

The Reference Values of YBT-LQ in Indian School Going Children- A Cross Sectional Study

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ABSTRACT

Introduction: Balance plays an important role in growing children for playing, jumping, hopping and running activities. These sports like activities need dynamic balance to perform without falls. YBT –LQ is reliable tool to evaluate both static and dynamic balance on lower limb in standing. Among children of age 6 to 12 years reference values are not available in literature. Hence present study determine reference values of Y-Balance Test-Lower Quarter(YBT-LQ) in Indian school going children and to find out correlation of anthropometric measures, age and gender with YBT-LQ.

Material and Methods: Total 364 typically developing children were randomly selected of both genders (182 boys and 182 girls) of age 6to12 years. Three successive trials of YBT-LQ were performed for each leg in standing on Y-balance kit. The mean of three successful trials was noted for three directions of YBT-LQ for lower extremities.

Data analysis and Results: ANOVA and Bonferroni test were used to analyze correlation and association of YBT-LQ values with anthropometric data, age and gender respectively with 95% of confidence interval. The reference values of YBT-LQ of anterior, posteromedial and posterolateral reach values ranged from 45.54cm to 76.48cm, 60.77cm to 102.8cm and 60.58cm to 99.96cm respectively in children age 6 to12 years. Height, age and gender are the contributing factors affecting YBT-LQ reach scores.

Conclusion: The reference values of YBT-LQ can be use as baseline data for balance evaluation in children of age 6 to 12 years. Height is the major factor causing variations in YBT-LQ reach scores.

Key words: Balance, India, School Children, YBT-LQ, Height, Gender.

INTRODUCTION

Balance is the ability to maintain the line of gravity of a body within the limits of the base of support. [1] Static and dynamic balance helps to maintain postural control during the performance of functional task.

[1] Balance plays a vital role as it is required to initiate as well as to complete the movement. [1] Balance is the coordinated function of multiple systems like central nervous system, musculoskeletal system (including many joints and muscles), and multiple sensory systems (i.e. vestibular-somatosensory-visual system). [2,3]

In normal development, balance is developed from birth and matures at approximately 6 to 7 years of age. [4] The infants and young children of age 4 months to 2 years are more dependent on visual system, whereas the children of age of 3 to 6 years start using somatosensory system more than the other systems and from age of 7 years to 10 years, the children can now resolve a sensory conflict and uses vestibular system more as reference to maintain balance. [4,5] Children with motor defect also show postural instability or imbalance during daily activities. [5] Dysfunction of any of these system i.e. visual, proprioceptive, vestibular, neuromuscular components or the connections between these systems, either through disease and/or tissue injuries will lead to difficulty in maintaining the correct position of the body in space. [6] In children, balance is required in most of the activities

such as standing, sitting, squatting, walking, ascending and descending stairs, playing, running, reaching etc. [7] Loss of balance lead to difficulty in walking, repeated falls, and other lower limb activities like riding a bicycle, running, skipping in children. [8]

Balance evaluation is one of the important components of physical therapy assessment. [9] In order to evaluate, balance related problems in children, there are various reliable tests available. [10,11,12] Among available balance tests, Y-balance test (YBT)-LQ(lower quarter) is the one which is used to measure lower limb balance and there is no special equipment required if performed on ground. [11,12] YBT-LQ is an instrument version of component of star excursion balance test (SEBT). [11] YBT-LQ kit also can be use for the test as it is portable and YBT-LQ is easily administered in order to evaluate both static and dynamic standing balance. [12] The intra-rater reliability ranged from 0.85 to 0.91 and inter-rater reliability ranged from 0.99 to 1.00. [12] It utilizes the anterior, postero-medial and posterolateral component of SEBT. [10-13] The test-retest intra-class correlation coefficients (ICCs) for three directions i.e. anterior is 0.98, postero-medial is 0.98, and postero-lateral is 0.99 respectively and was proved to have excellent reliability among children of age 7 to 12 years as well as among college athletes. [12,13] It is used to identify chronic ankle insufficiency, person at greater risk of lower extremity injury, functional symmetry and is also act as predictive of injury. [12]

To date studies showed that YBT-LQ is reliable tool among adult as well as in pediatric population [12,13] and there are racial as well as anthropometric variations present among pediatric population. [14] The previous studies found that height, [4,14] age and gender contributes significantly for changes in balance performance among children of age 6 to 12 years. [4] The reference values of YBT-LQ are not yet established in Indian school going children. Therefore, the purpose of the study is to determine the reference values of YBT-LQ

and to find out correlation of height and age with YBT-LQ in Indian school going children of age 6 to 12 years.

METHODS

A cross sectional study was performed in sample size of 364 school going children (182 boys and 182 girls). The list of schools was obtained from city block education office. Children were included from two local schools of city which was selected by random number table method out of total 244 schools. Typically developing children of both the gender were taken into consideration for inclusion in study within the age group of 6 to 12 years. The children were divided into 7 subgroups depending on the age that is 6, 7, 8, 9, 10, 11 and 12 years. Each subgroup had 52 subjects (26 boys and 26 girls), using multi-stage stratified sampling method.

Typically developing children of both gender between the ages of 6 and 12 years with the ability to stand for at least 2 minutes without support were included in the study. [4] Children with any history of systemic problems, middle-ear infection within the past 6 months, [4] any uncorrected visual difficulties, any history of recent lower limb fractures, lower limb knee joint was evaluated by Beighton's criteria [15] and if height or weight fell below the 10th or above the 90th percentile [16] for gender and age were excluded. [4]

Procedure

Permission and approval from the institutional head, ethical committee and scientific committee was obtained prior to the commencement of the study. Permission was taken from the block education officer and the list of schools was collected. Out of 244 higher primary schools of city, four schools were selected by simple random sampling using random number table method. Permission was obtained from the school authorities to carry out the study. The classes where the target population was present were selected by lottery method. Total 734 subjects were screened from two

schools in present study. All the children from each class were screened and 52 (26 boys, 26 girls) subjects were selected from each class, by random number table method. The subjects were selected based on inclusion and the exclusion criteria. The information sheet and the consent form were sent for the approval of their parents and assent form was filled by the subject and once the approval was received, the subject was included for the study.

The research purpose of the study and the test procedure of YBT – LQ [12,17,18] (Appendix) were elaborately explained and a standard video was demonstrated to teachers and children. The demographic data of the subjects i.e. age and gender was

obtained from the school records. The weighing scale and measuring scale was used to measure anthropometric data such as weight in kilograms and height in centimeters respectively.

The test was determined by qualified Physical therapy expert. Prior to the testing, each subject had 6 practice trials followed by 3 successive trials of YBT-LQ in each direction, with shoes off with rest period of one minute on YBT kit. The average reach score of these three trials in all three directions (anterior, posterior-lateral, and posterior- medial) was calculated and recorded. Starting position and test perform in all three directions are explained.(Figure 1,2,3 and 4)

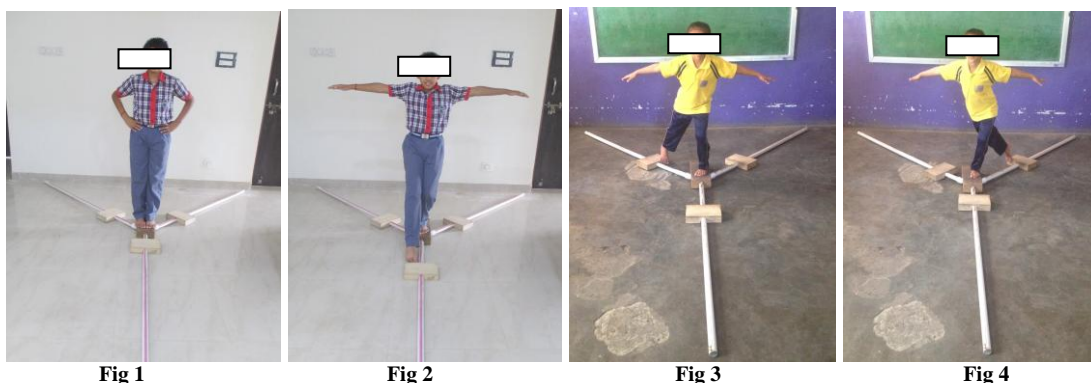


Figure 1: Starting Position for Y Balance test
Figure 2: Position for Y balance test: Left Anterior Reach
Figure 3: Position for Y balance test: Right Posteromedial Reach
Figure 4: Position for Y balance test: Right Posterolateral Reach

DATA ANALYSIS

Statistical Package for Social Science (SPSS) Version 20.0 was used for analysis. Descriptive statistics were obtained for reference values of YBT-LQ in all three directions for all the age groups of 6 to 12 years, and 95% confidence intervals were determined. Karl Pearson's product moment was used to examine associations between age and height. A regression analysis was performed to obtain reference values of the YBT-LQ with respect to age and height.

RESULT

Out of 384 children (182 boys and 182 girls) were included in the study. The height and weight, among girls ranged from

112.7± 6.1cm to 143.3± 8.4cm and 19.8± 2.3Kg to 38.9± 6.4kg respectively whereas among boys ranged from 119.4 ± 9.5 cm to 147.1± 10.4 cm and 24.6± 3.3kg to 40.8± 6.3 Kg respectively. The height, weight and BMI of children were within 10th and 90th percentile normal limits for age group of 6 to 12 years among both genders for Indian population. [19] The demographic data of children are given in Table 1.

The mean and standard deviations of anterior reach, posteromedial (PM) reach and posterolateral (PL) reach distances are shown in Table 2. The reference values of YBT-LQ of anterior reach ranged from 45.54cm to 76.48cm, posteromedial reach ranged from 60.77cm to 102.78cm and posterolateral reach ranged from 60.58cm to

99.96cm in Indian school going children age 6 to 12 years. The reach score for anterior, PM and PL increases as age advances from 6 to 12 years in both gender.

Table 1: The Mean And Standard Deviation Of Demographic Data[Height(cm), Weight (Kg), BMI(Kg/m²)] among both gender.

Age (years)	Gender	Height(cm)	Weight (Kg)	BMI(Kg/m ²)
6	B	119.2 ± 9.5	24.6 ± 3.3	17.2 ± 0.4
	G	112.7 ± 6.1	19.8 ± 2.3	15.2 ± 0.8
7	B	119.4 ± 9.5	24.6 ± 3.3	17.2 ± 0.6
	G	117.9 ± 5.6	20.4 ± 2.1	14.6 ± 0.6
8	B	125.9 ± 7.4	24.6 ± 3.8	15.4 ± 1.0
	G	117.4 ± 9.2	23 ± 3.2	15.6 ± 1.1
9	B	129.1 ± 6.6	26.7 ± 4.4	15.9 ± 1.4
	G	128.6 ± 7.7	26.8 ± 4.9	16.0 ± 1.3
10	B	136.8 ± 8.6	29.8 ± 5.1	15.8 ± 1.0
	G	134.9 ± 9.2	29.5 ± 5.1	16.0 ± 1.4
11	B	143.8 ± 6.5	37.1 ± 5.2	17.8 ± 1.5
	G	139.7 ± 10.3	34 ± 6.7	17.2 ± 1.7
12	B	147.1 ± 10.4	40.8 ± 6.3	18.3 ± 3.3
	G	143.3 ± 8.4	38.9 ± 6.4	17.1 ± 1.8

Abbreviations: G, girl; B, boy, Values represent mean± SD

Table 2: The mean and standard deviation of reach values of anterior, posteromedial and posterolateral direction on YBT-LQ for Girls and Boys.

Age	Gender	Anterior reach		Postero-lateral reach		Postero-medial reach	
		Rt	Lt	Rt	Lt	Rt	Lt
6	B	45.81±9.06	46.50±9.88	61.69±9.05	60.58±9.32	61.38±6.43	60.77±7.43
	G	45.54±8.87	46.38±9.03	62.08±8.55	61.46±7.76	63.38±9.51	65.12±10.72
7	B	49.50±11.56	50.42±12.29	66.04±9.63	66.08±9.89	70.62±12.55	71.19±14.12
	G	46.88±5.93	47.35±6.86	62.85±6.18	62.65±7.18	63.77±6.39	64.15±6.95
8	B	57.96±17.63	58.50±15.71	73.88±11.95	73.54±11.95	73.92±14.73	74.54±13.12
	G	49.00±7.89	49.12±8.59	67.08±9.27	64.77±7.33	67.38±7.68	69.42±10.55
9	B	67.04±19.14	66.54±16.52	82.00±10.11	81.19±12.98	84.77±16.49	85.19±15.96
	G	65.46±18.03	63.15±16.66	77.62±9.30	77.08±10.54	80.38±7.37	82.04±9.28
10	B	66.92±14.97	66.73±14.54	83.15±13.15	86.69±16.68	84.84±13.68	86.62±13.55
	G	67.19±15.71	66.23±14.06	81.62±16.33	79.27±13.73	80.50±14.56	83.50±13.51
11	B	73.42±9.06	75.27±9.88	98.35±16.53	98.00±15.43	96.88±15.27	97.85±15.23
	G	68.88±10.51	69.92±11.08	84.81±13.13	85.77±17.37	88.00±15.53	87.46±17.09
12	B	75.12±20.73	76.48±15.15	99.74±16.17	99.96±17.94	102.78±19.43	102.52±16.71
	G	74.07±14.45	74.92±17.53	93.08±17.97	94.12±13.54	96.92±16.32	97.56±17.31

The comparison of YBT-LQ (Anterior, Posterolateral and Posteromedial reaches) with age among gender: As age advances the reach distance score in all the three directions increases i.e. from age 6 to 12 years among both genders. (Table 2)

Tables 3: Regression analysis to assess the effect of parameters of YBT-LQ on anterior reach, posteromedial reach and posterolateral reach.

YBT-LQ Reach Direction	Side Of Lower Limb	Parameters	Coefficients			t-value	Significance (p-value)
			Un-standardized		Standardized		
			β	Std. Error	β		
Anterior	Right	Age (a)	3.02	0.58	0.34	5.13	0.00**
		Height(b)	0.38	0.08	0.30	4.47	0.00**
		Constants(c)	-13.82	8.27	-	-1.67	0.09
	Left	Age(a)	3.31	0.56	0.39	5.96	0.00**
		Height(b)	0.34	0.08	0.29	4.23	0.00**
		Constants(c)	-9.16	7.81	-	-1.17	0.24
Postero-lateral	Right	Age(a)	3.88	0.56	0.44	7.24	0.00**
		Height(b)	0.35	0.08	0.27	4.54	0.00**
		Constants(c)	3.83	7.55	-	0.51	0.61
	Left	Age(a)	4.07	0.56	0.44	7.28	0.00**
		Height(b)	0.35	0.08	0.26	4.34	0.00**
		Constants(c)	2.92	7.87	-	0.37	0.71
Postero-medial	Right	Age(a)	4.42	0.57	0.47	7.61	0.00**
		Height(b)	0.29	0.08	0.21	3.45	0.00**
		Constants(c)	9.03	8.13	-	1.11	0.26
	Left	Age(a)	4.16	0.58	0.45	7.12	0.00**
		Height(b)	0.32	0.08	0.25	3.85	0.00**
		Constants(c)	6.09	8.21	-	0.74	0.46

p- value**-High significance

The comparison of YBT-LQ (Anterior, Posterolateral and Posteromedial reaches) results with height. The height significantly ($p < 0.001$) affect YBT-LQ reach scores in all the three directions among both the gender of ages 6 to 12 years. YBT-LQ reach score in all three directions significantly affected by age ($p < 0.001$) among both gender of 6 to 12 years. (Table 3)

Table 4: The formula to predict YBT-LQ values among children of age 6 to 12 years.

Formula	$Y_{[R,L]} = ax_1 + bx_2 + c$, Where, Y=YBT-LQ Reach distance (cm), x_1 = Age (years), x_2 = Height (cm), a,b,c= Coefficients Constants, R-Right side reach, L-Left side reach					
Direction/Side	Right side			Left side		
Coefficients Constants	A	b	c	a	b	c
Anterior YBT-LQ	3.02	0.38	-13.82	3.31	0.34	-9.16
Postero-lateral YBT-LQ	3.88	0.35	3.83	4.07	0.35	2.92
Postero-medial YBT-LQ	4.40	0.29	9.03	4.16	0.22	6.09

From the results it can be concluded that the reach distance values of YBT –LQ in all the three directions among both the gender could be significantly predicted by using the formula given in Table 4. The formula, $Y_{[R,L]} = ax_1 + bx_2 + c$, can easily be use to predict YBT-LQ values among children of age 6 to 12 years.

DISCUSSION

The anthropometric measurements of the subjects included in the present study were in agreement with the Indian data for the respective age groups. [4,19] The reference values of YBT-LQ of anterior reach ranged from 45.54cm to 76.48cm, posteromedial reach ranged from 60.77cm to 102.8cm and posterolateral reach ranged from 60.58cm to 99.96cm in children of age 6 to 12 years. Study proposed by Lee AC and Ong KB had proved YBT-LQ has excellent test-retest reliability for all the three directions in similar age group. [13] The effect of age and height on YBT-LQ was determined by using stepwise regression. Results showed that the anterior reach value, posterolateral as well as posteromedial reaches are affected significantly by age and height. It is known that physiologically as the age advances from 6 to 12 years, height increases proportionally in both genders with age. In current study, there is significant increase in height at the age of 8-9 years for girls whereas among boys there is significant increase in height at the age of 9-10 years, this follows normal growth spurt

phenomenon among both the gender. [4,19] This finding of current study was also supported by Parthasarathy A [19] and colleagues, who found that the gender difference observed in height may be due to variation in the timing of growth spurts or puberty in both boys and girls, which occurs earlier in girls i.e. by ages 8 to 13 years and in boys, by ages 9 to 14 years.

In various studies, Deshmukh AA, [4] Volkman KG [14] and Gribble PA [20] found that height significantly correlated with reach distance in the majority of the directions of FRT and SEBT scores respectively which support present study findings that height contributes significantly to YBT-LQ reach scores. In previous study it was stated that during the middle phase of childhood i.e. 6 to 10 years for girls and 6 to 12 years for boys, somatic growth velocity grows slower than the body growth, which becomes rapid during puberty and it was also found that taller children who are maturing early may show higher reach score as compared to children who are short stature and slow growing for particular age. [4] The results of the current study found that height was the major contributing factor affecting the reach score in all the three reach directions of YBT-LQ, in age of 6 to 12 years.

In the present study, boys exhibited significantly greater YBT-LQ reach distance score for all the three directions of YBT-LQ when compared to girls. This was also proved by Gorman P [18] and co-workers that boys performed better on various reach

directions of the YBT-LQ in comparison to girls. Tedla JS [21] and colleagues stated that boys are stronger and taller than girls because of their anatomical structural built and growth patterns which are different than girls. Study proposed by Lafortuna CL [22] and colleagues stated that gender had significant difference on upper as well as lower limb muscles strength, and males have higher lower limb power output as compared to females. Kumaresan A [23] found that there were significant differences between normal and overweight groups in SEBT score and stated that there is an inverse correlation between BMI and SEBT scores whereas study done by Deshmukh AA [4] who found that weight did not contribute to any significant change in FRT or LRT values in either gender. A study done by Gorman P [18] also showed that there is no correlation between weight and SEBT scores. In the present study, children fell within the standard ranges of weight for their age [19] and hence, weight of the children was not considered for comparison with YBT-LQ.

In the present study, it was observed that among the three direction score of YBT-LQ, the anterior reach score is smaller than the posteromedial and the posterolateral values in the age group of 6 to 12 years. Previous studies done by Gorman P [18] and Gribble PA [20] also found anterior reach scores lesser than posteromedial and posterolateral scores in YBT-LQ and SEBT respectively. This was in agreement with the findings of Coughlan GF [17] and colleagues who stated that the visual system is used as a reference point for orientation of body in space and along with somatosensory system is responsible for maintaining balance. In the present study during reach in all three directions, visual feedback was similar for both the gender hence no gender difference in anterior reach values were found, but when compared to posteromedial and posterolateral reach, children has to depend on muscle strength and somatosensory system to maintain balance. As stated by Lafortuna CL [22] that among gender, males

have higher lower limb power output as compared to females, which might showed more reach score among boys in postero-lateral and postero-medial direction than girls.

Finally from the present study, it can be stated that age and height are the main contributing anthropometric factors leading to variations in YBT-LQ reach score among both gender.

Implications for Research and Clinical Practice

The reference YBT-LQ reach score obtained in study can be used as baseline data for assessment of balance in Indian school going children while screening for sports activity in schools. In outdoor or field sports activities, school children can be screened for balance with help of YBT –LQ in children with chronic ankle insufficiency, or at greater risk of lower limb injury. YBT-LQ can also be used as an exercise for balance training purpose among children. In the present study, lower limb strength and joint position sense error evaluation was not considered, which could affect the balance test scores in YBT-LQ, hence in future research muscle strength of lower extremity should be evaluated along with knee and ankle joint position error.

CONCLUSION

From the present study it can be concluded that, the range of reference reach scores of YBT–LQ for anterior reach is 45.54cm to 76.48cm, posteromedial reach is 60.77cm to 102.8cm and the posterolateral reach is 60.58cm to 99.96cm in Indian school children of age 6 to 12 years. Height and age are the factors affecting YBT-LQ reaches, out of which height is the major factor causing variations in YBT-LQ reach scores.

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REFERENCES

1. Venetsanou F, Kambas A. The effects of age and gender on balance skills in preschool children. *Phys Edu and Sports*. 2011;9(1):81-90.
2. Kejonen P. Body movements during postural stabilization: measurements with a motion analysis system. *Biomed research*. 2002;1-80.
3. Forssberg H, Nashner LM. Ontogenic development of postural control in man: adaptation to altered support and visual conditions during stance. *J Neurosci*. 1982; 2:545-552.
4. Deshmukh AA, Ganesan S, Tedla JS. Normal values of functional reach and lateral reach tests in Indian school children. *Pediatr Phys Ther*. 2011;23:23-30.5.
5. Westcott SL, Lowes LP, Richardson PK. Evaluation of postural stability in children: current theories and assessment tools. *Phys Ther*. 1997;77(6):629-645.
6. Clark MS. The unilateral forefoot balance test: reliability and validity for measuring balance in late midlife women. *N Z J of Physiother*. 2007;35(3):110-118.
7. He H, Kiguchi K, Horikawa E. A study on lower-limb muscle activities during daily lower limb motions. *Int J bioelectromagnetism*. 2007;9(2):79-84.
8. Melo RDS, Silva PW, Tassitano RM, Macky CF, Silva LV. Balance and gait evaluation: comparative study between deaf and hearing students. *Rev Paul Pediatr*. 2012;30(3):385-391.
9. Franjoine MR, Gunther JS, Taylor MJ. Pediatric balance scale: a modified version of the berg balance scale for the school-age child with mild to moderate motor impairment. *Pediatr Phys Ther*. 2003;15: 114-128.
10. O'Sullivan S, Schmitz TJ. Examination of motor function: *Physical Rehabilitation*. 5th ed. New Delhi, India: Jaypee brothers; 2007:254-259.
11. Westrick RB, Miller JM, Carow SD, Gerber JP. Exploration of the Y balance test for assessment of upper quarter closed kinetic chain performance. *Int J Sports Phys Ther*. 2012;7(2):139.
12. Plisky PJ, Gorman PP, Butler RJ, Kiesel KB, Underwood FB, Elkins B. The reliability of an instrumented device for measuring components of the star excursion balance test. *N Am J Sports Phys Ther*. 2009; 4(2):92-99.
13. Lee AC, Ong KB. The test-retest reliability of 'Y-Balance Test' as dynamic balance measure on Malaysian primary school children. *J Of Teach Educ*. 2012;1(7):331-337.
14. Volkman K, Stergiou N, Stuberger W, Blanke D, Stoner J. Factors affecting functional reach scores in youth with typical development. *Pediatr Phys Ther*. 2009;21: 38-44.
15. Deshmukh AA. Normal values of functional reach and lateral reach tests in children with knee hypermobility. *Pediatr Phys Ther*. 2014; 26(2):230-6.
16. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*. 2000;320:1240.
17. Coughlan GF, Fullam K, Delahunt E, Gissane C, Caulfield BM. A comparison between performance on selected directions of the star excursion balance test and the y balance test. *J Athl Train*. 2012;47(4):366-371.
18. Gorman PP, Butler RJ, Kiesel K, Rauh MJ, Plisky PJ. Differences in dynamic balance scores in one sport versus multiple sport high school athletes. *Int J Sports Phys Ther*. 2012;7(2):148-153.
19. Parthasarathy A, Menon PSN, Gupta P, Nair MKC. Growth and development. In: Agarwal KN, ed. *IAP Textbook of Pediatrics*. 4th ed. New Delhi, India: Jaypee brothers; 2009:94.
20. Gribble PA, Hertel J. Considerations for normalizing measures of the star excursion balance test. *Meas Phys Educ Exerc Sci*. 2003;7(2):89-100.
21. Tedla JS, Shenoy UV, Jeganathan PS, Reddy RS, Gopalakrishna A. Normative Data for Trunk and Lower Extremity Muscle Strength by Hand Held Dynamometer for Indian Children Aged 5-14 Years: A Cross Sectional Study. *Int J Health Sci Res*. 2012;2(6):1-19.
22. Lafortuna CL, Maffiuletti NA, Agosti F, Sartorio A. Gender variations of body composition, muscle strength and power output in morbid obesity. *Intern J Obes*. 2005;29:833-841.
23. A Kumaresan, T Kavithayini. The impact of body mass index on performance of the star excursion balance test. *Int J Pharmaceutical sci health care*. 2012;2(2):79-86.

APPENDIX

YBT-LQ TEST PROCEDURE: [12,17,18]

- I. The Y Balance Test Kit consists of a stance platform to which three pieces of PVC pipe are attached in the anterior, postero-medial, and postero-lateral reach directions.
- II. The posterior pipes are positioned 135 degrees from the anterior pipe with 45 degrees between the posterior pipes.
- III. Each pipe is marked in 5 millimeter increments for measurement.
- IV. First, the subjects viewed a standard video demonstration followed by six practice trials prior to testing. Afterwards, all subjects performed the YBT-LQ with shoes off in an effort to decrease the possible influences footwear may have on balance.
- V. The subject began the test by standing with one foot on the stance plate with the most distal aspect of the foot at the starting line, and then was asked to reach with the opposite leg in the anterior, postero-medial, and postero-lateral directions.
- VI. The testing order was 3 trials standing on the right foot reaching in the anterior direction (right anterior reach) followed by 3 trials standing on the left reaching in the anterior direction.
- VII. This procedure was repeated for the postero-medial and then the postero-lateral reach directions.
- VIII. During the trials, the reach foot was not allowed to touch down on the floor or gain balance from the reach indicator or support pipe.
- IX. If the subject was unable to perform the test according to the above criteria in six attempts, the subject failed that direction, no data were collected and another trial was conducted.
- X. Reach distance was measured from the most distal aspect of the toes of the stance foot to the most distal aspect of the reach foot in the anterior, postero-medial, and postero-lateral directions.
- XI. The average of three trials for each direction, for each leg, was used for analysis.

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