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Original Article

Association of Body Mass Index and Static Balance Among Young Adults

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ABSTRACT

Background: Body characteristics are thought to affect postural stability apart from age and gender. Higher weight has increased the stress within joints, soft tissues and bones, and it results in impaired musculoskeletal function. **Objective:** The goal of this investigation is to gauge the relationship of BMI with static balance among young adults. **Methods:** This study was an analytical cross-sectional study. Data was collected from different universities in Lahore by using a non-probability convenience sampling technique. Permission was taken from the Departmental Research Committee of the University of South Asia and before taking the data informed consent was signed from the participants. Both males and females with an age range of 18-25 years were included. Participants with any recent history of injury to the spine and lower limb, and medicines that can change balance e.g., anti-depressants, anti-anxiety, antihistamines, or pain relievers and comorbidities like rheumatic disease, and neurological disease were excluded. The sample size was 385, calculated by using Rao software. Outcome variables were body mass index and static balance measured by the body mass index online calculator after taking height in feet and weight in kg and uni pedal stance test on both legs separately respectively. The uni-pedal stance test was performed by the participants, with their opened and closed eyes and their hands placed on their hips. **Results:** The mean age of 385 young adults was 21.28±2.2 years. There were 191 males and 194 females. There were 83 underweight, 234 normal, 52 overweight and 16 obese young adults. In the right uni pedal stance test with eyes open, only 47 young adults have a high risk of falling with impaired balance while with eyes closed 158 young adults have a high risk of falling with impaired balance. In the left uni-pedal stance test with eyes open, only 82 young adults have a high risk of falling with impaired balance while with eyes closed 201 young adults have a high risk of falling with impaired balance. **Conclusion:** There is no association between body mass index and static balance among young adults.

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INTRODUCTION

Harmful falls result in significant human and economic damages annually. As a result, contemporary techniques have been utilized to assess balance control to recognize individuals who might be susceptible to future falls.[1] Within healthy adults, the thresholds for maintaining posture stability are determined by mechanical elements encompassing both personal and environmental attributes. Besides age and gender, bodily traits are also believed to impact postural stability.[2,3] Body mass index does not have any negative impact on the locomotor system but obesity has a great impact on increased falling risk and injury. Obese individuals have a higher chance of falling and loss of balance than non-obese individuals.[4] A healthy individual's normal functions are affected if that individual is overweight. Obese individuals have a higher chance of falling and loss of balance than non-obese individuals. Higher weight has increased the stress within joints, soft tissues, and bones, and it results in impaired musculoskeletal function.[5,6] Impaired balance, strength, sensory function, gaits and neuromuscular function have a strong chance of falling.

Obesity can result in changes in gait that are linked with more chances of falling. Changes in obese individuals' gait patterns can cause instability and loss of balance.[7] The dynamic effect of gaits like speed, stride and support base are effectively lower in obese individuals. Obese individuals have very poor skeletal performance, metabolic disturbance and constant physical exhaustion.[1] For good performance and daily living activities, mobility and a well postural balance are essential.[8] Equilibrium is a continually changing interaction of muscles and joints, including a reconciliation between various frameworks, for example transmitting, identifying, motor information, handling sensorial, in the adapting responses that are motor and CNS to understand the body's fair stances corresponding to the environment and adjusting one's focal point of gravity within the help center.[8-10] CNS which can keep up with the soundness of the body. It should integrate the visual, interceptive system, vestibular system, and proprioceptive systems such as the systems that are used to promote integration between the external environment and the body.[3,9,11] A healthy individual's normal functions are affected due to changes in anthropometric measurements.[12,13]

Moreover, factors like foot dimensions and complications such as foot abnormalities have been recognized as contributors to functional limitations, including postural instability. In summary, variations in bodily characteristics are thought to influence the limits of individual postural stability. This variability could influence the choice of motor techniques individuals employ to uphold their standing balance control.

METHODS

This study was an analytical cross-sectional study. Data was collected from different universities in Lahore by using a non-probability convenience sampling technique. Permission was taken from the Departmental Research Committee of the University of South Asia and before taking the data informed consent was signed from the participants. Both males and females with an age range of 18-25 years were included. Participants with any recent history of injury to the spine and lower limb, medicines that can change balance e.g., anti-depressants, anti-anxiety, antihistamines, or pain relievers, and comorbidities like rheumatic disease, and neurological disease were excluded. The sample size was 385, calculated by using Rao software. Outcome variables were body mass index and static balance measured by the BMI online calculator after taking height in feet and weight in kg and unipedal stance test on both

legs separately respectively. The unipedal stance test was performed by the participants, with their opened and closed eyes and their hands placed on their hips. Participants stood on one leg without any support, time begins when the opposite foot leaves the ground; time stops immediately when the opposite foot touches the ground and/or when hands leave the hips. If unable to stand for 5 seconds or less client is at greater risk of injury from a fall. The average normal value of a single leg stance of healthy individuals (18-39 years) with eyes open is 43 seconds, less than 24 sec will lead to a high risk of fall, and above 33 sec it will lead to the least risk of fall. The average normal value of single leg stance of a healthy individual (18- 39 years) with eyes closed is 9 sec.[14]

RESULTS

The mean age of 385 young adults was 21.28±2.2 years. There were 191(49.6%) males and 194(54.4%) females. The mean weight was 57.87±11.78 kg and the mean height of participants was 5.43±0.46 feet. There were 83(21.55%) underweight, 234(60.77%) normal, 52(13.5%) overweight and 16(4.15%) obese young adults. In the right uni-pedal stance test with eyes open, only 47 young adults have a high risk of falling with impaired balance while with eyes closed 158 young adults have a high risk of fall with impaired balance. In left unipedal stance test with eyes open only 82 adults have high risk of fall with impaired balance while with eyes close 201 young adults have high risk of fall with impaired balance.

Table 1: Association of BMI and Static Balance Among Young Adults

Categories		BMI				Total	p-value
		Underweight n=83	Normal n=234	Overweight n=52	Obese n=16		
RT.E.O*	High risk	6	27	12	2	47	0.194
	Least risk	52	135	29	10	226	
	Normal	25	72	11	4	112	
RT.E.C**	High risk	42	100	29	7	158	0.673
	Least risk	13	43	6	3	65	
	Normal	28	91	17	6	142	
LT.E.O***	High risk	11	58	11	2	82	0.156
	Least risk	55	120	31	12	218	
	Normal	17	56	10	2	85	
LT.E.C****	High risk	41	131	27	8	201	0.487
	Least risk	9	39	7	3	58	
	Normal	33	64	18	5	120	

*RT.E.O: Right leg standing with eyes open **RT.E.C: Right leg standing with eyes close ***LT.E.O: Left leg standing with eyes open ****LT.E.C: Left leg standing with eyes close

DISCUSSION

The study participants consisted of 385 participants with an average age of 21.28±2.2 years, encompassing 191(49.6%) males and 194(50.4%) females. The participants' average weight was 57.87±11.7 kg, and the mean height was 5.43±0.46 ft. The distribution of BMI categories indicated that 83(21.55%) participants were underweight, 234(60.77%) were of normal weight, 52(13.5%) were overweight and 16(4.15%) were classified as obese. To evaluate static balance, the uni-pedal stance test was used. During the right uni pedal stance test with eyes open, 47 young adults exhibited an elevated risk of impaired balance. This number rose to 158 when participants performed the test with their eyes closed. Similarly, the left unipedal stance test demonstrated that 82 individuals displayed a high fall risk with open eyes, while the number increased to 201 with closed eyes. The subsequent analysis of the collected data did not reveal any significant association between BMI and static balance among the young adult participants. The computed p-value exceeded the predefined threshold of 0.05, indicating that BMI might not be a substantial contributing factor to static balance. In a study involving middle-aged adults, Rezaeipour et al. in 2018 noted a minimal association between BMI and static balance.[15]

On the contrary, the research by Carral et al. in 2019 on an older adult population found a modest correlation between BMI and postural stability.[16] A review of the literature highlights the diversity in research outcomes regarding the relationship between BMI and static balance among young adults. Some studies are in line with the present study's results, showing a lack of significant correlation between BMI and static balance. For instance, the study by Do Nascimento et al. in 2017 investigated a similar demographic and found no noteworthy link between BMI and static balance.[5] These age-specific results highlight the complexity of the BMI-balance relationship across the lifespan. The interaction between BMI and static balance may evolve due to changes in musculoskeletal structure, sensory systems, and motor control mechanisms that occur with aging. While the current study's findings suggest no significant link between BMI and static balance among young adults, the context changes when considering other age groups.[12] In conclusion, the present study adds to the body of knowledge by suggesting no significant association between BMI and static balance among young adults. While some previous studies align with these findings, others propose subtle connections or discrepancies. These conflicting outcomes underscore the complexity of the relationship between BMI and static balance and highlight the need for further research considering various contextual factors and methodological considerations. The limitation of the study was dominant side was not considered and gender differences were not seen. Further research should consider dynamic balance and different populations like athletes.

CONCLUSION

In this study, there is no association between body mass index and static balance among young adults.

DECLARATIONS

Consent to Participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

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