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Original research article

DIFFERENCES BETWEEN THE MOTOR ABILITIES OF STUDENTS ATTENDING A REGULAR SECONDARY SCHOOL AND THOSE ATTENDING A SECONDARY SCHOOL FOR THE EDUCATION OF CHILDREN WITH DISABILITIES

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Abstract. *Because of relatively few studies concerning the differences in motor abilities between adolescents with mild intellectual disabilities and their peers without any such impairments, the need for this type of research activities is increasing. The aim of the current research was to determine whether there is statistically significant difference in the motor abilities of adolescents attending special and regular schools, as well as potential gender differences. Forty-five students with disabilities and forty- eight typically developing students (both genders), age 16 ± 6 months, participated in the cross-sectional research. Motor abilities were assessed by following tests: plate tapping, forward lean, open-eyes one-leg stand, standing broad jump, 20m run, sit-ups and the flexed arm hang. Multivariate analysis of variance (MANOVA) was used to determine the differences between the groups, whereas differences between groups for each individual variable were determined by univariate analysis (ANOVA) at the p≤0.05 significance level. The research results indicate that the students with mild intellectual disabilities had statistically significant lower results in manifesting motor abilities: plate tapping (f=134.155; p=0.000), forward lean (f=29.876; p=0.000), open-eyes one-leg stand (f=27.220; p=0.000), standing broad jump (f=6.189; p=0.015) and sit-ups (f=18.189; p=0.000). Gender differences were also statistically significant in favor of the males and females attending regular schools. Inferiority of the students attending special schools in relation to their typically developing peers is due to poor cognitive development and a sedentary lifestyle, caused by decreased physical activity due to the lack of possibilities for engaging in an organized physical activity.*

Key words: *mild intellectual disability, special and regular schools, adolescents, motor abilities, differences.*

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INTRODUCTION

Physical activity is of crucial significance for the proper growth and development from an early age and in adolescence, for the improvement of health as well as for the reduction of the risk of occurrence of cardiovascular and metabolic diseases during adulthood. The existing guidelines recommend at least 60 minutes of moderate to intensive physical activity for adolescents, almost every day during the week (Strong et al., 2005). With that purpose in mind, it is necessary to provide prerequisites for the physical activities of adolescents with intellectual disability, in order to provide them with the same opportunities as their peers have. The aforesaid can be achieved through several forms of physical activities (physical education classes, inclusive activities, classroom activities, involvement in various sport activities, etc.), with the guidance of a dedicated and competent physical education teacher (Pitetti, Beets, & Combs, 2009).

Regular physical activity contributes not only to the improvement of muscular strength and aerobic endurance, but it also improves the balance and self-perception in people with mild intellectual disability (Carmeli, Zinger-Vaknin, Morad, & Merrick, 2005). Engagement of such children and adults in recreation and sport activities often improves the overall quality of their lives and improves social inclusion (Wilson, 2002). However, there are obstacles which often disable or reduce the opportunity of involvement in regular physical activities of persons with intellectual disability. They include certain functional limitations of some people, the lack of appropriate objects, terrains or specialized programs, as well as high cost of organization of such forms of physical activities (King et al., 2003). Regardless the aforesaid, persons with intellectual disability have the right to equal participation in recreation, sport and all other forms of physical activities (Eminović, Čanović, & Nikić, 2011) because of the positive effects on overall health and good quality of life.

There are relatively few studies concerning motor abilities of children with mild intellectual disability (Vuijk, Hartman, Scherder, & Visscher, 2010), but the authors in almost all of the conducted studies indicate their inferiority in regard to typically developing children in terms of motor abilities (Graham, & Ried, 2000; Pitetti, Millar, & Fernhall, 2001; Lotan, Isakov, Kessel, & Merrick, 2004; Kosma, Acock, Rintala, & Wood, 2004; Pappa, Evaggelinou, Varda, Giagazoglou, & Goudesidou, 2004; Carmeli, Bar-Yossef, Ariav, Levy, & Liebermann, 2008; Frey & Chow, 2006). As the adequate level of motor abilities can positively contribute to everyday life, the need for this type of research activity is increasing (Watkinson et al., 2001).

Intellectual disability implies essential limitations in current functioning (Tomić et al., 2011, according to: American Association on Intellectual and Developmental Disabilities, 2002). It occurs before the age of eighteen, and is characterized by level of intellectual functioning which is very much below the average. It can exist simultaneously with restrictions in two or more segments of adaptive behavior, or relate to the aforementioned, expressed in conceptual, social and practical adaptive skills. This definition is based on several assumptions. They primarily refer to stagnations in various spheres of adaptive skills, and not only intellectual ones (Wittchen et al., 2011).

The data on the prevalence of disability in intellectual development indicates its presence in the general population with approximately 2% and 3%. Of that number, approximately 70% of cases refer to mild intellectual disability, while 30% refers to the other 44 levels. The incidence is slightly higher in boys, which is explained with genetic factors (Battaglia, 2011).

The goal of this study was to establish the differences in motor abilities of children with mild intellectual disability (special school students) and children with typical intellectual development (regular school students), as well as potential gender differences.

THE METHOD

Participants

The study, which represents a cross-sectional study, comprised of 45 subjects with mild intellectual disability of both genders (25 male and 20 female participants), students attending the Secondary School for Children with Disability, without significant physical disabilities, who attend regular physical education classes in their school (classes last for 40 minutes), and 48 typically developing children (25 male and 23 female participants), attending a regular secondary school. Both schools are from Novi Sad (Serbia). The age of students is 16±6 months.

Measuring instruments

The sample of tests for the assessment of motor abilities was formed proportionally according to the share of certain motor abilities in the definition of general motor factors (Kurelić et al., 1975; Gredelj, Metikoš, Hošek & Momirović, 1975). The following measurements of motor fitness variables were conducted - plate tapping (speed of hand movement), sit-and-reach (flexibility), one-leg stand on the balance bench, eyes open (the balance), the standing broad jump and 20-m dash (explosive strength), bent-arm hang (isometric muscular endurance) and sit-ups with crossed arms (isotonic muscular endurance). The battery of these 7 motor tests assessed the following functional mechanisms: tonus and synergetic regulation, regulation of excitation intensity and regulation of excitation duration.

The procedure

The testing was carried out in physical education classes, from 8 am to 1 pm, and required the previous consent of parents and the principals of both schools. The tests were arranged in such way to completely remove the influence of fatigue on the results. Every subject performed a trial test in order to get familiar with the protocol. After that the results were recorded.

Statistical analysis

The statistical procedure included descriptive statistics, a multivariate (MANOVA) and univariate analysis of variance (ANOVA) to establish the differences between the groups of participants and between the groups of participants for each individual variable, at the $p \leq 0.05$ level of significance.

THE RESULTS

Table 1 presents the basic measures of central tendencies of the esults in all parameters of motor statuses: arithmetic mean (AM), and the measures of variables - standard deviation (SD), minimal (MIN) and maximal (MAX) results. The multivariate analysis of variance

(MANOVA) established statistically significant differences between the group of participants with mild intellectual disability and typically developing children (F=22.489; P=0.000). The univariate analysis of variance (ANOVA) established the differences in all individual parameters.

Table 1 Descriptive statistics and analysis of differences between the groups of the whole sample (N=93)

Variables	Special school students (N=45)				Regular school students (N=48)				f	p
	AM	SD	MIN	MAX	AM	SD	MIN	MAX		
Plate tapping	30.76	8.169	13	52	47.87	5.277	35	60	134.155	**.000**
Sit-and-reach	37.16	10.523	12	53	47.15	5.978	35	64	29.876	**.000**
One-leg stand	431.24	214.039	29	600	596.74	22.116	450	600	27.220	**.000**
Standing broad jump	154.16	37.261	75	231	175.20	39.576	117	280	6.189	**.015**
20-m dash	41.24	5.191	33	55	41.00	5.125	30	50	0.044	.835
Sit-ups with crossed arms	30.13	9.851	3	60	39.67	10.490	12	62	18.189	**.000**
Bent-arm hang	21.29	22.754	0	88	29.91	23.080	0	81	2.942	.090
F=22.489 P=**0.000**										

The results of the study indicate that the subjects with mild intellectual disability achieve statistically significant results as compared to typically developing children, in five of seven motor tests (F=22.489; P=0.000), except for the tests of assessment of the running speed (20 m dash) and the static strength of arms and shoulder girdle (bent-arm hang). In all other parameters, statistically significant differences were established in favor of typically developing children.

Table 2 presents descriptive statistics and analysis of the differences between the male participants with mild intellectual disability and typically developing children. Statistically significant differences (F=12.282; P=0.000) were established for the male sample, as well as in each individual parameter.

Table 2 Descriptive statistics and analysis of differences between the groups of male participants with mild intellectual disability and typically developing students (N=50)

Variables	Special school students (N=25)				Regular school students (N=25)				f	p
	AM	SD	MIN	MAX	AM	SD	MIN	MAX		
Plate tapping	31.67	8.138	21	52	49.82	4.677	41	60	87.856	**0.000**
Sit-and-reach	37.77	10.013	12	53	47.73	6.001	35	60	10.977	**0.002**
One-leg stand	436.53	207.170	29	600	593.18	31.980	450	600	12.299	**0.001**
Standing broad jump	162.87	35.312	75	231	207.00	31.585	124	280	21.643	**0.000**
20-m dash	39.97	4.453	33	51	37.32	4.401	30	49	4.534	**0.038**
Sit-ups with crossed arms	32.43	8.736	16	60	42.77	8.652	27	62	17.923	**0.000**
Bent-arm hang	24.80	23.952	0	88	45.27	19.518	15	81	10.796	**0.002**
F=12.282 P=**0.000**										

Table 3 presents descriptive statistics and analysis of the differences between the groups of female participants with mild intellectual disability and typically developing children. The results indicate to statistically significant differences in the following tests: plate tapping, sit-and-reach, the one-leg stand, standing broad jump and sit-ups with crossed arms. No statistically significant difference was established for the 20-m dash and bent-arm hang tests.

Table 3 Descriptive statistics and analysis of differences between the groups of female participants with mild intellectual disability and typically developing students (N=43)

Variables	Special school students (N=20)				Regular school students (N=23)				f	p
	AM	SD	MIN	MAX	AM	SD	MIN	MAX		
Plate tapping	27.38	7.855	13	35	46.08	5.250	35	53	59.116	**0.000**
Sit-and-reach	34.88	12.744	18	51	48.46	5.771	37	64	17.454	**0.000**
One-leg stand	411.38	252.532	62	600	600	0.000	600	600	14.346	**0.001**
Standing broad jump	121.50	25.071	82	153	146.04	17.297	117	191	9.610	**0.004**
20-m dash	46.00	5.237	40	55	44.38	2.975	40	50	1.201	0.282
Sit-ups with crossed arms	21.50	9.426	3	33	36.83	11.374	12	59	11.764	**0.002**
Bent-arm hang	8.13	10.439	0	32	15.83	16.183	0	56	1.576	0.212
			F=9.078	P=**0.000**						

DISCUSSION

Children with mild intellectual disability are much more inferior in the demonstration of motor abilities as compared to their peers with typical intellectual development, in coordination, swiftness of alternative moves, explosive strength, balance, agility and basic body strength (Bala et al., 1985). The results of our study coincide with the results of research activities of this type (Paver, 1975; Bala et. al., 1985). The authors are of the opinion that such results are the consequence of CNS underdevelopment, as well as sedentary way of life of children with mild intellectual disability, that is, the inability to get involved into any form of planned physical activity.

The analysis of the obtained results indicate that the adolescents with mild mental disability and their regular developed peers significantly differ in the demonstration of motor abilities, except for the female participants, in terms of the demonstration of static muscle strength (bent-arm hang) and running speed (20 m dash). These results coincide with the results of the study conducted by Bale et al., (1985), and indicate the absence of a statistically significant difference in the demonstration of static strength of the participants with mild intellectual disability and the participants with typical intellectual status. One of the reasons, according to these authors, is that static strength demonstration does not include higher CNS levels, which are not as developed in students with mild mental disabilities. Thereby the demonstration of such motor ability does not represent such a serious problem in this population.

The results of the research conducted by Frey & Chow (2006), don't coincide with the results of our study. The students in our study showed better results for the tests of sit-and-reach and sit-ups with crossed arms.

In the assessment of motor frequency speed, agility, balance and explosive strength, the results indicate that motor abilities significantly depend on the functioning of higher CNS levels. Accordingly, much better results in assessment of such abilities were achieved by

students of typical intellectual development. However, in terms of static strength and the running speed of the female participants, that ratio cannot be taken into account, as there are no statistically significant differences. It can be concluded that the participants with mild intellectual disability, in resolving simple motor problems, are relatively equal to the students of typical intellectual status, meaning that certain differences should be searched for in the speed of information flow, that is, in synaptic transmission (Bala, et al., 1985).

The significant inferiority of the participants with mild intellectual disability occurs in solving complex motor tasks, due to poorly developed cognitive abilities. Such general ability of adaptation in resolving motor tasks in motor-cognitive problem situations can be defined as "motor behavior", and according to some experts, "motor intelligence" (Bala, 1999). The level of such behavior does not depend on complexity of motor, that is, motor and cognitive problems. This mean that if, the situation is simpler, motor behavior will not require significant incidence of cognitive components of such behavior. If the situation is more complex, motor behavior gradually turns to cognitive behavior, with maximal economy and efficiency of use of appropriate effectors. However, such efficiency and economy in persons with mild intellectual disability is at a very low level, due to the underdevelopment of higher CNS levels.

Also, it is important to mention the attention deficit disorder and behavior disorder, reported in some participants with mild intellectual disability, which is characterized by the passiveness and the lack of attention observed during the testing. The most frequent manifestation included low level of motor coordination, inattentiveness and short-term attention, which possibly affected the realization of the results of the motor tests.

One of the reasons for such poor results in the demonstration of motor abilities in students with mild intellectual disability is also their generally reduced physical activity during everyday life. Physical exercises and appropriate level of fitness are considered important for the health of people with mental disability, and regular physical activity as a part of life is recommended for the prevention of disease and increase of emotional stability. Regular physical exercise can promote an active lifestyle and increase physical and working capacities in this specific population. Nowadays, it is considered that such a low level of fitness in persons with mild intellectual disability is the consequence of a sedentary lifestyle, and the lack of opportunities for this population to get involved in any form of planned physical activity.

CONCLUSION

The results of our study indicate the fact that participants with mild intellectual disability are much more inferior in the demonstration of motor tasks as compared to their peers with regular intellectual development. Significant inferiority occurs, primarily, due to underdeveloped cognitive abilities but also due to sedentary lifestyle, that is, reduced physical ability during the developmental period and the lack of opportunity to get actively involved in organized physical activities.

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RAZLIKE U MOTORIČKIM SPOSOBNOSTIMA UČENIKA KOJI POHAĐAJU REDOVNU SREDNJU ŠKOLU I UČENIKA SREDNJE ŠKOLE ZA OBRAZOVANJE DECE SA SMETNJAMA U RAZVOJU

Zbog relativno malog broja istraživanja o razlikama u motoričkim sposobnostim adolescenata sa blagom mentalnom ometenošću i njihovih vršnjaka bez, potreba za ovakvom vrstom istraživanja je u porastu. Cilj ovog istraživanja bio je da se utvrdi razlika u motoričkim sposobnostima adolescenata koji pohađaju specijalne i redovne škole, kao i eventualnih rodnih razlika. Četrdeset pet ispitanika sa mentalnom ometenošću i četrdeset osam tipično intelektualno razvijenih adolescenata (oba pola), dobi od 16 ± 6 meseci, učestvovalo je u ovom transverzalnom istraživanju. Motoričke sposobnosti procenjene su testovima: taping rukom, pretklon u sedu raznožno, stajanje na jednoj nozi uzdužno na klupici za ravnotežu otvorenim očima, skok udalj sa mesta, trčanje 20 m, podizanje trupa i izdržaj u zgibu. Multivarijatnom analizom varijanse (MANOVA), utvrđivane su razlike između grupa a razlike u svakoj pojedinačnoj varijabli utvrđene univarijatnom analizom varijanse (ANOVA), na nivou značajnosti p≤0.05. Rezultati pokazuju da učenici sa blagom intelektualnom ometenošću imaju statistički značajno niže rezultate: taping rukom (f = 134,155; p = 0,000), pretklon u sedu raznožno (f = 29,876; p = 0,000), stajanje na jednoj nozi na klupici za ravnotežu, otvorenim očima, (f = 27.220; p = 0.000), skok udalj sa mesta (f = 6.189; p = 0,015) i podizanje trupa (f = 18,189; p = 0,000). Razlike u odnosu na pol statistički su značajne u korist učenika i učenica redovne škole. Inferiornost učenika specijalnih škola u odnosu na njihove vršnjake iz redovnih je zbog lošeg kognitivnog razvoja i neaktivnog načina života, izazvanog smanjenom fizičkom aktivnošću zbog nedostatka mogućnosti uključivanja u organizovane fizičke aktivnosti.

Ključne reči: *blaga mentalna ometenost, specijalne i redovne škole, adolescenti, motoričke sposobnosti, razlike.*