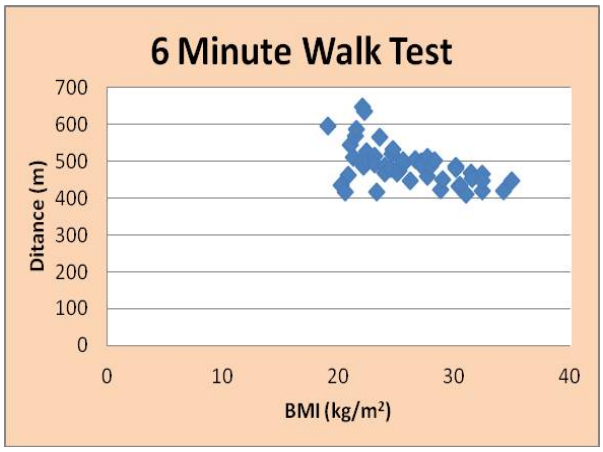


Fig. 2: Showing correlation between BMI and the Balance (Tandem stand).

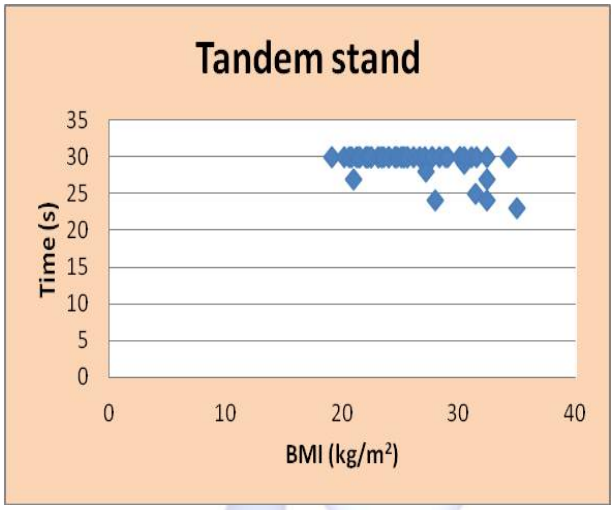
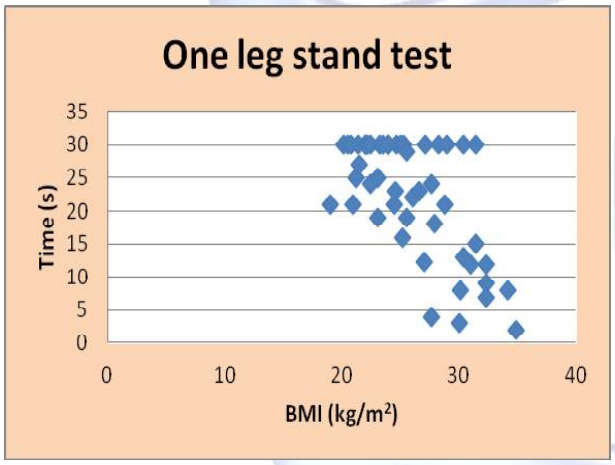


Fig.3: Showing correlation between BMI and the Balance (one leg stand).



There is a significant correlation between mobility and BMI at 0.01 levels.

There is also a significant correlation between balance and BMI though there was no significant correlation found between standing with narrow base balance and BMI.

DISCUSSION

When examining balance and mobility across weight groups in younger adults, there were more

differences in mobility than in balance. Individuals who were classified as being of normal weight and those classified as overweight were similar in mobility and balance, but individuals with moderate obesity demonstrated consistently lower performance than the other groups.

LaCroix et al [10] found that there was a strong association between loss of mobility and high BMI levels. Differences in static balance among weight groups may be clinical meaningful. A greater number of individuals with moderate obesity were unable to complete the performance-based measures of balance compared with those who were of normal weight and those who were overweight. Lack of completion of balance measures in participants with higher BMI was related to inability to assume the test positions (eg, tandem stance & single leg stance). Thus, had all participants with obesity been able to complete the balance measures, our results may have differed.

Many of the impairments to walking related to obesity can be attributed to differences in temporospatial gait parameters observed between obese and normal weight populations. When walking at a self selected pace, obese individuals walk at a slower velocity with shorter stride length and spend more time with their feet contacting the ground via longer double support times and stance times [11]. Obese adults also walk at a slower cadence with wider step widths and shorter swing times [12].

Obesity may also affect adaptation and mobility by limiting an individual's ability to motor plan, the ability to pre-plan a movement before the movement is executed. Poor motor leads to poor performance on tasks [13]. This could be a detriment to adaptation because adaptive behavior involves tailoring actions to variations in one's environment. Therefore motor plans need to be changed during motor actions [14]. In the obese population, poor motor planning and an inability to adapt motor plans during the course of action could lead to more frequent losses of balance or the inability to recover from unavoidable losses of balance.

Obesity is associated with increased burden of chronic disease and decreased physical activity level, both of which have been shown to negatively affect mobility [10]. In the current study, individuals with obesity were less likely to engage in physical activity compared with those who were overweight and those of normal weight. The association between BMI and mobility was partially explained by these factors. Using mean speed of foot centre of pressure (COP) to approximate balance stability, Hue et al. [15] estimated the contribution of body

weight to postural stability in conditions of vision and no vision. The study noted a strong correlation between increased body weight and decreased postural stability, as evidenced by increased COP speed to maintain stability, decreased mean peak stability times and increased mean distance between stable positions. These measurements suggest that obese persons are less responsive to perturbation than normal weight subjects. One potential explanation for this decreased sensitivity is the increase in mean pressure that the mechanoreceptors – the body's sensory receptors for pressure – are under due to an elevation in body weight.

Existing evidence shows that patients with obesity adapt their gait in order to accommodate excess weight and temporarily protect bones and joints however by doing so put themselves at greater risk for damage to their joints and associated pain. In addition to impairments of the musculoskeletal system those patients with obesity may also have cognitive impairments that could interfere with motor planning and therefore also contribute to mobility disability. The age of the patient, distribution of body fat, and factors in the environment in which the person plans to be physically active must also be considered.

Weight loss programs should include the adoption of resistance exercise and regular physical activity. Individuals with obesity were less likely to engage in physical activity compared with those who were overweight and those of normal weight. Young adults with obesity should be routinely advised by their health care provider to become more physically active for the purpose of losing weight and reducing cardiovascular and metabolic risk profiles. Although such advice is well intended to promote health and wellness, changes to physical activity levels and the associated benefits are illusive unless issues related to functional mobility are addressed.

Limitations of the study Includes:

The results of the study may not apply to the general community-dwelling older population, smaller sample size and more sophisticated measures of total body fat are available.

CONCLUSION

Higher BMI levels are associated with poorer mobility and balance. Furthermore, individuals classified as being of normal weight and those classified as overweight were similar in mobility and balance, whereas individuals with obesity had greater impairments in mobility and balance.

Conflicts of interest: None

REFERENCES

[1]. Mendez MA, Monteiro CA, Popkin BM. Overweight exceeds underweight among women in most developing countries. Am J Clin Nutr. 2005;81:714–721.

[2]. Kopelman PG. Obesity as a medical problem. Nature. 2000;404:635–643.

[3]. Pi-Sunyer FX. Medical hazards of obesity. Ann Intern Med. 1993;119(7pt2):655–660.

[4]. Han TS, Tijhuis MA, Lean ME, Seidell JC. Quality of life in relation to overweight and body fat distribution. Am J Public Health. 1998;88:1814–1820.

[5]. Blaum CS, Xue QL, Michelon E. The association between obesity and the frailty syndrome in older women: the Women's Health and Aging Studies. J Am Geriatr Soc. 2005;53:927–934.

[6]. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: executive summary; Expert Panel on the Identification, Evaluation, and Treatment of Overweight in Adults. Am J Clin Nutr. 1998;68:899–917.

[7]. Browning RC, Baker EA, Herron JA, Kram R. Effects of obesity and sex on the energetic cost and preferred speed of walking. J Appl Physiol. 2006;100:390–398.

[8]. De Souza SA, Faintuch J, Valezi AC, et al. Gait cinematic analysis in morbidly obese patients. Obes Surg. 2005;15:1238–1242.

[9]. Corbeil P, Simoneau M, Rancourt D, et al. Increased risk for falling associated with obesity: mathematical modeling of postural control. IEEE Trans Neural Syst Rehabil Eng. 2001;9:126–136.

[10]. LaCroix AZ, Guralnik JM, Berkman LF, et al. Maintaining mobility in late life; II: smoking, alcohol consumption, physical activity, and body mass index. Am J Epidemiol. 1993;137:858–869.

[11]. Lai PP, Leung AK, Li AN et al. Three-dimensional gait analysis of obese adults. Clinical Biomechanics 2008;23(Suppl.1):S2–S6.

[12]. Wearing SC, Hennig EM, Byrne NM et al. The biomechanics of restricted movement in adult obesity. Obesity Reviews 2006;7:13–24.

[13]. Wolpert DM & Miall RC. Forward models for physiological motor control. Neural Networks 1996;9:1265–1279.

[14]. Adolph KE, Joh AS, Franchak JM et al. Flexibility in the development of action. In: The psychology of action. New York: Oxford University Press, 2008;2:399–426.

[15]. Hue O, Simoneau M, Marcotte J, Berrigan F, Doré J, Marceau P, Tremblay A, Marceau S, Teasdale N. Body weight is a strong predictor of postural stability. Gait Posture 2007;26(1):32-38.

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