



EFFECT OF BASKETBALL TRAINING ON MOTORIC ABILITIES IN INDIVIDUALS WITH INTELLECTUAL DISABILITIES

UTJECAJ KOŠARKAŠKOG TRENINGA NA MOTORIČKE SPOSOBNOSTI OSOBA S INTELJEKTUALNIM POTEŠKOĆAMA

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DOI: 10.69589/hsv.39.2.5

ABSTRACT

This study aimed to examine the effects of basketball training in adolescents with intellectual disabilities on their basic motor abilities, speed, strength, balance, and coordination. For this aim 70 boys (aged 16 – 19 years) who were attending one of four Special Education Centres in Zagreb and Karlovac, all classified as light or mild ID according to their intelligence quotient of ≤ 70 , were divided into two groups which underwent 6 months of supervised physical activity program. The experimental group (EG, N=34) had three times a week one hour of special basketball training, while the control group (CG, N=36) had three regular physical education classes prescribed by the plan and program of the Ministry of Science and Education of the Republic of Croatia. Both groups were tested with a battery of 12 tests to evaluate their basic motor abilities at the start and the end of the experiment.

The final results of the study led to the conclusion that the size of the changes from the initial to the final state is different for the groups that were subjected to different treatments. The group subjected to basketball training showed a greater sensitivity to kinesiology treatment, that is, this treatment produced a greater effect on the subjects' basic motor skills than physical education treatment. Physical education did not lead to significant changes in the number of monitored abilities, which of course leads to the question of the regularity of the conception, that is, the content and modalities of physical education.

Key words: basketball, motor abilities, adolescents, intellectual disability

SAŽETAK

Ovo istraživanje imalo je za cilj ispitati učinke treninga košarke kod adolescenata s intelektualnim teškoćama na njihove bazične motoričke sposobnosti, brzinu, snagu, ravnotežu i koordinaciju. U tu svrhu 70 dječaka (u dobi od 16 do 19 godina) koji su pohađali jedan od četiri Centra za specijalno obrazovanje u Zagrebu i Karlovcu, svi klasificirani kao laka ili blaga ID prema njihovom kvocijentu inteligencije ≤ 70 , podijeljeni su u dvije skupine koje su prošle šest mjeseci programirane tjelesne aktivnosti pod nadzorom. Eksperimentalna skupina (EG, N=34) imala je tri puta tjedno po jedan sat posebnog košarkaškog treninga, dok je kontrolna skupina (KG, N=36) imala tri redovita sata tjelesne i zdravstvene kulture propisane planom i programom Ministarstva znanosti i obrazovanja Republike Hrvatske. Obje skupine testirane su baterijom od 12 testova za procjenu njihovih bazičnih motoričkih sposobnosti na početku i na kraju eksperimenta. Konačni rezultati istraživanja doveli su do zaključka da je veličina promjena od početnog do konačnog stanja različita za skupine koje su bile podvrgnute različitim tretmanima. Skupina podvrgnuta košarkaškom treningu pokazala je veću osjetljivost na kineziološki tretman, odnosno ovaj je tretman imao veći učinak na bazične motoričke sposobnosti ispitanika nego tretman tjelesnog odgoja. Nastava tjelesnog odgoja nije dovela do značajnijih promjena u većem broju praćenih sposobnosti, što naravno dovodi u pitanje pravilnost koncepcije, odnosno sadržaja i modaliteta tjelesnog odgoja.

Ključne riječi: košarka, motoričke sposobnosti, adolescenti, intelektualne poteškoće

Intellectual disability (ID) is defined, according to the American Association on Intellectual and Developmental Disorders, as a state “characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills.”²⁸ (Schalock RL i sur.) Persons with ID have difficulties in performing practical daily activities as well as appropriately functioning in different social situations. This disability originates before the age of 22. ID is a permanent companion of humanity and represents a very complex human problem.

There is no exact data on the development of motor skills of persons with ID^{4,11}, but it is known that mental factors dominate over physical factors in their development¹⁶. Children with ID have delays that affect growth and development⁶, and there are deficits in the motor and cognitive field^{2,14,22}. Optimal predictors of coordination in persons with ID, along with motivation and age, are cognitive processes - the ability to perceive and logical thinking. Other motor skills include spatial imagination and reactivity¹⁶. As early as 1928, Piaget¹³ concluded that sensorimotor intelligence is followed up by conceptual intelligence. For the sensorimotor stage of intelligence development language and symbolic activity are reduced at a minimum. The child must integrate sensory information with a specific motor response, which normally happens around the age of seven. In persons with ID, progress through the intellectual developmental stages is slowed down, which in other words means that persons with ID need more experience to be able to focus attention on the relationships between their own body and other objects in space to develop a certain scheme of spatial relationships in their sensory-motor system.

Sport, as a form of physical activity, due to its extremely positive impact on the integrity of personality, has already assimilated in the treatment of people with ID of different degrees, especially in working with people with moderate and severe ID¹⁹. The positive impact of physical activity on the biopsychosocial status of people with ID has been known for years⁵. A series of researchers^{2,3,7,18,21,27} based on the results of their studies concluded that a systematic program of engaging in kinesiological activities affects not only the improvement of the results of the subjects motor tests but also in tests to assess cognitive functioning. Despite these results, several studies confirmed that children with ID have low levels of physical activity when compared to their pairs without ID^{10,26,23}.

We are sure that in the habilitation process every sport discipline, as a form of physical activity, if applied in the correct way and with adequate loads, can have multiple positive impacts on a person with ID. In the opposite case, inadequate application of sports activities can have negative consequences and significantly reduce the value of the habilitation process.

This study aimed to examine the effects of basketball training in adolescents with ID on their basic motor abilities, speed, strength, balance, and coordination.

METHODS

Participants

We recruited 70 boys (aged 16 – 19 years) who were attending one of four Special Education Centres in Zagreb and Karlovac. They were all classified as light or mild ID according to their intelligence quotient of ≤ 70 .

The participants were divided into two groups which underwent 6 months of supervised physical activity program. The adolescents of the experimental group (EG, N=34) had three times a week one hour of special basketball training aimed at developing basic and specific motor skills, while the control group (CG, N=36) had three regular physical education classes prescribed by the plan and program of Ministry of Science and Education of the Republic of Croatia.

The parents or legal guardians of participants gave informed consent for participation in the study and the procedure applied was approved by the Committee of Research Ethics Faculty of the Kinesiology University of Zagreb and followed the rules of the Declaration of Helsinki.

Variables

The battery of 12 tests was used to evaluate basic motor abilities: side steps for assessing agility, obstacle-course backward for assessing coordination, seated straddle stretch for assessing flexibility, standing on one leg lengthwise on a bench with open eyes for assessing balance, arm plate tapping and foot tapping for assessing movement frequency, standing long jump and squat jump for assessing jumping explosive power, 20 m dash for assessing sprinting explosive power, 2 kg supine medicine ball throw for assessing throwing explosive power, crossed-arms sit-ups for assessing repetitive strength, bent arm hang for assessing static strength and/or muscle endurance. Tests were previously used in persons with ID (Paver, 1987) and showed good reliability.

A repeated measures design was used, with a baseline assessment before the intervention period and a follow-up assessment after the intervention which lasted 6 months.

Data analysis

Data analysis was performed in the Faculty computing center using the DDIFFG program⁹. The descriptive data are presented as means and standard deviations. The analysis of variance and discriminative analysis were used to investigate the differences between the groups at the beginning of the study and also for the differences between the starting point and the end of the intervention. The significance level was set at $p < 0.05$.

RESULTS

The study sample included 70 boys aged 16 to 19 years. Obtained results are presented in tables. In Table 1. the

Table 1. Descriptive statistics of basic motor abilities pre- and post-intervention for experimental and control group
 Tablica 1. Bazične motoričke sposobnosti sudionika eksperimentalne i kontrolne grupe prije i poslije intervencije

Variable (measuring unit)	Experimental group				Control group			
	pre		post		pre		post	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Medicine ball throw (cm)	722.4	154.8	847.8	210.1	674.8	200.3	751.8	207.5
Standing long jump (cm)	162.6	29.6	167.1	30.3	154.9	31.9	168.5	31.6
Seated straddle stretch (cm)	34.8	6.3	39.1	7.7	38.0	7.3	38.3	10.0
Bent arm hang (ds)	239.6	134.9	280.9	142.7	262.1	179.8	324.1	196.6
Side steps (ds)	138.5	16.5	121.0	13.6	132.0	24.4	139.0	25.2
Obstacle-course backward (ds)	170.7	31.0	161.1	29.4	162.8	44.0	157.9	37.3
Standing on a bench (ds)	20.6	8.3	29.0	13.5	24.9	13.0	35.3	17.9
Foot tapping (n/15s)	13.8	1.8	15.6	1.8	14.8	2.4	15.4	2.2
Arm plate tapping (n/15s)	23.8	4.0	25.4	4.0	22.6	4.6	25.0	4.9
Crossed-arms sit-ups (n/min)	28.0	8.1	33.5	10.2	39.4	8.3	39.5	7.5
Squat jump (cm)	27.5	6.1	31.2	7.2	28.2	8.3	33.6	8.4
20 m dash (ds)	43.9	4.4	39.4	3.9	43.1	3.7	43.0	4.9

descriptive data for basic motor abilities at the beginning and the end of the study for both groups are presented. Analysis of distribution parameters indicated that there were no significant deviations from normal distribution in any variable, so all variables were suitable for further multivariate statistical analysis.

Tables 2. and 3. present the results of uni- and multivariate analysis of variance and discriminative

analysis which were used to test the differences between the groups that underwent two interventional programs. The tests were used separately for the initial and final stadium.

From the results, it is obvious that there were no statistically significant differences at the beginning of the study, although the experimental group had better scores in the standing long jump, medicine ball throw, and arm tapping. The other results were slightly lower in this group,

Table 2. Differences (R) between experimental and control groups for every implemented test and initial and final measurements, F-tests and their significance

Tablica 2. Razlike (R) između eksperimentalne i kontrolne skupine za svaki provedeni test te inicijalna i finalna mjerenja, F-testovi i njihova značajnost

Variable	Initial			Final		
	R	F-test	p	R	F-test	p
Medicine ball throw	47.1	1.17	.28	97.5	3.70	.06
Standing long jump	6.6	.80	.38	-2.6	.13	.72
Seated straddle stretch	-3.1	3.75	.06	0.7	.10	.76
Bent arm hang	-22.4	.34	.56	-43.1	1.08	.30
Side steps	5.3	1.11	.30	-19.4	16.03	.00
Obstacle-course backwards	7.6	.69	.41	3.3	.16	.69
Standing on a bench	-3.2	2.61	.11	-6.6	3.97	.05
Foot tapping	-0.9	2.91	.09	0.1	.10	.75
Arm plate tapping	1.2	1.48	.23	0.5	.17	.69
Crossed-arms sit-ups	-2.4	1.46	.26	-6.0	7.58	.01
Squat jump	-0.7	.19	.67	-1.3	1.64	.20
20 m dash	0.8	.69	.41	-3.5	10.82	.00
F-test	1.52			4.63		
Wilks lambda	.81			.51		
p	.17			.00		

but none of them were significant. This was confirmed by the discriminative analysis where very low, almost zero discriminative coefficients were present.

The structure of the discriminative function changes in the final measurement. Differences between the experimental and control groups are predominantly due to the results of side steps, 20m dash, and medicine ball throw in which the control group was significantly better, and crossed-arms sit-ups and standing on a bench in which the same group was worse.

Analysis of the six-month treatment effects is presented in Table 2. The arithmetic means of the discriminative functions of one and the other group are statistically significantly different, as are the arithmetic means of the main components. Partial discriminative coefficients are higher in the group of basketball players. They are high for the foot tapping, 20 m dash, and crossed-arms sit-up tests. For other tests, they are significantly lower, and for some, they are almost zero.

Table 3. Results of testing the significance of differences in quantitative changes in basic motor abilities of the experimental and control groups

Tablica 3. Rezultati ispitivanja značajnosti razlika u kvantitativnim promjenama bazičnih motoričkih sposobnosti eksperimentalne i kontrolne skupine

D1	9.39
D2	21.35
FD	164.50
DF	68.00
Q	.00

Arithmetic means of discriminative functions (D), significance test of the differences of those means (FD), and the probability of the hypothesis $D1 = D2$ (Q)

DISCUSSION

Research into the basic motor abilities of people with ID is usually related to a comparison with the performance of the same tasks by people without ID. A typical example can be seen in the work of Tregold and Soddy²⁰ from 1970, who states that people with ID find it difficult to adopt coordinated actions, and even when they do, balance and body movements often remain clumsy and clumsy. Such comparative studies lead to the conclusion that people with ID lag behind their peers with average IQ in their motor abilities²³. Weaker results were recorded in almost all motor skills - coordination, speed, flexibility, balance, strength, endurance. Otherwise, the structure of the motor space of people with ID and people of average intelligence does not differ, only the results of people with ID in tests that define common factors are significantly weaker. It is interesting to note that the backwardness of basic motor skills of people with ID increases as a function of chronological age, that is, the older people with ID are, the greater the differences.

In the final phase of the research, i.e. after six months of kinesiology treatment, both the experimental and control groups mostly showed positive changes in basic motor skills. In the group that underwent basketball training, all tests used to assess motor skills improved statistically significant. As it was expected, the biggest positive changes were obtained in abilities that are known to be of particular importance for success in the basketball game, such as explosive strength and coordination. However, it is noticeable that other motor skills were not neglected in the training either. The subjects significantly improved their endurance, movement frequency, and balance. The results of the control group in the final measurement also mostly improved. The exception is the test side steps, that is, the test for assessment of coordination, where a somewhat weaker result was recorded. Physical education classes mostly improved explosive power and endurance.

Similar results were recorded in some earlier research. Sun et al.¹⁷ found that after 9 months of adapted physical activity, there was an improvement in muscle endurance, flexibility, and coordination. Statistically, they did not record significant differences between the control and experimental groups, but the improvements were still more pronounced in people with ID who were subjected to the training process for 9 months. They concluded that a positive impact on flexibility could help in reducing the chances of injuries and musculotendinous strains in adolescents with ID. Several other studies evaluated the influence of exercise programs on flexibility (evaluated with sit-and-reach test) among adolescents with ID but without positive impacts^{8,17}. Wu and his colleagues²⁴ through a customized program that lasted 10 weeks with 5 times a week for 50 minutes of vigorous aerobic and muscular endurance exercises caused significant positive changes in students (13-19 years old) in muscular endurance (sit-ups). The program of adopted gymnastics exercises over 16 weeks resulted in improvements in most of the monitored physical fitness parameters of children with ID, especially in abdominal strength and upper limb muscle strength when compared to the control group²⁵.

The insignificant differences between the experimental and control groups at the beginning of our study became significant at the end of the six-month treatment to which they were subjected. Better results were achieved by the basketball players concerning abilities that are more interesting for success in basketball, namely explosive strength of arms and legs and coordination. Interestingly, the control group achieved significantly better results in the high jump test the difference that was already present at the beginning of the research increased. Given the ubiquitous importance of the jump in the basketball game, both in attack and defense, this result was certainly not expected. However, perhaps it can be explained by the otherwise less present jump in basketball matches of people with ID, where the accuracy of the shot at the basket increases by staying on a stable surface.

Basketball, as a sport, appears as one of the dominant sports in the world sports movement of persons with ID. There are certainly more reasons for this, and they should be sought primarily in the utilitarianism of this game in the treatment of people with ID. Basketball is a collective sports game where players work together to achieve the same goal. Success in the game requires mastering the basic basketball technique, elementary tactics, as well as the rules of the game. In other words, every person with ID will develop and improve at the same time by practicing elementary technique and motor capacities, stimulating intellectual processes when solving simple tactical tasks, influencing the formation of a conative structure by accepting sports rules and behavior, and socializing within the team. As a rule, basketball is a non-contact game. Knowing the value of the motor and functional abilities of people with ID and the fact that ID is usually accompanied by a motor disorder, the statement presented is just one more positive moment for the inclusion of this game in the treatment program of people with ID.

Aksović and his coworkers¹ conducted an extensive review of current research conducted on adolescents and youth with ID to determine the effects of sports games on their motor skills. They searched different electronic databases (PubMed, MEDLINE, Google Scholar, ScienceDirect, and ERIC) from 2001 to 2023, and included different types of studies, mainly randomized controlled and non-randomized studies. In total seventeen studies

were included in their systematic review, among which basketball interventions were the most common. The authors concluded that basketball can be recommended as an effective and practical program for youth with ID in the sense of improving their fitness, motor skills, and interaction aspects.

CONCLUSION

It can be concluded that the size of the changes from the initial to the final state is different for the groups that were subjected to different treatments. The group subjected to basketball training showed a greater sensitivity to kinesiology treatment, that is, this treatment produced a greater effect on the subjects' basic motor skills than physical education treatment. Physical education did not lead to significant changes in the number of monitored abilities, which of course leads to the question of the regularity of the conception, that is, the content and modalities of physical education. What should be highlighted from the practical side, the results of this research indicate that in the process of education of people with ID in terms of improving basic motor skills, in addition to physical education classes, carefully designed training processes can be applied (basketball, but it can be assumed that other sports activities also come into account, related to the possible preferences of residents of such institutions).

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