DOI Number: 10.5958/0973-5674.2020.00033.7

Assessment of Body Coordination, Strength and Agility Using Bruininks- Oseretsky Test of Motor Proficiency (BOT-2) in Overweight and Obese Children Aged 7-12 Years

Preeti Gazbare[1], Shivani Deshmukh[2], Tushar J Palekar[3], Neena Varghese[4], Blessy Abraham[4], Gurjit Singh[2], Roopa Desai[1]

[1]Associate Professor, [2]Postgraduate student, [3]Principal, [4]Intern, Dr. D. Y Patil College of Physiotherapy, Pune, Dr. D.Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune

Abstract

Background - Childhood obesity is a major health problem in many developing countries, including India. As a result, overweight and obese children achieve fewer opportunities to develop proficient motor skills. Early assessment should be done to evaluate children having poor coordination problem and early intervention should be given to avoid risk of any neuromotor disturbances later. This study is done to find out the level of motor proficiency in terms of Body coordination, strength and agility in overweight and obese school going children aged 7-12 years using BOT-2 test.

Method: A cross sectional analytical study was conducted using BOT-2 long form. Purposive sampling of 54 overweight and obese children (32 males and 22 females) aged 7-12 years who met the inclusion criteria were taken for the study and assessed under 2 motor area composite of BOT -2. The study was conducted after the ethical clearance obtained by the institutional ethical committee. Each task was explained verbally and demonstrated to each student, to ensure proper understanding of the task.

Results: 54 children were assessed (59.2% males and 40.8% females) and standard score of the BOT -2 test was calculated which signifies the level of proficiency. For Body coordination component mean standard score of 45.07 and for strength and agility component it was 37.79.

Conclusion: This study concludes that according to Descriptive Category of BOT -2 test in Body coordination 33%, in Strength and agility 74% of overweight and obese children aged 7-12 years has motor deficits.

***Key Words**: Obesity, Body Coordination, Strength and agility, BOT-2.*

Introduction

Prevalence of Childhood obesity has increased at an alarming rate. An approximately 42 million school children aged less than 5 years are overweight and close to 35 million of these are living in developing countries. 10% of children around the globe aged between 5 to 17 years are overweight out of which 70% grow up to become obese adults. [1]

Bruininks-oseretsky Test of motor proficiency, Second Edition (BOT-2) is an individually administered test that uses engaging, goal- directed activities to measure a wide array of motor skills in individuals of age 4-21.The BOT-2 uses a subset and composite structure that highlights motor performance in the broad functional areas of stability, mobility, strength, coordination and object manipulation. Four motor area composites of BOT- 2 are as follows: 1. Fine Manual Control, which encompasses motor skills involving control and coordination of the distal musculature of the hands and fingers. 2. Manual Coordination, which encompasses motor skills involving control and coordination of the arms and hands, especially for object manipulation. 3. Body Coordination, which encompasses control and coordination of the large musculature used in maintaining posture and balance. 4. Strength and Agility, which encompasses aspects of fitness and coordination involved in casual play, competitive sports,

and other physical activity. [2] In the present study only 2 motor area composites were considered i.e. Body Coordination, Strength and agility, which had 4 subtests namely bilateral coordination, balance, running speed and agility, strength.

Motor development is the gradual process by which child gains balance and coordination of the large muscle of legs, trunk and small muscle of the hand. A motor skill is a learned series of movement that combines to produce a smooth, efficient action. [3] Balance is an ability to maintain the line of gravity of a body within the base of support with minimal postural sway. An increase in sway isn't essentially an indicator of dysfunctional balance such a lot as it is an indicator of reduced sensorimotor control. [4] Maintaining balance requires coordination of input from multiple sensory systems including the vestibular, somatosensory, and visual systems. [5]

Vestibular system has sense organs that regulate equilibrium; directional information because it relates to head position (internal gravitational, linear, and angular acceleration) Somatosensory system, senses proprioception and kinesthesia of joints; information from skin and joints (pressure and vibrating senses); spatial position and movement relative to the support surface; movement and position of different body parts relative to each other. Visual system refers to the verticality of body and head motion; spatial location relative to objects. [6]

Bilateral coordination refers to the flexibility to coordinate each side of the body at a constant time in an exceedingly controlled and arranged manner, for example; stabilizing paper with one hand while writing/ cutting with the other. It is the ability to use both sides of the body in an integrated and skillful manner. [7] Good bilateral coordination/integration is an indicator that both sides of the brain are communicating effectively and sharing information. Inadequate bilateral coordination can adversely affect overall motor coordination as well as cognitive development, therefore negatively moving educational performance.[8]

Motor competence can be defined as a person's movement coordination quality when performing different motor skills, ranging on a continuum from gross to fine motor skills [8]. Majority of available studies on motor skill competence in overweight and obese children focuses exclusively on gross motor skills, like balance and gait. Marshall and Steele (2004) found body composition to be negatively related to locomotor skill proficiency (running, jumping) but did not reveal differences in the motor skill level of relatively stationary object control tasks (e.g. striking, throwing, catching etc.) Till date, there is less research in the literature which has evaluated the relation between motor competence and BMI in Indian obese children. The purpose of the present study was to find the association between both gross and fine motor skills and BMI in children (overweight, obese) using BOT – 2.[9]

Material and Methodology

In this study, 148 children were screened for BMI from 4 different schools out of which 54 were included in the study who fulfilled the inclusion criteria of age between 7-12 years with BMI of 23 and above. Then they were assessed under 2 motor area of BOT – 2 like body coordination, Strength and agility. It took approximately 10 minutes to prepare the testing area and 20 – 25 minutes to administer the form. Item raw scores were determined for each item and for multiple trials when allowed. Each item raw score reflects one of the variety of possibilities such as the number of correct responses for a given item (e.g., number of sit-ups correctly completed) or the number of seconds an activity is sustained (e.g., seconds able to stand on one leg on a line – eyes open). Each item raw score was converted to a point score using information provided on the Record Form. For each subtest, the point scores were summed, creating total point scores.

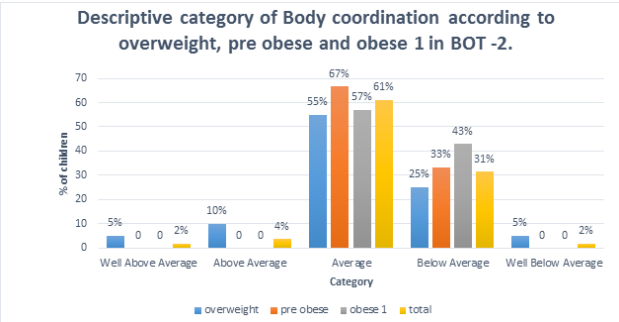
Once total point scores were determined, each subsequent step involved looking up information in the tables provided in the manual. First, each subtest total point score was converted to a scale score. Second, the sum of the scale scores for each subtest within a Motor Area composite was converted to a standard score. Finally, the Motor Area composite standard scores were summed and this sum was converted to a Total Motor Composite standard score. For all of the scale and standard scores, confidence intervals (95%) was determined and used when interpreting a child's performance. Then the data collected was analyzed using Epi info 7 software.

Photograph 1 – Assessing touching nose with

Photograph 2 – Assessing standing on index finger for bilateral coordination. One leg on balance beam for balance.

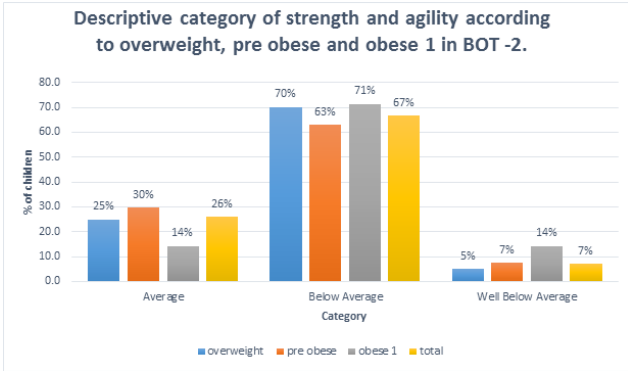
Photograph 3 – Assessing V-up for strength.

Data Analysis



Graph 1 - Descriptive category of Body coordination according to overweight, pre obese and obese 1 in BOT -2.

Interpretation – Graph 1 represents that out of 54 children 2% falls under well below average category, 31% falls under below average, 61% under average category, and 4% under above average and 2% under well above average category in body coordination motor area composite of BOT 2.



Graph 2 - Descriptive category of strength and agility according to overweight, pre obese and obese 1 in BOT -2.

Interpretation – Graph 2 represents that out of 54 children 7% falls under well below average category, 67% falls under below average, 26% under average category in strength and agility motor area composite of BOT 2.

Results

Graph 1- represents that in body coordination maximum children i.e. 61.1% falls under average category, 31% under below average, 2% under well below average, 4% under above average and 2% under well above average category. Only in overweight category 5% were well below average, 25% were below average, 55% were average, 10% were above average and 5% were well above average. In pre obese category 33% were below average, 67% were average. In obese 1 category 43% were below average, 57% were average.

Graph 2- shows that in strength and agility 67% falls under below average category, 7% under well below average, 26% under average and 0% under above average and well above average category. Then only in overweight category children 5% were well below average, 70% were below average category, 25% were average. In pre obese 7% were well below average, 63% were below average, 30% were average. In obese 1 category 14% were well below average, 71% were below average, 14% were average.

Discussion

The aim of the study was to assess motor proficiency in terms of Body coordination, Strength and agility using Bruininks- oseretsky test of motor proficiency [BOT-2] in overweight and obese children aged 7-12 years" In this study 148 children were screened for BMI from 4 different schools out of which 54 were included in the study from which 37.30% were overweight with the BMI (23-24.9), 50% were pre-obese with BMI (25-29.9) and 12.96% were obese 1 with BMI (30-40).

The ULC subtest relies heavily on hand–eye coordination of a child. Traditionally, most children would participate in catching and throwing activities from a young age that would help develop hand–eye coordination. Therefore, it's not shocking to visualize youngsters falling below expected proficiency levels for the Upper limb coordination (ULC) subtest, given the reduction in physical activity and motor skill competence in recent years. Previous analysis has shown that cultural variations influence the motor skill proficiency of kids (Bardid et al., 2015). However, it is also important to mention that there is some evidence that video gaming can lead to improvement in manual dexterity and hand–eye coordination in laparoscopic surgery training in surgeons (Adams et al., 2012; Badurdeen et al.,2010; Rosser et al., 2007). Touch screen devices require several actions such as swiping, dragging and dropping, pushing or tapping which all require fine motor skill to perform. [10]

It was found that maximum of obese 1 were in below average according to the descriptive category. Strength and agility included activities like stepping sideways over a balance beam, one-legged side hop, standing long jump, pushups etc. It seems obvious that having more fat mass does not help a child in motor activities that involve changes in center of mass. The idea that carrying too much weight may have such an effect was termed the morphological constraint hypothesis coined by Chivers et al.[11] The morphological constraint hypothesis states that children who are overweight or obese have to move within high biomechanical constraints and are therefore more challenged in tasks that involve changes in center of mass. [12]

A study on gait control in obese and normal-weight children investigated the effect of vision in children in their early teens. The obese children were more dependent on vision than the normal weight children. The authors concluded that the obese children not only suffer from the mechanical problem of moving excess of mass but also seem to have a different linkage between perception and action, which leads to a poorer motor performance. D'Hondt et al. [13] hypothesized that the reason for this is that sensory information is processed differently in obese children when controlling locomotion. The effect of body mass on motor planning and skills was also studied in experiments examining obstacle crossing through 3D kinematics and kinetics. The results showed that the obese children had more difficulty in motor planning and motor skills, as their strategy left them less stable after crossing the obstacles. The difficulty that obese children experience in planning and controlling their additional weight seems obvious to Gill et al. [14]

Also excessive body weight affects body geometry and increases the mass of different body segments, which makes non-stationary activities more demanding. Lower actual and perceived motor competence might limit obese children's participation in recreational activities and sports, which are typically enjoyed by their motor proficient peers. Stodden et al. proposed that the development of motor skill competence is a primary underlying mechanism that promotes the engagement in physical activity, which in turn encourages motor skill competence. The reciprocal influence between physical activity and motor skill competence increases as children enter in middle and late childhood. Lopes et al. showed that the strength of the negative association between motor competence and BMI, increases up to the age of 11. Hence children might have showed lower motor deficits in strength and agility motor area composite especially in push-ups subtest.

Conclusion

This study concluded that in Body coordination 33%, In Strength and agility 74% of overweight and obese children aged 7-12 years has motor deficits.

Acknowledgment: The authors would like to thank authorities of Dr. D Y Patil Vidyapeeth for allowing us to conduct this study by providing infrastructure and equipment. I also do thank the school authorities for giving us permission to conduct the study in their school premises and also trusting us with their students. Last but not the least, I would like to express my sincere thanks to all the children whose willingness to be a part of this study helped this work see the light of the day.

No financial support has been provided for the study and no conflict of interest exists.

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