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Comparison of strength, balance and mobility between obese versus non-obese adolescence

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Abstract
Aim of the study is to compare strength, balance and mobility between obese and non-obese adolescents. Weight, height and BMI for age are parameters for assessment of nutritional status in children. In obese children, skeletal muscle changes and development of muscle function are seen. A sample of 40 adolescents 20 obese and 20 non-obese is collected from random population. Participants were assessed for height and weight for calculating their body mass index. Balance was assessed with Star Excursion Balance Test and Timed up & go test (TUG) for mobility and Standing Long Jump Test for strength**.** Present study conducted between obese and non-obese among the age group 11-16 years shows hardly any significant associations between variables of balance, mobility, and lower extremity muscle strength. The children with increased BMI affects the balance, strength and speed i.e. mobility. There is not much significant correlation between obese and non-obese adolescents.

Keywords: body mass index, obesity, star excursion balance test, timed up and go test, mobility

1. Introduction

The World Health Organization (WHO) has declared overweight as one of the top ten health risks among any individual. The term overweight refers to an excess of body weight 10 percent greater than the normal, whereas obesity is used to describe an excess body weight 20 percent or more than the normal. Childrens may face many problems due to their weight. In obese children, skeletal muscle changes, such as increased muscle lipid content, raising concerns about the development of muscle function are seen. Obesity is the kind of disease which not only affect the physical heath but also affect the child mentally. Weight, height and Body Mass Index for age are parameters for assessment of nutritional status in children[3]. The BMI is expressed as BMI= Weight in kg / (Height) in m^2. Excessive sugar intake by soft drink, increased consumption of junk products, and decline in physical activity have been playing major roles in the increasing rates of obesity. Lower performance levels in balance and muscle strength have been observed in children compared to young healthy adults. Physical strength is the quality or state of being physically strong. Deficits in lower extremity muscle strength and balance represent major intrinsic fall and injury-risk factor. Children seem to be at great risk of fall as neuromuscular system is not fully developed. Daily activity must be performed under single task like standing or waling and dual task like performing some movement or talking to someone while walking. Dual task performance requires increased level of attention for regulation of postural control. All induvial need to be mobile and active in daily routine. Mobility refers not only transfer from one place to other but also be fit to perform task[1]. Balance and mobility also go hand in hand. Obese child may have difficulty with gait and maintaining the same posture while walking[2]. Comparison of strength balance and mobility is important so that we get an idea of difficulties face by the child.

2. Materials and methods

The study was conducted among the obese and non-obese adolescents with age group of 11-16 years. The informed written consent was obtained from the participants regarding the procedure prior to the study. Materials used are as follows Inch tape, Chalk, Data collection sheet, Pen, Pencil, TUG test performa, Star excursion test performa, Standing long jump test performa. Procedure is divided in 3 section. Standing Long Jump test is used to test strength as measuring parameter. The participant stood behind the starting line, with feet together, and pushed off vigorously and jumped forward as far as possible. The distance is measured from the take-off line to the point where the back of the heel nearest to the take-off line lands on the mat or non-slippery floor. The test was repeated twice, and the best score was retained. Star Excursion Balance test is used to assess balance in obese and non-obese adolescents. The participants stand in a square at the center of the grid with 8 lines extending from the center at 45° increments. Each of the 8 lines extending represent the individual directions which each subject are required to reach out with the most distal part of their reach foot. The eight directions consist of antero-lateral (AL), anterior (A), antero-medial (AM), medial (M), postero-medial (PM), posterior (P), postero-lateral (PL) and lateral (L). A standard tape measure (cm) was used to quantify the distance the subject had reached from the center of the grid to the point that the subject managed to reach along each diagonal line Timed up and go test used for mobility is described by Podsialdo and Richardson. Participants are asked to perform TUG at their normal speed. One practice and one test trial are performed. Time recorded by stopwatch is nearly 0.01sec. Children must be seated and instructed to walk 3m, turn around, walk back to their chair and sit.

3. Results & Discussion

The collected data was analyzed by using unpaired t test.

Table 1: Demographic profile of all participants

Demographic Characteristic	
AGE	11 ±16
GENDER RATIO (Boys/Girls)	22:18

Table 2: Comparison of Star Excursion Balance Test between Obese and Non-obese

	Non-Obese	Obese	P value	T value	Result
Mean ± SD	21.047±1.0058	16.311±1.5462	0.0001	10.7565	Extremely statistically significant

Mean value for Star Excursion Balance Test between Non-Obese &Obese were as follows:
Mean ±SD: 21.047±1.0058 for Non-Obese and 16.311±1.5462 for Obese.
T value is 10.7565.
P value and statistical significance: P value is less than 0.0001 and this difference is considered to be extremely statistically significant.

Table 3: Comparison of Timed Up and Go test between Obese and Non-obese

	Non-Obese	Obese	P value	t value	Result
Mean ± SD	7.090 ± 0.608	8.405 ± 0.885	0.0001	5.4792	Extremely statistically significant

Mean value for Timed Up and Go Test between Non-Obese &Obese were as follows:
Mean ±SD: 7.090 ± 0.608 for Non-Obese and 8.405 ± 0.885 for Obese.
T value is 5.4792.
P value and statistical significance: P value is less than 0.0001 and this difference is considered to be extremely statistically significant.

Table 4: Comparison of Standing Long Jump Test between Obese and Non-obese

	Non-Obese	Obese	p value	t value	Result
Mean ± SD	42.365± 4.079	33.960± 3.813	0.0001	6.7305	Extremely statistically significant

Mean value for Standing Long Jump Test between Non-Obese &Obese were as follows:
Mean ±SD: 42.365 ± 4.079 for Non-Obese and 33.960 ± 3.813 for Obese.
T value is 6.67305.
P value and statistical significance: P value is less than 0.0001 and this difference is considered to be extremely statistically significant.

Table 5: Comparison of SEBT, TUG and SLJ test between Obese and Non-Obese

	Non-Obese	Obese
Star Excursion Balance Test	21.04 ± 1.058	16.61 ± 1.546
Times up and go test	7.090 ± 0.608	8.405 ± 0.885
Standing Long Jump Test	42.36 ± 4.07	33.96 3.81

Study was conducted and sampling was done from random population. The two categories of sample were collected that is obese and non-obese based on body mass index. The test was performed successfully amongst the adolescent age group of 11-16 years which include both male and female. A comparison of strength, balance and mobility among obese and non-obese is main criteria of study. Lean body consist of less amount of fat accumulation within body. This also makes one's body more flexible to perform the task. On the other side child with an BMI being overweight or obese are more likely to be weak and less flexible. Performing balance test requires abdominal, lower limb, back muscle strength. Participants with lean BMI could reach more in all the eight directions. Their body while performing the test was quite stable and they had low chances of fall risk. Whereas the participants with overweight or obese had to perform more than three trials. They were likely more unstable and had more chances of fall risk. Sedentary lifestyle can reduce the mobility. Mobility can be assessed by using Timed Up and Go Test. Primary objective of TUG is assessing functional balance, functional mobility or activity. Participants with overweight took more time compared to the normal child. Weight could be one factor that could reduce the speed on an individual. Normal individual has comparative more strength in lower limb so the time taken by normal individual is less. Based on results and the findings reported in the study for different age groups and testing methodologies seems possibly true to argue that balance, mobility, and muscle strength are independent of each other and may have to be trained complementarily for lower extremity fall and injury prevention purposes

Conclusions

Present study conducted between obese and non-obese among the age group 11-16 years shows hardly any significant associations between variables of balance, mobility, and lower extremity muscle strength.

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