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RESEARCH ARTICLE

COMPARISON OF STRENGTH, BALANCE AND MOBILITY BETWEEN NORMAL AND OVERWEIGHT ADOLESCENT AMONG THE PHYSIOTHERAPY COLLEGE STUDENTS

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ABSTRACT

Background and Objectives: The world health organization (WHO) has declared overweight as one of the 10 health risk among any individuals. Lower performance level in balance and muscles strength has been observed in children compared to healthy adults. Deficit in lower extremity muscles strength and balance represents major intrinsic fall and injury risk factor. In overweight children skeletal muscles changes and development of muscles function are seen. Child with increased BMI affects the strength, balance, and mobility. The objectives of the study are to compare the strength, balance and mobility among normal and overweight among student of Physiotherapy College. **Method**: 140 adolescent with age group of 18 to 22 years was selected on basis of inclusion criteria from the college. Anthropometric measurement is taken for calculating body mass index. Body mass index is calculated based on subject height and weight. Height was measured in cm. and body mass in kg. Standing long jump test is used to assess the strength of the lower limb. Balance is assessed by the Y balance test and Mobility is assessed by timed up and go test. **Result**: Data analyzed by using t-test and Pearson correlation coefficient which showed significantly negative correlation of standing long jump test ($r=0.0741, p<0.05$) and ($r=0.6573, p<0.05$) shows negative correlation of Y balance test of right leg, (r=0 3486*p.<0.05)shows negative correlation of y balance test of left leg. ($r=0.4928$, $p<0.05$) which shows negative correlation of timed up and go test. **Conclusion:** Present study conducted between normal and overweight adolescent among age group of 18 to 22 years shows hardly any significant associations between variables of balance, mobility and lower extremity muscles strength. The children with increased BMI affect the balance, strength, speed .i.e.-mobility. There is not much significant correlation between normal and overweight adolescent among student of Physiotherapy College.

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INTRODUCTION

The world health organization (WHO) has declared overweight as one of the 10 health risk among any individuals. The term overweight refers to the body weight 10 percent greater than normal. The term obesity is used to describe an excess body weight 20 percent or more than standard. Hormonal imbalance, emotional trauma and alteration in basic homeostatic mechanism all have been shown to be either directly or indirectly related to onset of obesity. Environmental factor such as cultural habits, in adequate physical activity and improper diet are major cause of obesity (Harine Sarganam, 2014). Overweight and obesity is a condition where excess body fat negatively Affect child's health or wellbeing (Harine Sarganam, 2014). As a method to determine body fat directly are difficult, diagnosis of obesity often based on BMI (Harine Sarganam, 2014). Prevalence is higher in urban area. In India, pediatric obesity is an emerging public health problem, especially among higher socioeconomic group (Dhiraj kumar srivastva, 2017).

In India, prevalence of pediatric obesity and overweight in the age group of 9-15 years range from 9.9% to 18.5% (Dhiraj kumar srivastva, 2017). Studies have shown that there had been significant gender difference in the prevalence of obesity with more prevalence of obesity and overweight among boys of affluent society (12.4% &15.7%) compared to girls (9.9%&12.9%) (Dhiraj kumar srivastva, 2017). World health organization (WHO) has recommended various indices based on anthropometry to evaluate Nutritional status of children (WHO,1995) (Harine Sarganam, 2014). BMI is expressed as BMI=Weight in kg/height in m^2. MI is inexpensive &easy to perform method of screening for weight categories that may lead to health problem (Harine Sarganam, 2014). BMI is age and sex specific and is often referred to as BMI for age (Harine Sarganam, 2014). On the other hand, there was supportive evidence that excessive sugar intake by soft drink, increased portion size and steady decline in physical Activity have been playing major role in the rising rates of obesity all around the world (Harine Sarganam, 2014). Consumption of food prepared Away from home often represents a diet that is high

in fat and energy (Harine Sarganam, 2014). Meals provided through school cafeteria have also been shown to contain more fat than recommended (Harine Sarganam, 2014). Fast food are one of the most advertised product on televisionand children are often targeted market (Harine Sarganam, 2014). When outdoor Activity of children compare with their BMI status, there is significantly higher prevalence of overweight and obesity in children with only indoor Activity such as television viewing (>20 hrs /week), computer and video games (> 10 hrs/week), sleeping(>10 hrs/day) and long school hours (Harine Sarganam, 2014). The immediate consequences of overweight in childhood are often psychological and also include cardiovascular risk factor such as hypertension high blood cholesterol and abnormal glucose tolerance (Harine Sarganam, 2014). Overweight and obese children have higher blood pressure more abnormalities in serum lipid level and higher level of serum insulin resistance than children of normal weight (Harine Sarganam, 2014). All of this condition are hall mark of every metabolic disease and susceptibility to atherosclerosis and other cardiovascular disease (Harine Sarganam, 2014).

Obesity is an independent risk factor for cardiovascular disease and significantly increase morbidity and mortality (Harine Sarganam, 2014). Many of the morbid condition like metabolic, cardiovascular, psychological, orthopedic, neurologic, hepatic, pulmonary, and renal disorder are seen in Association with childhood obesity (Harine Sarganam, 2014). Overweight and obesity in childhood have significantly impact on both physical and psychological health (Harine Sarganam, 2014). Strength is a ability of muscles to produce force against resistance[4]. Lower performance level in balance and muscles strength has been observed in children compared to young healthy adults. Deficit in lower extremity muscles strength and balance represents major intrinsic fall and injury risk factor (Benedicie, ?) .For example McGraw *et al*. (?) reported decreased mediolaterl stability during standing in obese prepubertal boys compared with Non obese boys (Benedicie, ?). This could also explain that why women's postural stability is more easily impacted by overweight than the abilities in men (Hannag, 2012). Research studies have typically recorded a higher level of absolute strength in both trunk and lower limb muscles of obese individuals as compared to their normal weight peer. However when a greater concern in the obese and morbidly obese (Nascimento, 2017). Although the presence of even moderate overweight(BMI>29) has a significant effect on women's performance corrected for the independent effect of fat free mass or adjusted for total body weight, obese individuals actually have lower level of strength and power ouput than lean counterparts (Hannag, 2012).

Previous studies have shown that males shows reduced peak torque in planter flexion strength and female shows decreased knee extension strength leading to increased tendencies to fall in obese elderly subject (Hannag, 2012). Good postural balance and mobility are essential for adequate performance of most daily task as well as recreational activities (do Nascimento, 2017). Balance is a constantly adjusting process of joint and muscles, involving an integration between different system such as detecting, transmitting and processing sensorial and motor information in the central Nervous system and adapting motor response to determine the body posture in relation to environment, thus maintaining one's center of gravity within support core (do Nascimento, 2017). The suggestion was made that , when an obese person is submitted to a small and normal forward oscillation , an abnormal distribution of body fat in abdominal area (center of mass position relative to ankle joint) yields to an increased destabilizing ankle torque needed to regain balance (Oliveier Ave et, 2007). This suggest that, when submitted to daily postural stresses and perturbation, obese person particularly those with an abnormal distribution of body fat in the abdominal area, may be at higher risk of falling than lightweight individuals because they have to generate ankle torque more rapidly and with a much a higher rate of torque development to recover balance (Oliveier Ave et, 2007). Body fatness is inversely associated with walking and balance abilities suggesting that body composition is in balance test, men 's performance is not compromised unless subject experience obesity(BMI>30) (do Nascimento, 2017). Mobility refers Not only transfer From one place to other but also be fit to perform task. Obese child may have difficulty with gait and maintaining same posture while walking. Dynamic aspect of gait like speed cadence , stride and support base and foot angle wear significantly lower in obese subject, except for support base which was more (Aparna Sarkar, 2017). This wear consistent with poor skeletal muscles performance, high metabolic expenditure and constant physical exhaustion (Aparna Sarkar, 2011).

METHODOLOGY

The study was conducted among normal and overweight adolescents with age group of 18 to 22 year of 140 subject. 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, Y balance test, Standing long jump test performa. Body weight (BW) was measured on the scales while wearing light weight clothing, on barefoot, with upright body position, and eyes straight ahead. Height was measured in an upright position on barefoot, from floor to the top of the head.BMI value (kg/m2) was calculated from weight in Kilograms (kg) divided by Squared height in meters(m2) (Lucky prasetiowati, 2017). (BMI= Weight in (kg)/Height in (m2)). 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. Y - balance test is used to Assess balance in obese and Non obese a dolecents. The participants reached with one foot in the Anterior, poster medial and poster lateral direction during standing on other foot on a central plastic footplate. All testing and practice were performed barefoot with both left and right limb to eliminate additional balance and stability from shoes. Each subject was allowed 6 practice trial in each direction and on each leg prior to formal testing for familiarization , then conducted 3 test trial in each direction and the mean value of 3 test trials was determined for data Analysis. We allowed Rest on a chair for 3 min between practice and recorded trials, but not between trials. The subject maintained a single leg stance with hands on the pelvis while pushing a rectangular reach indicator block with the contra lateral leg as far as possible along 3 directions.

The reach distance was recorded to the subject maintained a single leg stance with hands on the pelvis while pushing a rectangular reach indicator block with the contra lateral leg as far as possible along 3 direction. The reach distance was recorded to the nearest 0.5 cm as the point at which reach indicator was pushed closest to the central footplate .The specific testing order was right anterior, left anterior, right poster medial, right posteromedial, right posterolateral, left posterolateral. A trial was classified as invalid if the participants did not return to the starting position. Kicked the plate with reaching foot to gain more distance, failed to maintain unilateral stance on the platform, stepped on top of the reach indicator for support, or removed her hands from her hip. If an invalid trial occured, the data were discarded, and the repeated the trial. For normalization, the participants lower limb length while lying in the supine position (Anterosuperior iliac spine to the centre of the ipsilateral medial malleolus) was measured in centimeter bilaterally. For data analysis, the reach distance in each direction was Normalized to lower limb length by calculating the Maximized reach distance (%MAXD) using the formula (6 excursion distance/both lower limb length .3) 100=%MAXD because of leg length difference within individuals .The sum of 6 Normalized reach distance (right and left in all 3 direction) was then averaged to generate a composite distance. Timed up and go test (TUG) was used to measure the mobility of participants. Several studies have applied this test, particularly in elderly populationand patient with neurological condition.TUG has also demonstrated good interrater reliability (ICC=0.99) in elderly when this parameter is used to assess functional mobility. The testing procedure required the participant to stand from a seated position on a standardized chair with seat height of40 cm to 50 cm walk at a normal walking speed along a 3m distance and turn and walk back toward the chair to sit again.TUG was chosen to reflect mobility based on its characteristic that involves transition of multiple activities of sit to stand, walking at short distanceand changing direction. A short time to complete the test indicates good functional mobility.

RESULTS AND DISCUSSION

Data were analyses by software SPSS version 15. Mean and standard deviation were calculated as measure of central tendency and measure of dispersion respectively. t -test were used to determine the degree of correlation between strength, balance and mobility in normal and overweight adolescent. Above table 1 shows correlation of standing long jump test between normal and overweight adolescent. Mean value of Standing long jump test for Normal adolescent is 127.6032 and for Overweight adolescent 116.7500. Standard deviation of Standing long jump test for Normal adolescent is 23.3774 and for Overweight adolescent 29.0041. t value of Standing long jump test for Normal and Overweight adolescent is 1.8080. Pearson correlation of Standing long jump test in normal and overweight adolescent demonstrate a Negative correlation ($r=0.0741$, $p<0.05$) which shows moderately Negative correlation. Above table 2 shows correlation of Y balance test of right leg between Normal and Overweight adolescent. Mean value of Y balance test for Right leg Normal adolescent is 123.7268 and for Overweight adolescent 121.0617.Standered deviation of Y balance test for Right leg. Normal adolescent is 25.7425 and for Overweight adolescent 22.6912. t value of Y balance test for Right leg Normal and Overweight adolescent is 0.4453.Pearson correlation of Y balance test of right leg in Normal and Overweight adolescent demonstrate a Negative correlation($r=0.6573$,$p<0.05$)which shows moderately Negative correlation. Above table 3 shows correlation of Y balance test of left leg between Normal and overweight adolescent.Mean value of Y balance test for Left leg Normal adolescent is 124.6094 and for Overweight adolescent 118.5954.Standered deviation of Y balance test for Left leg Normal adolescent is 28. 2862 and for Overweight adolescent 21.3989. t value of Y balance test for Left leg Normal and Overweight adolescent is 0.9426.Pearson correlation of Y balance test of left leg in Normal and Overweight adolescent demonstrate a Negative correlation ($r=0.3486$, $p<0.05$) which shows moderately negative correlation. Above table 4 shows correlation of Timed up and go test between Normal and overweight adolescent. Mean value of Timed up and go test for Normal adolescent is 6.9762.and for Overweight adolescent 6.8083.Standered deviation of Timed up and go test for Normal adolescent is 0.9562 and for Overweight adolescent 1.1710.. t value of Timed up and go test for Normal and Overweight adolescent is o.6888.Pearson correlation of Standing long jump test in Normal and Overweight adolescent demonstrate a negative correlation ($r=04928$,$p<0.05$) which shows moderately negative correlation.

DISCUSSION

Study was conducted and sampling was done from Physiotherapy college in Surat. The major finding of present study was to compare strength, balance and mobility between Normal and overweight adolescent among student of Physiotherapy College. The test was performed successfully amongst the adolescent of 18 to 22 year which includes both male and female. A comparison of strength, balance and mobility among the normal and overweight adolescent is main criteria of study. The result of the present study shows significant negative correlation of standing long jump test between normal and overweight adolescent($r=0.0741$,$p<0.05$) and shows significant negative correlation y balance test of right leg between normal and overweight adolescent ($r=0.6573$, $p<0.05$) and shows negative correlation of y balance test of left leg between normal and overweight adolescent ($r=0.3486$,$p<0.05$) and also shows significant negative correlation of timed up and go test between normal and overweight adolescent ($r=0.4928$,$p<0.05$) there by supporting null hypothesis. Lean body consists of less amount of fat accumulation within body. This also makes one's body more flexible to perform 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 require abdominal, lower limband back muscles strength. Participants with lean BMI could reach more in all three 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. There is positive relation between the weight and static balance. This result is probably due to this fact the higher the weight is, the more power is needed for disturbing the static balance and the stability of a person would have higher stability and static balance. As said before, the higher perimeter of the limb is an index of more percentage of muscles in the limb. The higher muscles percentage and higher BMI with less fat can produce more force and dynamic stability in the lower limb joint (Hossein Berenjeian Tabrizi, 2013).

Table 1. Correlation of standing long jump test between Normal And Overweight adolescent

	Mean	Standard deviation	Std. Error Mean	t test	df	sig(2 tailed)	Mean diffrence	Std. Error difference
Normal	127.6032	23.6032	2.9453	1.8080	85	0.0741	10.8532	6.0029
Over weight	116.7500	29.0041	5.9204					

Table 2. Correlation of Y balance test of right leg between Normal and Overweight adolescent

	Mean	Standard deviation	Std. Error Mean	t test	df	Sig (2 tailed)	Mean diffrence	Std. Error diffrence
Normal	123. 7268	25.7425	3.2432	0.4453	85	0.6573	2.6652	5.98
Over weight	121.0617	22.6912	4.6318					

Table 3. Correlation of Y balance test of left leg beetween Normal and Overweight adolescent

	Mean	Standard deviation	Std. Errorme	t test	df	Sig (2 tailed)	Mean diffrence	Std. Error difference
Normal	124.6094	28.2862	3.5637	0.9426	85	0.3486	6.0239	6.3804
Over weight	118.5954	31.3989	4.3680					

Table 4. Correlation of Timed Up and go test in Normal and Overweight adolescent

	Mean	Staderd deviation	Std. Error Mean	t test	df	Sig (2 tailed)	Mean diffrence	Std. Error diffrence
Normal	6.9762	0.9520	0.1199	0.6888	85	0.4928	0.1679	0.2437
Over weight	6.8083	1.1710	0.2390					

Table 5. Comparison of Standing long jump test Y balance test and Timed up and go test between Normal and Overweight adolescent

	Normal adolecent	Overweight adolecent
Standing long jump test	127.6032+23 .3774	116.7500 +29.0041
Y - balance test	124.6094+28.2862	121.0617 +22.6912
Timed up and go test	6.9762 +0.9520	6.8083 + 1. 1710

Mobility can be assessed by using Timed up and go test. Primary objectives of TUG are assessing functional balance, functional mobility or activity. Participants with overweight took more time compared to normal child. Weight could be one factor that could reduce the speed on individuals. Normal individuals have comparative more strength in lower limb so the time taken by normal individuals is less.

Conclusion

Present study conducted between normal and overweight adolescent among age group of 18 to 22 years shows hardly any significant associations between variables of balance, mobility and lower extremity muscles strength. The children with increased BMI affect the balance, strength, speed .i.e.- mobility. There is not much significant correlation between normal and overweight adolescent among student of Physiotherapy College.

Limitation of the study:

- Small sample size.
- The population is not homogeneous.
- Result cannot be generalized to all population because study age group is between 18 to 22 years.
- We only examined y balance test performance on lower limb.
- We only examined the students of physiotherapy college.
- Use of BMI as an identification tool of obesity prevalence.
- Female represented approximately one third of sample.
- Every time motivation is required.
- Y balance test measure two component's simultaneously, thus it does not distinguish balance from flexibility.

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