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Original Article

Effect of Core Stability Exercises and Balance Training in Postural Control among Children with down Syndrome

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ABSTRACT

Posture, balance, and movement issues are common in children with Down syndrome. Emerging research suggests that balance training may be advantageous for children with Down syndrome, making it a crucial component of physical activity programmes. **Objective:** to ascertain the impact of balance training and activities for core stability on postural control in kids with Down syndrome. **Methods:** single blinded RCT study was conducted, in which assessor was kept blind. While taking into account inclusion and exclusion criteria, children with Down syndrome were randomly divided into two groups with ages ranging from 5 to 17 years. There were 20 patients in the sample. Exercises for core stability were given to Group 2 and balance training to Group 1. The time between treatments was six weeks. The Comprehensive Rehabilitation facility Chakwal is where the data is gathered. The pre- and post-values of postural stability were measured using the paediatric Berg balance scale. **Results:** The present results are significantly better in the group B than in the group A. Core stability exercises shows better results than balance training. **Conclusion:** According to the results of the current study from the data of before the treatment and after the treatment, it revealed a positive change. In the duration of six weeks the core stability exercises were more effective than balance training in developing postural control among children with Down syndrome.

INTRODUCTION

Down syndrome (DS) also called trisomy 21 is a chromosomal disorder caused by the presence of an extra copy of chromosome 21. This is generally associated with physical growth deficits, mild to moderate intellectual disability and distinctive facial features Children with Down Syndrome have frequent strokes and delayed brain maturation [1]. There may also be many other minor irregularities of the face, head, neck, and clinically inappropriate feet, and the height is generally reduced [2]. Children with Down syndrome also display deficiencies in muscle strength, muscle capacity, and growth of motor skills [3]. Children DS with the shown disparity in developing both musculoskeletal and active motor control components relative to the developmentally normal children [4]. Most children with Down's syndrome have mild to moderate cognitive impairment [5]. Word is slow, impacting both memories in the short and the long term. Children with DS face a substantial delay in acquiring motor skills and contextual speech discrepancies concerning children without Down syndrome [6]. The word ' core ' or ' core stability ' encompasses anterior-aspect muscles such as abdominals, later gluteal and paraspinal muscles, and lower pelvic floor with hip girdle musculature Core stability exercises show a vital part in PT strategies and influence

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children's equilibrium with DS [7]. These exercises increase muscle strength in the lower extremities, improve motor performance, develop cognitive skills, and activate the locomotive control system [8]. Performing core stability activities daily has the same benefits for older adults with Down Syndrome and strengthens lower limb strength, coordination, and walking skills. This development leads to improving the functional capacities of daily activities and people with DS [9]. Core stabilization can help to increase the balance between fluid and muscle control between the lower and upper extremities and lower the risk of fracture and muscle inequalities [10]. In pain reduction core stability exercises have a beneficial effect, loosening of deep abdominals, improving the strength of the lumbar spine, and increasing muscle strength of patients [11]. The major impact of core stabilization training can be because core stability training increases the performance of the neuromuscular system, resulting in an optimum chain of lumbar-pelvic mobility in DS children [12]. In adolescents with down syndrome suffering from coordination problems, core stability therapy can be used to enhance equilibrium and reduce the risk of collapse and injury, contributing to a better quality of life. Requires core stability preparation to enhance efficiency and reduce incidents [12]. Postural regulation is a term used to describe how our central nervous system (CNS) controls sensory information from other systems to generate sufficient motor activity to sustain a regulated, upright posture. The major sensory mechanisms involved in postural regulation and coordination are the auditory, vestibular, and somatosensory systems [13]. Postural stability is the ability to maintain equilibrium in a gravity field by sustaining or restoring the Body mass center above its support base. Unsupported, standing people are in unstable equilibrium or equilibrium since muscle strength will constantly overcome the force of gravity [14].People with DS have a sensory impairment attributed to hypotonic and ligamentous laxity, agonist and antagonist muscle co-contraction, and coordination and postural deficiencies [15].The postural control structure has two core functions: first, building up attitude towards gravity and ensuring equilibrium is sustained; and second, setting the direction and location of the parts that serve as a frame of reference for vision and movement towards the outside world [16]. Children with DS have severe problems when standing up straight in maintaining correct posture and/or balance. In addition, while their physical development is somewhat complete, some of their engine functions remain inadequate [17]. To the Researcher's best knowledge so far there is no such study that compares these two approaches. The key aim of the current analysis was to evaluate the core permanence and balance exercise in postural control amid DS. So that in the future we developed a better treatment plan for CP & Stroke patients to develop postural control. And previously most studies focus on functional training rather than core stability

METHODS

It was a single-blinded randomized control trial, in which the assessor was kept in blindness. The sampling technique applied was non-probability purposive. This research work was approved ethically by an institutional board review committee of the international university Ripha Lahore campus. The study registration number was S18C13G37009. The objective of this research work was to to evaluate the core permanence and balance exercise in postural control amid DS. An alternative hypothesis was that balance training and core stability exercises are not equally effective in children with Down syndrome. Data was collected from the Comprehensive rehabilitation center Chakwal and Private physical therapy institute of Lahore while following consort guidelines. The duration of the study was 6 months after approval of synopsis from 15-09-19 to 30-03-20. This study had taken a sample size of 20 participants. Each group has 10 participants. Size d =1.5662217 α err prob=0.05, Power (1-β err prob) =0.95, Allocation ratio N2/N1=1, Output: Non centrality parameter δ=3.50, Critical t=1.7340636 Df=18, Sample size group 1 & 2=10 in each group, Total sample size=20, Actual power= 0.957404. 20 participants were randomly allotted in 2 groups, 10 participants in each group. Randomization was done through the lottery method and concealment was done. Group A (n=10) was managed with trunk balance exercises, while Group B (n=10) was managed with abdomen core stability exercises and conventional treatment was given to both groups. Inclusion Criteria include both female and male, age 5 to 17 years, trisomy 21 by genetic karyotype, low muscle tone, joint Laxity, psychomotor progress deficits, normal visualisation, and audible range. Exclusion Criteria include patients suffering from Seizure, multiple sclerosis, or epilepsy, muscular dystrophy, mental retardation, severe learning disability or sensory deficits, using inhibitory splints or a polyethylene ankle/foot orthosis, severe cognitive and perceptual issues. Once the inclusion and exclusion criteria mentioned above have been taken into account potential participants have been considered. They were asked to take part in the study. Written consent foam has been granted. Each participant was requested to draw either the number one or the number two from the box. The number one was assigned to Group A and the number two was allocated to Group B. for data collection. For Down syndrome children Paediatric berg scale Stability is used to measure the core stability and consistency in this study.

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Paediatric Berg balance scale is 14 –item parameter referred test which evaluates functional balance in the sense of the daily task in peace population. (a) The scores of the item level vary from 0 to 4, which is calculated by the capacity to carry out the assessed activity. (b) Items scores are then summed up (c) Total score is 56 [18]. Head, upper limbs and trunk rotation from a kneeling position, flexion/extension in upper limb with concurrent movement of head from position of kneeling, Pelvic bridging, elating contrary upper/lower limbs from a position of Quadruped, Heel/toe elevations, substitute escalating are all part of Group A balance exercise. Abdominal bracing with or without heel slide in lying position, or Leg lifts with same position, same abdominal position with bridging, or standing with abdominal bracing are all examples of Group B core stability exercises. Both groups got standard treatment. In conventional treatment isometric muscle contraction (hamstrings, quadriceps, hip extensors, anterior tibial group, and calf muscles). Dosage was 10 Repetitions with 5 seconds hold three times per day. Session was last for 6 weeks and 3 sessions each week. Data were examined by means of SPSS for windows software version 21.0, numerical consequence was set at p=0.05. Regularity table, pie charts, bar charts were applied to demonstrate conclusions of collection assessment restraint ended period. nonparametric test was used to find change between the group and within groups. Changes between successive visits: Change between successive visits: t test was used to show the progress of two groups between any two successive visits in terms of subjective and objective measurements. Difference between Groups: Independent sample t test was used. This a nonparametric test that is used to compare two populations at different various intervals.

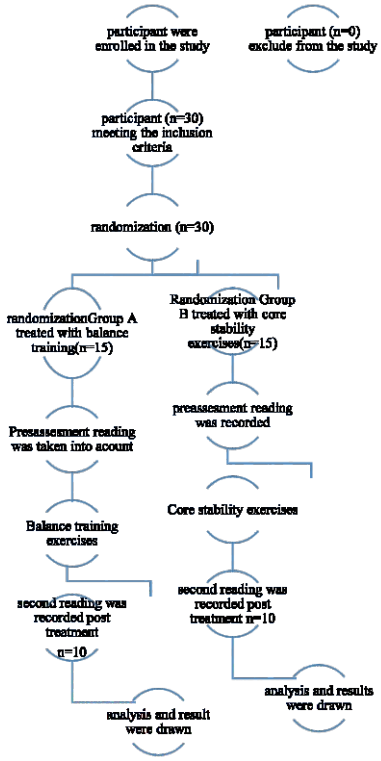

Figure 1: CONSORT diagram

RESULTS

Baseline values of demographic data of both groups were comparable on basis of to mean± SD. Participants mean age in group A was 8.70±3.23 years compared to 7.30±2.49years in group B. The percentages of female participants were 40.00% whereas male participants were 60.00%. Independent t-test was used for analysing the difference between 2 groups and paired t-test was used for evaluating the data pre and post treatment in the group. Table 1 reveals the comparison of Total Paediatric Berg scale between two groups before and after treatment session. In group 1 (Trunk Balance Exercises) mean±SD before treatment was 10.30±5.77 and after treatment it was 12.40±2.79. While in group B (Truncal Core Stability Exercises) mean & standard deviation formerly treatment was 8.50±3.47 and after treatment it was 20.10±12.09. With p<0.04 which shows that Trunk Core Stability Exercises more significant result as compared to Trunk Balance Exercises

Variable	Outcome measurement	Trunk Balance Exercises n (10) Mean ± SD	Trunk Core Stability Exercises n (10) Mean ± SD
Total Test score	Pre	10.30±5.77	8.50±3.47
	Post	12.40±2.79	20.10±12.09
P		< 0.4	< 0.02
P (Coefficient of alpha, P≤0.05), SD (Standard Deviation), Pre (Pre-treatment), Post (Post treatment)			

Table 1: Across the group comparison using Independent Sample Test Total pre and post scoring.

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Study Group		Baseline Mean±SD	PostTreatment Mean±SD	p-value
Balance Training	Sitting to standing	1.00±0.94	2.20±1.03	0.00
	Standing to sitting	1.10±0.99	1.80±1.39	0.025
	Transfer	1.50±0.53	2.60±0.52	0.001
	Standing unsupported	1.30±0.67	2.10±0.99	0.003
	Sitting unsupported	1.40±0.96	2.10±0.99	0.000
	Standing unsupported with eye closed	0.90±0.88	2.10±1.19	0.000
	Standing unsupported with feet together	0.60±0.88	1.70±0.94	0.000
	Standing unsupported with one foot in front	0.90±0.57	1.90±0.56	0.000
	Standing on foot	1.00±0.94	2.20±1.13	0.000
	Turning 360 degrees	0.80±0.91	2.00±1.24	0.000
	Turning to look behind left & right shoulders while standing still	0.90±0.74	2.00±1.15	0.001
	Retrieving object from floor	2.10±1.11	2.80±0.91	0.001
	Placing alternating foot on stool	0.90±0.88	2.10±1.10	0.000
	Reaching forward with outstretched arms while standing	1.10±0.881	1.90±0.871	0.000
	Total test score	0.30±5.774	2.4±2.79	0.217
Core Stability Exercises	Sitting to standing	1.30±0.94868	2.30±0.94	0.000
	Standing to sitting	1.70±0.15950	2.70±1.15	0.008
	Transfer	1.30±0.82327	2.40±1.26	0.000
	Standing unsupported	1.30±0.67495	2.40±0.84	0.000
	Sitting unsupported	1.30±0.94868	2.80±0.78	0.000
	Standing unsupported with eye closed	1.10±0.73786	2.30±0.67	0.000
	Standing unsupported with feet together	1.00±0.81650	2.40±0.84	0.000
	Standing unsupported with one foot in front	1.00±0.81650	1.00±0.81	0.000
	Standing on foot	0.90±0.87560	2.00±0.94	0.000
	Turning 360Turning to look behind left & right shoulders	1.30±0.94868	2.50±0.97	0.000
	while standing still	1.00±0.81650	2.50±1.17	0.000
	Retrieving object from floor	1.20±0.91894	2.40±0.96	0.000
	Placing alternating foot on stool	0.90±0.56765	2.50±0.70	0.000
	Reaching forward with outstretched arms while standing	1.40±.84327	2.30±0.822	0.000
	Total test Score	0.85±3.47211	2.8±10.7	0.003

Table 2: Within the group comparison of pre and post treatment mean values in each group using Paired sample t test.

DISSUSSION

Main purpose of the current study was to associate the result of core stability and balance exercise in postural control amid Down syndromes. Patients aged 5-17 years were randomly allocated including both genders. During the selection analysis for postural influence, statistically separate findings occurred between the two groups, suggesting clear improvement in one group. The aftereffect of current investigation found that there was a critical increment in the examination gatherings anteroposterior, mediolateral and in general dependability lists contrasted with the post treatment bunch as there was a huge impact of centre solidness practices on post strength. These results are similar with Ghaeeni et al. who studied the effect of core stability on the static balanceofyoungsterswithDSassessed by a modified stork stand test, by improvingdeep muscle strength and endurance of the core stabilization region [6]. The aftereffects of current investigation indicated an improvement in postural control in one gathering when looking at pre and post treatment measurements. This improved might be ascribed with the impact of activity treatment on balance pose control and quality activities. That was predictable with the aftereffect of Gupta et al. who examined the impacts of opposition, equalization practices on quality and offset in individual with DS. Improvements in strength and balance were observed just after exercise regime [19]. In this investigation it has been indicated that the fundamental effect of centre strength preparing can be a scribed to the way that the centre strength preparing improves the adequacy of NM framework that causes upgraded stumble pelvic – hip chain portability and incredible speeding up and deceleration suitable strong equalization proximal soundness and great capacity. It impacts in the reinforcing of lower extremity muscles which can regulator the development. This is steady with the finding of kibleret et al who contended that fortifying the profound muscles of trunk would settled and set up the lower limit development The transverse abdominal muscle, the inner and outer abdominal muscles and the rectus abdominal muscles stabilize the spine and promote lower extremity movement. Transverse abdominalandmultifidus muscles support the spine as well.When the transverse abdominal muscles contract, the internal abdominal pressureand the thoracolumbar fascia are increased to stabilize the region[20].In the present study, we observed that core stability trainings enhanced the sequence of trunk musclestrength andactivity and this agree with the discovery of Hodges and Richardson who recognized muscle activity of trunk before lower extremity activity, assisting the

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spine to leading a framework for purposeful movements.They identified that the transverse abdomen is main muscle of becoming active before the definite movement of the limb,this preprogrammed activation of the transverse abdomen was part of the plan used by the central nervous system to control spinal stability[17].The core is essential because the anatomical place in the body where the center of gravityis situated and the movements generate from it, so the reinforcement of the muscles of the core tends to cause the improved performance of the neuromuscular system and the reduction of the center of gravity displacement and swaying. It is believed that the current study will help to resolve this impairment and will promote further research into the important and growing rapidly specialty of pediatric therapy.

CONCLUSION

Core stability exercises were more effective in improving postural control among children with Down syndrome.

REFERENCES

[1] Caracausi M, Ghini V, Locatelli C, Mericio M, Piovesan A, Antonaros F, et al. Plasma and urinary metabolomic profiles of Down syndrome correlate with alteration of mitochondrial metabolism. Scientific reports. 2018 Feb; 8(1):1-16. doi: 10.1038/s41598-018-20834-y.

[2] Crawford D, Dearmun A. Down's syndrome. Nursing children and young people. 2016 Nov; 28(9):17. doi: 10.7748/ncyp.28.9.17.s19.

[3] Maïano C, Hue O, Lepage G, Morin AJ, Tracey D, Moullec GJPt. Do exercise interventions improve balance for children and adolescents with Down syndrome? A systematic review. 2019 May; 99(5):507-18.

[4] Maris M, Verhulst S, Wojciechowski M, Van de Heyning P, Boudewyns A. Prevalence of obstructive sleep apnea in children with Down syndrome. Sleep. 2016 Mar; 39(3):699-704. doi.org/10.5665/sleep.5554

[5] Diaz AJ, Rosety I, Ordonez FJ, Brenes F, Garcia-Gomez N, Castejon-Riber C, et al. Effects of Resistance Training in Muscle Mass and Markers of Muscle Damage in Adults with Down Syndrome. International journal of environmental research and public health. 2021 Aug; 18(17). doi.org/10.1016/j.jbmt.2012.06.003

[6] Miyake Y, Kobayashi R, Kelepecz D, Nakajima M. Core exercises elevate trunk stability to facilitate skilled motor behavior of the upper extremities. Journal of bodywork and movement therapies. 2013 Apr; 17(2):259-65. doi: 10.1016/j.jbmt.2012.06.003.

[7] Azab AR, Mahmoud WS, Basha MA, Hassan SM, Morgan EN, Elsayed AE, et al. Distinct effects of trampoline-based stretch-shortening cycle exercises on muscle strength and postural control in children with Down syndrome: a randomized controlled study. European Review for Medical and Pharmacological Sciences. 2022 Mar; 26(6):1952-62.

[8] Rahmat A, Hasan D. The effect of core stabilization exercises on factors physical fitness to mental retardation. Sports Medicine Journal/Medicina Sportivâ. 2013 March; 9(1).

[9] Shin YA, Hong SM, Lee JS, Jeong HB, Shin YA, Hong SM, et al. The Effect of Resistance and Balance Training on Postural Control and Physical Fitness in Adults with Down Syndrome. Exercise Science. 2021 May; 30(2):175-82. doi.org/10.15857/ksep.2021.30.2.175

[10] Yu S-H, Park S-D. The effects of core stability strength exercise on muscle activity and trunk impairment scale in stroke patients. Journal of exercise rehabilitation. 2013 Jun; 9(3):362-7. doi: 10.12965/jer.130042.

[11] Kibler WB, Press J, Sciascia A. The role of core stability in athletic function. Sports medicine. 2006; 36(3):189-98. doi: 10.2165/00007256-200636030-00001.

[12] Schilling JF, Murphy JC, Bonney JR, Thich JL. Effect of core strength and endurance training on performance in college students: randomized pilot study. Journal of bodywork and movement therapies. 2013 Jul; 17(3):278-90. doi: 10.1016/j.jbmt.2012.08.008.

[13] Horak FB. Clinical measurement of postural control in adults. Physical therapy. 1987 Dec; 67(12):1881-5. doi: 10.1093/ptj/67.12.1881.

[14] Shumway-Cook A, Woollacott MH. Dynamics of postural control in the child with Down syndrome. Physical Therapy. 1985 Sep; 65(9):1315-22. doi: 10.1093/ptj/65.9.1315.

[15] Leetun DT, Ireland ML, Willson JD, Ballantyne BT, Davis IM. Core stability measures as risk factors for lower extremity injury in athletes. Medicine & Science in Sports & Exercise. 2004 Jun; 36(6):926-34. doi: 10.1249/01.mss.0000128145.75199.c3.

[16] Toosizadeh N, Mohler J, Armstrong DG, Talal TK, Najafi B. The influence of diabetic peripheral neuropathy on local postural muscle and central sensory feedback balance control. PloS one. 2015 Aug; 10(8):e0135255. doi: 10.1371/journal.pone.0135255.

[17] Giagazoglou P, Kokaridas D, Sidiropoulou M, Patsiaouras A, Karra C, Neofotistou K. Effects of a trampoline exercise intervention on motor performance and balance ability of children with intellectual disabilities. Research in developmental disabilities. 2013 Sep; 34(9):2701-7. doi: 10.1016/j.ridd.2013.05.034.

[18] Franjoine MR, Darr N, Held SL, Kott K, Young BL. The performance of children developing typically on the pediatric balance scale. Pediatric physical therapy. 2010 Dec; 22(4):350-9. doi: 10.1097/PEP.0b013e3181f9d5eb.

[19] Cabeza-Ruiz R, García-Massó X, Centeno-Prada R, Beas-Jiménez J, Colado J, González L-M. Time and frequency analysis of the static balance in young adults with Down syndrome. Gait & posture. 2011 Jan; 33(1):23-8. doi: 10.1016/j.gaitpost.2010.09.014.

[20] Queiroz BC, Cagliari MF, Amorim CF, Sacco IC. Muscle activation during four Pilates core stability exercises in quadruped position. Archives of physical medicine and rehabilitation. 2010 Jan; 91(1):86-92. doi: 10.1016/j.apmr.2009.09.016.