Asian Pac. J. Health Sci., 2017; 4(1):152-160 e-ISSN: 2349-0659, p-ISSN: 2350-0964

Document heading doi: 10.21276/apjhs.2017.4.1.25 Research Article

Assessment of balance using bot-2 in age group 5-15 year school going children

Pooja Narendra Yengde*, Sanjivani Dhote, Tushar Palekar, Apoorva Dighe, Antara Pande

Dr. D. Y. Patil College of Physiotherapy, Pimpri, Pune, India

ABSTRACT

Introduction: Motor development is the gradual process by which child gain balance and coordination of the large muscle of legs trunk and arm and small muscle of the hand. The bruininks-Oseretsky test of motor proficiency Test that uses engaging, goal-directed activities to measure a wide array of motor skills in individuals ages 4 through 12.**Material and method:** In this study cross sectional analytical study design was used study setting was in Pimpri chinchwad municipality, Pune. Sample population was 5-15 year school going male and female, multistage stratified sampling method was used, sample size was 516, inclusion criteria was 5-15 year children male and female and exclusion criteria was neurological trauma or deficit, visual problem and other diagnosed medical condition. Required material was ruler, marker, measuring tap, stop watch and balance beam of bot kit. Outcome measure was balance total point score and descriptive category. **Conclusion:** The study concludes that there is slight difference in population male and female. But male performance is better than female in balance. According to age groups, 1, 3, 4, 5 is consistently increasing, age group 2 has more good performance.

Keywords: Balance, Bruiniks-Oseretsky**,** Motor development

Introduction

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 [1]. It includes age related changes in posture, movement and balance. Motor skill is a learned series of movement that combine to produce a smooth, efficient action. Neuromuscular development starts in embryonic stage and continues after birth.[1]Balance is an ability to maintain the line of gravity of body within the base of support with minimal postural sway.[2] A certain amount of gravity of a body with (e.g., breathing, shifting body weight from one foot to the other or from forefoot to rearfoot) or from external triggers (e.g., visual distortions, floor translation). An increase in sway is not necessarily an indicator of dysfunctional balance so much as it is an indicator of decreased sensorimotor control. [2] Maintaining balance requires
coordination of input from multiple sensory systems including the vestibular, somatosensory, and visual systems[3].

**Correspondence*

Pooja Narendra Yengde

Dr. D. Y. Patil College of Physiotherapy, Pimpri, Pune

E Mail: poojayengde@yahoo.com

Vestibular system: sense organs that regulate equilibrium; directional information as it relates to head position (internal gravitational, linear, and angular acceleration)[4]

Somatosensory system: senses of proprioception and kinaesthesia of joints; information from skin and joints (pressure and vibratory senses); spatial position and movement relative to the support surface; movement and position of different body parts relative to each other [4]

Visual system: Reference to verticality of body and head motion; spatial location relative to objects [4]

Balance is the ability to neutralize forces that would disturb equilibrium. Simply watching a young toddler take those first steps is evidence of this. Further evidence of balance can be seen in a variety of movement: from someone simply standing on one leg, to an intricate, dynamic movement during execution of a specific sports skill.[5]Balance deficit is observed in children with Hyperactive disorder,[6]autism spectrum disorder,[7] vestibular disorder,[8]developmental coordination disorder,[9] learning disability,[10] sensory integrative dysfunction,[11] and other motor impairment.[9]Functional tests of balance focus on maintenance of both static and dynamic balance, whether it involves a type of perturbation/change of canter ofmass or during quiet stance. Standardized tests of balance are available to allow allied health care

professionals to assess an individual's position control. Some functional balance tests that are available are: Romberg Tests functional reach test, performance-oriented mobility assessment (POMA) timed get up and go test, Balance efficacy scale[12],Berg balance scale[13], Star excursion test[14], Balance evolution systems test (BEST)[15],Balance error scoring system (BESS), bruininks-Oseretsky Test of motor proficiency (Bruininks, 1978) and also its second edition.[1]The Bruininks-Oseretsky test of motor proficiency, Second edition (BOT-2) is an individually administered test that uses engaging, goal-directed activities to measure a wild array of motor skills in individuals ages 4 through 21. The BOT-2 uses a subtest and composite structure that highlights motor performance in the broad functional areas of stability, mobility, strength, coordination, and object manipulation. This report will discuss four motor-area composite that is Fine Manual Control (FMC), Manual coordination (MC0, Body Coordination (BC) and Strength and Agility (SA). Each comprising two subtest and a Total Motor Composite.5 That total 8 subtests have 53 items. As BOT-2 testing involves game-like motor tasks which capture the child's interest and are not verbally complex, It is suitable for children of non-English speaking background. Also the authors report that it can identify motor deficits in individuals with 'mild to moderate' motor impairment and is validated and reliable for assessing subjects with 'mild to moderate' mental retardation. Furthermore, the motor activities incorporated in BOT-2 include gross motor (GM) tasks that assess hoping, jumping, running, ball skills, balance, strength and coordination and fine motor (FM) tasks that assess precision, integration and manual dexterity through drawing, writing and functional tasks such as threading blocks5. BOT-2 has been empirically validated for high-functioning persons diagnosed with autism, Asperger's, developmental coordination disorder, and mild/moderate intellectual disabilities.[16]The balance subtest of BOT-2is the fourth subtest, body coordination (BC), under gross motor composite and contain eight test-items, Balance subtest evaluates motor-control skills that are integral for maintaining posture when standing, walking or reaching. That is both static and dynamic balances. The number of performance trials for each item is 2 time. A raw score is recorded in best on them. Then converted to a numerical point score.[16]The skills that BOT-2 measures an important role in everyday tasks, including walking, running and participating in recreational and competitive sports. Learning about how an individual performs these task helps to identify special needs so that plans can be made to accommodate these need and develop programs to improve performance. [5]Aim of the study was to assess balance using Bruinink Oseretsky test of motor proficiency scale, 2nd edition in age group 5-15 year school going children and 1st objective of study to find out balance score using bruinink-oseretsky test-2 of motor proficiency scale, 2nd edition. 2nd objective was to find out balance descriptive category using Bruininks-oseretsky test-2 of motor proficiency, 2nd edition, 3 objective to find out balance point score and descriptive category among male and female using Bruininks-Oseretsky Test -2 Of Motor Proficiency, 2nd edition. And 4th objective was to find out balance point score and descriptive category according to age group using Bruininks Oseretsky Test of motor proficiency, 2nd edition.

Material and methods

Research committee of Dr. D. Y. Patil College of Physiotherapy approved this study. The tools used in this study were BOT-2 kit includes examiner manual, individual record from, student booklet, balance beam, target, ruler, marker, measuring tap, stopwatch.

Five hundred sixteen samples were assessed, in which 268 were female (mean age 10.69 years±) and 248 were male (mean age 10.66years±3.02). Information provided by the class teacher and school record were used to include the 5-15 year old children in five group (The age group 1 - 5.0-7.11, age group 2 - 8.0-9.11, age group 3 – 10.0-11.11, age group 4 – 12.0-13.11 and age group 5 – 14.0-15.11) according to the following criteria: no neurological trauma like spinal fracture, 6 month back, no visual and musculoskeletal problem, no neurological deficit or other diagnosed medical condition, The sample characteristic of the 516 is described in the table 1.

Table 1: Description of the study sample

AGE GRP	FEMALE	MALE
1(5,6,7)	59	52
2(8,9)	46	49
3(10,11)	61	47
4 (12,13)	51	49
5(14,15)	51	51

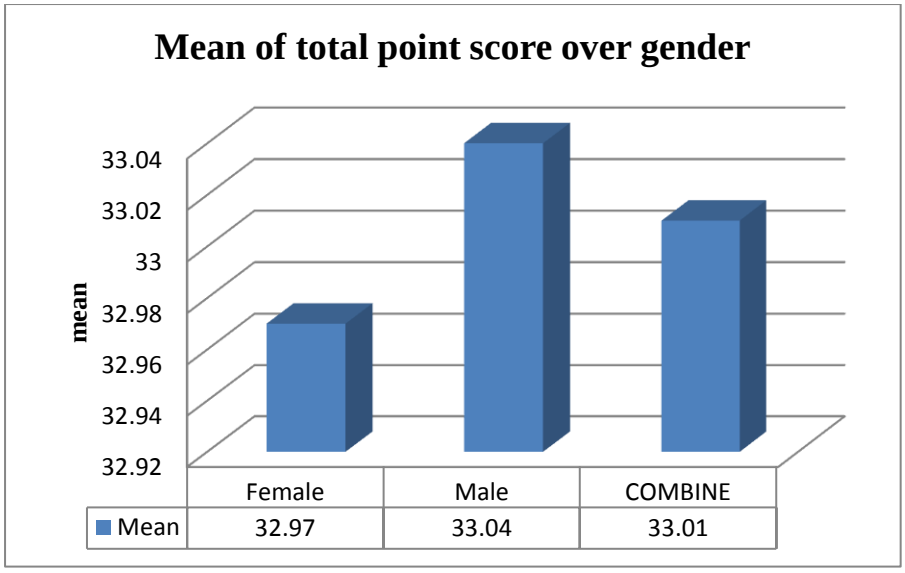
Result

Data analysis: Data analysis will consider age, gender and descriptive category according to BOT-2

Table 2: Data analysis

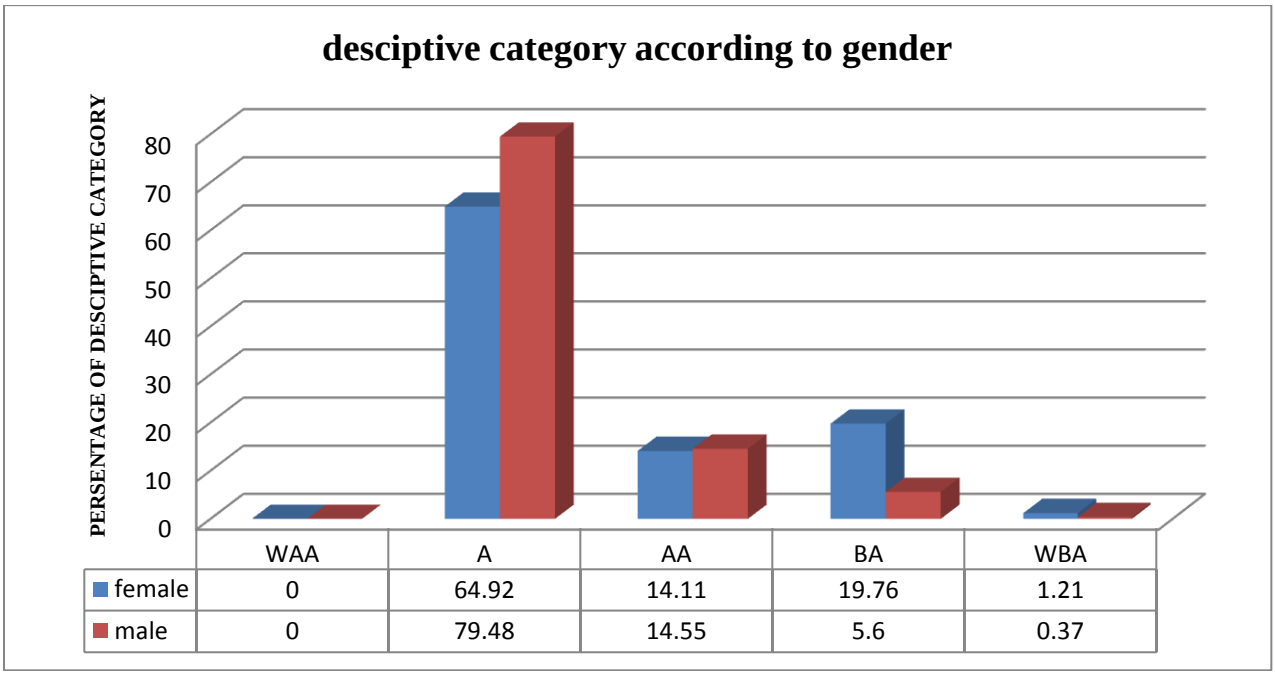
	Mean	Standard deviation
Female	32.97	3.02
Male	33.04	4.13
COMBINE	33.01	3.64

Graph 1: Mean of total point score over gender



Interpretation: graph no 2 represent that mean of balance total point score in female is 32.97 and mean of balance total point score in male is 33.04 and combine of female and male balance total point score is 33.01,

Graph 2: Represent mean of balance total point score in female

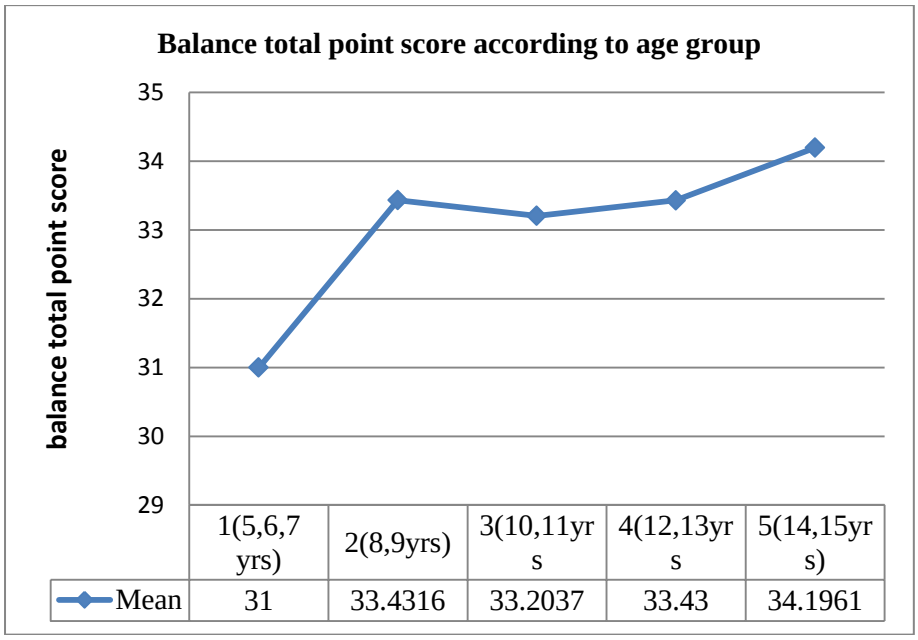


Interpretation: Graph 2 represent the population of female and male descriptive category in WAA is minimum that is 0%.In above average descriptive category 14.11% in female and 14.55% in male. In average descriptive category 64.92% in female and 79.48% in male. In below average descriptive category 19.76% was female and 5.6 % was male. In well below average descriptive category 1.21% was female and 0.37% was male.

Table 3: Age group versus sex and number

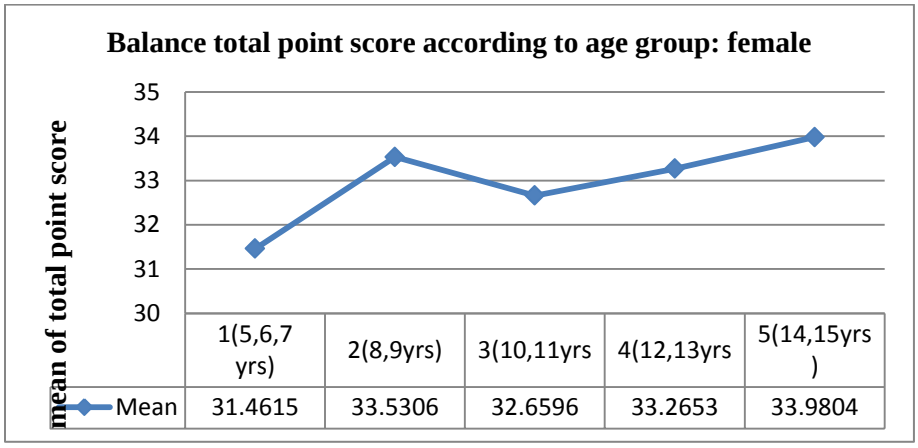
Age Gr.	Sex	n	B	
			Mean	SD
1	COM	111	31	4.94
	M	59	30.59	5.36
	F	48	31.46	3.46
2	COM	95	33.43	2.57
	M	46	33.33	2.49
	F	49	33.58	2.54
3	COM	108	33.2	4.17
	M	61	33.36	4.55
	F	47	32.66	4.17
4	COM	100	33.43	2.21
	M	51	33.59	2.2
	F	49	33.27	2.22
5	COM	101	34.2	2.32
	M	51	34.41	2.44
	F	51	33.98	2.39

Graph 3A: Balance total point score according to age group



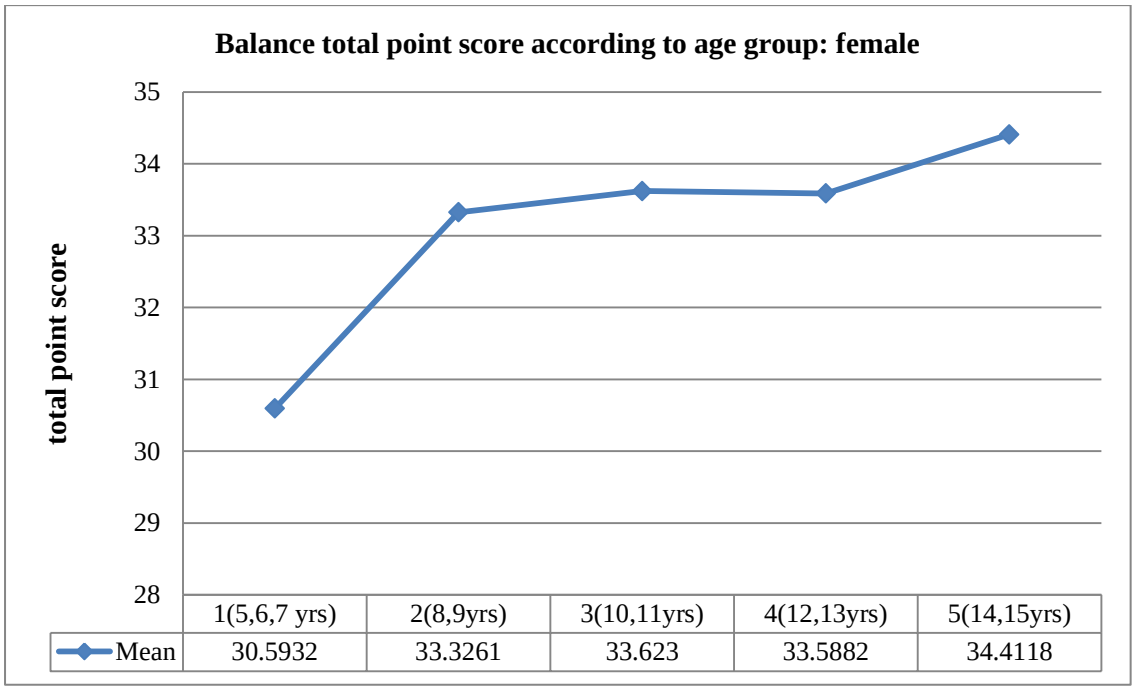
Interpretation:
Graph no 3A represent that in age group 1 there is mean of total point score is 31, and standard deviation is 4.94, In age group 2 there is mean of total point score 33.43 and standard deviation is 2.57, In age group 3 there is mean of total point score is 33.20 and standard deviation is 4.17, in age group 4 there is mean of total point score is 33.43 and standard deviation 2.21,in age group 5 there is mean of total point score is 34.19 and standard score 2.34.

Graph 3B: Balance total point score according to age group: female



Interpretation:
Graph no 3B represent that in age group 1of female there is mean of total point score is 31, and standard deviation is 3.46, In age group 2 female there is mean of total point score 33.53 and standard deviation is 2.54, In age group 3 female there is mean of total point score is 32.62 and standard deviation is 4.17, in age group 4 female there is mean of total point score is 33.26 and standard deviation 2.22,in age group 5 female there is mean of total point score is 33.98 and standard score 2.36.

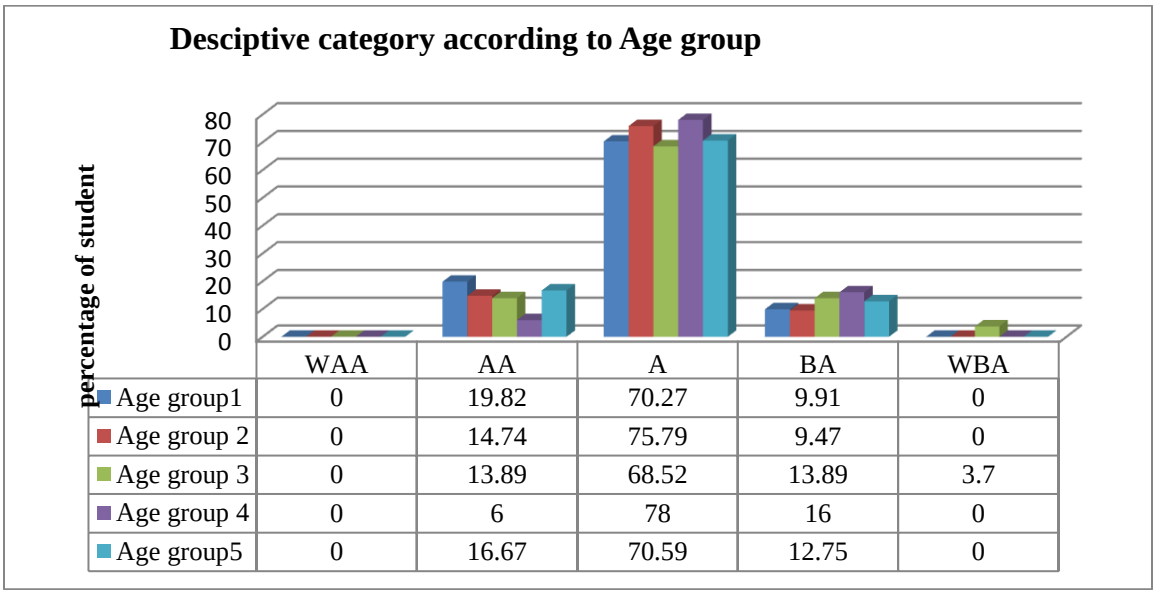
Graph 3 C: Balance total point score according to age group: female



Interpretation:

Graph no 3C represent that in age group 1of female there is mean of total point score is 30.59, and standard deviation is 3.46, In age group 2 female there is mean of total point score 33.33 and standard deviation is 2.49, In age group 3 female there is mean of total point score is 33.36 and standard deviation is 4.55, in age group 4 female there is mean of total point score is 33.59 and standard deviation 2.2,in age group 5 female there is mean of total point score is 34.41 and standard score 2.44.

Graph 4: Desciptive category according to age group



	WAA	AA	A	BA	WBA
Age group1	0	19.82	70.27	9.91	0
Age group 2	0	14.74	75.79	9.47	0
Age group 3	0	13.89	68.52	13.89	3.7
Age group 4	0	6	78	16	0
Age group5	0	16.67	70.59	12.75	0

Interpretation

Graph no 4 represent descriptive category well above average in all age group is 0 %. In descriptive category above average in age group 1 is 19.82%, in age 2 is 14.74%, in age group 3 is 13.89%, in age group 4 is 6% and in age group5 is 16.67%. In Descriptive category average in age group 1 is 70.27%, in age 2 is 75.79%, in age group 3 is 68.52%, in age group 4 is 78% and in age group 5 is70.59 %. In Descriptive category below average in age group 1 is 9.91%, in age 2 is 9.47%, in age group 3 is 13.89%, in age group 4 is 16% and in age group 5 is 12.75 %. In Descriptive category well below average in age group 1 and 2 is 0%, in age group 3 is 3.7% and in age group 4 and 5 is 0 %.

Discussion

primary aim of the study was to find affection of balance in school going of 5-15 year of age group by using BOT-2.the balance subtest evaluates motor control skill that are integral for maintaining posture when standing, walking or reaching. Sample score is consistent with individuals who can maintain stability in a fixed position standing one leg on a balance beam when the eyes are open and when the eyes are closed. This study was conducted among 516 subject(mean age 10.67 year±3.2) in which 248 were male(mean age 10.69 year± 3.04) and 268 were female (mean age 10.66 year ± 3.02).According to data analysis of balance total motor score and gender graph there is slight difference in male and female mean of total point score which is slight more in male because male participate more in sports than female so males have more developed vestibular system, somatosensory system and visual system than female.[1]Descriptive category according to gender, According to the study done, in well below average descriptive category 1.21% were female and 0.37 % were male. In below average descriptive category, 19.76% were female and 5.6% were male. Maximum subject falls under average category that is 64.92% were female and 79.48% were male, In above average category 14.11 were female and 14.55 were male and in well above average category there was 0% population, these performance differences in males and female can be due to the nutritional status, the dietary intake of boys is more than girls. Nutrition status appears to be signification predictor for both fine and gross motor development.[1] Nutritional status may alter the learning process by influencing brain development and physical growth and accordingly modify the movement proficiency of the children by adjusting the strength, power, coordination and perception.[1] And it significantly related to physical growth and other parameters. Performance related fitness, is necessary for the execution of sports skill which is more in males than female, so that is the reason there is a great performance difference between the two.[1]Graph 3A, 3B and 4C shows total motor point score according to age group, in which the study reveals that as the age increases the mean values of point score also increases. Barnekow-Bergkvist et al. (1998) found that performance in physical test; height, weight and physical activity at the age of 13 contributed best of explain adult physical performance and physical activity. Therefore, it may be concluded that so far all the subject of coordination was concerned age factor was responsible for the higher mean value. Age group 4 and 5 having higher age, they had significantly performed better in comparison to age group 1, 2 &3 boys & girls. Balance is also related to limb length, general musculature and neuromuscular coordination, which are definitely influenced by the advancement of age. The remaining motor performance is related to lean body mass, general muscular, aerobic capacity and certain psychological state of mind (willingness to accept pain) and development of all of age. Therefore, it is obvious that age group 1, 2 and 3 will have less motor quality than that of age group 4 and 5 because of structural and functional differences with the higher age group.[20]Graph 4th shows descriptive category according to age groups ,in which the study revealed that in age group 1,2,3,4 and 5 descriptive category Average were more followed by Above Average ,Below Average than Well Below Average, study shows that difference between all age group is not linear because of descriptive category was according to the scale score and score that have undergone statistical transformation will be less exact in ability to detect real change that occurred because this standard score are age adjusted, progress will not be reflected in the test score unless the progress is faster than typical maturation.[21] difference can be due to socioeconomic status as we have taken homogenous sample from both public and private schools.[20] Children grow at different rates at different ages, and different children also develop at different rates, so there will be early and late developers. Not only are the rate of growth different, but also the changes in the body proportions can vary, and this will directly affect the ability to perform. Moreover, the motor performance is related to body stature, body weight, growth spurt, body composition, cardiovascular fitness and muscle strength.[20]

Acknowledgement

Having surmounted all the difficulties and after reaching the shore by completing the work of this study, I am realizing the limitations of language and words while acknowledging thanks to all those who helped me in this voyage.I thank my mother Mrs. Neena Yengde, my father Mr. Narendre Yengde & my sister miss manjari and shraddha for their moral support, prayers and encouragement that have been a pillar of strength throughout this work.Words are few and language seems feeble when the heart is full of gratitude, these few words cannot express my deep sense of gratitude to my esteemed **Guide Dr. Sanjivani Dhote**, who has been a constant source of inspiration to me since the very beginning of this work. Her unsurpassable teaching experience & scientific approach has increased my interest and knowledge in the subject. It is only because of her constructive supervision and overall encouraging sympathetic attitude that my work has acquired the present shape. It is with deep sense of gratitude and sincerity that I thank **Dr. TusharPalekar**, principal of Dr. D. Y. Patil College of Physiotherapy, Pimpri, Pune and **DR. D. Y. PATIL UNEVERSITY** for allowing to conduct project and helping me to successfully complete this study. From him I have tried to imbibe values, vast knowledge, experience and a high sense of professionalism. I am highly indebted to My Friends especially, **Prajkta K**, **Apoorva D, Antara P, Ashish G, Diksha G, Gurjit S, and Nargis H** for constantly supporting me and for bearing the brunt of this Herculaneum task.Finally, I express my sincere thanks to all my patients and the secretary of all schools, whose willingness to be a part of this study helped this work see the light of day**.** Lastly I would like to thank **God** for sending all these wonderful opportunities and giving me a chance to prove myself.

Reference

1. Satabsi Ghosh, Sutanu dutta chowdhury, Ananga Mohan Chandra and Tusharkanti Ghosh.(2012) "A study on the influence of occupation on development of motor activities in children"
2. Shmway- cook A.anson D.haller. Postural sway biofeedback "effect on restabilising stance stability in hemiplegic patient". arch. Phys. Med. Rehabil.1988;69 (6):395-400
3. Davidson; Madigan Nussbaum(2004)." Effects of lumber extension fatigue and fatigue ret on postural sway" European journal of applied physiology
4. Gribble Herte. Effect of lower extremity fatigue on postural contral" archilles of physical medicine and rehabilitation.2008;85 (4):589-529
5. Chris Hobbs, Candidate for Master's Degree, United States Sports Academy America's Sports University. The Sport Digest-ISSN: 1558-6.448 "Importance of Balance and Stability to Master of Sport Skills"
6. Jan P Piek BSc(Hone) PhD, Thelma MPitcher BSc (Hons) PhD David A Hay MA(Hons) PhD "Motor coordination and kinaesthesis in body with attention deficit-hyperactivity disorder
7. Cynthia A.Molloy Kim N. Dietrich Amit Bhattachary "postural Stability in Children with Autism Spectrum Disorder
8. Yuri Agrawal, MD; John P. Carey, MD; Charles C. Della Santina, et al. Disorders of Balance and Vestibular Function in US Adults Data From the National Health and Neutrition Examination Examination Survey, 2001-2004
9. Chia-Liang Tsai, Sheng K. Wu Chi-Huang Huang "static balance in children in children with developmental coordination disorder"
10. Byron P. Rourke Gerald C. Young Antoon A. Leenaars "A childhood learning disability that predisposes those Afflicted to Adolescent and adult depress and suicide risk."
11. Nancy N. byl, John M. Gray Complex balance reaction in different sensory condition: Adolescent with and without idiopathic scoliosis Authors.
12. O'sullivan, Susan; shmitz, Thomas (2007). Physical rehabilitation (fifth ed.). Philadelphia: F.A. Davis Company.pp 254-259.
13. Blum, Lisa; Korner-Bitensky, Nicol. "Usefulness of the berg balance scale in stroke rehabilitation: A Systematic review". Physical Therapist.2008; 88(5): 559-566.
14. Hrysomallis, C. "Balance ability and athletic performance". Sports Medicine (Auckland, N.Z.).2011;41(3): 221-232.
15. Horak; et al."Balance evaluation systems test (BESTest) to differentiate balance deficits" journal of the American physical therapy association.2009;89 (5): 484-498.
16. Bruinink-oseretsky test of motor proficiency second edition complete from repoet H. bruinink, PhD, and Brett D.Bruininks, PhD.
17. Bell D.R., Guskiewicz K. M., Clark M. A., Padua D. A. "Systematic review of the balance error scoring system". Sport Health: A Multidisciplinary Approach.2011; 3 (3): 287-295.
18. Valovich T. C. Perrin D. H., Gansneder B. M. "Repeat administration elicits a practice effect

with the balance error scoring system but not with the standardized assessment of concussion in high school athletes". Journal of Athletic Training.2003; 38 (1): 51-56.

19. Pradip Kumar paul assistant Teacher, Naihati Narendra Vidyaniketan, 24 Pgs. (N), WB, Indian "Comparative Study on Balance and Coordination of 12 and 13 years Boys"

Abbreviation

1. BOT-2 : Bruininks-Oseretsky Test Second Edition
2. F: Female
3. M: Male
4. StdDev: Standard Deviation
5. WAA: well Above Average
6. AA: Above Average
7. A: Average
8. BA: Below Average
9. WBA: Well Below Average

Source of Support: Nil
Conflict of Interest: None