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BALANCE PERFORMANCE IN CHILDREN WITH BORDERLINE INTELLECTUAL FUNCTIONING AND SPECIFIC LANGUAGE IMPAIRMENT

Aivars Kaupuzs
Rezekne Academy of Technologies, Latvia
Viesturs Larins
Latvian Academy of Sport Education, Latvia

Abstract

The balance is one of the substantial motor skills that ensure development of normal movement patterns. There are limited body of research on motor performance in children with borderline intellectual functioning (BIF) that manifesting as cognitive and behavioural problems and specific language impairment (SLI) that is a developmental disorder involving delayed language. The aim of the research is to find the differences of vestibular system indicators in specific groups. The balance Sway Index (SI) was tested by digital platform BioSway using the m-CTSIB test in four conditions. The research group included participants at 11-13 years age who are enrolled in special schools. The normative data of m-CTSIB test were gained in previous researches. The findings show that boys exhibited greater SI than girls. Children with disorders demonstrated significantly lower balance performance in two test positions in each group. Participants with BIF had significantly higher SI than typically developing peers in two test positions with eyes open. Children with SLI had significantly higher SI accordingly in two test positions on firm surface respectively eyes open and eyes closed. The findings suggest that mechanism of vestibular adaptation in challenging environments differ with disorder diagnosis.

Keywords: *balance, BioSway, borderline intellectual functioning, children, specific language impairment.*

Introduction

The quality of education and accessibility for all persons is a topical issue in modern society. Inclusive education is stated as process, which is provided with the multiple needs in different communities, increasing the opportunities for participation in the learning process and reducing exclusion from education process for each learner (The Guidelines for the Development of Education for 2014-2020, 2014). The identification of target groups and the timely diagnostic of special needs in all education levels are the main principles of the

inclusive education. It is also an important role to providing of support for teachers with the methodological materials.

National Research Program "Innovative solutions in social rehabilitation in Latvian schools in the context of inclusive education" (INOSOCTEREHI) exploring the opportunities to phase in the issues of inclusive education principles in schools. As one of the study phase is to explore the impacts of postural balance aspects on children's socio - emotional state (Rutka, Ušča, Žogla, & Kriņģele, 2016). The balance is one of the most important motor skills of the postural control and ability to move. Regardless of one's age good balance control is significant ability in relation to participating in physical activities, dealing with daily activities, and avoiding injuries. Postural control is a determining factor in motor development in childhood that affects also the socialization processes (Usca, Žogla, & Rutka, 2016).

Limitations in motor development are a common characteristic in persons with intellectual disabilities (ID). It is proven that deficient brain cognitive development affects the motor functions as well (Westendorp, Houwen, Hartman, & Visscher, 2011). Numerous scientific studies have found lower performance on standard fitness tests of strength, balance, endurance, flexibility and motor coordination in persons with ID (Hayakawa & Kobayashi, 2011; Hartman, Houwen, Scherder, & Visscher, 2010). In 2007 Pratt & Greydanus stated that persons with ID have limitations in developmental skills in several domains of functioning including motor, cognitive, auditory, language, psychosocial, moral judgment and specific integrative adaptive activities of daily living (Pratt & Greydanus, 2007).

Children with ID often experience balance problems that are reflected in their reduced motor capacity. Lowered level of physical fitness at later stages of life is a result of impairments in cognitive, social and adaptive behaviour.

Borderline intellectual functioning (BIF) is a contentious neurodevelopmental clinical category that remains to be clearly defined (Cornoldi, Giofre, Orsini, & Pezzuti, 2014) and for which specific diagnostics tools and therapeutic approaches do not exist (Baglio et al., 2016). It is including a wide range of cognitive difficulties, with an intelligence quotient (IQ) between 70 and 85 points (American Psychiatric Association, 2000). Usually children with BIF have a heterogeneous neuropsychological profile including difficulties in executive functions that could affect to learning capabilities, social interactions, and personal independence. It is defined as a boundary status between disease and typical development, not caused from a single neurodevelopmental syndrome (Salvador-Carulla et al., 2013).

There are limited data of research on motor performance and balance in children with borderline intellectual functioning although this is a quite large group of the school-going population comprising up to 7% (Karande, Kanchan, & Kulkarni, 2008). According to the Centre for Disease Prevention and Control of Latvia data there were 3052 children with F90-F98 diagnose (Behavioural and emotional disorders with onset usually occurring in childhood and adolescence -International Classification of Diseases) in 2014 (CDPC, 2014).

Children with BIF usually have poor performance in all school subjects (reading, writing, mathematics) and behavioural problems (hyperactivity, aggression) as well. These problems could lead to socialization restrictions and physical inactivity could be as a consequence. Balance performance is very close related to overall motor skill development that lead to presume that children with BIF could demonstrate lower ability to maintain postural stability.

The child's language development is closely linked to psiho-emotional and social well-being (Usca Lubkina, & Pīgozne, 2012). Formation of the personality is a complex process associated by many factors at the same time. Combining of various negative factors can affect

developing of cognitive and motor performance disorders. Studies have shown that up to 71 percent of cases, children with behavioural problems have language disorders as well (Benner, Nelson, & Epstein, 2002).

There is increasing evidence that children with language disorders have insufficient motor skill development as well. Finlay & McPhillips (2013) mentioned that these children could be difficult to carry out the fine hand movements (cutting with scissors, drawing) and gross motor skills (locomotion and manipulation). Developmental dyslexia is considered as most common disorder of phonological skills. According to research data, dyslexia could affect between 5% and 17% of the population (Shaywitz & Shaywitz, 2003). Balance has been defined as an important prospective indicator of dyslexia risk (Fawcett & Nicolson, 2004).

Another developmental speech and language disorder - Specific Language Impairment (SLI) could be less explored as it occurs in 6.3% of children with the male rate approximately double in comparison of female rate (Pinborough-Zimmerman et al., 2007). Children with SLI delay in expressive/receptive language development, in the absence of mental retardation, neurological disorders, or hearing loss (Müürsepp, Aibast, Gapeyeva, & Pääsuke, 2014). As many researches show motor control deficiency inherent 34 to 90% in children with language disorders (Pieters et al., 2012; Rechetnikov & Maitra, 2009). Studies indicate that language disorders are often combined with cognitive and perceptual problems (Ullman & Pierpont, 2005). Children's socialization and learning problems are the consequences of these disorder problems. Various studies indicate that the language system disorders affect 2 to 8% of children population and it is about 5% in Latvia (Usca et al., 2012).

Postural balance as one of the motor development component is widely studied in children with various disabilities (dyslexia, Attention Deficit Hyperactivity Disorder, autism, Asperger's syndrome etc.). However, there are still unknown factors that could affect balance development at adolescents' age.

Object of the research: characteristics of vestibular system parameters in specific conditions.

Aim of the research: to determine the differences of postural balance maintaining in challenging environments in BIF and SLI groups and compeer it with normative data.

Participants of the research

The 17 participants (12 boys and 5 girls) at the age of 11 to 13 were recruited from special school that provide special education programs for children with language system disorders. The language disorders were not specified as total number of students with similar diagnosis was too small at this age group. The aggregated title was defined as Specific Language Impairment (SLI) group.

The participants with BIF were enrolled from special school that provide special education programs for children with learning and mental health disorders. The research group included 25 adolescents (17 boys and 8 girls) at the same age. The disorders of participants were not specified.

All students are enrolled in schools with decision of State Pedagogical Medical Commission according to according to their diagnoses.

As SLI and BIF could involve a wide range of disorders the selection criteria were set as: age, normal neurological and health status, and diagnosed one of disorder criterion. The study excluded children with Down syndrome, metabolic diseases, as well as musculoskeletal, cardio and respiratory system diseases.

Informed consent for the children's participation was obtained from the parent(s) and all procedures were in accordance with the ethical standards. Stabilometry testing was done in schools medical offices.

The normative data of m-CTSIB test was gained from 305 participants in previous researches of National Research Program "Innovative solutions in social rehabilitation in Latvian schools in the context of inclusive education" (Kaupužs & Lāriņš, 2015).

Methods of the research

Postural balance test was done by portable stabilometry platform BioSway (Biodex Medical Systems, Inc., Shirley, NY, USA). The modified Clinical Test of Sensory Interaction on Balance (m-CTSIB) quantified postural sway velocity of the children standing quietly on the force platform. This test consisted of four different conditions (three consecutive trials lasting of 30 s with 10 s rest). Three of four conditions are challenging for balance maintaining and causing additional stress to proprioception and vestibular systems.

First position - standing with eyes open on a firm surface.

Second position - standing with eyes closed on a firm surface.

Third position - standing with eyes open on a foam surface.

Fourth position - standing with eyes closed on a foam surface.

m-CTSIB is one of the most widely used tests of balance function assessment in research and clinic environment (Murray et al., 2014).

Participants were tested in bipedal stance and instructed to stand upright as steady as possible with the arms by their sides' do not moving the feats on platform. The sway index (SI) reflects postural stability. SI as standard deviation represents fluctuations of the centre of pressure (COP) around the zero point of the platform. A smaller sway index score represents less deviation from zero point and better postural balance maintaining.

Statistical analysis was performed using the SPSS 18.0 statistical software. Descriptive statistics were used to describe arithmetic mean and standard deviation of SI in four test positions. Comparative analysis between children with BIF, SLI and normative data was done by using the Mann–Whitney U tests for not normally distributed data. A level of $p < 0.05$ was considered to indicate statistical significance.

Results and discussion

Table 1 provides descriptive statistics of normative data that are gained during the research that was supported by National Research Program "Innovative solutions in social rehabilitation in Latvian schools in the context of inclusive education".

Table 1. The percentile thresholds of Sway Index (N=305)

		Eyes open on a firm surface	Eyes closed on a firm surface	Eyes open on a foam surface	Eyes closed on a foam surface
Mean (SD)		0.39 (0.11)	0.73 (0.26)	0.70 (0.15)	1.83 (0.33)
Percentiles	25	0.27	0.55	0.56	1.58
	50	0.33	0.74	0.64	1.80
	75	0.43	0.89	0.76	2.08

Table 2 displays comparisons of children with borderline intellectual functioning and special language impairment mean values, SD and significant values of Sway Index.

Table 2. Comparisons of children with borderline intellectual functioning (BIF) and special language impairment (SLI) to normative data limits

	Eyes open on a firm surface	Eyes closed on a firm surface	Eyes open on a foam surface	Eyes closed on a foam surface
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Normative N=305	0.39 (0.11)	0.73 (0.26)	0.70 (0.15)	1.83 (0.33)
BIF N=25	0.44 (0.17) p**=.028	0.74 (0.2) p***=.027	0.93 (0.44) p**=.012	1.99 (0.63)
SLI N=17	0.48 (0.14) p*=.001	1.02 (0.57) p*=.000	0.77 (0.31)	2.06 (0.64)

Significant values are indicated where relevant
p < 0.05 compared to normative data.*
*p** < 0.05 compared to normative data.*
*p*** < 0.05 compared to SLI .*

The intergroup comparison of the Sway Index showed significantly lower results than normative in the test conducted under visual control in BIF group on firm surface (p = 0.044) and on foam surface (p = 0.012). Whereas children with SLI had significantly higher SI accordingly in two test positions on firm surface respectively eyes open (p = 0.001) and eyes closed (p = 0.000). There was recorded significant difference between SLI and BIF only in one test position – eyes closed on firm surface (p = 0.027).

The mean values, SD and significant values of balance test performance (SI) for the measured all groups and comparison between genders are displayed in Table 3.

Table 3. Comparisons of balance test performance (SI) between genders

	Eyes open on a firm surface	Eyes closed on a firm surface	Eyes open on a foam surface	Eyes closed on a foam surface
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Girls N=155	0.35 (0.12)	0.68 (0.29)	0.71 (0.28)	1.82 (0.38)
Boys N=192	0.44 (0.35) p=.000	0.75 (0.22) p=.01	0.79 (0.31) p=.000	1.86 (0.5)

The comparison between genders was done included all results of the research that were gained by BioSay balance platform. Three hundred and forty-seven children of 12 to 14 ages were tested during National Research Program. Data shows that girls at this age have better balance than boys. Lower Sway Index for girls was set in three of four test positions. The significance of differences was high (p = 0.000 to p = 0.01).

Regardless of one's age, a good balance control is an important motor skill in relation to coping with daily activities, participating in physical activities and avoiding injuries. Children's movements are not fully matured and postural sway performances in younger children differ from adults. There are evidences that improvement of postural control strategy continues beyond 10 years of age, probably until young adult age (Wu et al., 2009). Recent studies emphasize the value of a social and physical active lifestyle, particularly when started early in life. Children with developmental disorders often experience complications in understanding and engaging in socializing activities with peers, which may lead to reduced

daily physical activity and fitness levels (Van der Niet et al., 2014). The timely done diagnostic and intervention procedures could diminish these risks.

The motor strategies used to maintain a postural balance are associated with the ability to precisely perceive the environment through visual, vestibular, proprioceptive inputs and analysing it at the level of the central nervous system. The performance of these systems could be analysed applying m-CTSIB test.

The main findings of this study were that children with disorders have worse balance than typically developing peers. There was set that children with BIF have higher fluctuations with visual control. This finding lead to assume that children with behavioural or cognitive problems can better concentrate and maintain stable posture in environment with reduced visual stimuli. Meanwhile children with language system disorders accomplish balance test better on more challenging and unstable environment. This indicates that central nervous system has higher compensation capacity at unusual conditions.

Balance test measures obtained with a force platform are objective and considered as a "gold standard" for assessing standing balance (Huurnik, Fransz, Kingma, & van Dieën 2013). However, it should be taken account that balance testing like many other biological assessments has an intrinsic variability influenced by psychosocial, biomechanical and physical factors. Hence, many factors could affect the accuracy of testing outcomes, such as motivation, concentration, emotional state or other behavioural aspects. In addition, the physiological indicators such as muscular strength, fatigue level or body mass index can influence to balance performance.

It has been shown that cerebellum and basal ganglia play important role in balance control as well as in language system operation. It means that a disturbed function of the left basal ganglia could be viewed as a consequence of speech disorders that correlate with balance problems (Fabbro, Clarici, & Bava, 1996). It can be suggested that the less efficient functional motor performance could be explained by the immaturity of these brain structures although overall physical development level should take in to consideration. There are evidences that muscular weakness is related to worse performance in proprioceptive postural control and could be associated with functional link between contractile and sensory muscular processes (Butler, Lord, Rogers, & Fitzpatrick, 2008). Muscular weakness can be affected by fatigue that cause reduced performance of the postural control system (Pau, Ibba, & Attene, 2014).

Conclusions

The present study's results confirm the conclusion of Müürsepp et al. (2014) stated out that the children with speech disorders have worse static balance performance. Vuijk, Hartman, Scherder, & Visscher (2010) found alike results in research of children with borderline intellectual functioning as well.

Our findings about gender differences are compatible with the study results of Nolan, Grigorenko, & Thorstensson (2005). The authors founded that boys exhibited greater fluctuations in standing balance than girls at 9 to 10 years of age. Accordingly, to the study of Geldhof et al. (2006) girls performed better on all of the 4 sensory conditions of the m-CTSIB test compared to boys aged 9 to 10 years.

Thereby, it might be presumed that a gender difference of balance persists in the later age group. These findings show a need to study the sexes separately when research the balance in children population.

The research data highlights the importance of early diagnosis of balance problems in both children with borderline intellectual functioning and with language system disorders. The present study suggests that children with developmental disorders might benefit from intervention actions that address their motor skills, especially those involving static balance.

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References

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), 4th Edn.* Washington, DC: American Psychiatric Association.

Baglio, G., Blasi, V., Sangiuliano Intra, F., Castelli, I., Massaro, D., Baglio, F., … & Marchetti, A. (2016). Social Competence in Children with Borderline Intellectual Functioning: Delayed Development of Theory of Mind Across All Complexity Levels. *Frontiers in Psychology, 7*, 1604.

Benner, G. J., Nelson, J. R., & Epstein, M. H. (2002). Language skills of children with EBD a literature review. *Journal of Emotional and Behavioral Disorders*, *10* (1), 43-56.

Butler, A. A., Lord, S. R., Rogers, M. W., & Fitzpatrick, R. C. (2008). Muscle weakness impairs the proprioceptive control of human standing. *Brain research*, *1242*, 244-251.

Centre for Disease Prevention and Control (CDPC). (2014). Bērnu un jauniešu uzvedības traucējumi. Retrieved from: http://www.rspsac.lv/specialie_pedagogi/pdf_doc/Berni%20ar%20UT%202016.pdf

Cornoldi, C., Giofre, D., Orsini, A., & Pezzuti, L. (2014). Differences in the intellectual profile of children with intellectual vs. learning disability. *Res. Dev. Disabil., 35,* 2224–2230.

Fabbro, F., Clarici, A., & Bava, A. (1996). Effects of left basal ganglia lesions on language production. *Perceptual and motor skills*, *82* (3_suppl), 1291-1298.

Fawcett, A. J., & Nicolson, R. I. (2004). *Dyslexia Screening Test-Junior (DST-J).* Oxford: Harcourt Assessment, Inc.

Finlay, J. C., & McPhillips, M. (2013). Comorbid motor deficits in a clinical sample of children with specific language impairment. *Research in Developmental Disabilities, 34* (9), 2533–2542.

Geldhof, E., Cardon, G., De Bourdeaudhuij, I., Danneels, L., Coorevits, P., Vanderstraeten, G., & De Clercq, D. (2006). Static and dynamic standing balance: test-retest reliability and reference values in 9 to 10 year old children. *European journal of pediatrics, 165*(11), 779-786.

Hartman, E., Houwen, S., Scherder, E., & Visscher, C. (2010). On the relationship between motor performance and executive functioning in children with intellectual disabilities. *Journal of Intellectual Disability Research*, *54*(5), 468-477.

Hayakawa, K., & Kobayashi, K. (2011). Physical and motor skill training for children with intellectual disabilities. *Perceptual and Motor Skills, 112*(2), 573–580.

Huurnink, A., Fransz, D. P., Kingma, I., & van Dieën, J. H. (2013). Comparison of a laboratory grade force platform with a Nintendo Wii Balance Board on measurement of postural control in single-leg stance balance tasks. *Journal of biomechanics*, *46*(7), 1392-1395.

Izglītības attīstības pamatnostādnes 2014.-2020.gadam [*The Guidelines for the Development of Education for 2014-2020]*. (2014). Latvijas Vēstnesis, 103 (5163).

Karande, S., Kanchan, S., & Kulkarni, M. (2008). Clinical and psychoeducational profile of children with borderline intellectual functioning. *Indian journal of pediatrics*, *75*(8), 795-800.

Kaupužs, A., & Lāriņš, V. (2015). The Comparative Analysis of the Postural Stability Assessment Methods. In *Society. Integration. Education. Proceedings of the International Scientific Conference, 3,* 547-557).

Murray, N., Salvatore, A., Powell, D., & Reed-Jones, R. (2014). Reliability and Validity Evidence of Multiple Balance Assessments in Athletes With a Concussion. *Journal of Athletic Training*, *49* (4), 540–549.

Müürsepp, I., Aibast, H., Gapeyeva, H., & Pääsuke, M. (2014). Sensorimotor function in preschool-aged children with expressive language disorder. *Research in developmental disabilities*, *35* (6), 1237-1243.

Nolan, L., Grigorenko, A., & Thorstensson, A. (2005). Balance control: sex and age differences in 9-to 16-year-olds. *Developmental Medicine & Child Neurology*, *47* (7), 449-454.

Pau, M., Ibba, G., & Attene, G. (2014). Fatigue-induced balance impairment in young soccer players. *Journal of athletic training*, *49* (4), 454-461.

Pieters, S., De Block, K., Scheiris, J., Eyssen, M., Desoete, A., Deboutte, D., et al. (2012). How common are motor problems in children with a developmental disorder: Rule or exception? *Child: Care, Health and Development*, *38* (1), 139–145.

Pinborough-Zimmerman, J., Satterfield, R., Miller, J., Bilder, D., Hossain, S., & McMahon, W. (2007). Communication disorders: Prevalence and comorbid intellectual disability, autism, and emotional/ behavioral disorders. *American Journal of Speech-Language Pathology*, *16* (4), 359–367.

Pratt, H. D. & Greydanus, D. E. (2007) Intellectual disability (mental retardation) in children and adolescents. *Primary Care, 34*, 375–86.

Rechetnikov, R. P., & Maitra, K. (2009). Motor impairments in children associated with impairments of speech or language: A meta-analytic review of research literature. *American Journal of Occupational Therapy, 63,* 255–263.

Rutka, L., Ušča, S., Žogla, I., & Kriņģele, K. (2016). Teenagers' Physical, Mental, Social Balance as a Developmental Problem. In *Society. Integration. Education. Proceedings of the International Scientific Conference*, *2* (pp. 319-329).

Salvador-Carulla, L., Garcia-Gutierrez, J. C., Ruiz Gutierrez-Colosia, M., Artigas-Pallares, J., Garcia Ibanez, J., Gonzalez Perez, J., et al. (2013). Borderline intellectual functioning: consensus and good practice guidelines. *Rev. Psiquiatr. Salud Ment., 6,* 109–120.

Shaywitz, S. E., & Shaywitz, B. A. (2003). Dyslexia (specific reading disability). *Pediatrics in Review*, *24,* 147–152.

Ullman, M. T., & Pierpont, E. I. (2005). Specific language impairment is not specific to language: The procedural deficit hypothesis. *Cortex*, *41*, 399–433.

Usca, S., Lubkina, V., Pīgozne, T. (2012). A Model of Developing Communicative Competence for the Needs of Adolescents with Language Disorders. In *International Conference on Financial, Management and Education Science (ICFMES 2012). Beijing, China, May 19-20*. Science Technology Pres Co. Limited (pp. 44-52).

Usca, S., Žogla, I., & Rutka, L. (2016). Physical Balance of 12-13 Year Old Adolescents in Latvia: Problems and Solutions. *Social Welfare: Interdisciplinary Approach*, *1* (6), 138-147.

Van der Niet, A. G., Hartman, E., Moolenaar, B. J., Smith, J., & Visscher, C. (2014). Relationship between physical activity and physical fitness in school-aged children with developmental language disorders. *Research in developmental disabilities, 35* (12), 3285-3291.

Vuijk, P. J., Hartman, E., Scherder, E., & Visscher, C. (2010). Motor performance of children with mild intellectual disability and borderline intellectual functioning. *Journal of intellectual disability research*, *54* (11), 955-965.

Westendorp, M., Houwen, S., Hartman, E., & Visscher, C. (2011). Are gross motor skills and sports participation related in children with intellectual disabilities? *Research In Developmental Disabilities*, *32*(3), 1147-1153. doi:10.1016/j.ridd.2011.01.009

Wu, J., McKay, S., & Angulo-Barroso, R. (2009). Center of mass control and multi-segment coordination in children during quiet stance. *Experimental brain research*, *196* (3), 329-339.

BALANCE PERFORMANCE IN CHILDREN WITH BORDERLINE INTELLECTUAL FUNCTIONING AND SPECIFIC LANGUAGE IMPAIRMENT

Summary

Aivars Kaupuzs, Rezekne Academy of Technologies, Latvia
Viesturs Larins, Latvian Academy of Sport Education, Latvia

Postural stability is considered to be one of the most important functional capabilities that are critical for the acquisition of the postural control and ability to move. Regardless of one's age, good balance control is significant ability in relation to participating in physical activities, dealing with daily activities, and avoiding injuries. The motor strategies used to maintain a postural balance are associated with the ability to precisely perceive the environment through visual, vestibular, proprioceptive inputs and analysing it at the level of the central nervous system.

Vestibular disorders are most commonly found in the elderly population, but this problem has not been adequately studied in children and adolescents. Many scientific studies have found lower performance on standard fitness tests of strength, endurance, flexibility and motor coordination, in persons with intellectual disabilities and developmental speech and language disorders. There are limited body of research on motor performance in children with borderline intellectual functioning (BIF) that manifesting as cognitive and behavioural problems and specific language impairment (SLI) that is a developmental disorder involving delayed language.

The aim of the research is to find the differences of vestibular system indicators in specific groups. The data are gained during the research that was supported by National Research Program "Innovative solutions in social rehabilitation in Latvian schools in the context of inclusive education". The balance sway index (SI) was tested by digital platform BioSway using the m-CTSIB test in four conditions. The research group included 17 participants with SLI and 25 children with BIF diagnosis at the 11-13 years age range who are enrolled in special schools. The normative data of m-CTSIB test was gained from 305 participants in previous researches of National Program. Data shows that girls at this age have statistically significant better balance than boys. Lower Sway Index for girls was set in three of four test positions. The significance of differences was high ($p = 0.000$ to $p = 0.01$).

It was found statistically significant differences ($p=0.027$) of SI between BIF and SLI groups in one test position (eyes closed on foam surface). Children with disorders demonstrated significantly lower balance performance in two test positions in each group. Participants with BIF had significantly higher SI than typical children in two test positions with eyes open. Respectively on firm surface ($p=0.028$) and on foam surface ($p=0.012$). Children with SLI had significantly higher SI accordingly in two test positions on firm surface respectively eyes open ($p=0.001$) and eyes closed ($p=0.000$). The findings suggest that mechanism of vestibular adaptation in challenging environments differ with disorder diagnosis. That indicates the need for further researches in these specific groups.

In conclusion, the present study's results confirm the findings of others researches that the children with speech disorders and borderline intellectual functioning have worse static balance performance (Müürsepp et al., 2014; Vuijk et al., 2010).

The present study findings about gender differences are compatible with the study results of Nolan et al. (2005). The authors founded that boys exhibited greater fluctuations in standing balance than girls at 9 to 10 years of age. Accordingly to the study of Geldhof et al. (2006) girls performed better on all of the 4 sensory conditions of the m-CTSIB test compared to boys aged 9 to 10 years.

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Corresponding author email: aivars.kaupuzs@rta.lv