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A Survey of Balance in Healthy School Going Obese Children between the Age Group of 8 to 12 Years Using Pediatric Balance Scale (PBS)

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ABSTRACT

Purpose: Evidences show that childhood obesity is significantly associated with presence of many musculoskeletal, neurological and cardiovascular risk factors in childhood. Most common issue caused by functional problems related to childhood obesity is physical imbalance causing fall. Repeated falls lead to physical injury which may result into painful movements of injured joints, inadequate strength to perform activities or altered biomechanics of the injured joints which minimizes participation in social and sports activities. This has a negative impact on quality of life of that respective obese child. Thus, the present study is done to survey the balance among obese children between age group of 8 to 12 years and to form baseline for estimation of frequency of fall among them.
Aim and objective: The aim and objective of the study is to survey balance among healthy school going obese children and find out which component is most commonly affected in pediatric balance scale.
Method: Cross sectional study.
Result: Results indicate that average mean of PBS score of healthy obese children is 19.71 with mode of 17 with median of 20.
Conclusion: This study concludes that PBS scores of healthy obese children remain on lower side in most cases. Item analysis showed that domain including standing on one foot is severely affected followed by domain including alternate foot on stool.

Key words: pediatric balance scale, childhood obesity, balance

INTRODUCTION

Globally, the prevalence of overweight and obesity among children and adolescents increased by 47.1% between 1980 and 2013. Low and middle income countries, including those in South-East Asia, had the highest increase in prevalence of childhood obesity in the past two decades. With a rapid demographic and socioeconomic transition, India is becoming the epicentre of epidemics of both adult and childhood obesity, especially in urban populations. Although the age-standardized rates are low, in absolute terms India is the country with the third-highest level of obesity in the world. Asian-Indian children and adolescents are increasingly susceptible to a high percentage of body fat and abdominal adiposity. The growing body of literature on the developmental origin of chronic disease suggest a life-course approach for tackling risk factors. Childhood obesity is one of the prominent risk factors with serious health implications across the lifespan. [1] Childhood obesity is considered as curse of millennium. Due to social stigma and inability to cope up with physical capacity of fellow children, obese

children avoid participation in community which affects their physical and cognitive development. This physical inactivity further leads to increase in body fat. There are lot of clinical consequences of childhood obesity which include asthma, type 1 diabetes, low grade systemic inflammation, sleep apnea and musculoskeletal disorders particularly of lower limbs and feet. [2] The preadolescence age is very important for awareness as well as promotion of physical fitness and presence of such clinical consequences during childhood surely alters the rate and quality of physical, mental and emotional development of that respective individual. Childhood obesity is also associated with a range of functional problems including pain, discomfort and joint stiffness, lower muscular strength and postural deformities particularly in lower extremity.[3] Children with overweight or obesity may have to face social consequences of obesity like weight based victimization, teasing or bullying. It is a societal belief that weight stigma will motivate people to lose weight, rather than it shows behaviours like binge eating, social isolation, avoidance of health care services, decreased physical activity, and increased weight gain over time, which worsen obesity and create barriers to healthy behaviour.[4] Obesity can also cause behavioural problems in school reflected by inadequate academic achievement and absenteeism, a sign of student's failure to gain educational or social skills expected of them.[5] Thus, solutions designed to solve those problems should be customized rather than generalized. Taking all these factors into consideration, there is dearth of data available which can be used as baseline to form rehabilitation program for obese children.

Aim:

The aim of the study is to survey balance among healthy school going obese children.

Objective:

Objective of the study is to find out which component among all components of pediatric balance scale is most commonly affected among healthy school going obese children.

Significance:

The significance of my study is to provide data according to Indian scenario to develop customized rehabilitation program to reduce falls among obese children as well as create awareness regarding physical fitness among young adolescence children which will help them to enhance their quality of life.

Materials:

Materials used were writing material (pen, pencil and paper), weighing machine, height chart, pediatric balance scale (ICC-0.997) and CDC growth chart.

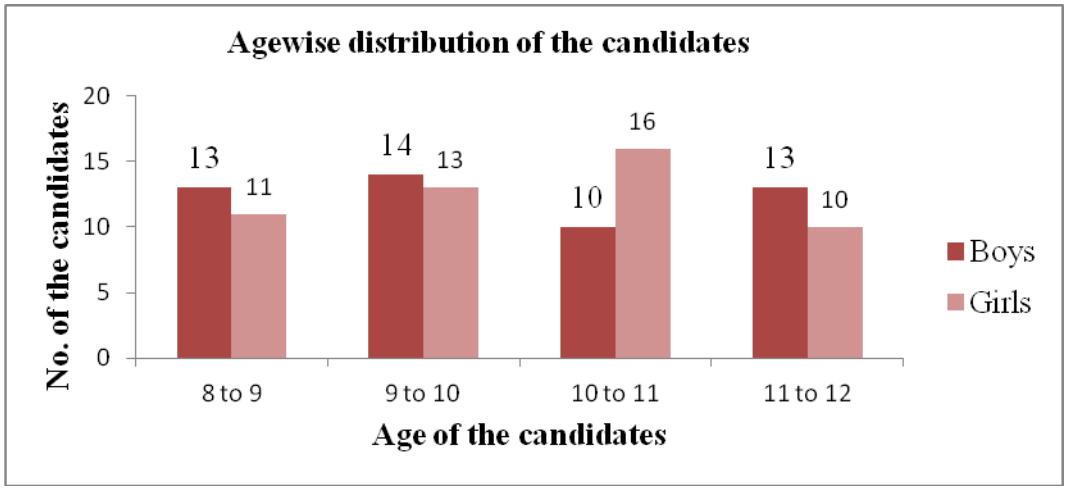
METHOD

This is a cross sectional study in which 100 school going obese children of both genders between age group of 8 to 12 years were selected from schools in and around Pune through convenient sampling during a survey over the period of 12 months. For selected candidates, Body Mass Index (BMI) score is above 95th percentile. Obese children suffering from acute infection or trauma to lower extremity or having any psychological, pathological, neurological disorders leading to balance impairments were excluded from study.

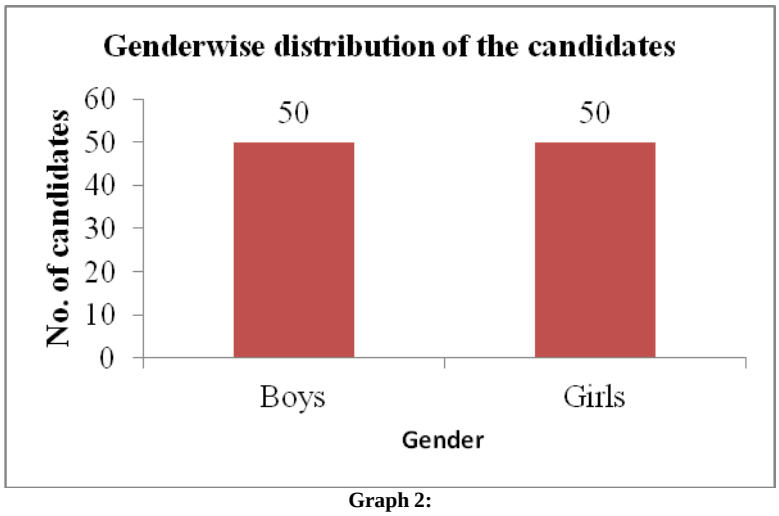
Statistical analysis:

Descriptive statistics:

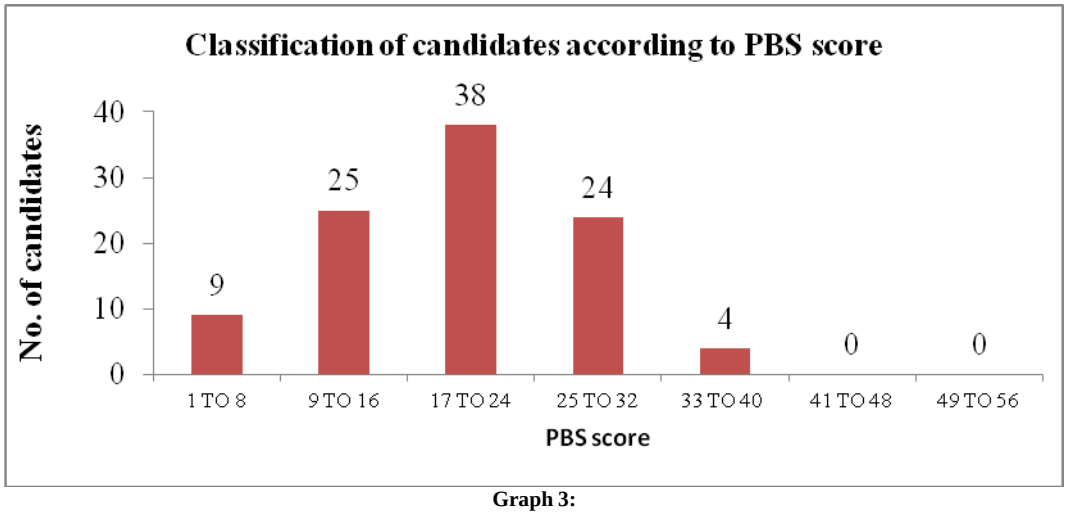
Sr no.	Heading	Category	Total	Mean	Std. Dev.
1	Age	Boys		9.98	±1.26
		Girls		10.09	±1.15
2	Gender	Boys	50	-	-
		Girls	50	-	-
3	Height (m)	Boys		1.29	-
		Girls		1.30	-
4	Weight (kg)	Boys		41.94	-
		Girls		45.4	-
5	BMI(kg/m^2)	Boys		25.05	
		Girls		26.48	



Graph 1



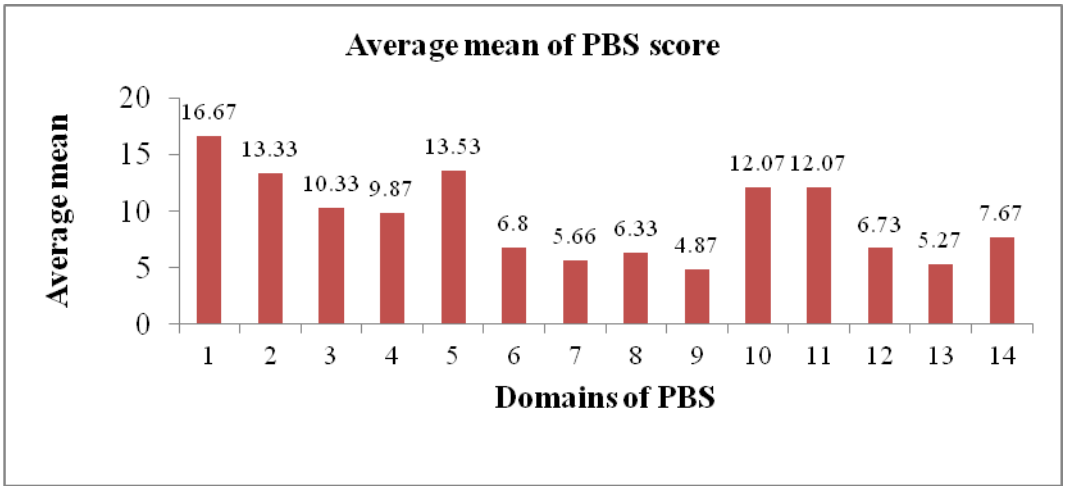
Graph 2:



Graph 3:

In this graph, all 100 candidates were divided according to scores which shows that maximum samples had scored between 17 to 24 points.

In this graph, all 14 domains of pediatric balance scale were assessed and average of each domain is plotted. This showed that stand on one foot domain is severely affected followed by alternate foot on stool domain.



Graph 4:

RESULTS

Assessment of all domains of pediatric balance scale like stand to sit, transfers, standing balance, sitting balance, stand eye closed, stand feet together, tandem standing, stand on one foot, turn 360 degrees, turn and look behind, pick up object, stepping and functional reach were done which shows that stand on one foot domain (Avg.= 4.87) is severely affected. Results indicate that average mean of PBS score of healthy obese children is 19.71 with mode of 17 with median of 20.

DISCUSSION

Obesity is defined as excessive body fat content with increased morbidity. [6] Prevalence of childhood obesity is high in developed as well as developing country. [7] Childhood is the most important stage in growth and development. Being overweight or obese during this period can influence movement ability and postural control. Apart from obvious health hazards posed by obesity, mostly ignored is their balance mostly in physically inactive children. [3] Maintaining a stable posture is essential for many daily activities, as well as for injury prevention. Postural balance is the act of achieving, maintaining or restoring a state of balance during any posture or activity. Most daily activities involve components of static balance as well as complex dynamic movements. Static postural balance is the ability to maintain a base of support with minimal movement, whereas dynamic postural balance reflects the ability to perform a task while maintaining or regaining a stable position. [8] The difficulty in maintaining the body balance in obese children is mainly related to the physical modifications of the body, combined to the smaller amount of body experiences. [9] In small children, centre of mass (COM) is at T12 level. As height increases, COM shifts to L5- S1 level. But uneven distribution of body mass during obesity doesn't allow easy downward shift of COM which deviated COM from ideal LOG leading to postural imbalance. [10] The primary causes for postural imbalances are core muscle weakness, inverted cylinder, latency to reaction time and postural strategies. Author Devarshi and Bamini concluded that in obese children, abdominal bulge and exaggerated lumbar lordosis is due to core muscle weakness leading to deviation from ideal line of gravity. [10] Core is defined as a cylinder that extends from superior ribcage till inferior aspects of pelvis. The core muscles consist of transverse abdominis, internal and external obliques and rectus abdominis. Contraction of transverse abdominis increase intra- abdominal pressure and stabilizes lumbar spine. Contraction of rectus abdominis and obliques provide postural support before limb movement. The external oblique is responsible for anterior pelvis tilting and helps the core to remain stable by fixing the

position of pelvis. Thoracolumbar fascia along with contraction of surrounding muscles activates proprioception. [11] From a morphological point of view, in obesity, excess body fat is distributed unevenly across the body regions mainly around abdominal area. This results in huge upper body supported on small base of support. Author Bushbacher's explained in his study that sensory and motor nerve impulse amplitude is significantly correlated to BMI and is approximately 20-40% lower in obese than normal weight person. The recruitment of motor units also seems to be altered with obesity leading to latency and poor motor performance.[12] Author Mignardot and Oliver explained in their study that from a biomechanical point of view, postural control during daily activities is maintained by horizontal acceleration of centre of mass between centre of pressure (COP) and centre of mass (COM). In human being, during erect posture, COM is located just forward to ankle joint. At that time, plantarflexors are continuously acting to adjust COP under COM. In the absence of muscle contraction, torque is generated between COM and COP. This generated torque is cancelled by contraction of triceps surae muscle to continuously adjust COP under COM. In obese children, due to uneven distribution of body mass, COM position deviates for each body segment, creating difficulty in adjusting COP under COM. [11] The mass of the pendulum in obese children is high, causing the muscles to generate torques of higher amplitude in order to maintain balance. As obese children mostly suffer from decreased muscle tissue relative to the increased body weight, their muscles often cannot respond quickly and strongly enough to the higher centre of pressure (COP) displacement. The increased magnitude of the COP combined with relatively weak muscles might increase the risk of falling in obese children. [8] As compared to normal weight children, obese children have lower postural stability, greater sway area with greater instability and different postural strategies with reduced balance capabilities. Due to the higher COP speed and greater postural instability of obese children, the time it takes them to correct their movements during different tasks is much longer. [8] Postural balance is controlled by using perceptual information obtained from the environment by the peripheral sensory systems. Maintenance of postural balance requires an integration of the visual, vestibular and somatosensory systems, in order to coordinate the sensory perception of the body's position and execute motor responses. [8] Somatosensory system might be less effective in obese children. [8] Obesity causes a higher than expected pressure on children's feet. This seems to be related to the decline in plantar sensitivity, leading to a smaller capacity to receive sensory information and to promote postural adjustments. [9] From neurological point of view, the stretching of the skin in obese children is believed to increase the distance between the cutaneous mechanoreceptors and to reduce the discrimination of somatosensory perception. Furthermore, the body schema is constructed based on multisensory inputs, including cutaneous and proprioceptive receptors and with obesity, these receptors can provide altered information of the somatosensory cortical area, modifying the representation of the body schema in obese individuals. [9] Macialczyk- Paprocka et al reported that excessive body mass was connected with suboptimal postures in the children at the age of 7-12. The most common deviations from normal posture in obese children and teenagers included genu valgum and flat feet. Wyszy'nska et al established that fat content can influence a variety of postural parameters like obliquity of the thoracolumbar segment, angle of the shoulder line and position of the scapula. [13] Body mass index is inversely correlated with physical function. This supports the idea that the diminished ability to move with increasing weight leads to a decrease in caloric expenditure with the potential consequences of a further mismatch in

energy balance leading to additional weight. [14]

CONCLUSION

This study concludes that among all the domains of pediatric balance scale, domain including standing on one foot is severely affected for healthy obese children followed by domain including alternate foot on stool. The detail analysis of all domains of pediatric balance scale gives the exact idea about present functional capacity of the child and helps to plan the treatment protocol of healthy obese child by taking into consideration physical limitation of child. The domains of pediatric balance scale mostly mimic activities the child requires in day to day life. For example standing on one foot is required during play activities like skipping, hopping. Alternate foot on stool closely resembles to stair climbing. So, these daily activities or play activities can be consider as functional goals to be achieve at the end of rehabilitation protocol.

Conflict of interest: None.

REFERENCES

1. Praveen PA, Tandon N. Childhood obesity and type 2 diabetes in India. WHO South-East Asia J Public Health 2016; 5(1): 17–21.
2. Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, et al. health consequences of obesity. Arch Dis Child. 2003; 88:748-52.
3. Shultz SP, Byrne NM, Hills AP. Musculoskeletal function and obesity: implications for physical activity. Curr Obes Rep. 2014 (3): 355- 60
4. Pont SJ, Puhl R, Cook SR, et al, AAP section on obesity, The obesity society. Stigma experienced by children and adolescents with obesity. Pediatrics. 2017;140(6): e20173034
5. Carey FR, Singh GK, Brown HS 3rd, Wilkinson AV. Educational outcomes associated with childhood obesity in the United States: cross-sectional results from the 2011-2012 National Survey of Children's Health. Int J Behav Nutr Phys Act. 2015; 12 Suppl 1:S3.
6. John R, David W. Children obesity: ABC of obesity. BMJ. 2006 Dec; 333; 1207.
7. Nora B, Abeer B, Haitham F.Prevalence of overweight and obesity in primary school children in Port Said city. Egyp Pediatr Asso. 2013 Jan, Vol 61(1): 31-36.
8. Steinberg N, Nemet D, Pantanowitz M, Eliakim A. Gait Pattern, Impact to the Skeleton and Postural Balance in Overweight and Obese Children: A Review. Sports (Basel). 2018; 6(3):75.
9. Lara S, Graup S, Balk RS et al. Association between postural balance and anthropometric indexes in elementary school children. Rev. Paul. Pediatr. 2018 Jan-Mar; 36(1): 59- 65.
10. Devashish T, Bhamini R, John S. Normative scores on pediatric balance score: A cross sectional study. Indian J. of Physiother and Occup Ther. 2011 April-Jun; Vol.5 (2); 45 to 48.
11. Jean- Baptiste Mignardot, Isabelle Olivier. Origins of balance disorders during daily movement in obese: Can biomechanical factors explain everything? PLoS One [Internet]. 2013 Apr 3; 8(4).
12. Buschbacher RM (1998) Body mass index effect on common nerve conduction study measurements. Muscle Nerve 21: 1398–1404.
13. Rusek W, Baran J, Leszczak J, et al. The Influence of Body Mass Composition on the Postural Characterization of School-Age Children and Adolescents. Biomed Res Int. 2018; 2018:9459014.
14. Khodaverdi F, Alhani F, Kazemnejad A, Khodaverdi Z. The Relationship between Obesity and Quality Of Life in School Children. Iran J Public Health. 2011; 40 (2):96-101.

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