ISOMETRIC BALANCE OF FORCES OF SEPARATE MUSCLE GROUPS OF PERSONS WITH VISUAL IMPAIRMENTS DEPENDING ON PHYSICAL ACTIVITY

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Abstract

The aim of the research is to define and assess the isometric balance of forces of separate muscle groups of persons with visual impairments and its dependence on physical activity.

In the research 38 respondents participated voluntarily: the respondents having moderate degree of acquired visual impairment (severe eye weakness) (n = 15) and the respondents without visual impairments (n = 23). The age of the respondents was 18 - 69 years. The research was performed in 2010-2011. The methods of the research: testing with the diagnostic equipment "Back – Check", by which the isometric balance of forces of separate muscle groups (flexors/extensors, lateral (left/right)) has been evaluated and survey using International Physical Activity Questionnaire, by which the level of the respondents' physical activity has been measured. The results of testing have been processed, assessed and compared with referential data with Dr. Wolff "Back – Check" software. The results have been analyzed according to individual parameters of every respondent: age, gender, weight, height.

Having performed the research it has become clear that the differences in evaluations of the isometric balance between different research groups and separate muscle groups and of the isometric balance of forces and different levels of physical activity of persons with visual impairments are not statistically significant.

Key words: *visual impairment, isometric force, balance of forces, physical activity.*

Introduction

Health is physical, mental, emotional, social and spiritual human welfare (Skurvydas, 2010). Regular physical activity positively influences all these areas (Lieberman, McHugh, 2001). Physical activity is considered as one of the conditions of individual's physical, social and emotional welfare. It is the basis for optimal human growth and development (Krikščiūnas, 2008). During the recent 20-30 years in the world natural physical activity of people necessary for health improvement and maintaining normal physical state especially has started to decrease. In Lithuania over per 50 per cent of men and about 80 - 90 per cent of women move insufficiently (Skurvydas, 2010). The level of physical state of persons with visual impairments (both blind and visually impaired) because of insufficient physical activity is lower that of persons without visual impairments. Such a conclusion was presented in the review of scientific researches performed by Skaggs and Hopper (1996). However, the aforementioned investigation of physical features of persons with visual impairments is limited. In this review the analysis of only 11 scientific researches performed from 1950 to 1993, in which physical features are analyzed is presented. Although in the researches the unanimous conclusion has been reached that persons having visual impairments demonstrate significantly poorer indicators of physical features, not in all researches distinct characteristics of eyesight have been presented, the results of the research are non-representative, therefore, the comparison of the results is problematic. In the opinion of Lieberman and co-authors (1999, 2001), persons with visual impairments do not have the same possibilities to participate in everyday physical activity and do not get the same psychological, social or physical benefit as persons without visual impairments. It is also proved by the data of the research on the way of life of adult people in Lithuania that show that physical activity of the inhabitants of Lithuania is encouraged passively both in social environment and in health care institutions. Only a very small part of the respondents stated that doctor (6,9%), health care specialist (1,6%), family members (24,1%) or other persons (10,2%) advised to increase physical activity (Skurvydas, 2010). Therefore, the shortcomings of management of all motor skills should be accentuated not as genetic limitation, but as a reaction towards parents' excessive care or the avoidance of physical training specialists to work with persons who need complementary assistance to orient in the environment. Persons with visual impairments have the same potential to develop motor skills and physical features as people without visual impairments do, only the lack of opportunities, faith and trainings, education leads to lagging psychomotor development and decreasing physical state. In addition, many scientists admitted that the level of physical state of physically active persons with visual impairments does not differ from persons without visual impairments (Lieberman, McHugh, 2001). Therefore, the statement that visual impairment is a factor determining the indicators of persons' physical features is unsubstantiated.

Houwen, Visscher, Lemmink and Hareman (2009) have also performed the review of 39 scientific researches analyzing the management of motor skills of children and youth with visual impairments. According to the authors, at the moment because of methodological insubstantiality of the researches evaluating identical physical features, controversial results and other important reasons, it is not possible to present final conclusions proving direct impact of one or other variables (level of eyesight, duration of visual impairment, eye disease, etc.) on physical activity of persons with visual impairments, the formation of motor skills or indicators of physical features.

The most important question is left unanswered: "Does the relation of cause-consequence exist between visual impairment, physical activity and the peculiarities of physical and functional state?"

Most often the impact of visual impairment on person's ability to keep unchanging standing body position, dynamic balance and the factors conditioning these abilities are analyzed (Giagazoglou et al., 2009; Hakkinen, Holopainen, Kautiainen, Sillanpaa, 2007; Houwen et al., 2009a, 2010; Juodžbalienė, Muckus, 2006; Lee, Scudds, 2003; Paunksnis, Kušleika, Kušleikaitė, 2005). In order to ensure the stability of balance complementary forces should come into action (Dutton, 2004). A person maintains the body in the vertical position when forces of muscles stabilizing neck-waist-hips are in action (Dudonienė, 2010). Muscle force (ability to shrink) is shown by the level of maximal efforts a muscle can achieve under the conditions of isometric contraction (Thomson, Floyd, 2004). When the capacities of forces situated in both sides of the axis of the lever makes up unequal moments of force, symmetric parts of body are situated asymmetrically, muscles are constantly shortened or extended with regard to one another, the balance of muscle force is disordered (Dutton, 2004; Page, Frank, Lardner, 2010). The disorder of the balance of the force of these muscle groups (left/right, agonist/antagonist) may be a decisive factor hindering from keeping a vertical body position that is one of the main conditions of effective management of movements (Kendall, McCreary, Provanse, Rodgers, Romani, 2005; Skurvydas, 2010; 2011). There are no researches on how visual impairments influence the balance of isometric force of separate muscle groups in adults although it is muscle force that is the factor that gives a human a possibility to maintain vertical body position, to move, also the main reason of the most frequent complaints of physically inactive people such as various pains in the neck, back, waist is weak muscles and a disorder of the balance of the forces of muscle groups. Therefore, the question arises *how a visual impairment, a factor that restricts person's physical activity, conditions isometric balance of forces of separate muscle groups? Do the indicators of isometric balance of forces of separate muscle groups of persons with visual impairments depend on their physical activity?*

Object of the research – the isometric balance of forces of separate muscle groups of persons with visual impairments and its dependence on physical activity.

Aim of the research – to measure and assess the isometric balance of forces of separate muscle groups of persons with visual impairments and its dependence on physical activity.

Methodology and organization of the research

In order to evaluate the respondents' isometric balance of the forces between agonist/antagonist, symmetric muscle groups (left/right) the method of testing has been chosen.

By testing the following is evaluated: 1) isometric force of trunk flexors, extensors and lateral trunk muscles; 2) isometric force of cervical flexors, cervical extensors and cervical lateral muscles; 3) isometric force of hip extensors, leg abductors and leg adductors.

The results have been analyzed with regard to every respondent's individual parameters: age, gender, height, weight, i.e., isometric force of muscles is evaluated according to individual body mass index.

Isometric force of muscles is evaluated following the same scheme for all the respondents: 1) one probation movement is performed; 2) test: the best result is left from the series of three movements. Every movement is maintained for 4-5 s. The rest of muscles between the movements – 60 seconds.

Diagnostic equipment "Back – Check 607/608" has been chosen as an instrument for data collection. It is an electronic instrument for the evaluation of muscle force measuring and evaluating isometric force (weight in kilograms) of muscles of back, upper and lower limbs using two evaluation sensors under stable and constant resistance in a closed kinetic chain.

Diagnostic equipment to evaluate isometric force of muscles on a computer indicating separate muscle groups with different colours has shown: 1) which muscles are the strongest, which are to be trained (weak muscles are indicated in red, average in yellow and strong in green); 2) indicating recommended isometric force of muscles according to individual body mass index it has revealed effective interaction of separate muscle groups; 3) it has revealed relative balance of isometric force of separate muscle groups that is indicated by five parameters: 1 – very bad, 2 – bad, 3 – satisfactory, 4 – good and 5 – ideal. The results of testings have been processed, assessed and compared with referential data referring to automatic calculation of Dr. Wolff "Back – Check" software.

In the research 38 respondents voluntarily participated. The first group (Group I) has been formed by target sampling. These are students of Šiauliai State College of the programme of vocational training "Masseur" meant for persons with visual disability who have acquired moderate (severe eye weakness) degree of visual impairment (the respondents' sharpness of sight with the better seeing eye with the best correction was from 0,05 to 0,09 or field of view in angular degrees from 10 to 20°) and the members of the Association of the Blind and Visually Impaired of Šiauliai (n = 15). The second group (Group II) has been formed by random sampling. These are the respondents without visual impairments (n = 23). The age of the respondents was from 18 to 69 years (35,8 ±14,5). In the groups the respondents have distributed in the following way: the age of the respondents in Group I – from 20 to 69 years (37,2 ± 18,5). The age of the respondents in Group II –from 18 to 56 years (35 ± 11,5). In this research 17 men (44,5%) and 21 women (55,3%) have been evaluated. Group I consisted of six women (40%) and nine men (60%), while Group II – of 15 women (65,2%) and eight men (34,8%). The aim to form the sample of the respondents of as different as possible age and to achieve maximal representability from the aspect of the variable of gender and equal distribution of the dispersion of different age and gender in the research groups although in a random way but has been achieved.

The level of the respondents' physical activity has been evaluated according to International Physical Activity Questionnaire. With the regard to the respondents' answers three levels of physical activity have been distinguished: low, average and high. The proportion of the levels of physical activity of both groups is quite close (see Table 1).

Table 1. Proportion of the levels of physical activity between different research groups, n (%)

Level of eyesight	***Respondents' physical activity***			**TOTAL:**
	Low	**Average**	**High**	
Respondents of Group I	9 (60)	5 (33,3)	1 (6, 7)	23
Respondents of Group II	13 (56,5)	9 (39,1)	1 (4,3)	15
TOTAL:	22 (57,9)	14 (36,8)	2 (5,3)	38 (100)

Results of the research

In order to evaluate whether visual impairment influences the isometric balance of forces of separate muscle groups in adults isometric testing of separate muscle groups of persons with and without visual impairments has been performed and the balance of forces of muscle groups has been calculated (see Table 2).

Table 2. Evaluation of isometric balance of forces of separate muscle groups in Groups I and II

Muscle groups	**Very bad**		**Bad**		**Satisfactory**		**Good**		**Ideal**		**Did not perform**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**%**	**N**	**%**	**N**
1. *Group I*	16	69,6	3	13	1	4,3	1	4,3	2	8,7	-	-
1. *Group II*	10	66,7	1	6,7	2	13,3	-	-	2	13,3	-	-
2. *Group I*	8	34,8	5	21,7	7	30,4	2	8,7	1	4,3	-	-
2. *Group II*	5	33,3	4	26,7	4	26,7	1	6,7	1	6,7	-	-

Continued Table 2

3. *Group I*	12	52,2	5	21,7	3	13	1	4,3	2	8,7	-	-
3. *Group II*	8	53,3	2	13,3	1	6,7	1	6,7	3	20,0	-	-
4. *Group I*	9	39,1	7	30,4	4	17,4	1	4,3	2	8,7	-	-
4. *Group II*	4	26,7	2	13,3	5	33,3	2	13,3	2	13,3	-	-
5. *Group I*	8	34,8	3	13	7	30,4	1	4,3	3	13	1	4,3
5. *Group II*	4	26,7	4	26,7	3	20,0	-	-	3	20,0	1	6,7
6. *Group I*	10	43,5	5	21,7	5	21,7	-	-	3	13	-	-
6. *Group II*	8	53,3	2	13,3	1	6,7	-	-	3	20,0	1	6,7
7. *Group I*	9	39,1	3	13	3	13	4	17,4	4	17,4	-	-
7. *Group II*	5	33,3	2	13,3	3	20,0	1	6,7	4	26,7	-	-

1. Balance of isometric forces of trunk muscles (extensors and flexors); 2. Balance of isometric forces of lateral trunk muscles (left and right); 3. Balance of isometric forces of cervical muscles (extensors and flexors); 4. Balance of isometric forces of cervical lateral muscles (left and right); 5. Balance of isometric forces of leg abductors; 6. Balance of isometric forces of leg adductors; 7. Balance of isometric forces of hip extensors (left and right).

The results of the research have shown that the isometric balance of forces of separate muscle groups in both groups is *very bad* and *bad*. The isometric balance of forces of separate muscle groups of just an insignificant part of the respondents has been evaluated as *ideal* and *good*.

The differences in the evaluations of the isometric balance of forces of separate muscle groups in the respondents of Group I and Group II are not statistically significant. The dispersion between different parameters is even.

In order to evaluate whether the disorder of the isometric balance of muscle forces is the result of the impact on the weakness of the isometric balance of muscle forces the following data have been analyzed: 1) the mean of the isometric force of separate muscle groups and the significance of the difference between evaluations between groups is calculated; 2) the relation between the respondents' present and recommended isometric force of muscles is evaluated.

The *differences in evaluations of the isometric force of separate muscle groups between the respondents of Group I and Group II* are not statistically significant (see Table 3). The relation between the level of eyesight and isometric force has not been identified.

Table 3. Evaluation of isometric force of separate muscle groups (arithmetical mean ± standard deviation)

Muscle groups	I research group	II research group	p`*
Trunk extensors isometric force (kg)	30,2 ± 15,5	32,6 ± 20,7	p = 0,246
Trunk flexors isometric force (kg)	35,5 ± 19,7	26,6 ± 17,2	p = 0,414
Lateral (left) trunk muscle isometric force (kg)	24,9 ± 13,3	24,8 ± 14,8	p = 0,481
Lateral (right) trunk muscle isometric force (kg)	30 ± 19,2	25,6 ± 13,5	p = 0,428
Cervical extensors isometric force (kg)	16,1 ± 6,1	13,9 ± 8,2	p = 0,589
Cervical flexors isometric force (kg)	9,8 ± 5,4	10,1 ± 7	p = 0, 523
Cervical lateral (left) muscle isometric force (kg)	12,3 ± 5,8	11,6 ± 4,5	p = 0,297
Cervical lateral (right) muscle isometric force (kg)	12,7 ± 6,4	11,6 ± 4,8	p = 0,294
Leg abductors (left) isometric force (kg)	19,8 ± 9,8	21,7 ± 9,5	p = 0,774

Continued Table 3

Leg abductors (right) isometric force (kg)	18,9 ± 8,3	22 ± 9,2	p = 0,691
Leg adductors (left) isometric force (kg)	17,1 ± 10,1	17,8 ± 11	p = 0,565
Leg adductors (right) isometric force (kg)	20,3 ± 10,8	22,5 ± 11,5	p = 0,285
Hip extensors (left) isometric force (kg)	22,8 ± 16,7	24,9 ± 12,6	p = 0,632
Hip extensors (right) isometric force (kg)	24,7 ± 13,9	25,8 ± 10,9	p = 0,573

*the meaning of p calculates the significance of the difference in the results of the evaluations of Group I and II according to x^2 criterion ($p < 0,05$).

Having evaluated the relation between present and recommended isometric force of separate muscle groups (see Table 4), poorer results of the evaluation of isometric force of trunk muscles (extensors) in Group I have been encountered. Although the differences of evaluations are not statistically significant, the relation between the variables is weak.

Other differences between the evaluations of present and recommended isometric force of separate muscle groups are not statistically significant. The relation between the evaluated variables is strong and very strong, statistically significant. Therefore, it is not possible to state that the cause of the disorders of the balance of isometric force of separate muscle groups is insufficient isometric force of muscles.

Table 4. Correlation of isometric force of separate muscle groups between present and recommended evaluations (r, p)

Muscle groups	I research group	II research group
Trunk extensors isometric force (kg)	r = 0,324, p = 0,238	r = 0,551**, p = 0,006
Trunk flexors isometric force (kg)	r = 0,515*, p = 0,049	r = 0,674**, p = 0,001
Lateral (left) trunk muscle isometric force (kg)	r = 0,958**, p = 0,000	r = 0,961**, p = 0,000
Lateral (right) trunk muscle isometric force (kg)	r = 0,999**, p = 0,000	r = 0,954**, p = 0,000
Cervical extensors isometric force (kg)	r = 0,952**, p = 0,000	r = 0,911**, p = 0,000
Cervical flexors isometric force (kg)	r = 0,899**, p = 0,000	r = 0,957**, p = 0,000
Cervical lateral (left) muscle isometric force (kg)	r = 0,957**, p = 0,000	r = 0,955**, p = 0,000
Cervical lateral (right) muscle isometric force (kg)	r = 0,990**, p = 0,000	r = 0,961**, p = 0,000
Leg abductors (left) isometric force (kg)	r = 0,949**, p = 0,000	r = 0,927**, p = 0,000
Leg abductors (right) isometric force (kg)	r = 0,952**, p = 0,000	r = 0,982**, p = 0,000
Leg adductors (left) isometric force (kg)	r = 0,887**, p = 0,000	r = 0,665**, p = 0,001
Leg adductors (right) isometric force (kg)	r = 0,990**, p = 0,000	r = 0,991**, p = 0,000
Hip extensors (left) isometric force (kg)	r = 0,917**, p = 0,000	r = 0,956**, p = 0,000
Hip extensors (right) isometric force (kg)	r = 0,982**, p = 0,000	r = 0,940**, p = 0,000

(r – the meaning of Pearson's correlation coefficient indicating the strength of the relation between variables, *- $p < 0,05$, **- $p < 0,01$; p - Sig. (2-tailed) – statistic significance)

Not having verified the dependability of the relation between the isometric balance of forces of separate muscle groups and the weakness of isometric force it has been aimed to evaluate the dependability of the relation between the isometric balance of forces of separate muscle groups of persons with visual impairments and physical activity (see Table 5).

The differences between the levels of physical activity of the respondents with visual impairments and the isometric balance of forces of separate muscle groups are not statistically significant.

Table 5. Evaluation of the correlation between the balance of isometric force of separate muscle groups and different levels of physical activity among the respondents with visual impairments (r, p)

		Isometric balance of forces of trunk muscles (flexors and extensors)					**Total:**	**r, p**
		Very bad	**Bad**	**Satis-factory**	**Good**	**Ideal**		
Respondents' level of physical activity:	**Low**	5	-	1	1	2	9	**r = 0,076, p = 0,788**
	Average	3	2	-	-	-	5	
	High	-	-	-	-	1	1	
	Total:	8	2	1	1	3	15	
		Isometric balance of forces of lateral trunk muscles (left and right)					**Total:**	**r, p**
		Very bad	**Bad**	**Satis-factory**	**Good**	**Ideal**		
Respondents' level of physical activity:	**Low**	2	3	3	-	1	9	**r = 0,012, p = 0,966**
	Average	3	1	1	-	-	5	
	High	-	-	-	1	-	1	
	Total:	5	4	4	1	1	15	
		Isometric balance of forces of cervical muscles (flexors and extensors)					**Total:**	**r, p**
		Very bad	**Bad**	**Satis-factory**	**Good**	**Ideal**		
Respondents' level of physical activity:	**Low**	5	-	1	1	2	9	**r = 0,076, p = 0,788**
	Average	3	2	-	-	-	5	
	High	-	-	-	-	1	1	
	Total:	8	2	1	1	3	15	
		Isometric balance of forces of cervical lateral muscles (left and right)					**Total:**	**r, p**
		Very bad	**Bad**	**Satis-factory**	**Good**	**Ideal**		
Respondents' level of physical activity:	**Low**	2	1	3	2	1	9	**r = 0,070, p = 0,805**
	Average	2	1	2	-	-	5	
	High	-	-	-	-	1	1	
	Total:	4	2	5	2	2	15	
		Isometric balance of forces of led abductors					**Total:**	**r, p**
		Very bad	**Bad**	**Satis-factory**	**Ideal**	**Did not perform**		
Respondents' level of physical activity:	**Low**	2	4	1	1	1	9	**r = 0,154, p = 0,584**
	Average	1	-	2	2	-	5	
	High	1	-	-	-	-	1	
	Total:	4	4	3	3	1	15	

Continued Table 5

		Isometric balance of forces of leg adductors					Total:	r, p
		Very bad	Bad	Satis-factory	Ideal	Did not perform		
Respondents' level of physical activity:	Low	6	2	-	1	-	9	r = 0,132, p = 0,639
	Average	1	-	1	2	1	5	
	High	1	-	-	-	-	1	
	Total:		2	1	3	1	15	
		Isometric balance of forces of hip extensors (left and right)					**Total:**	**r, p**
		Very bad	**Bad**	**Satis-factory**	**Good**	**Ideal**		
Respondents' level of physical activity:	Low	5	1	1	1	1	9	r = 0,364, p = 0,182
	Average	-	-	2	-	3	5	
	High	-	1	-	-	-	1	
	Total:	5	2	3	1	4	15	

(r – the meaning of Pearson's correlation coefficient indicating the strength of the relation between variables, *– p < 0,05, **– p < 0,01; p – Sig. (2-tailed) – statistic significance)

Discussion on the results of the research

In the majority of sources it is stated that the disorders of visual senses have negative influence on people's psychomotor development (Adomaitienė, 2003; Gudonis, 1998; Skaggs, Hopper, 1996; Skirius, 2007), restrict physical motor activity, cause the changes of balance and position of body segments, response to the stimuli of the environment (Juodžbalienė, Muckus, 2006), interfere with the development of muscle and coordination mechanisms necessary for the perfect development of complex movements, the shortcomings of physical development become distinct. However, not following the social factors conditioning wellness, because of immobile life style muscles may become languid, skeleton may become deformed (Gudonis, 1998; Gudonis, Ivaškienė, Zachovajevas, 2007), the following biosocial functions as the possibility to orient, move in the environment, receive or transfer information, work (Kriščiūnas, 2008) may become disturbed also in people without visual impairments. Skaggs and Hopper (1996), Lieberman and Wilson (1999), Houwen, Visscher, Lemmink and Hareman (2009; 2009a) and other scientists have been trying to solve the same dilemma.

Because the researches that evaluate how visual impairment influences the isometric balance of forces of separate muscle groups in adults, it has been aimed to evaluate the impact of visual impairments as the factors that restrict human physical activity on the isometric balance of forces of separate muscle groups and the dependability of the latter variable on physical activity.

The choice of the variables of the research (the isometric balance of forces of separate muscle groups and the level of physical activity) is based on the data that the main cause of the most frequent complaints of physically inactive people such as various pains in neck, back, waist are weak muscles and the disorder of the balance of the forces of muscle groups (Dudonienė, 2010), because when symmetrical forces situate asymmetrically fatigue and structural deformations appear (Muckus, 2006). Meanwhile, successful functioning of skeleton muscles that perform dynamic and static work allows maintaining normal length-tension dependence between agonists and antagonists, which ensures normal maintaining of the balance of symmetric (left /right, front /back) forces in neck-trunk-waist-hip complex (Dudonienė, 2010).

The performed data of the research have proved the opinion of Lieberman and Wilson (1999), that persons with visual impairments have the same potential to develop motor skills and physical features as persons without visual impairments because the differences of the evaluations of the research between different levels of eyesight were not statistically significant. The relation between visual impairments and the isometric force of separate muscle groups, the balance of forces has not been verified. These results of the research correspond to the data of the research performed by Giagazoglou and co-authors (2009), although during the research only lower limbs were investigated. During this research isometric balance of forces of lower limbs of women with and without visual impairments was evaluated. The differences of evaluations were statistically insignificant.

Although by the performed research it has been proved that there is no relation between visual impairment and isometric balance of muscle forces, nevertheless, very bad isometric balance of separate muscle groups has been diagnosed to the majority of the respondents. Fatigue of motor system, harmonious body composition, i.e. the balance of muscle forces influencing the appearance of fatigue, pain, structural deformations etc. may be disturbed because of many reasons (Dutton, 2004; Muckus, 2006; Page et al., 2010; Skurvydas, 2010). Although it is stated that the main cause of the most frequent complaints of physically inactive people such as various pains in the neck, back, waist are weak muscles and the disorder of the balance of the forces of muscle groups, the European guidelines declare that there is not enough data about the influence of muscle force on the pains in the lower back (Sinkevičius, Varnienė, Telšinskienė, 2009).

This statement encouraged to evaluate the impact of the disorder of the isometric balance of muscle forces on the weakness of isometric muscle force and the impact of visual impairment on isometric force of separate muscle groups.

Although during the research it has been evaluated that the relation between present and recommended isometric force of separate muscle groups is strong and statistically significant ($p < 0,01$; $p < 0,05$), the results of the assessment of the isometric force of trunk extensors of persons with visual impairments were slightly different. Weak relation has been encountered among these muscle evaluations. These evaluation results correspond to the data of the research performed already in 1985 by Mayer and Smith that verified the relation between the weakness of the isometric force of muscles and chronic backache. The isometric force of trunk muscles (especially extensors) among persons complaining with chronic backaches was much weaker than among persons not feeling backaches. These results have shown that the weakness of muscle force is an important factor conditioning the appearance of backaches. The question "Is the disorder of the balance of muscle force the result of the impact on the weakness of the isometric muscle force?" is open for other investigations because referring to the only case it is not possible to state that the reason of the disorders of the balance of isometric force of separate muscle groups of the respondents is insufficient isometric muscle force.

Referring to the data of the performed research it is possible to disprove the relation between visual impairment and isometric muscle force. Differences in evaluations between different levels of eyesight were statistically insignificant, therefore, visual impairment does not condition isometric force. This conclusion corresponds to the data of the research performed by Hakkinen et al. (2007). During this research evaluating the maximal isometric muscle force in blind and sighted boys (age groups – 9-13 years and 15-18 years) statistically significant difference between the respondents were not encountered. The same results during this research were also received performing other static tests of physical capacity.

There are quite many researches that state that physical activity is a factor that may strongly influence the indicators of the research and that having evaluated students' physical activity the dependability between the latter variable and visual impairment has been encountered. However, according to Houwen and co-authors (2009), the relation between physical activity of persons with visual impairments and the indicators of motor skills has not been sufficiently proved. During the performed research the differences between isometric balance of the forces of separate muscle groups and different levels of physical activity have not been statistically significant. Dependability between these variables has not been encountered.

Consequently, referring to the results of the research it is possible to state that visual impairment or different level of physical activity of people with visual impairments does not have direct impact on the balance of isometric force of separate muscle groups. Therefore, the shortcomings of the management of all motor skills should be accentuated as the impact of parents' overcare, avoidance of physical training specialists to work with persons, social environment, not ergonomic positions, psychological factors and other reasons.

Conclusions

1. Having evaluated the balance of isometric forces of separate muscle groups in the respondents of Group I and II with diagnostic equipment "Back – Check" it has been found out that in average 44,1% of the respondents, out of all performed evaluations, have very bad balance of isometric forces of muscles. The biggest disorders (n = 68,4% – very bad balance) has been noticed evaluating the balance of isometric forces of trunk extensors and flexors. Differences in evaluations between different research groups and the balance of isometric forces of separate muscle groups are not statistically significant.
2. Differences in evaluations of isometric force of separate muscle groups between the respondents of Group I and II are not statistically significant. There is no relation between these variables.
3. Having evaluated the relation between present and recommended isometric force of separate muscle groups poorer results of the evaluation of isometric force of trunk extensors in the respondents of Group I have been obtained. Although the differences in evaluations are not statistically significant the relation between the variables is weak. Differences in evaluations of present and recommended isometric force of other muscle groups are not statistically significant. The relation between evaluated variables is strong and very strong, statistically significant ($p < 0,01$; $p < 0,05$). Therefore, it is not possible to state that the cause of the disorders of the balance of isometric forces of separate muscle groups in the respondents is insufficient isometric muscle force.
4. Differences in evaluations of the balance of isometric forces of separate muscle groups and different levels of physical activity in persons with visual impairments are not statistically significant. There is no relation between these variables.

References

1. Adomaitienė, R. (Red.) (2003). *Taikomoji neįgaliųjų fizinė veikla*. Kaunas: Lietuvos kūno kultūros akademija.
2. Dudonienė, V. (2010). *Šiuolaikinės juosmens stabilizavimo koncepcijos*. Pranešimas, skaitytas Lietuvos kineziterapeutų draugijos suvažiavime 2010 m. rugsėjo 6 d. Kaunas.
3. Dutton, M. (2004). *Orthopaedic Examination, Evaluation, and Intervention*. United States of America: the McGraw - Hill Companies.
4. Giagazoglou, P., Amiridis, I. G., Zafeiridis, A., Thimara, M., Kouvelioti, V., Kellis, E. (2009). Static

balance control and lower limb force in blind and sighted women [accessed 2010-12-10]. Internet access: <www. springerlink.com /content/r148375433742548/>.

5. Gudonis, V., Ivaškienė, V., Zachovajevas, P. (2007). *Sutrikusios regos vaikų mokomoji strategija ir fizinis ugdymas:* mokomoji knyga. Kaunas: Lietuvos kūno kultūros akademija.
6. Gudonis, V. (1998). *Tiflologijos pagrindai*. Šiauliai: Šiaulių universiteto leidykla.
7. Hakkinen, A., Holopainen, E., Kautiainen, H., Sillanpaa, E., Häkkinen, K. (2007). *Neuromuscular function and balance of prepubertal and pubertal blind and sighted boys* [accessed 2011-03-01]. Internet access: <http://onlinelibrary. wiley. com /doi/10.1080/08035250600573144/full>
8. Houwen, S., Visscher, Ch., Lemmink, K., Hareman, E. (2009). *Motor Skill Performance of Children and Adolescents with Visual Impairments: A Review* [accessed 2011-03-11]. Internet access: <http://eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=EJ844207&ERICExtSearch_SearchType_0=no&accno=EJ844207>.
9. Houwen, S., Hareman, E., Visscher, Ch. (2009a). *Physical Activity and Motor Skills in Children with and without Visual Impairments* [accessed 2011-03-11]. Internet access: <http://journals.lww.com/acsm-msse/Abstract/2009/01000/Physical_Activity_and_Motor _Skills_in_Children.11.aspx>.
10. Houwen, S., Hartman, E., Visscher, Ch. (2010). *The Relationship Among Motor Proficiency, Physical Fitness, and Body Composition in Children With and Without Visual Impairments* [accessed 2011-03-14]. Internet access: <http://www. ingentaconnect.com/content /aahperd/rqes /2010 / 00000081 /00000003 /art 00006>.
11. Juodžbalienė, V., Muckus, K. (2006). The influence of the degree of visual impairment on psychomotor reaction and equilibrium maintenance of adolescents. *Medicina (Kaunas)*, 42(1), 49-56.
12. Kendall, F. P., McCreary, E. K., Provanse, P. G., Rodgers, M. M., Romani, W. A. (2005). *Muscles: testing and function with posture and pain: fifth edition. Lippincott Williams & Wilkins.*
13. Kriščiūnas, A. (2008). *Reabilitacijos pagrindai*. Kaunas: Lietuvos kūno kultūros akademija.
14. Lee, H., Scudds, R. J. (2003) *Comparison of balance in older people with and without visual impairment* [accessed 2011-02-10]. Internet access: <http://ageing.oxfordjournals.org/content/32/6/643.short>.
15. Lieberman, L. J., Houston - Wilson, C. (1999). *Overcoming the Barriers to Including Students With Visual Impairments and Deaf-Blindness in Physical Education* [accessed 2011-02-23]. Internet access:< http://www.aph.org/pe/art_l_hw.html>.
16. Lieberman, L. J., McHugh, E. (2001). *Health - Related Fitness of Children Who Are Visually Impaired* [accessed 2011-02-24]. Internet access: <http://www.afb.org/jvib/jvibabstractNew.asp?articleid=jvib950503>.
17. Mayer, T. G., Smith, S. S., Keeley, J., Mooney, V. (1985). *Quantification of Lumbar Function: Part 2: Sagittal Plane Trunk Force in Chronic Low-Back Pain Patients* [accessed 2011-02-12]. Internet access: <http://journals.lww.com/ spinejournal/abstract/1985/10000/ quantification_of_ lumbar_function_part_2_.12.aspx>.
18. Muckus, K. (2006). *Biomechanikos pagrindai.* Kaunas: Lietuvos kūno kultūros akademija.
19. Page, P., Frank, C., Lardner, R. (2010). *Assessment and Treatment of Muscle Imbalance* [accessed 2011-01-26]. Internet access: <http://books.google.com/books?id=TkMyMb_z6HkC&printsec=frontcover&dq=muscle+imbalance&hl=en&ei=DBXMTeaYEqnYiAKS6bipBQ&sa=X&oi=book_result&ct=book-thumbnail & resnum =1&ved =0CDA Q 6wEwAA#v=onepage&q&f=false>.
20. Paunksnis, A., Kušleika, S., Kušleikaitė M. (2006). The relationship of the intensity of lens opacity with physical activity. *Medicina (Kaunas)*, 42(9), 738-743.
21. Sinkevičius, R., Varnienė, L., Telšinskienė, R. (2009). Fiziniai veiksniai turintys įtakos paauglių nugaros skausmui. *Reabilitacijos metodų ir priemonių efektyvumas: Lietuvos reabilitologų asociacijos konferencijos medžiaga* (p. 253-256). Birštonas.
22. Skaggs, S., Hopper, Ch. (1996). *Individuals With Visual Impairments: A Review of Psychomotor Behavior* [accessed 2011-03-13]. Internet access: <http://journals.humankinetics.com/apaq-back-issues/APAQVolume13Issue1January/IndividualsWithVisualImpairmentsAReviewof-PsychomotorBehavior>.
23. Skirius, J. (2007). *Sporto medicina*. Kaunas: Lietuvos kūno kultūros akademija.

24. Skurvydas, A. (2010). *Judesių mokslas: raumenys, valdymas, mokymas, reabilitavimas, sveikatinimas, treniravimas, metodologija*. Kaunas: Lietuvos kūno kultūros akademija.
25. Skurvydas, A. (2011). *Modernioji neuroreabilitacija. Judesių valdymas ir proto treniruotė.* Kaunas: Lietuvos kūno kultūros akademija.
26. Thomson, C. W., Floyd, R. T. (2004). *Manual of Structural Kinesiology*: fifteenth Edition. McGraw-Hill, New York.