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*"Storms make the oak grow deeper roots".
(George Herbert)*

Dear reader,

According to one of the hottest start of summer, the temperature of some 36-37 degrees Celsius it was prepared this issue of Sport Science. So, clearly and definitely, with and without that, it was built in solar energy, energy of creativity, exceptional energy but not the energy of devastation. This number is, hopefully, and particularly interesting and there are authors from very broad environment, from: Germany, Slovenian, Polish, Italian, Croatian, Greek, Czech Republic, Turkey, Iran, Macedonia, Montenegro, Kosovo, Serbia and Bosnia and Herzegovina. Contributions were also chosen as a particularly interesting and relate to: access to dance, biomechanical research in athletics, use of the riding in school, Bologna developments, motor learning, the concepts of PE and the game, aerobic capacity, inclusion in the PE, the satisfaction of trainer, training fencing, agility performance, handball, water polo, endurance training, six year-old children motor skills, education funding and analysis of boxing. Really rich offer from which you can probably find what you are most interested. As you can see, in these financially difficult times we do everything we can to retain its status as magazine and its value, and therefore if the recession is the financial storm, then we believe the roots of the journal will be even deeper and stronger. To all of which constantly receive praise and encouragement, we say that we will continue as before. Thanks to all who in any way support our work and activities.

*Executive Editor
Sen.Assist.Danijela Bonacin, MSc*

*"Zbog oluje hrast pušta dublje korijenje".
(George Herbert)*

Dragi čitatelju,

Po jednom od najtoplijih početaka ljeta, po temperaturi od nekih 36-37 stupnjeva celzijusa slagan je ovaj broj Sport Science-a. Dakle, nedvojbeno i sigurno, s tim a i bez toga, u njega je ugrađena energija Sunca, energija stvaralaštva, iznimna energija ali ne i energija pustošenja. Ovaj broj je, nadamo se, i posebno zanimljiv i u njemu su autori iz jako širokog okruženja: Njemačke, Slovenije, Poljske, Italije, Hrvatske, Grčke, Češke, Turske, Irana, Makedonije, Crne Gore, Kosova, Srbije i Bosne i Hercegovine. Prilozi su također izabrani kao posebno zanimljivi i odnose se na: pristupe plesu, biomehaničko istraživanje u atletici, korištenje jahanja u školi, Bolonjska dešavanja, motoričko učenje, koncepte TO-a uz igru u nastavi, aerobni kapacitet, inkluziju u TO, zadovoljstvo trenera, trening u mačevanju, iskazivanje agilnosti, rukomet, vaterpolo, trening izdržljivosti, vještine šestogodišnje djece, financiranje obrazovanja i analize boksa. Zaista bogata ponuda iz koje ćete vjerojatno moći pronaći ono što vas najviše zanima. Kao što vidite, u ova financijski teška vremena činimo sve što možemo da časopis zadrži svoj status i svoju vrijednost, pa dakle ako je recesija financijska oluja, onda će vjerujemo korijenje časopisa biti još dublje i čvršće. Svima vama od kojih stalno dobivamo riječi pohvale i ohrabrenja poručujemo da ćemo nastaviti kao i do sada. Hvala svima koji na bilo koji način podupiru naš rad i djelovanje.

*Izvršni urednik
Viši Assist.Mr. Danijela Bonacin*

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STUDYING DANCE AT GERMAN UNIVERSITIES – A RESEARCH AND LECTURING AREA CAUGHT IN BETWEEN RESEARCH AND PRACTICE

Rolf Kretschmann

Department of Sport and Exercise Science, University of Stuttgart, Stuttgart, Germany

Review paper

Abstract

Being interested in studying dance in Germany at a university, inevitably leads to a department of sport science. Thus, dance (often coupled with rhythmic gymnastics to fuse into one subject) is obligatory within the studies of sport science. Taking a closer look at the practical dance seminars, one can easily identify inconsistencies in the conceptually intended interlinking of theory, research and practice. However, the subject dance at German universities is factually constrained with the enforced aim of exercising students in dance techniques and skills, and therefore disregarding the scientific claims of a predominant amount of theoretical and scientific theory and reflection.

Key words: dance education; curriculum; higher education; sport science; dance research; dance practice

Dance as a subject within German universities

Studies in dance do not loom large within German universities. Unfortunately, there are no majors (undergraduate studies) in dance or dance pedagogy at German universities at all.¹ Dance as a subject only exists as a peripheral area within majors in theatre science, social sciences, and cultural studies. Thus, one can sadly state that dance is not important within German higher education. Regarding other educational areas, vocational schools and conservatories offer programs related to dance.

For example, the Palucca School² offers two vocational training programs: professional dancer, and dance educator for professionals. Moreover, dance is integrated into conservatory programs of conservatories for music and – self-evidently – conservatories for dance. Due to the fact that vocational schools and conservatories do not belong to higher education, their degrees are of lower status compared to higher education degrees (Kretschmann & Mathis-Masury, 2009).

Dance within Departments of Sport Science in Germany

As already stated, there are rare programs for solely studying dance in German higher education. Therefore, interest in studying dance in Germany at a university inevitably leads to a department of sport science, because dance as a subject is obligatory within the studies of sport science. But it is mostly coupled with rhythmic gymnastics to fuse into one subject. Studying sport science in Germany means studying two different faces of this scientific discipline. On the one hand there is the “scientific” side of sport science, being taught within lectures and seminars, and dealing with usual topics of sport-scientific sub-disciplines (e.g. sport pedagogy, sport psychology, sport medicine, etc.) (Heim, 1996; Lüsebrink, 2003).

On the other hand there are the studies of certain sports (e.g. track and field, basketball, swimming, dance, etc.) (Bräutigam & Brettschneider, 1996; Kuhlmann, 2003; Thierer, 2003). These are being taught at the gym, the natatorium, or the stadium. Within those “practical seminars” students are enforced to be physically active. They have to get exercise *and* learn about the theoretical background of the specific sport in question (Haag, 1996, p. 69). Furthermore, a didactical focus is the conceptual basis of such practical seminars. The main focus is on teaching techniques. The examination at the end of the “dance-semester” consists of a written test and a practical examination (bodily movement). The practical examination guidelines normally are very strict, depending on studying and examination regulations interlinked to the degree aimed for, being hardly changeable by the lecturer. Students usually have to perform selected dance techniques, a given choreography, and/ or an improvisation part. Practical test content depends on the current study conditions by the particular university. However, status, content, and didactical/ curricular position concerning the relationship between the theoretical and the practical section within sport science studies in Germany is not clear. In addition, the theory-and-practice relationship within practical seminars focuses similar constraints. In sum, dance is part of the so called “praxis” section among other sports and therefore features inherent problems within sport science studies: theory vs. practice (“praxis”).

Problem Areas of Dance Education within Departments of Sport Science in Germany

Taking a closer look at those practical seminars within dance in reality, and beyond that ideal concept, one can easily identify inconsistencies in the intended interlinking of theory, research and practice (as physical and exercise practice or experience) (Kretschmann, 2008).

Heterogeneity is obvious: Students aim for different degrees (Staatsexamen³ for becoming a physical education teacher, Diplom⁴, Bachelor/ Master), attending with different skill levels, prior experiences and knowledge, due to missing standardized quality of dance education within school and (obligatory) qualifying examination for the studies of sport science. Hence, the ontological issue, whether dance is a sport, an art, or something in between, is systematically disregarded. Lectures normally do not know the professional reality outside university, what leads to the absence of an interexchange of dance education at universities and dance education in professional training and institutions. The practical section within German sport science studies seems to be a closed world, not interaction with other entities. Moreover, internationalization still needs to come. Striking international literature is not covered and is even not cited within German scientific literature of dance and dance education. The subject of dance primarily reduces on didactical methods of motor learning, by the way not differentiating between different individuals being taught (e.g. students in physical education class or athletes in professional clubs), and not involving theories from sport-scientific sub-disciplines. Thus, a German textbook for dance and dance education and a coherent standardized concept for the subject of dance within sport science are still missing. Regarding modernity, the question arises which kind of dance should be sealed within the higher education curriculum. Should it be Ballet, Jazz, Modern, Hip-Hop, or even Tinikling⁵? Furthermore, the question of canon can also be asked for dance as a part in the studies of sport science. Can or should dance be substituted? Is dance of same worth as basketball, volleyball, etc.? (Kuhlmann, 1996, p. 26). Legitimatization of dance in the higher education curriculum for sport science studies is needed. The examination conditions at the end of a practical seminar are contrary to the vocational fields in which students want to achieve a career. For instance, good teachers have good teaching skills. They do not need to have good skills in motor performance. Therefore, it does not make sense to leave a teaching skills test aside completely. Prospective students of sport science in Germany have to pass an entrance exam. This exam is obligatory and it is a practical exam only. Participants have to pass different motor skills tests in various sports (e.g. track and field, volleyball, soccer, etc.), but dance is only obligatory for women. Furthermore, test conditions vary from university to university. Usually, the required skills in dance do not match most requirements in the studying regulations of the different degree programs. Most lecturers in the praxis section are originally practitioners. Scientific standards, research, and research literature are contradictory to the subjective theories of these lecturers. This leads to a relativization of scientific theory in favor of an individual didactical concept, a so called "praxeology". Moreover, scientific literature and empirical research results are not noticed by the

praxis section. Scientificness therefore is decreased. Unfortunately, the status of the praxis section is regarded much lower than the status of the theory section within German sport science. Normally, associate and full professors do not teach practical seminars. External lecturers are often hired for this "dirty" job. Overbooked courses and decreasing resources are a result of this lower status. Moreover, digital media is not used in practical seminars in general. In sum, study aims are foggy and still not clear. What skills should students have developed at the end of their studies? Motor skills, cognitive and knowledge skills, and didactical and pedagogical skills obviously lead to different directions. An integrative concept for university education within German sport science is still missing.

Conclusion – Research vs. Practice

It seems like the concept of studying dance within the studies of sport science at a German university lacks of coherence concerning with a sophisticated concept of studying-aims of a university itself. The ideal university-course intends students aiming for the abilities of a researcher (e.g. scientific theories, research methods and methodology, research designs and results). However, the subject dance is factually constrained with the enforced aim of exercising students in dance techniques and skills, and therefore disregarding the scientific claims of a predominant amount of theoretical and scientific theory and reflection. The question how to bring theory and practice to a sensible proportion still needs to be solved. At the moment, the notion of theory and practice building opposite poles is set up (Kuhlmann, 1999).

Notes

1. Meanwhile the German Sport University Cologne recently launched a Master-of-Arts program entitled "Tanzkultur" (English translation: dance culture). Additionally, several departments (Performance Studies and Theatre Science) outside sport science have established dance-specific parts within their study program (Siegmund, 2010).
2. The Palucca school is a famous vocational training school in Dresden, Germany, named after the world-famous dancer Margarethe Palucca.
3. The "Staatsexamen" is a special degree that is needed to become a teacher at a German school. The Staatsexamen can be studied for primary or secondary school. The Staatsexamen for secondary school is equivalent to a Master of Education degree.
4. The "Diplom" is an old-fashioned degree that is equivalent to a Master degree. The German higher education system had to change its degree programs from Diplom to Bachelor/ Master by reason of the *Bologna process* (1999). The purpose of the Bologna process is to create a European higher education area by making academic degree standards more comparable and compatible throughout Europe. Therefore, European countries have to change their degree system to Bachelor/ Master.
5. Tinikling is a traditional Philippine folk dance.

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STUDIRANJE PLESA NA NJEMAČKIM UNIVERZITETIMA – ISTRAŽIVAČKO I NASTAVNO PODRUČJE ZAROBLJENO IZMEĐU ISTRAŽIVANJA I PRAKSE

Sažetak

Biti zainteresiran za studiranje plesa na univerzitetima u Njemačkoj neminovno vodi prema odjelu za sportsku znanost. Dakle, ples (često u sprezi s ritmičkom gimnastikom u jedan sadržaj) je obavezan unutar studiranja sportske znanosti. Detaljniji uvidom u plesne seminare, netko bi mogao otkriti nedosljednosti u konceptualnim namjerama povezivanja teorije, istraživanja i prakse. Međutim, predmet plesa na univerzitetima u Njemačkoj je činjenično ograničen forsiranim ciljem vježbanaj studenata u plesnim tehnikama i vještinama, i tako ne uvažava znanstvene ciljeve predominantne količine teorijske i znanstvene teorije i refleksija.

Ključne riječi: plesna edukacija, kurikulum, visoko obrazovanje, sportska znanost, istraživanja, praksa

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BIOMECHANICAL STUDIES OF 110 M HURDLE CLEARANCE TECHNIQUE**Milan Čoh¹ and Janusz Iskra²**¹ Faculty of Sport, University of Ljubljana, Slovenia² Opole University of Technology, Opole, Poland*Original scientific paper***Abstract**

The objective of this study was to establish and analyse those kinematic and dynamic parameters which to the largest extent generate efficient hurdle clearance technique as one of the most important factors of performance of hurdlers in the 110m hurdle event. Test runs from starting blocks with the clearance of five hurdles, set in accordance with the competition rules, were carried out on a sample of four male hurdlers. Kinematic analysis was performed by the use of a 3 - D Ariel video system. The dynamic parameters of the take-off and landing of hurdle clearance were determined by means of Kistler force platforms. It was found that efficient hurdle clearance technique is generated by the following factors: contact time of take-off, an optimal ratio of the braking phase to propulsion phase of take-off, the ratio of the point of take-off to landing relative to the hurdle, flight time, short braking phase in landing, high position of the centre of gravity (CG) at landing and minimal reduction in the horizontal force of the CG at landing.

Key words: 110 m hurdle clearance technique, kinematic, dynamic, model

Introduction

The high hurdles are among the technically most demanding of track and field events. According to some researches carried out so far (Schluter, 1981; Mero & Luhtanen 1986; La Fortune, 1988; McDonald & Dapena, 1991; Dapena, 1991; McLean, 1994; Kampmiller, slamka & Vanderka, 1999, Iskra & Čoh, 2011), the hurdle clearance technique is one of the key elements defining the competition result. From the aspect of biomechanics, hurdles are a combination of cyclic sprinting and acyclic clearance of ten 1.067m hurdles. The hurdler must thus possess a high level of sprinting abilities, special flexibility at the hip joint, fast strength, and a high level of technical knowledge.

During clearing the hurdle, the loss of horizontal velocity must be as small as possible; however, this depends on numerous factors, especially those which define the take-off before hurdle clearance, the trajectory of the movement of the CG, and the landing after hurdle clearance. For efficient hurdle clearance, the point of the take-off and the point of landing of hurdle clearance are important. The correct position of these two points is a prerequisite for an optimal trajectory of the flight of the CG and reflects in the flight time which must be as short as possible (Schluter, 1981; Dapena, 1991; Grimshaw, 1995). In addition to the correct position, the kinematic-dynamic structure of take-off and landing which directly affects the velocity of hurdle clearance (La Fortune, 1988; McLean, 1994; Iskra, 1995) is also important. Therefore, the objective of the present study was to establish, by combining a 3 - D kinematic analysis and the method of measurement of ground reaction forces, those most important parameters which generate the most efficient hurdle clearance technique.

Methods

Biomechanical analysis was performed on a sample of four male athletes, whose average age was 23.5 ± 5.06 years, average body height 184.72 ± 1.53 cm, and the average weight 80.4 ± 5.84 kg. The mean result in the 110m hurdles was 14.63 ± 0.59 sec; the best result was 13.90 sec. The measurements were carried out on a track-and-field stadium with a tartan ground. According to the protocol, each athlete carried out three runs from starting blocks with the clearance of five hurdles, set at standard race distances from the start. The kinematic and dynamic analysis of the technique were performed at the fourth hurdle. A 3 - D kinematic system ARIEL (Ariel Dynamics inc., USA) with two mutually synchronised digital cameras SONY DSR, operating at a frequency of 50 Hz and placed at an angle of 90° with respect to the object filmed, were used to establish the kinematic parameters. Analysed were the stride before hurdle clearance, the hurdle clearance, and the stride after hurdle clearance. To measure the ground reaction forces during the take-off and landing of the hurdler, force platforms KISTLER 9287, covered with a tartan layer and mounted at the same level as the track, were used. The vertical and horizontal ground reaction force data for the take-off and landing were collected at a frequency of 1000 Hz (Figure 1, 2). The quality of the technique of clearing the fourth hurdle was measured with a set of infra-red photocells, placed at a distance of 5 m before and 5 m after the hurdle.

Results and Discussion

The result in **Table 1** show us the basic kinematic and dynamic characteristics of hurdle clearance. The speed of the hurdlers in the zone of hurdle clearance was $7.54 \pm 0.2 \text{ m.s}^{-1}$.

Table1: Kinematic and dynamic parameters of take – off phase (hurdle 5)

Parameters	Unit	Subject A	Subject B	Subject C	Subject D	Mean	SD
Rhythmic Units (Hurdle ± 5 m)	m.s ⁻¹	7.87	7.35	7.51	7.40	7.54	0.23
Take – off (braking phase)							
Horizontal velocity of CM	m.s ⁻¹	8.25	7.45	7.26	7.47	7.61	0.44
Vertical velocity of CM	m.s ⁻¹	0.05	-0.02	-0.45	-0.61	-0.26	0.32
Velocity resultant of CM	m.s ⁻¹	8.26	7.45	7.28	7.51	7.63	0.43
Braking time	s	0.79	0.78	0.89	0.83	0.82	0.05
Braking time %	%	59.8	58.2	60.5	58.1	59.15	1.19
Peak horizontal force	N	-1681	-1589	-1798	-1801	1717.25	102.14
Peak vertical force	N	3641	4056	3203	3475	3593.75	357.16
Take – off (propulsion phase)							
Horizontal velocity of CM	m.s ⁻¹	7.88	6.88	6.64	7.38	7.20	0.55
Vertical velocity of CM	m.s ⁻¹	2.26	2.14	2.41	2.26	2.27	0.11
Velocity resultant of CM	m.s ⁻¹	8.20	7.20	7.06	7.72	7.55	0.52
Height of CM	m	1.21	1.20	1.21	1.19	1.20	0.01
Foot to hurdle distance	m	2.36	2.27	2.32	2.27	2.31	0.04
Contact time	s	0.132	0.134	0.147	0.143	0.139	0.01
Propulsion time	s	0.53	0.56	0.58	0.60	0.57	0.03
Propulsion time %	%	40.2	41.8	39.5	41.9	40.85	1.19

Table 2: Kinematic and dynamic parameters of landing phase (hurdle 5)

Landing (braking phase)	Unit	Subject A	Subject B	Subject C	Subject D	Mean	SD
Horizontal velocity of CM	m.s ⁻¹	7.65	7.21	7.10	7.39	7.34	0.24
Vertical velocity of CM	m.s ⁻¹	-1.72	-1.81	-1.73	-1.53	-1.70	0.12
Velocity resultant of CM	m.s ⁻¹	7.85	7.44	7.31	7.56	7.54	0.23
Foot to hurdle distance	m	1.28	1.39	1.19	1.42	1.32	0.11
Braking time	s	0.17	0.48	0.14	0.14	0.23	0.17
Braking time %	%	17.4	39.1	11.6	12.3	20.10	12.93
Peak horizontal force	N	-678	-1179	-824	-845	-881.50	211.78
Peak vertical force	N	2867	3304	2477	2569	2804.25	372.43
Landing (propulsion phase)							
Horizontal velocity of CM	m.s ⁻¹	7.97	7.32	7.39	7.59	7.57	0.29
Vertical velocity of CM	m.s ⁻¹	-1.31	-0.51	-0.77	-0.74	-0.83	0.34
Velocity resultant of CM	m.s ⁻¹	8.09	7.34	7.39	7.59	7.60	0.34
Contact time	s	0.098	0.123	0.121	0.114	0.114	0.01
Propulsion time	s	0.081	0.075	0.107	0.100	0.091	0.02
Propulsion time %	%	82.6	60.9	88.4	87.7	79.90	12.93

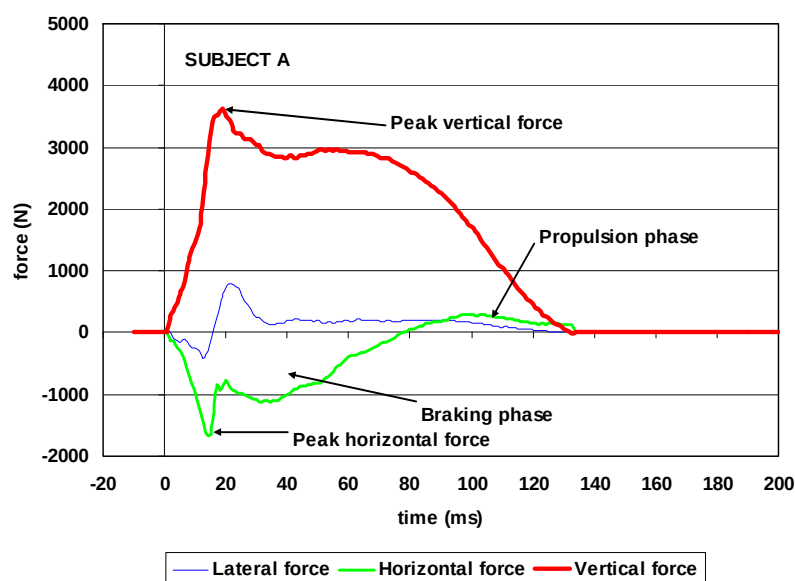


Figure 1. Force diagram of the take-off phase - hurdle 5

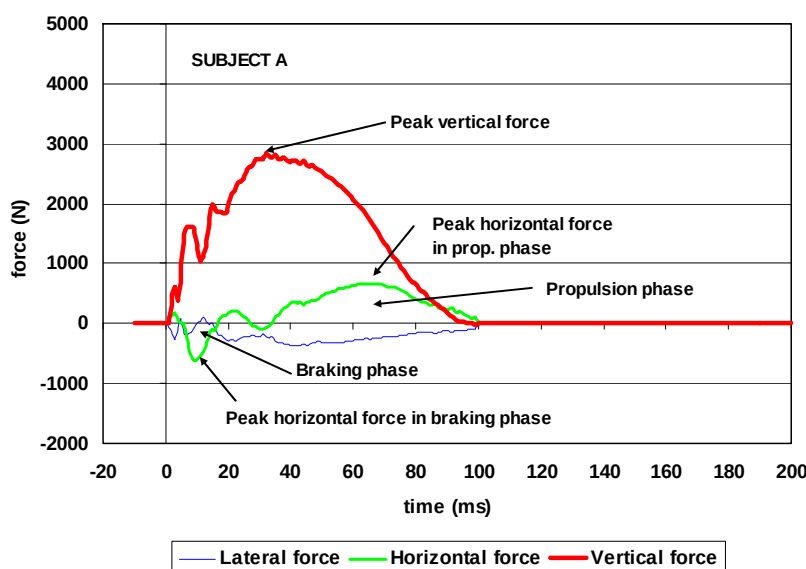


Figure 2: Force diagram of the landing phase –hurdle 5

During take-off the horizontal velocity of the CG decreased in the braking phase by $0.41 \text{ m}\cdot\text{s}^{-1}$, while at the same time the vertical velocity in the propulsion phase increased to $2.53 \text{ m}\cdot\text{s}^{-1}$, which is the consequence of the requirement to raise the centre of gravity over the hurdle. The change in the relationship between the horizontal and vertical velocity is associated with the dynamic parameters of take-off. The braking phase lasts 59 %, and the propulsion phase 41 % of the total contact time. The total time of the contact phase of hurdlers in front of the hurdle is $0.139 \pm 0.01 \text{ s}$.

Similar values of take-off parameters were established in the study by McLean (1994). In the braking phase, defined with the centre of gravity to foot distance = $0.50 \pm 0.08 \text{ m}$, the hurdlers develop a peak horizontal force of $-1717 \pm 102 \text{ N}$ and a peak vertical force of $3593 \pm 357 \text{ N}$, which represents 4.5 times their body weight. The primary reason for the reduction in the velocity of centre of gravity is thus the horizontal vector of the ground reaction force acting in the direction opposite to the direction of the movement of the hurdler. An efficient execution of take-off in front of the hurdle has also a direct effect on the efficient trajectory of the movement of the CG, which is expressed in the height and time of the flight of the hurdler. In athletes of our sample, the flight phase lasts $0.395 \pm 0.01 \text{ s}$, and the fastest athlete (subject A) has also the shortest flight time 0.38 s . In addition to the magnitude and relationship of the forces which the hurdler develops during take-off, the foot to hurdle distance = $2.31 \pm 0.04 \text{ m}$ is important for the definition of an efficient trajectory of the centre of gravity. This distance is individual and is associated with the morphological characteristics of the hurdler and with the take-off angle = $71.6 \pm 1.37^\circ$. In our hurdlers, the total length of the stride over one hurdle is $3.64 \pm 0.15 \text{ m}$. The landing occurs at $1.32 \pm 0.11 \text{ m}$ from the hurdle.

With respect to the results of the studies (La Fortune, 1988; McLean, 1994; Mc Farlane, 1994; Salo, Grimshaw, 1995; Kampmiller et al., 1999), the optimal ratio of the take-off to landing point is 65 % : 35 %. In our study we obtained almost the same result. The ratio of the take-off to landing is 63.7 % : 36.3 %. In subject B, who attained the worst result, this ratio is 62.0 % : 38.0 %. For the fastest hurdler (subject A) we found that he has the largest foot to hurdle distance of 2.36 m (64.9 %), the shortest landing to hurdle distance of 1.28 m (35.1 %), the smallest take-off angle = 71.0° , the consequence of which is a low position of the centre of gravity over the hurdle (0.33 m) and thus a short time of flight phase - 0.38 s . For efficient hurdle clearance technique, the landing phase is equally important (Figure 2, Table 2). A poor technique in performing this component, of which a long contact time and a large percentage of braking time is characteristic, results in a large loss of the horizontal velocity of the hurdler (La Fortune, 1988; Dapena, 1991; Salo & Grimshaw, 1997; Jarver, 1997). The landing technique differs significantly from the take-off technique. The braking phase lasts only 20 % of the total contact time which amounts to $0.114 \pm 0.01 \text{ s}$. This means that the athlete must place the foot as close as possible directly beneath the body's centre of gravity at landing. In top hurdlers, the braking phase lasts only 9 - 10 % of the contact time (Schluter, 1981; McLean, 1994; Bowerman et al., 2009). The fastest hurdler in our experiment (subject A) has also the shortest contact time of 0.098 s and uses only 17 % of this time for braking. In the remaining propulsive part of the contact time, he increases the horizontal velocity of the centre of gravity by $0.32 \text{ m}\cdot\text{s}^{-1}$, which is the highest value among all athletes who participated in the experiment. The hurdler who attained the worst time in the zone of hurdle clearance (subject B) has the longest contact time of 0.123 s , and uses even 39 % of this time for braking.

The peak horizontal force attained by the athletes in our sample in the braking phase is -881 ± 211.7 N, and the peak vertical ground reaction force is 2804 ± 372.4 N. This data points to a large vertical impact force which the hurdlers can sustain by correctly placing the leg which must be fully extended. In addition to the correct technique, the ability of the muscular system to resist fast stretching - stiffness is important in this case. Stiffness as a neural mechanism of muscle action depends above all on the preactivation of the muscles and action of the reflexes: myotactic reflex and Golgi tendon reflex (Gollhofer & Kyrolainen, 1991; Komi & Gollhofer, 1997; Enoka, 2003).

With respect to the biomechanical characteristics of landing, short-range elastic stiffness is characteristic, where an immediate mechanical response of the activated muscle to the eccentric contraction in the braking phase of landing is involved. The criterion of efficiency of the execution of this phase is the height of the CG in the braking phase and it is 1.23 ± 0.03 m. The height of the CG in the phase of landing depends, of course, also on the morphological characteristics of the hurdlers, especially their body height. The best athlete (subject A) managed - despite the fact that he has the smallest body height in the experimental sample (BH = 183.4) - to maintain the highest position of the centre of gravity after landing and the largest horizontal velocity of 7.97 m.s^{-1} . The landing phase is important above all from the aspect of the transition from hurdle clearance into sprinting to the next hurdle.

In the athletes of our sample, the horizontal velocity in the braking phase of landing is $7.34 \pm 0.24 \text{ m.s}^{-1}$, which indicates that in the phase of hurdle clearance, the horizontal velocity decreased only by 0.27 m.s^{-1} , from which we can conclude that the level of efficient hurdle clearance technique is high.

Conclusion

On the basis of the results of the present biomechanical study we can establish that the execution of take-off and landing defines the degree of efficiency of hurdle clearance, which undoubtedly an important factor is determining the competition results of athletes in the 110m hurdles event. The time relationship between the braking phase and propulsion phase is completely different in take-off and landing. The function of take-off is to ensure suitable transformation of the horizontal velocity of the CG into the vertical velocity.

The horizontal velocity decreases, and the vertical velocity increases due to the change in the direction of the movement of the CG. In the landing phase, which is one of the most important components of the technique, the contact time and the braking phase of the contact time must be as short as possible in order to maintain the horizontal velocity of the CG while clearing the hurdle. The efficiency of hurdle clearance is also defined by the take-off angle, the correct ratio of the foot to hurdle distance in take-off and landing, flight time, and the height of the centre of gravity over the hurdle.

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BIOMEHANIČKA ISTRAŽIVANJA TEHNIKE KVALITETE PRELASKA PREPONE U TRČANJU NA 110 M

Sažetak

Svrha ovog istraživanja je bila utvrđivanje i analiza onih kinematičkih i dinamičkih parametara koji u najvećoj mjeri generiraju efikasno razriješenje preponske tehnike kao jedan od najvažnijih faktora u izvođenju trčanja na 110 m prepone. Test, izvođen iz startnog bloka s praćenjem 5 prepona postavljenih u skladu s pravilima natjecanja, proveden je na uzorku od četiri atletičara. Kinematička analiza je provedena korištenjem 3-D Ariel video sistema. Dinamički parametri odraza i doskoka na prelasku prepone utvrđeni su korištenjem Kistler platform snage. Dobiveno je da je efikasna tehnika prelaska prepone generirana od slijedećih faktora: kontaktno vrijeme odraza, optimalni odnos kočione faze prema propulziji odraza, odnos točke odraza prema doskočnoj relativno u odnosu na preponu, vrijeme leta, kratko kočenje kod doskoka visoka pozicija centra mase (CG) kod doskoka i minimalna redukcija horizontalne sile kod CG doskoka.

Ključne riječi: 110 m prepone, tehnika prelaska, kinematika, dinamika, model

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EQUESTRIAN REHABILITATION. "THE BENEFITS OF APPROACH WITH THE HORSE IN SCHOOLS AND IN THERAPEUTIC"

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Review paper

Abstract

Those who work in the sports world knows that one of the deepest concern by parents is to find the sport more suitable for their children. Normally, we try a sport "complete" and the question most often asked is what is the sport "most comprehensive" ever. Obviously, the answer is given in these cases is that there is a sport, really, absolutely complete, since any physical activity, when it is transferred to a specialist, the practitioner promotes certain characteristics at the expense of others. Popular culture sees in the swimming discipline that best meets the needs of sports' all-inclusive ", but a closer examination, it is clear that even swimming can acquire this title, because, for example, does not intervene on important quality such as' ability to coordinate the body with respect to the surrounding space, the proprioception, the ability to jump, run or throw objects and the ability to socialize and work together with others towards a common goal.

Key words: *start-up, racing, auxology, psychology, social learning, hippotherapy*

Introduction

Those who work in sports world knows that one of the deepest concern by parents is to find the sport more suitable for their children. Normally, we try a sport "complete" and the question most often asked is what the sport "most comprehensive" ever. Obviously, the answer is given in these cases is that there is a sport, really, absolutely complete, since any physical activity, when it is transferred to a specialist, the practitioner promotes certain characteristics at the expense of others. Popular culture sees in the swimming discipline that best meets the needs of sports' all-inclusive ", but a closer examination, it is clear that even swimming can acquire this title, because, for example, does not intervene on important quality such as' ability to coordinate the body with respect to the surrounding space, the proprioception, the ability to jump, run or throw objects and the ability to socialize and work together with others towards a common goal. But then, what sport to choose and at what age to begin the start-up sports? First you need to know if the request comes from physical activity organized by the child or parent. Often, the child simply shows a strong and natural desire to move, while the parent is the desire to enroll in a course rather than another, perhaps for reasons of convenience in the organizational family. To give the first indication is that the child should have fun doing what he does. Enroll in a course, even prestigious, where, however, the small pupil is not at ease, it is certainly harmful. Since schools usually start small sport accept beginners aged five and up, our analysis will consider the age group of between five and seven years. In this period of growth, the child has strong motivations to sport. When a passion for motor activity, of course, in the form of play and fun, he showed a commitment and highlights the presence of a concrete motive and dominant. Probably, the two primary factors that act as spring are the game and the players, as well as other secondary factors.

In particular, we should not underestimate the competitive spirit, which translates into reality, a symbolic level, the person needs all-natural, at this age, linked to aggression, self-assertion, the interaction with reality. The competitive spirit, then, being a factor compensation, balancing and liberating, if you lived in an organized, managed by an instructor trained and controlled properly, acts as a decongestant psychic, mental and emotional growth fostering of 'student. The sport with sporting events, therefore, may not solve, but it helps to work on individual needs and anxieties of the child, and to promote its inclusion "social". The so-called secondary factors alluded to, are probably more important in boys and 'no adult in the child, in fact, can be attributed to variable factors related to communication, projective, cathartic - liberators, aesthetic, affiliates, conformist, economic -social, if not neurotic anxieties to reactive, compensatory forms, related to 'sexual identity. They can, however, also appear in this age, when, for example, the child "feels" strongly that the parent wants to practice a certain activity that he does not want to disappoint him, and, if not the passion. Enrolling a child in a course of introduction to the sport, therefore, also means acting on his mental development, as well as on the physical. The sport long, in fact, has an effect on personality, as demonstrated, for example, that can act on any obsessive behavior, or attitudes of coarctation emotional histrionics. The important thing is that more activity is proposed, both by parents and teachers as something fun, that "it is nice to do" to avoid athlete's symptoms of psychopathology, demonstrating that sport, in some its excesses, it is always good, such as, for example, fear of failure syndrome. This is a kind of anxiety pre-competitive, with a complex psychic and somatic symptoms. While the athlete is training and working adults depending on the outcome, this must not happen for the child and the young.

Among other things, this is not only wrong, obviously, on an ethical and social, but also functional and specialization: a great specialist of tomorrow, in fact, must now be a child who likes to play sports and growing balanced and rich in motor experiences. He has no reason to be, therefore, the fear of some parents that their child can not become a champion if you do not begin to specialize at an early age. It is closer to the truth quite the contrary. However, it is important that as a child to acquire various experiences of movement. Stress should be avoided at all costs competitive: an athlete must have a mature psychological charge that do fight to the end, in the race against his opponent, even if it's his best friend. In a child, however, this would mean a whole load of pressure affective environment: parents, coach, friends that he keeps. The anxiety may be greater than the pleasure of the sport. That's why the specialization is delayed as much as possible. For further confirmation, here are the famous "Table Filin" indicating those that were the young age of admission of the Soviet Union in sports schools. Age Sport 7-8 swimming, figure skating, gymnastics, tennis 8-9 Acrobatics, Gymnastics, diving, cross country skiing 10-11 Figure skating, rowing, basketball, hockey, soccer, volleyball Athletics 11-12 (excluding throws), shooting, horse riding 12-13 boxing, cycling, athletics, heavy 13-14 Launch of Athletics The ages shown are those in which the young students were trained in a specialized sport. Even from these data we can extract arguments to reassure parents about the fact that for children aged between five and seven years is not, absolutely, should be identified already a specialized curriculum. Needs of children and factors of choice. Said that, let's now in the role of conscientious parent, realizing the importance of a healthy physical and psychological bodily activity for the child, is in their hands three or four leaflets of sports clubs and centers of introduction to the sport and must choose which course to enroll. To give you some advice we need to understand what needs a child aged between five and seven years. The environment of origin should first take into account the environment of origin of the child. In rural areas, there may be no problems that exist in an urban environment where children sometimes are literally deprived on the way - Motor: countless hours spent watching television or the computer or video games to, confined spaces and monotonous, the 'unnatural interdiction motor, produces strong deficiencies in motor skills, which must be retrieved by the teacher sport. This, however, can not occur by means of gymnastics or sports ritualized repetitive little cognitive content, such as swimming, when practiced in a traditional way, but through different programs, continually enriched sense of fun and extremely varied. In contrast, a child who at five years to climb trees and play 'with their peers has opened such a gap to recover. The factors chosen according to the CONI: CONI in Italy, when drawing up programs for start-up centers to sports for children of both sexes between 5 and 7 years, provides that, in this age, the 'sport is oriented for

"physical - training," pausing 's attention on four key points that describe the characteristics and needs of children in various age groups: 1. The factor auxological; 2. The psychological factor - social; 3. The structuring of the basic activities of motion; 4. The mode of learning.; Let's look at the characteristics of each of these: 1. The factor Auxologico: Between 5 and 6 years, the child c 'is the first extension, which consists of a boost in length and mostly affects the osseous system, rather than the muscle that focuses, above all, in the legs. It happens, therefore, the skeleton weight gain, bone levers to stretch without there being, however, a change in muscle strength. The spine may tend to curl, giving rise to attitudes such as kyphosis and scoliosis, especially when the development is not symmetrically placed on the left side and on the right side of the body. From 7 years, increased breathing capacity, therefore, the spine and rib cage suffer, especially if there is no 'adequate physical activity. From 8 years, however, c 'is an increase in body mass and muscle strength, which, if wisely guided, leads to compensate for the shortcomings of previous periods. 2. The psychological factor - social: It is not possible to summarize accurately the psychological characteristics of the pupils of this age, because there are significant differences between each of the three ages and still, scientific research does not give answers that could be construed as final. In five years, the child still suffers the process of identification with the parent of the same sex, while being aware of its diversity and body. There is, however, a moral and emotional dependence on adults. The play between children of this age, which is the main way in which social behavior occurs, is characterized by constant quarrels and physical assaults, possibly violent, but short-lived. The ongoing process, however, leads to type more associated attitudes, all 'inside of which the children play and act to achieve the same purpose. From 6 years, however, begin to be significant progress in the 'acquisition of the awareness of your body and your psyche. Also begins to understand how others see him and judge him, therefore, requires others to be respected and be taken into due consideration. Responds to the rewards and reprimands. The seven-year manifested a great interest in her body and likes to explore the features and capabilities. His social skills and increases slowly, tend to decrease egocentric. At eight years, finally, increases and becomes quite clear the need by the child, self-realization, even in the adult role models gives. 3. The structuring of the basic activities of motion: The child goes through, slowly and throughout the 'arc of' school age, a neurophysiological process of evolution, called "domination", which means that, usually, the left side of his body has support functions, support and defense, while the right has functions of attack, momentum and offense. This process originates and evolves from the hand, then, around the side of the body, up to the so-called "lateralization", ie the division of the nervous control of the two halves of the body. No lateralization was not able to do, effectively, athletic movements.

The lateralized child is born, but becomes so on the basis of the maturation of the nervous structures, and until she reaches her body image and 'efficiency of his movements will be inaccurate. 4. The modes of learning: Be advised that not always the motor learning, by imitation, it is useful and profitable for the child. The student, in fact, can perform the gestures engine only if, previously, has been afforded an opportunity to have learned motor experiences simpler and more elementary. The 'learning of each gesture can be impossible if the first child has not learned the simplest gestures that serve as "building blocks" to build the most complex. Thus, the traditional process of teaching the gestures engines "prove" - "to do" - "fix" could not be more correct, because charges could lead to situations of anxiety or frustration. The task, then, is to route the 'student on his way to a good running motor so that the child acquires mastery of gestures i. From the five years, therefore, the motor learning should always be gradually and encouraging individual expression and spontaneous, joyful and playful form. Children learn from their mistakes. An important feature of the teacher, therefore, must be not to point out the error and correct it, but to stimulate the capacity of self-correcting 'students by including motivators' s attention and repetition, to avoid the child, overwhelmed from 'failure or frustration and rebuke, to retract from repeating the experience. The perfect sport The sporting ideal, therefore, is that:

- It is managed by a teacher who knows these four elements;
- It is organized according to these four factors.

Material and methods

It is well known, always, because, already, the Egyptians and the Greeks had in their traditions, that 'riding brings with it a number of charitable feelings: it produces a sense of independence, provides acoustic stimuli, visual, tactile and olfactory particular, stimulates the attention and will, strengthens the sense of self, induces feelings of respect and collaboration as well as a lot of vibration and affective thymelogs. Due to these considerations is almost self-evident that a "good ride" is good for everyone, from children to old and may be useful to improve conditions such as listlessness, decreased mood, vague anxiety, psychasthenia, and neurotic insights. Speaking of horses, we must also stress that: The movement in three directions, and sinusoidal space may be useful in cases of muscular and motor deficits (especially of the trunk and neck), in situations ranging from neuromuscular paraplegia to actual paralysis, spasms, disharmony and clones; - The 'horse riding can also be a great way to turn on interpersonal relationships, to friendships and knowledge, to expand consciousness and one's self to the future, planning, vitality and life. It is clear that these benefits can be obtained if the rider has a functioning psycho - mental and psycho - motor, as well as an appropriate affective attitude (respect) toward you, toward the animal and also to the natural environment or the handling.

Very different is the situation when the rider is not cooperating, is passive, distracted, apathetic or even oppositional. In these cases, we speak of pathology and therefore the speech of horse that is good for purchases of all particular values. We can refer to when: the horse-riding behavior is entirely passive or like that of libidinal stimulation (auto-erotic). This is observed in cases of autism or developmental disorders, as well as in many diseases such as Down syndrome, cerebral palsy, in all forms psycho - pathological in which may be evidenced by an operating state I - weak.

In these cases, you should carefully consider the possible consequences because the stimuli can induce worsening regressive behavior, but, above all, enhance the development and deficits lead to the development of a chronic irreversible deficits: - The 'equestrian activity can induce neuromuscular stimulation - psychic capable of activating epileptogenic foci, the crisis of opposition and aggression, moments of self - marginalization and isolation. From these considerations, it is clear that we must differentiate very precisely, the 'fun to ride as a practice - which has recreational, increasingly, its positive aspects, facilitators and able to "feel good", since the use of horse for therapeutic purposes and / or rehabilitation (also consider that a ride is beneficial, almost never, structured as continuous as it is instead a hippotherapy). In the case of rehabilitation by means of the horse, it is clear that the 'exercise should be practiced under control, with the help of therapists who are mostly doctors, psychologists, psychotherapists, educators who have specialized nell' hippotherapy. .With these characteristics, the use of the horse becomes, based on decades of experience, a practice of "alternative medicine", capable of inducing not only improvements, but also functional and global recoveries or even overcoming those deficits which may underlie disability and / or disability. From these observations, it is clear that one must distinguish the pet - from equestrian rehabilitation therapy because this activity is designed to encourage improvements and / or cures in many cases of mental disorders - physical and mental - mental. If a doctor or a neurologist can advise in cases of hippotherapy: - Osteoarthritis in its early stages; - Mild dysplasia of the hips; - Results from trauma head - cerebral; -

Paraparesis with spasm and / or clones; - Varying degrees of scoliosis, And 'in the face of developmental psychopathology and regressive to those that accompany other diseases that rehabilitation by means of the horse, its enormous therapeutic possibilities. In all these cases, the 'horse therapy must be applied together with a specific therapy and rehabilitation programs because only a global integrated planning, multi-disciplinary monitored and was able to lead us to overcome the disability. This is all the more confirmed by the fact that in many cases, the boys have recovered completely: - The educational prerequisites and then, they have developed up to their potential to re - consider entirely normal;

Application and volitional capacities that have allowed the 'integration into football teams and / or volleyball team; - The quality competitive enough to be entered in equestrianism (of gymkhana and jumping) with significant results because on several occasions exceeded the normal size peers - with; -

The values necessary to participate in walks of country and require long-term desire, strength, endurance of fatigue, ability to overcome obstacles large and small also unexpected; - The potential global personological (affective, cognitive, adaptive, problem solving, behavior control), which led us to program the "free school cadet instructors." These achievements are the result of chance or of fairy tales, but the progress made by our boys with hard work, application and self-criticism. They have also been disclosed and discussed with parents, teachers, psychologists, child psychiatrists, and all interested parties, who have participated in conferences, radio and television programs and even developed in two World Congresses on the Internet.

The benefits of the factors' riding (application play - train) and enjoy its lulling pace (fun application - recreational) are clearly demonstrable as well as numerous including: - Strengthening muscle tone and coordination of movements; - Stimulate attention and kept on task; - The need to learn the orders to be transmitted accurately to the animal; - Firmness in making decisions; - The courage to face difficult situations and unforeseen; - The need to know how to orient themselves in space, time and speed; - Need to store in exactly the strategies to extricate themselves from situations from the tax; - Increase the balance. Even in the "groundwork" (care for the needs of the animal), the rider must develop important qualities such as: - Recognize the needs of 'other and respect its idiosyncrasies; - Pay attention to their movements, their own actions they can also cause unpleasant reactions; - Learn to use well-coordinated movements and precise; - Be able to devote himself to 'a more accommodating attitude of help; - Understand the need to invest in the welfare of the 'other to gain advantage; - To reach a self-confidence.

We must not forget, then, the benefits to be derived from the actual ride: - See the world from a 'different perspective temporo - spatial and helps to broaden one's conscience; - Know how to gain visibility is also able to observe and be seen on the other; - To experience feelings of satisfaction in reaching the goals mediated by the guide of the horse; - Understanding of being able to also address the unpredictable behavior of the "buddy" who is still an animal; - Learn tolerance as well as the necessary will to achieve their goals; -

Understand how a particular goal can be achieved only by collimating and coordinate their movements with those of the "right horse"; - Recognize the need to live in the here and now, leaving aside speculations, fantasies, reveries and distractions

dangerous; - Discover the true meaning of psychic equilibrium and ability to orient themselves in space and time, as well as the metaphor that he wants the shortest route is almost never a straight. It is evident that all these observations lead one to conclude that the horse, as a whole, can be very useful for restoring and improving the sense of relationship with oneself is essential to know how to govern their bodies and develop their minds. All these benefits are, however, reached only intervenes when the leadership of the human mind, which knows how to choose, plan, design, promote, guide, provide, enhance, desire, want, etc....

When the rider is a "normal" person, ie, their mental capabilities - active and mentally intact, is his mind which creates efficiency and effectiveness; very different is the theme, when the rider does not have all the qualities necessary to "create" the benefits of going on horseback. The issue of disability (especially temporary) requires the "need for the therapist" (in this case, of 'hypnotherapist) who must be wary of: - Observe the emotional dynamics of the horse and rider; - Consider setting offered by the operational situation (soil type, light intensity, quality of stimuli such as music accessories, participation of the auxiliary, etc.). - Provide the quality and quantity of each intervention; - Read the emotional changes - and consider the child's emotional responses of the horse, - Choose the appropriate horse for the personal situation of each patient; - Determine at any time the type of practical application (speed, intensity, complexity of the exercises) in relation to the objectives, the couple's real possibilities rider - horse, alertness and commitment demonstrated by the child; - Decide if you need to get on the horse with the little patient when it is small (even pick him up, if necessary) or when it is necessary to transmit a "concrete thinking"; - To live each therapy session with a calm attitude, relaxed, engaged, characterized by stimuli seductive, soothing and pleasant, however, always aimed at the therapeutic outcome. - Use any time during therapy to proceed to a careful analysis of situations and to 'constant adaptation of interventions to achieve the objectives.

As highlighted underlines how important the work of therapists who have: • lavish care and therefore, know what and how are the interventions that, through the horse, can be applied to solve problems of posture, balance, motor deficits, limitations of bone - joint; • understand the needs, anxieties and desires (through a subtle observation of attitudes) to achieve the targets, using instinctive stimulus to growth and development of psycho - affective; - Create a pleasant setting, a constant balance between the fun - recreational and therapeutic - rehabilitation; • be an educational center for the 'student purchasing behaviors, more appropriate and correct, so that he can feel "happy" entered, not libidinal impulses - instinctive (childhood), but, deductive cognition; • prepare the horses for a delicate, precise and continuous use knowing the compounds most suitable food and

doing "bucking" the fiery steeds and lead then to an exact level of operational capability; • assume the role of instructor to obtain a correct riding posture on the horse, the exact temporal disengagement maneuvers - Space, the maximum integration between rider and horse. From our observations, it appears that it is risky to refute expressions and false and it is also important that you do not create confusion on the positive results that can be obtained with hippotherapy. The horse therapy or rehabilitation by means of the horse are of a technical "alternative medicine" that must be applied by skilled professionals and also (it is always desirable) in a multidisciplinary intervention system. We must, always, keep the goals offered by well-differentiated offering an equestrian activity: a) whether it should be fun - recreational, pre - recreational or sporting purposes only has a nice, psycho - physical and if you will, to improve the quality of life; b) if you want to ride in the spirit of a disabled pet - remember that moments regressive therapy (autoerotic instinctive or libidinal), although they are nice (this is beneficial in cases of serious illness and / or non-recoverable), can be very detrimental if applied (especially if in a regular and continuous basis, capable of creating "libidinal expectations") in children or young people who have symptoms referable to a I - weak or a delay - developmental arrest psycho - mental. In these cases, hippotherapy is integrated with other rehabilitative interventions to produce recovery and / or care, taking into account that "... there is no time to lose! "; c) if you want to do therapy or rehabilitation, we must choose centers, programs and therapists prepared, trained and follow the criteria of medical treatment, prognosis, careful evaluation of the results obtained in connection with the purposes considered in planning.

Conclusion

When you proceed to apply a scientific hippotherapy has the prerogative to be a technique of alternative medicine-type rehabilitation (functional and global), we must think of a child or a young man who exceeds, with the help of her therapist, the dynamics regressive (though nice), happy to "let yourself go," look for their emotional pleasure - instinctively (characteristics of the pet - therapy). In rehabilitation, a disabled person begins to regain a sense of self, supported by a "secondary narcissism" is an expression of 'entry into operation of the so-called "Name of the Father", a prerequisite for overcoming the oedipal dynamics and to conquer one's self. We will see that these children take the reins and begin to drive their horse with increasing security, tackling trot, canter, turns, jumps, and Gymkhana. If from a psychological point of view, we emphasize: - Containment of emotional shock; - Development of behavioral and affective thymologies - Development of processes related to the visibility; - Neglect of the needs of the symbiotic type binding; - Overcoming the stigma of regressive 'omnipotence of' self-centeredness; - Acquisition of values related to the emotional generosity, sharing, to 'altruism and gratitude; - Perhaps the adaptive re-uniting of 'I'; - Organization of the dynamics of the self; - Quality of the learning problem - solving skills; - Recovery of higher analytic functions - deductive, however, high in the practice and behavior, discover the thrill of finding subjects, individuals, people-friendly, integrated, able to express their needs, but also to defend their rights; rejoice with their parents for being able to go a fraught and difficult, but at last light, projected into the future, the true well-being, happiness, and pervaded by the certainty that "together we can."

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REHABILITACIJA JAHANJEM. "KORISTI OD PRISTUPA S KONJEM U ŠKOLI I TERAPIJI"

Sažetak

Oni koji rade u sportu znaju da je jedna od najdubljih briga roditelja da pronađu sport koji najviše odgovara njihovoj djeci. Uobičajeno, mi promatramo sport "cjelovito" i pitanje koje se dosta često postavlja jest koji je sport uvijek najbolji. Očito, u ovom slučaju odgovor je zadan da je taj sport, zaista, posve cjelovit, prije bilo koje tjelesne aktivnosti, kad se prenese specijalisti, praktična promocija određenih značajki na teret ostalih. Popularna kultura vidi u plivačkim disciplinama da one najbolje zadovoljavaju potrebe inkluzivnog sporta, ali pobliže promatranje jasno pokazuje da nije sve baš tako jednostavno, jer iako plivanje može ponijeti ovaj naslov, ali zato što npr. ne intervenira u važnost kvalitete kao što je sposobnost koordiniranja tijelom uz respekt prema okolini (mediju), ono što jest važno jesu propriocepcija, sposobnost skoka, trčanja ili bacanja objekata i sposobnost socijalizacije i zajedničkog rada s drugima, a to je možda i primarni cilj.

Ključne riječi: početak, utrke, auksologija, psihologija, socijalno učenje, hipoterapija

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COMPARATIVE ANALYSIS: SUPPORT FOR STUDENT - ATHLETES AND THE GUIDELINES FOR THE UNIVERSITIES IN SOUTHEAST EUROPE

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Review paper

Abstract

Multitude of different studies confirmed that it is rarely possible to combine higher education and sport successfully without some level of flexibility in educational programmes. Some of the European countries and its universities have adjusted entry requirements that offer flexible arrangements and support systems for student athletes. The main purpose of this paper is to consider the role of universities in balancing athletic performance and education of student-athletes. The support services to the student-athletes at university generally include some of the following measures: flexible timetabling and permission for absence at training/competition, unlimited student status, distance learning and e-learning programmes, individual tutor support and monitoring, etc.. According to the best practices in Europe, we have proposed the list of the Guidelines for promoting dual career in educational institution that have been adjusted towards universities' abilities and student-athletes needs in this region.

Key words : higher education, support for athletes, guidelines, best practices

Introduction

The White paper on Sports regulates sporting careers and education: „ In order to ensure the reintegration of professional sportspersons into the labour market at the end of their sporting careers, the Commission emphasises the importance of taking into account an early stage the need to provide „dual career“ training for young sportsmen and sportswomen and to provide high quality training centres to safeguard their moral educational and professional interests.”¹ Once the compulsory school is terminated, athletes are confronted to several different choices: to abandon their studies and keep on training and competing or to keep on training and continue their professional education through the available ways in their country (the Study on training of young sportsmen/women in Europe, 2008). Following the European Council's Declaration 2008 to address the question of "dual careers", the European Commission has emphasised the importance of ensuring that young high-level athletes are offered a quality education in parallel to their sport training. Many efforts have been made in the most European countries with the aim to allow high level young athletes to combine higher education studies and high level sport. According to the several studies, the practice often shows that this is not sufficient and that many high level athletes cannot go on studying efficiently if they want to reach the high level on the sports side. Athletes are surrounded by an entourage of supporters and stakeholders, all whom want to influence young sportspersons in ways they feel are best for their development: 1. *Sports stakeholders* – often include a team drawn from sports club, coaches,

physiotherapist, psychologist, nutritionists, medical advisers and others, 2. *Personal development* of the entourage include family, friends and peers and 3. *Education* brings teachers, tutors, mentors and others into the entourage (Education of young sportspersons, pp. 158). Support from all the members of the entourage is the key to enable the athletes to achieve a balance between their education, sport and social development. Most of the studies that we have analyzed emphasize that athletes go through several stages of their career transition when these pressures and conflicts may become acute. In the periods of transferring up to the next level, they may need additional help and support in respect of managing failure and in dealing with the end of sporting career. Managing these career transition issues is a significant factor of the athlete's overall welfare and success. The challenge of balancing academic and sport development, together with managing personal development, continues into higher education. Some of the European universities have adjusted the entry requirements and they offer flexible arrangements and support systems of studying to student athletes (Athletes To Bussines results – educational institutions, Education of young sportspersons: pp. 142-153). The main purpose of this paper is to consider the role of universities in balancing athletic performance and education of student-athletes. In order to have a clear picture, we have analyzed different European models and best practices from different studies. According to all these data as well as the sports tradition and culture, the final result of this paper is the list of the guidelines for the universities in Southeast Europe which was adjusted with its abilities and student – athletes needs identified in a few studies in this region.

¹ Commission of the European Communities, White Paper on Sport, Brussels, 11 July, 2007, COM (2007), 391, page 6.

Comparative analysis of the European models

The comparative analysis of students-athletes support in higher education was based on the following studies: 1. Combining sports and education: Support for athletes in the EU Member State (2003) – study which had the aim to explore how the different EU Member States deal with educational opportunities and long term athletes career prospects, 2. Education in Elite Sport in Europe (2004) – the study with the aim to add contributions towards the enhancement of potentialities for impelling innovation and progress among actors on varying organisational levels and to promote structural cooperation models between high performance sport and education, 3. Education of young sportspersons (2005) that have been focused on the situation in Europe related to the education of young sportsmen and women and their return to education and/or employment once their sporting careers have ended all across the European Union Members States, 4. Study of training young sportsmen/women in Europe (2008) - analysis related to the national and European legal and political frameworks preserving and promoting the training of young athletes in the 27 Member States and 5. EU Project: AthletesToBusiness (2010-2011) that has analyzed the obstacles, barriers and opportunities that athlete face during their years when they must combine education, sports life and the beginning process of their career which is called "dual career" as well as the published articles related to this topic. Central question of this paper is what can be done to support student-athletes and promote dual career issue by higher educational institution? The general studies findings underline the need to encourage young sportspersons to achieve a proper balance between education and sport development and the high level of flexibility is required to support elite athletes during higher education to enable them to combine training and education successfully. According to Espwall et al., (2004) sport and the educational involvement are characterised by increasing time-consume during childhood and particularly adolescence: at late youth age, in most sports, 15 to 25 training hours per week are suggested in federations' concepts. During the same age, time expenditure in school ranges from 25 to 35 hours per week. In universities, these values are widely exceeded. Additional demands result from homework, studying, changeover, passages, and competition trips. In order to facilitate the compatible and successful coupling of individual sporting and educational development, manifold structural models of cooperation between high-performance sport organisations and educational institutions were built up in diverse systems in Europe. Particular attention has been focussed on flexible solutions for time-management. Henry (2010) made analysis based on findings of four studies: Amara et al., 2004; Aquilina, 2009; Aquilina et al., 2005; Review of Performance Lifestyle initiatives in UK, 2010. These studies identified the kinds of specialist provisions evident in higher

education institutions seeking to meet athletes' needs: 1. Facilitation by Universities of the academic experience of elite athletes by providing services such as: flexibility and time tabling (Cyprus, Germany), distance learning (Denmark, Sweden) and transfer between campuses and unlimited tenure of student status (Greece, Latvia), 2. Enhancement by Universities of the sporting experience of elite athletes by providing services such as: sport scholarships (Austria, Ireland, Slovenia, Poland, Portugal), elite sport development programmes (Finland, Spain, Germany, Sweden, UK) and professional supporting services (Belgium, France, Spain, UK) and 3. Universities providing assistance with post-athletic career opportunities through: study grants (Germany, France, Finland, UK) and new programmes (Sweden, The Netherlands). It is well known that the Government regulation and approval is important in the whole process. The author has identified four principal categories the kinds of state's role in this field: a/ State-centric System of defined legal obligation which provides adapted opportunities for student-athletes, b/ State sponsored formal system established on Permissive Legislation is the system which authorising but not requiring universities to make special provision for athletes, c/ Representation of Athletes Educational Interests by Sporting bodies provides representation of athletes' educational interest by sporting bodies which is based on the negotiation with the university and which is very similar to the the last category d/ „Laisser faire" - no formal structures where any arrangements fall back on individually negotiated agreements (Henry, 2010). Some of the best practices of the European countries for each category are presented in the Table 1. In general, the studies have highlighted that a high level of flexibility is required to support elite athletes during higher education to enable them to combine training and education successfully. The majority of European countries offer positive measures to support student-athlete at this level, although the nature of such support varies between countries. The support services for the student athletes at university generally include some of the following measures: individual tutor support and monitoring, personalized study programmes, distance learning and e-learning programmes, transfer between departments or campuses, unlimited student status, flexible timetabling and permission for absence at training/competition.

Promoting sporting careers and education in the South-East Europe universities

The term Southeast Europe is often replaced with the term Balkan region which very often has a negative connotation. The countries located fully in the peninsula are the following: Albania, Bosnia and Herzegovina, Kosovo, Bulgaria, Greece, Macedonia, and Montenegro. The geographic definition may also include countries that are significantly located in the peninsula: Croatia and Serbia and some countries which are located mostly outside of the peninsula: Romania and Turkey.

Table 1: Best examples in some of the European countries

CATEGORY	EXAMPLES
State – centric System of Defined Legal Obligation (EU countries: France, Hungary, Luxembourg, Spain, Poland and Portugal)	Hungary - Olympic medallist have the right to be admitted to any colleague/university without entrance examination. For the athletes who are beneficiaries of the agreement between the Olympic Committee and colleges/universities – the Universities offers elite athletes flexibility in relation to student athlete absence and their study examination timetable. Study activities are scheduled to accommodate the needs of training and competition, handbooks and other auxiliary educational materials during periods of absence for training or competition. Spain - legislation requires universities to reserve 3% of the total places provided for accredited high performance athletes who have at least the minimum academic requirements. Services: individual tutor, monitoring, reserving of place sin university residences, flexible timetables and flexible schedules for the sitting of exams....
State Sponsored Formal System Established on Permissive Legislation (EU countries: Belgium (Flanders), Denmark, Estonia, Finland, Germany, Latvia, Lithuania and Sweden)	Belgium - for the student-athletes who were ranked on the Olympic lists – a contract which allows them to combine elite sport and studies in higher education (scholarship for specific cost: 20,000 Euro. Special support programme STEP (workshops, communication skills, financial management, injury prevention and rehabilitation... Athletes could request to spread the work of one academic year over and extended time period (2 and more years). Germany - a contract between National Sport Federations and the University Sports Association and higher education institutions to have access to a range of services and benefits (flexible time table, examination timetable, flexibility for attendance at compulsory lecturers, tutor monitoring offered personal tutors and study counselling. German Aid Sports Foundation offers temporary bursaries of up to 3 years to professional athletes who have enrolled on a university programme and then retire from competitive sport.
Representation of Athletes Educational Interests by Sporting bodies (EU countries: Greece, United Kingdom)	Greece – provides some limited rights: entrance examination to any university department of their choice, unlimited length of time, two types of scholarships: annual scholarship for any educational level up to undergraduate studies, second for graduate studies and Greek universities or abroad. United Kingdom - a number of universities has traditionally informally offered special concessions in terms of exam dates, location for holding examinations, flexible duration of programmes of study. The Talented Athlete Scholarship Scheme (TASS) – government funding which is designed to promote a partnership between NOC and Higher education with the aim to reduce the drop out of talented athletes from sport due to academic and financial pressures.
„Laiser – faire“ – no formal structure (individual negotiation agreement where these prove possible) EU countries: Italy, Ireland, Malta, Austria, Czech Republic, Slovakia and Slovenia)	Italy – Flexibility for student athletes is possible in some private universities, in public universities requirements can be rigid and any request for flexibility is seen as a matter between the athletes and teaching staff. Some of the universities do have links with sport federations but not particularly strong. Student-athletes may negotiate individually with university staff. Malta is the country with small education system where it is difficult to adapt provision to accommodate the needs of athletes.

What are the common characteristics of these countries? In general they are smaller with long sports history and tradition and great wishes to promote themselves in the best way of the international level. Some of these countries have hosted big sports events (Winter Olympic Games, World and European sports competitions in different sport, Word University games and European University championship in some sports) where they shown them as the perfect organizer. Due to the same cultural tradition, common languages especially in the former Yugoslav countries, the sport system are organized on the same way: the National Olympic Committee as the umbrella NGO body for sport and the Ministry responsible for sport as the GO. A significant financial support for sport and elite sport is coming from the Governments and lottery. With this context in mind as well as the European best practices of student-athletes support in higher education we wish that the universities in the Region consider the implementation some of these support measure. For this purpose we have adjusted the Guidelines for promoting dual career (Table 2) in the EU towards Southeast European universities' abilities and student-athletes needs. The analysis of the attitudes and interests of Croatian female top level athletes (n= 352) on education and equality have confirmed the necessity to provide support in

educational system: individual tutor support and monitoring distance learning and e-learning programmes and flexible timetabling. (Caput-Jogunica, 2007, Matković, 2007, Caput-Jogunica and Razbornik, 2009). According to these results, the Croatian Olympic Committee, in the cooperation with the Ministry responsible for education and sport has provided the Project: "Top level athletes in educational system". In general, the project's feedback from the seven Croatian universities and Council of the Polytechnics reflects that the higher educational systems do not seem readily adapted to the needs of athletes: sportspeople overall express a need for more flexibility, lighter study conditions and better study advice. To address these demands and support a stronger structure to provide a fair access to athletes to be able to participate in sport and fulfil their long term dreams so that then they can bring this unique experience to the labour market after their sports career, it must start with a stronger relationship with the educational organisations. Furthermore, it is important to emphasize the role of lifestyle management advice in helping athletes to achieve an appropriate balance in their lifestyle: coaches and parents are usually the key factors, for young athletes they have a significant influence (Burden at al., 2004; CeciĆ-Erpić, 2001; Sotiriadou & Shilbury; 2009, Trninić at al., 2009).

According to the Guidelines of promoting dual career in the EU (2011) the first step must include the active promotion on increasing the cooperation with education and sport to be created or strengthened and maintained on different levels: local, national and regional. One strategy would be to have one body or team in the national sport organisation, institute for sport, department in the

ministry, etc., which takes the lead in developing dialogue between sports and educational institutions. According to the AthletesToBusiness conclusions, it is recommended to involve former top level athletes at the beginning of the “dual career” campaign with the aim to motivate and support young athletes’ efforts and in its decisions.

Table 2: Guidelines and proposal for actions for the Universities and Polytechnics

Guidelines for educational institutions to promote dual career	Actions
European Southeast countries should provide and enabling legal framework	<ol style="list-style-type: none"> 1. National authorities should promote and strengthen dialogue between sport and educational leaders (NOCs president and Minister responsible for education in cooperation with the university rectors) to develop concepts that could be adopted and based on a more flexible system for combining high level sports and academic education (Sports law, Law and other acts for higher educational institutions...). 2. Ministries for Education should implement guiding principles determining a structure for educational institutions to develop several criteria levels: first – minimum support, second – support for top level athletes, third: support for the members of the national teams...). 3. Relevant ministries should consider a budget for dual career allowing educational institutions to develop athlete friendly systems such as distance education (e-learning).
Collaboration should be promoted and maintained	<ol style="list-style-type: none"> 1. To identify the Universities that are interested to support the student-athletes 2. Universities should sign agreements with the National Olympic Committee to support the integration of student-athletes' sporting and academic ambitions. 3. In the effort to handle and maintain effective partnership, there could be a neutral body as bridge between sports and education to minimise conflicts. 4. National level strategic and action plans in both the educational and sports sector must discuss and plan the financial and human resources and their bearers.
Universities should envisage structural advancements	<ol style="list-style-type: none"> 1. University leadership and staff should allow for of adjustment the athlete-friendly environment by adopting new or altered elements in the institutions' regulatory documents. 2. Educational institutions should provide athletes with flexibility in time, options and process to successfully pursue higher education.
Provision of individual support assisted by networks	<ol style="list-style-type: none"> 1. In the frame of combined education and training, there should be a central guidance counsellor who could navigate athletes to the appropriate service provider in both, sports and education. 2. The advisor should be supported by a network comprising the stakeholders that appear locally relevant.
Higher authorities should create and strengthen dialogue	<ol style="list-style-type: none"> 1. Promote dual career on national basis: campaign with former top level athletes: round tables, workshops with the athletes, dialogue in media. 2. To identify the national conceptual model of the organisation and structure of sport policies and financial support related to athlete in whole educational system and well as the post-career support.

Conclusion

The field of athletes and education has been the subject of significant studies and projects. How do universities perceive students-athletes and what can they do to support them? This paper is just an addition to a small number of the papers in the Southeast Europe with the aim to promote this topic in academic society and to provoke the GOs responsible for education to implement some of the guidelines which could be helpful to achieve diploma in the end of study. Some of the European countries (UK, France, Germany, Belgium (Flanders), Sweden and Finland) offer a wide spectrum of advice and support on lifestyle, careers and education, as well as job opportunities, whereas other European and non European countries offer limited or no elements of support. The European countries and its universities in general have different positions as to policies towards, and legal/moral responsibility for supporting athletes-students. This paper is based on the analysis and results from different European projects.

The examples of mentioned European studies include advice and support, careers counselling, employment opportunities, financial support and incentives to return to education. Throughout the European studies which we have been presented in the paper, the need of flexibility was a key factor and especially highlighted by athletes as the most important for successfully combining sport, education and personal development. The flexibility in education is related to the timetabling, entry requirements, time off/extended deadlines and adaptation of the curriculum. Various examples of flexibility have presented within our comparative analysis of study results, categories and best practices. According to the European countries experience in order to provoke and encourage the Southeast universities to offer flexibility to students-athletes, the final result of this paper is the proposal of guidelines. It is important to emphasize that the universities are autonomous and therefore entitled to regulate themselves in that status and advantages allocated to student-athletes: flexibility in timetables, distance learning, tutors, etc.

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USPOREDNA ANALIZA: PODRŠKA STUDENTIMA – SPORTAŠIMA I UPUTE UNIVERZITETIMA JUGOISTOČNE EUROPE

Sažetak

Veći broj različitih stručnih analiza potvrđuje problem usklađivanja obveza u studiju i sport bez nekog oblika potpore nastavnika i prilagodljivosti obveza tijekom studija. Neke europske države i njihova sveučilišta propisala su uvjete koji pridonose lakšem ispunjavanju obveza aktivnim sportašima u visokom obrazovanju. Osnovni cilj ovog rada je razmotriti ulogu sveučilišta koja može pridonijeti uravnoteženom procesu sportske karijere i obrazovanja studenata-sportaša. Uvjeti koji mogu osigurati usklađivanju sportske karijere i obveza u studiju možemo odrediti kao mjere fleksibilnosti – prilagodljivosti obveza koje se odnose na sudjelovanje na nastavi, ispitni rokovi, neograničen status studenta, učenje na daljinu i ispunjavanje obveza on line, mentor i/ili tutor na studiju i dr. Na osnovu dobrih europskih primjera u praksi, predložena je lista smjernica za obrazovne ustanove prilagođena mogućnostima sveučilišta u ovoj regiji te potrebama sportaša.

Ključne riječi: visoko obrazovanje, potpora sportašima, smjernice, dobri primjeri prakse

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THE EFFECTS OF MOTOR LEARNING ON RESULTS OF STANDING LONG JUMP PERFORMED BY FEMALE STUDENTS

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Original scientific paper

Abstract

The aim of this study was to determine the influence of motor learning on efficiency of standing long jump test. For the needs of this experimental program the sample was made of 52 female students (27 in experimental group and 25 in control group) from the first and second year of the Faculty of Teacher Education. Both groups have been tested with single motor test - standing long jump - two times ranging of one month. Between initial and final measurement the experimental group have been practicing a dynamic stereotype of standing long jump during a regular class of physical education over a period of three weeks, once a week. The efficiency of motor learning was determined by using ANOVA and the t-test analysis for dependent samples. The obtained results of both analysis showed that in experimental group there were statistically significant changes in results in standing long jump between initial and final measurement, while control group had no statistically significant progress. These findings indicate that the efficiency of standing long jump performance can be significantly affected by the process of motor learning. According to results of this research, it can be concluded that before applying a standing long jump test it would be desirable to conduct (repeat) the test a several times before using it for prediction of the lower body strength and power.

Key words: *standing long jump, motor test, experimental program, female students, ANOVA, t-test*

Introduction

The main aim of each training process is transformation of abilities, characteristics, and overall potential of an individual, from the certain initial to the desired final stage. The difference in the final compared to the initial state should be reflected in how effective the changes are in his/her anthropological status with all its components. The process of motor learning requires the involvement of many operators, each of which causes specific changes that would made a transformation of the characteristics that are important for creating a dynamic stereotypes of an individual. The acquisitions of motor skills that are necessary for the execution of various motor tasks are an important part of training in sport (Horga, 1993), but also in the process of education. Learning of motor skills is the intellectual task because it depends on many mental processes such as memory, problem solving, and processing of information in the central nervous system etc. (Horga, 1993). For motor learning, essential items are the characteristics of the participants that are involved in the learning process and the level of the abilities that are required for motor learning and the finalization of the learned motor task. Also, in order to achieve meant transformation by using kinesiology stimulus's, the basic conditions such as the frequency of stimulation, appropriate training load (Sekulić & Metikoš, 2007), and selection of appropriate methods (Hamza & Bala, 2001) for motor learning, especially if the learned movements are using in everyday life (Prskalo, 2004) must be fulfilled. The final result of motor learning and its efficiency is suitable for research in various dimensions of the motor space (Tsigilis & Theodosiou, 2008).

The aim of this study was to determine the influence of motor learning on efficiency of standing long jump test using the experimental and control group of female students through regular class of physical education over a period of three weeks.

Biomechanical components (stand long jump)

Jumps are belonging to a group of biotic movement skills that serve to effectively overcoming obstacles (Sekulić & Metikoš, 2007). That is a very complex group of movement structures which can be divided according to takeoff and landing (Sekulić & Metikoš, 2007). The object of this study is the movement structure that begins from standing position, with two-leg takeoff forward and ends with landing on both feet, which is the beginning and the end of the biomechanical structure named standing long jump. How biotic motor skills for overcoming the obstacles are learned after the adoption of a minimum level of motor skills for the space overcoming (Sekulić & Metikoš, 2007), it can be assumed that in the early phase of motor learning of standing long jump an important role would have the coordination of movement, because the structure of this motor test is very complex and requires the activation of numerous muscles. The participants who in the process of their motor improvement have poor develop of coordination would also have problems with executing various motor structures. The purpose of motor test standing long jump is to evaluate the lower body strength and power. That is the ability to activate the maximum number of motor units in a piece of time (Findak, et al., 1996), or the ability to handle the resistance with high-speed contractions (Marković, 2008).

Standing long jump is an integral part of the testing process for estimating the efficiency of the physical education classes. During physical education lesson, but also in the training process, it serves as a test of the lower body strength and power. In numerous researches the motor test standing long jump is an integral part of the analysis of human motor space. The simple analysis of the motion structure of standing long jump indicate that there are the two most important motor abilities, arranged in three movement momentum whose synergy determines the efficiency during performance of this test: a) explosive strength, b) coordination during takeoff, c) coordination during landing. The process of motor learning should be based on improving these components. Especially, it should take into account the development of coordination. Namely, coordination is an essential component of standing long jump and its development should be preferred at the beginning of exercise (Bowerman, et al., 1998).

Methods

The sample of this study was made of 52 female students of first and second year of the Faculty of Teachers Education in Zagreb. The experimental group was consisted of 27 and control group was consisted of 25 female students. Both groups performed the test standing long jump (SLJ) at the beginning and at the end of the March 2010. Between initial and final measurement the experimental group have been practicing a dynamic stereotype of standing long jump during a regular class of physical education over a period of three weeks, once a week. The results were statistically processed with program package Statistics for Windows 7.0. The main descriptive parameters were calculated (arithmetic mean, standard deviation, skewness and kurtosis), normality of data distribution was tested by Kolmogorov – Smirnov test. The statistical significance differences between groups were tested by ANOVA and t-test analyses for dependent samples.

Results

Table 1. Descriptive statistics of standing long jump for control and experimental group

	Valid N	Mean	Std.Dev.	Skewness	Kurtosis	K-S
SLJI-CO	25	159,1	16,94	0,007	-1,00	0,14
SLJF-CO	25	160,1	14,95	-0,258	-0,93	0,11
SLJI-EX	27	154	19,0	0,24	-0,80	0,10
SLJF-EX	27	158	17,9	0,28	-0,73	0,08

Initial and final results standing long jump for control group (SLJI-CO), (SLJF-CO) and experimental group (SLJI-EX), (SLJF-EX)

The results of descriptive statistics show that the control group has higher mean values of initial testing for about 1 centimeter, when the experimental group has improved their mean result of standing long jump from initial to final measurements for 4.0 centimeters (Table 1).

Also, in control group the value of standard deviation has decreased like in experimental group. This indicates a higher homogeneity of results of the both groups in final testing. The Kolmogorov – Smirnov test in both groups indicated that normal distribution of variables. Results of univariate analysis of variance showed that the groups belong to the same population, or that they do not differ significantly from each other. This means that the results of arithmetic means of groups are within the range of common arithmetic mean of the group. This is supported by the F value which shows no significance difference between groups, and its value is less than 1.00 (0.63). However, its value indicates that there is a difference in the results between the initial and final measurements in the experimental group (11.88), which was the basic aim of this research. This means that the program had a significant impact on the trends of results found in the experimental group. It is also noted the existence of statistical significant differences within the group (4.19), which means that the results of some participants differ significantly in relation to the value of the arithmetic mean of their group. The obtained results of t-test analyses for dependent samples also indicate that in this research a statistical significant difference between initial and final measurement of dynamic stereotype of standing long jump only in experimental group (Table 3.) is achieved. Individual scores of participants in the control group showed constant values, in their results are not observed visible „jumps“ in terms of productivity growth of their scores compared to the initial measurement of the standing long jump. Even more, some participants have achieved poor results in the final measurement (participant number 2: -5 cm, participant number 4: -7 cm, participant number 9: -9 cm). The values of experimental group (Graph 2) show that participants generally improved their scores in the final measurement regardless of the relatively short duration of the program.

Table 2. The results of ANOVA

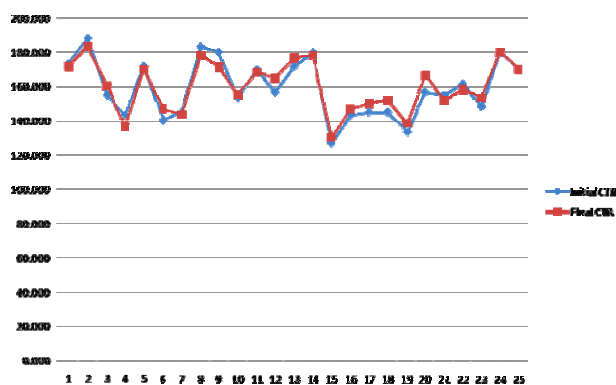
Source of variability	SS	df	MS	F	p
„Var3“	370	1	370	0,63	0,43
R1	157	1	157	11,88	0,00*
R1*„Var3“	56	1	56	4,19	0,05*

Groups („Var3“), repetition of measurement in experimental group (R1), variability inside groups (R1„Var3“), F value (F), stistic significanc (p)*

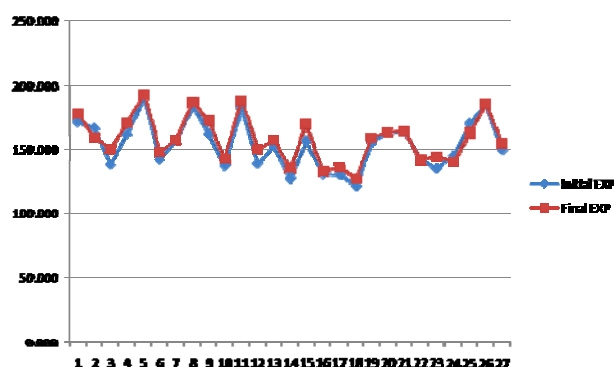
Table 3. The results of t-test analyses for dependent sample, level of significant $p < 0.050$

	Mean	Std.Dv.	N	Diff.	t	df	p
SLJI-C	159,07	16,94					
SLJF-C	160,07	14,95	25,00	-1,00	-1,01	24	0,32
SLJI-E	153,83	18,96					
SLJF-E	157,75	17,94	27,00	-3,93	-3,82	26	0,00*

Aritmetic mean (M), standard deviation (SD), number of subjects (N), different (Diff), value of t-test (t), degree of freedom (df) and stistic significanc (p)



Graph 1. Initial and final results of subject in control group



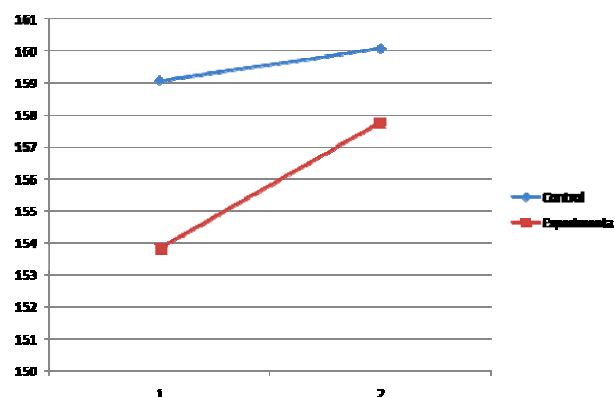
Graph 2. Initial and final results of subject in experimental group

From the third graph it is visible a positive trend of results (decrease of values) of the control and the experimental groups. By more detailed analysis it can be seen considerably "sharper" line growth in the experimental group. This indicates the existence of a quantitative and statistically significant difference between the initial and final measurements in the experimental group. It can be argued that a small number of targeted kinesiology iterations in the experimental group had generated a statistically significant difference. Slightly weaker result than in the final measurement can be seen in respondent number. 2 (- 7 cm) and in respondent number 25 (- 6.5 cm). It is hard to say exactly why there has been no improvement in the final results of measurements in those two participants. The reason may be in lack of motivation to achieve better results that is provoke by saturation of repetition of the same motor structure, in this case the standing long jump, regardless of the relatively short duration of the experimental program.

Discussion

During the process of motor learning of dynamic stereotype of standing long jump the experimental group of female students has statistically significantly improved their result from initial to final measurements, while the control group has not achieved statistical significant progress of results, although the values of their mean results was initially higher than in experimental group.

The similar founding was shown in research of Tsigilis & Theodosiou, (2008). The aim of their study was to examine whether familiarization with a psychomotor test would influence performance and/or learning.



Graph 3. Initial and final results of control and experimental groups

The results revealed that both groups improved their performance. The experimental group outperformed the control group. Although, the process of motor learning was limited with deficient frequency of repetition of motor information, a small number of stimuli and a wide range of time from stimulus to stimulus (one time per week), the experimental group achieved positive effects of learning process. They positively transform their motor skill on higher level. However, it is difficult to argue that the improvements found in the experimental group occurred only due to the increased number of kinetic stimuli. Before, it can be expected that the difference between the initial and final state in the experimental group conditioned the impact of increased number of frequencies (hops) on the cognitive circuit participating in research that contributed to effective results of the long jump, and better neuromuscular coordination (Sporiš et al., 2011).

It can be assumed that the impact on the results of the standing long jump may have and the fact that some participants had higher levels of acquired motor structures of the standing long jump from the earlier stage of education - although the introduction to the content of motor tests to achieve better results is more important in testing children (Tomac et al., 2011) - and the increased frequency of previously learned motor structure has caused its efficient performance in this study. In addition, reaching the automation level of knowledge of jump can directly affect the development of explosive strength and coordination (Delaš et al., 2008) which may also affect the achievement of better results. The higher values of mean results in control group than in experimental group indicate that a small amount of properly directed motor information can contribute to the efficiency of motor learning, what is demonstrated in this study.

Conclusion

The aim of this study was to determine the influence of motor learning on efficiency of standing long jump test using the experimental and control group of female students through regular class of physical education over a period of three weeks.

For the needs of this experimental program the sample was made of 52 female students (27 in experimental group and 25 in control group) from the first and second year of the Faculty of Teacher Education. Both groups have been tested with single motor test - standing long jump - two times ranging of one month. Between initial and final measurement the experimental group have been practicing a dynamic stereotype of standing long jump during a regular class of physical education over a period of three weeks, once a week.

The efficiency of motor learning was determined by using ANOVA and the t-test analysis for dependent samples. The obtained result of the both analyses showed that statistical significant difference between initial and final measurements of dynamic stereotype of standing long jump exist in experimental group. In the control group the difference was not statistically significant. The found of this study confirmed that even a small number of properly directed motor information can significantly affect the efficiency of motor learning. These findings indicate that the efficiency of standing long jump performance can be significantly affected by the process of motor learning. According to results of this research, it can be concluded that before applying a standing long jump test it would be desirable to conduct (repeat) the test a several times before using it for prediction of the lower body strength and power.

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EFEKTI MOTORIČKOG UČENJA NA REZULTATE U TESTU SKOK U DALJ S MJESTA KOD STUDENTICA

Sažetak

Cilj ovog istraživanja bio je utvrditi utjecaj motoričkog učenja na efikasnost izvedbe skoka u dalj iz mjesta. Za potrebe ovog eksperimentalnog programa korišten je uzorak od 52 studentica (27 u eksperimentalnoj grupi i 25 u kontrolnoj skupini) sa prve i druge godine Učiteljskog fakulteta u Zagrebu. Obje skupine su testirane s jednim motoričkim testom - skok u dalj iz mjesta - dva puta u rasponu od jednog mjeseca. Između inicijalnog i finalnog mjerenja eksperimentalna grupa je trenirala dinamičan stereotip skoka u dalj iz mjesta tijekom redovite nastave Kineziološke kulture u razdoblju od tri tjedna, jedanput tjedno. Efikasnost motoričkog učenja određena je pomoću ANOVA i t-test analize za zavisne uzorke. Dobiveni rezultati su pokazali da u eksperimentalnoj grupi postoje statistički značajne promjene u rezultatima u skoku u dalj iz mjesta između inicijalnog i finalnog mjerenja dok kontrolna grupa nema statistički značajan napredak. Ovi rezultati ukazuju na to da na učinkovitost izvedbe skoka u dalj iz mjesta značajno utječe proces motoričkog učenja. Prema rezultatima ovog istraživanja može se zaključiti da bi prije primjene testa skok u dalj iz mjesta bilo poželjno ponoviti test nekoliko puta prije nego ga se koristi za procjenu eksplozivne snage.

Ključne riječi: skok udalj s mjesta, motorički test, eksperimentalni program, studentice, ANOVA, t-test

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PHYSICAL EDUCATION AND SPORT IN THE CAMPANIA REGION

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Preliminary scientific communication

Abstract

The didactic of physical activities in the school, while exercising the individual technical skills, never loses sight of the unity of knowledge and invites the child to reflect on his actions, on his mental and physical changes, but also on his knowledge. For this reason, the school differs from sports federations and associations, and it must rise to the role of leadership in the sport education. After these necessary preambles, it seems now particularly interesting to introduce the scenario laid out by ISTAT (Italian Statistics Institute) survey "100 statistics to understand the country we live in". The ISTAT analysis shows how Campania is the region after Sicily with the highest percentage of people with a sedentary lifestyle. It seems that in Campania, the primary school fails in its leadership role with regard to the sports education and the motor practices and in supporting non-sedentary lifestyles. In fact, in Campania the sport practice is very low and the level of giving up is particularly high. This discussion starts from this point and should be considered as a pilot study to evaluate a possible contributory cause of the status here outlined, i.e. the perception that teachers have of their own basic and technical skills in the motor field. It is not forbidden to think that, if this survey shows a widespread perception of lack of ability, this will adversely affect the motor teaching and be at least partly responsible for the situation described herein. Therefore the aim of this research is to monitor the level of the basic skills and of the motor teaching skills of primary school teachers in the region Campania, and the way they perceive the movement, highlighting any possible critical factor.

Key words: *physical education, movement, knowledge, sport, didactics, Campania*

Introduction

In the last decades we have been witness of a deep change of the Italian education and training systems, particularly with regard to the teaching strategic choices and practices. Today, the previous models, primarily based on the transferable feature of the information and aimed to ensure knowledge and skills, do not seem to be feasible because of social, cultural and scientific changes, that, in an even quicker and more frequent way, are questioning knowledge and information. No wonder then, that, to restore value and meaning to the educational system, the attention of the theoretical paradigms has gradually shifted "from teaching to learning" because "it is not enough to teach, but you have to teach to learn". This theoretical change is reflected in all the teachings whose methods should be reconsidered in the light of learning and not as mere transmission of information (Malizia & Ciatelli, 2009). In this context, it seems clear that the teacher's role should be seen in a perspective which mainly focuses on the role of "constructor of learning environments" (Varani, 2002). In this theoretical framework, the teacher's educational choices play a key role in helping learners to start a personal educational route. Therefore, the teacher has not only to transfer information but also to encourage the student to reflect in different disciplines. Particularly, by examining the teaching of motor skills in primary school, the teacher's role is not only oriented to the transmission of the knowledge of motor practice, but also to the

reflection on one's own relationship with his/her body and with the knowledge and to the maintenance of good motor habits. Hence, the teaching in this subject area should practically be oriented to "make children live beautiful and meaningful experiences to learn the importance of movement" (Bertagna, 2004). On the other hand, children aged between 6 and 10 years have a strong development of their motor skills and are particularly keen to learn through the game and the movement. Therefore, avoiding using this opportunity for the individual's global education and for his mental and physical development would be a serious failure from an educational point of view. Hence, the school, while exercising the individual technical skills, never loses sight of the unity of knowledge and invites the child to reflect on his actions, on his mental and physical changes, but also on his knowledge. For this reason, it differs from sports federations and associations, and it must rise to the role of leadership in the sport education. To guide the students in this process, the teacher's role is that of a constructor of knowledge and it necessarily requires the possession of a portfolio of skills that take into account not only the specific knowledge and techniques related to his/her subject area but also basic skills (Sibilio, 2003) that promote interaction with learners and make it possible to start their personal training programs. After these necessary preambles, it seems now particularly interesting to

introduce the scenario laid out by ISTAT (Italian Statistics Institute) survey “100 statistics to understand the country we live in”. The ISTAT analysis shows how Campania is the region after Sicily with the highest percentage of people with a sedentary lifestyle. In particular in Campania 56.5% of people over the age of 3 states not to practice any physical activity; this datum appears particularly high when considered in relation to the Italian average which is equal to 36.1%. In this survey the sporting phenomenon seems to involve only the youth; in fact, more than 60% of those who practice physical activity in Italy is aged between 6 and 14 years. From what stated till now, it seems that in Campania, the primary school fails in its leadership role with regard to the sports education and the motor practices and in supporting non-sedentary lifestyles. In fact, in Campania the sport practice is very low and the level of giving up is particularly high. This discussion starts from this point and should be considered as a pilot study to evaluate a possible contributory cause of the status here outlined, i.e. the perception that teachers have of their own basic and technical skills in the motor field. It is not forbidden to think that, if this survey shows a widespread perception of lack of ability, this will adversely affect the motor teaching and be at least partly responsible for the situation described herein. The aim of this research is to monitor the level of the basic skills and of the motor teaching skills of primary school teachers in the region Campania, and the way they perceive the movement, highlighting any possible critical factor.

Methods

The adopted methodology has provided the following phases:

1. Analysis and selection of the skills required to the Italian Primary School teachers of Motor and Sport Education.

2. Preparation of a multiple choice questionnaire on specific skills by the School of Sport of CONI. The questionnaire was designed to allow the self-assessment of the skill levels identified through 15 multiple choice items on a 5 levels scale. The skills analyzed in the test took into account not only the knowledge of the motor activity teaching, but also the *basic skills*. According to what stated above in the introduction, they especially focused on verbal and social skills, which are necessary and essential to dialogue with learners.

3. Test administration and statistical processing of data.

4. Interpretation of the data collected.

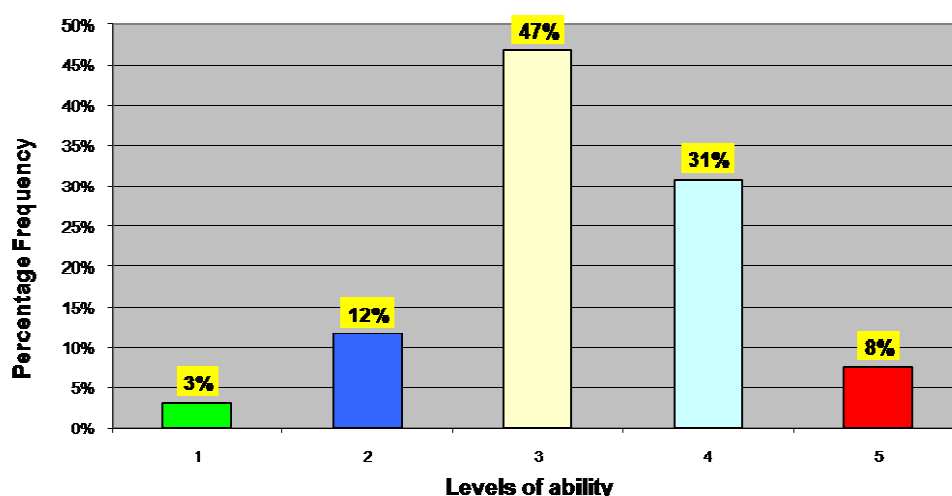
Sampling

The survey was conducted on a group of 120 primary schools teachers. Sixty primary schools in the provinces of Naples and Benevento and affiliated with the Department of Educational Sciences of the University of Salerno have been involved.

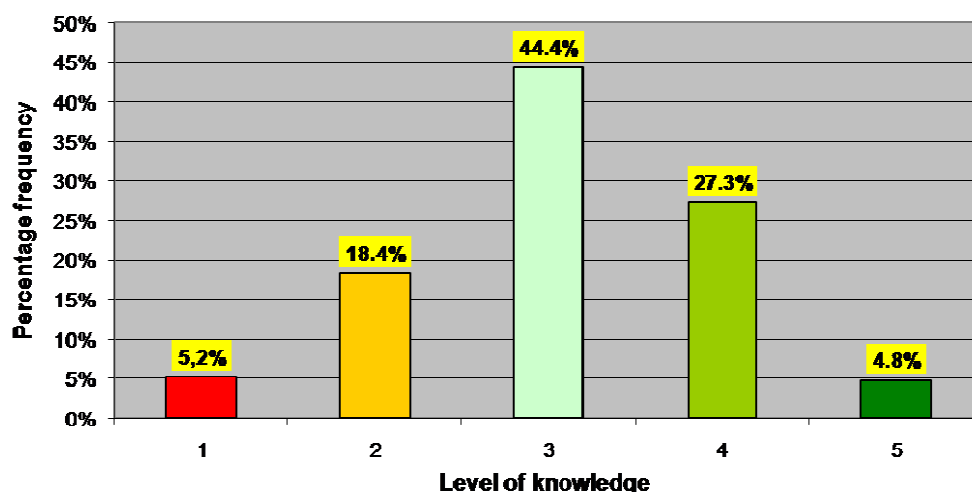
Data Analysis

Graph 1 shows the levels of basic skills as they have been perceived by the tested teachers. It is possible to note that this phenomenon tends to concentrate around the average and above it. Approximately 47% of teachers think their basic skills are in the average and about 39% of teachers feel that their basic skills are above the average. Only about 15% of teachers reported their basic skills as insufficient.

Graph 2 shows the levels of specific knowledge in the motor activity field. Even in this case the phenomenon is concentrated around the average. However, it is interesting to note that here the phenomenon is distributed differently with a higher share (equal to 23.6%) of interviewed who felt their knowledge in this field as insufficient.



Graph 1 Assessment of teacher's skills in Campania



Graph 2 Self-assessment of the levels of knowledge of Primary School Teachers in Campania Region

Discussions and conclusions

The data in our possession and the exploratory nature of this article do not reach a firm conclusion or a comprehensive analysis of the causes that may have caused the state of Campania as described in the introduction. It is very likely that this also depends on factors outside the school such as socio-economic, cultural, and other factors that have not been considered here. Starting from the assumption that the practice of the sport activity and the sedentary lifestyles found in Campania were also determined by how motor activities are taught in primary school, this survey focused on the analysis and identification of possible critical points in teaching this subject that may have contributed to the scenario herein described. The data suggest that a possible problem of the teaching of motor activities in Campania may depend not so much on the *basic skills*, but on the

specific knowledge in the motor field. In fact, the data show a widespread lack of preparation on the motor activity subject. Almost one out of four teachers perceives his/her own training in this specific subject area as poor or at least inadequate. This may have had a negative impact on the motor activity teaching, both in the methodologies used and in the time dedicated to it. It may also have contributed to the disastrous state of the current motor-sport practice in Campania. Without further investigations, it is not possible to establish exactly how and how much this may have influenced the sedentary lifestyles and the motor activity teaching in primary schools in the region Campania. However, from the situation described in this article it would seem necessary to intervene with training and qualification courses that will enable primary schools teachers in Campania to increase and re-evaluate their skills and knowledge in the motor field.

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TJELESNI ODGOJ I SPORT U REGIJI CAMPANIJA

Sažetak

Didaktika tjelesnih aktivnosti u školi, za vrijeme vježbanja pojedinačnih tehničkih vještina, nikad ne gubi iz vida jedinstvo znanja i poziva dijete da reagira na svoje akcije, na njegove mentalne i fizičke promjene, ali također i na njegova znanja. Iz ovih razloga škola se razlikuje od sportskih federacija i asocijacija i mora rasti do uloge vodilje u sportskoj edukaciji. Nakon ovih neophodnih pretpostavki, čini se od posebnog interesa predstaviti scenarij koji postoji u ISTAT (Talijanski Statistički Institut) kao anketa "100 statistika za razumijevanje zemlje u kojoj živimo". ISTAT analiza pokazuje kako je Campania regija koja poslije Sicilije ima najveći postotak ljudi sa sedentarnim načinom života. Izgleda da je u Campaniji, osnovna škola promašila u svojoj vodećoj ulozi u odnosu na sportsku edukaciju i motoričku praksu i isto tako u podršci nesesedentarnom načinu života. U stvari, u Campaniji sportska praksa je vrlo niska a razina odustajanja jako visoka. Rasprava počinje od ove točke i treba sve biti razmotreno kao pilot istraživanje za evaluaciju mogućih uzroka doprinosa ovdje rečenom status i.e. percepciji prema kojoj učitelji imaju svoje temelje i tehničke vještine u prostoru motorike. Nije pri tome zaboravljeno da ako ova anketa pokaže jako rasprostranjenu percepciju nedostatka sposobnosti, to te će štetno utjecati na motoričko učenje i bit će zadnji dio odgovoran za prethodno opisanu situaciju. Dakle, cilj istraživanja je praćenje razine temeljnih vještina i vještina motoričkog učenja učitelja u osnovnoj školi u regiji Campania, i načina na koji oni doživljavaju gibanje, osvjetljavajući bilo koji kritični faktor.

Ključne riječi: tjelesni odgoj, gibanje, znanje, sport, didaktika, Campania

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THE RELATIONSHIP BETWEEN PLAY AND PHYSICAL EDUCATION LESSON

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Review paper

Abstract

Play is essential to development because it contributes to the cognitive, physical, social, and emotional well-being of children and youth. The right to play is a child's first claim on the community. Play is nature's training for life. No community can infringe that right without doing deep and enduring harm to the minds and bodies of its citizens. Play also offers an ideal opportunity for parents to engage fully with their children. Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for some children. Play is integral to the academic environment. It ensures that the school setting attends to the social and emotional development of children as well as their cognitive development. Physical education and play are two areas that are alarmingly neglected in the public school system. Positive experiences of play and physical activity can also enhance children and young people's mental health by building up their confidence, self esteem and resilience. It is also through play, both in the community and at school, that children develop friendships and a sense of belonging to a peer group.

Key Words: motivation, game, physical activity, child development, teaching techniques

Introduction

In 2008, the U.S. Department of Health and Human Services issued physical activity guidelines for Americans, ages 6 and older. These guidelines recommend that children and adolescents should participate in 60 minutes or more of physical activity daily. Students need access to physical activity throughout the school day to meet these recommendations (Health Education Authority, 1998; Burdette & Whitaker, 2005; Timken & McNamee, 2012). Schools can integrate physical activity throughout the school day by scheduling physical activity breaks and including physical activities during academic classes. Physical education lesson provides unique opportunities for children to move with ease and confidence as they enjoy actions such as running, turning, twisting, chasing, throwing, catching, striking, floating and balancing (Ginsburg, 2007; Pangrazi, 2009). They are encouraged to respond to challenges to the mind and body, to participate, to compete and to co-operate with others. From their earliest years children enjoy physical activities (Erikson, 1965; Pellegrini & Boyd, 1993; Smith, 1995; Tsao, 2002; Bernstein, Phillips & Silverman, 2011). Play is a term employed in psychology and ethology to describe a range of voluntary, intrinsically motivated activities normally associated with recreational pleasure and enjoyment (Millar, 1967; Winnicott, 1971; Zhang et al, 2011). Play is most commonly associated with children and their juvenile-level activities, but play can also be a useful adult activity, and occurs among higher-functioning animals as well (Tsao, 2002; Ginsburg, 2007). Play is so important to optimal child development that it has been recognized by the United Nations High Commission for Human Rights (2008) as a right of every child. Children today have fewer opportunities for outdoor play than their predecessors.

Environments for outdoor play are generally underutilized and the role of the adult in this is frequently passive. Play has physical, social, emotional and cognitive benefits for children. It has been suggested that opportunity for spontaneous play may be all that is needed to increase young children's levels of physical activity, an appealing concept in view of our burgeoning, societal obesity epidemics (Dietz, 2001; American Academy of Pediatrics, Council on Sports Medicine and Fitness and Council on School Health, 2006). If play is beneficial to children's health and well being, then it follows that depriving children of play would have harmful effects. Yet despite this plethora of reports warning us of the dangers of producing a nation of couch kids, children are leading increasingly sedentary lives. There is less playtime at school, and their out of school lives are dominated by organized activities or hanging out at home in front of the TV or computer (Dietz, 2001; Zimmerman & Christakis, 2005). Many children get a portion of the U.S. Department of Health and Human Services (2008) recommended 60 minutes of daily physical activity from games played during physical education lesson. Using popular children's games during Physical Education lessons can help maximize student participation and involvement while providing physical activity (Department of Health, 2004; Pangrazi, 2009; Bernstein, Phillips & Silverman, 2011).

Definition of Play

The seminal text in the field of play studies is *Homo Ludens* by Johan Huizinga (1955). Huizinga defines play as follows: "Summing up the formal characteristic of play, we might call it a free activity standing quite consciously outside 'ordinary' life as being 'not serious' but at the same time absorbing the player intensely and utterly.

It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings that tend to surround themselves with secrecy and to stress the difference from the common world by disguise or other means." Play is often interpreted as frivolous; yet the player can be intently focused on his or her objective, particularly when play is structured and goal-oriented, as in a game. Accordingly, play can range from relaxed, free-spirited and spontaneous through frivolous to planned or even compulsive (Smith, 1982).

Forms of Play

The National Institute for Play (Department of Health, 2004) describes seven play types: Attunement (which establishes a connection, such as between newborn and mother), Body (in which an infant explores the ways in which his or her body works and interacts with the world, such as making funny sounds or discovering what happens in a fall), Object (such as playing with toys, banging pots and pans, handling physical things in ways that use curiosity), Social (which involves others in activities such as tumbling, making faces, and building connections with another child or group of children), Imaginative (in which a child invents scenarios from his or her imagination), Narrative (play of learning and language that develops intellect), Transformative (by which one plays with imagination to transcend what is known in the current state, to create a higher state).

Theories of Play

Since the early philosophers, people have been writing intermittently about children's play. Over time, the focus has moved from attempts to describe it to efforts to understand what children do when they are playing, and indeed the links between this and their development and learning (Erickson, 1985; Field, 2000). Modern and classical theories of play have identified the many ways in which play may affect children's wellbeing and advance their cognitive, social and emotional development (Takhvar, 1988). While freely engaging in play children acquire the foundations of self-reflection and abstract thinking, develop complex communication and metacommunication skills, learn to manage their emotions and explore the roles and rules of functioning in adult society. Sociocultural theorists discuss the overarching role of play in child development and view it as the most significant "leading" activity of the early childhood years (Vygotsky, 1978; Bodrova and Leong, 1996). Play theories are divided into 2 categories: Classical Theories (19th & Early 20th Century) and Contemporary Theories (after 1920).

Classical Theories

1. *Surplus Energy* (Spencer). Schiller, a German philosopher, defined play as 'the aimless expenditure of exuberant energy'.

Play is the result of surplus energy that exists because the young are freed from the business of self-preservation through the activities of their parents. Energy finds its release in the aimless exuberant activities of play. Surplus energy theory contends that humans have a finite amount of energy that is used mainly for work and survival. Children tend to play more than adults, as children are not so involved in work and survival activity, and therefore have greater amounts of energy to expend. By discharging excess energy in play, balance is restored to the human body (Spencer, 1873).

2. *Recreation – Relaxation* (Lazarus 1883, Patrick 1916). Play is seen as a mode of dissipating the inhibitions built up from-fatigue due to tasks that are relatively new to the organism. Thus, play is found more often in childhood. Play replenishes energy for as yet unfamiliar cognitive activities of the child and reflects deep-rooted race habits. Play alleviates boredom while the natural motor functions of the body are restored.

3. *Pre-exercise – Preparation for adulthood* (Groos). Groos (1898; 1901) presented a biological explanation for play in his books, *The Play of Animals* and *The Play of Man*. Play is essential to later survival. The playful fighting of animals or the rough and tumble play of children are essentially the practice of skills that will later aid their survival. Hence play is the practice and development of capacities, like sex and fighting, to be used later in life. Thus, for Groos, the purpose of play was a preparation for life and is the necessary practice for behaviors that are essential to later survival. Play develops skills necessary for functioning as an adult. Criticism—children may practice what they see adults do, but they cannot know what will occur in the future.

4. *Recapitulation* (Hall). Play is seen not as an activity that develops future instinctual skills, but rather, that it serves to rid the organism of primitive and unnecessary instinctual skills carried over by hereditary. Each child passes through a series of play stages corresponding to and recapitulating the cultural stages in the development of the race (Hall, 1904; 1920). The general meaning of Recapitulation theory is that eliminate ancient instincts by reliving evolutionary history of the human species. Criticism—if evolution is still occurring, it should also be evident in play.

5. *Growth Theory* (Appleton). Play is a response to a generalized drive for growth in the organism. Play serves to facilitate the mastery of skills necessary to the function of adult behaviors.

6. *Ego Expanding Theories* (Lange - Claparde). Play is nature's way of completing the ego an expressive exercising of the ego and the rest of the personality; an exercising that develops cognitive skills and aids in the emergence of additional skills (Alderman, 1974).

Contemporary Theories

In contrast to the classical theories, the modern dynamic perspectives seek to explain the content of play.

1. *Psycho-analytic – Cathartic Theory* (Freud). Freud's psychoanalytic theory of play was outlined in *Beyond the Pleasure Principle* (1920). Play as catharsis that allows children to rid of negative emotions & to substitute more positive ones in place. Express feelings through play. Through play, children dramatize the past, present and future. In this work, he explicitly conceptualized play as the repetition compulsion whereby a child wishes to constantly repeat or re-enact an experience. This he saw as the working out of his pleasure principle; the reduction of tension produced by the life instincts; and, when the experience was unpleasant, of the death instinct. The replacement of the pleasure principle, of which play is part, by the reality principle takes place phylogenetically in Freudian theory as well as ontogenetically within the individual child when its instinctual drives give way to reason.

2. *Infantile Dynamics* (Lewin). Play occurs because the cognitive life space of the child is still unstructured, resulting in failure to discriminate between real and unreal. The child passes into a region of playful unreality where things are changeable and arbitrary. The child plays because he is a child and because his cognitive dynamics do not allow for any other way of behaving. Play is an expression of the child's uncoordinated approach to the environment (Lewin, 1931).

3. *Meta-communicative* (Erikson). He is known for his theory (1965) on 'psychosocial development' and for coining the phrase "identity crisis". He was born out of an illegitimate affair and hence, the development of identity was one of his main concerns. Purpose of Play is: Play as ego mastery for emotional development, Play as social and Play as a lifelong phenomenon. Erikson's Play Levels are: Microsphere (Toys are used in two ways: Props for acting out their emotions and Tools to discover the limits of rules established by caregivers). Child gains mastery over the world as she controls toys and materials (Erikson, 1977). Macrosphere (The child develops a shared view of the world as she engages in sociodramatic play and games).

Cognitive theories of play

1. *Play as Intellectual Development* (Piaget). His theory (1962) on play is based on his four stages of development namely: Sensorimotor stage (Through play, children learn the actions of movement and the senses and of object permanence (using their senses of touch, taste, hearing, seeing and smell), Pre-operational stage (Through play, children acquire motor skills), Concrete operational stage (Through concrete activities (hands-on activities and things that can be seen) and games with simple rules, children begin to learn to think logically, Formal operational stage (Through rules and instructions, children begin to learn to think abstractly and independently)). Purposes of Play are: provides for wish fulfillment, play follows development and play allows children to sublimate reality through a process involving accommodation and assimilation.

Play reduces anxiety by giving children a sense of control over their world and an acceptable way to express forbidden impulses.

2. *Play as Rehearsal* (Bruner). He stated that one of the main functions of child's play was to rehearse actions to various real-life scenarios in a safe, risk-free environment so that when confronted with a difficult situation, it would not be so stressful (Bruner, 1972).

3. *Play as Preparation* (Dewey). Play is a subconscious activity that helps an individual develop both mentally and socially (Dewey, 1910). It should be separate from work as play helps a child to grow into a working world. As children become adults, they no longer "play" but seek amusement from their occupation. This childhood activity of play prepares them to become healthy working adults. His theories provided the basis for contemporary educational uses of children's play. To help children reconstruct their experience and gain meaning from it, children learn to function at higher levels of consciousness and action and teachers were to create an environment to nurture play that would support desirable mental and moral growth (Dewey, 1916).

4. *Play as Sensory Learning* (Montessori). According to Montessori method, which is still employed today in private schools, children would be best served spending their play time learning or imagining. Montessori play is sensory, using a hands-on approach to everyday tools like sand tables. The child sets her own pace, and the teacher is collaborative in helping the child play to learn. Montessori is particularly interested in how play developed the mind, body, brain and senses in terms of gaining greater awareness of properties through use of the bodily senses, sharpening abilities to gather and organize information and organize sensory impression (Fisher, 1992).

5. *Play as Social Development* (Vygotsky). He suggested that children will use play as a means to grow socially (1933). In play, they encounter others and learn to interact using language and role-play. Vygotsky is most noted for introducing the ZPD (zone of proximal development). This suggests that while children need their peers or playmates to grow, they need adult interaction as they master each social skill and are ready to be introduced to new learning for growth. His works included an emphasis on interpersonal relationships and on higher mental functions through interactions with significant people in an individual's life (Bodrova & Leong, 1996). His play theory emphasizes social development. He suggests that there is an ability level that children can reach but not without help from adults, which he refers to as a zone of proximal development, or ZPD. When children play, they give cues to adults about their readiness to learn new skills with assistance (Vygotsky, 1962; 1978). In conclusion, we can see from the above discussion that theorists hold quite fundamentally different views about the nature and purposes of play. Freud regarded play as having a strong affective purpose, Piaget argued for cognitive development through play.

While Vygotsky regarded imaginative play as liberating children from their immediate situational constraints. However, they all agree on one thing – that there are benefits for children when they play.

Play and Children

In young children, play is frequently associated with cognitive development and socialization (Henry, 1990; Field, 2000). Play that promotes learning and recreation often incorporates toys, props, tools or other playmates (Erikson, 1977). Play can consist of an amusing, pretend or imaginary activity alone or with another. Some forms of play are rehearsals or trials for later life events, such as "play fighting", pretend social encounters (such as parties with dolls), or flirting (Winnicott, 1971; Bruner, Jolly & Silva, 1976). Modern findings in neuroscience suggest that play promotes flexibility of mind, including adaptive practices such as discovering multiple ways to achieve a desired result, or creative ways to improve or reorganize a given situation (Millar, 1967; Shonkoff & Phillips, 2000). Learning through play has been long recognized as a critical aspect of childhood and child development. Play also promotes healthy development of parent-child bonds, establishing social, emotional and cognitive developmental milestones that help them relate to others, manage stress, and learn resiliency (Schaeffer, 1993; Gagen & Getchell, 2006). According to Siraj-Blatchford & Sylva (2004) the most effective centers "play" environments were used to provide the basis of instructive learning. However the most effective pedagogy combines both teaching and providing freely chosen yet potentially instructive play activities. Freely chosen play activities often provided the best opportunities for adults to extend children's thinking.

The importance of Play in Physical Education

All children need to play and be active. Play is essential to the healthy physical, social and emotional development of all children, and a fundamental part of childhood (Atkinson, 1964; Pellegrini & Boyd, 1993; Smith, 1995; Nutbrown, 2006). Play allows children to use their creativity while developing their imagination, dexterity, and physical, cognitive, and emotional strength. Play is important to healthy brain development (Shonkoff & Phillips, 2000; Tamis-LeMonda, Shannon, Cabrera & Lamb, 2004). It is through play that children at a very early age engage and interact in the world around them. Play allows children to create and explore a world they can master, conquering their fears while practicing adult roles, sometimes in conjunction with other children or adult caregivers (Cohn, 1990; Tsao, 2002). As they master their world, play helps children develop new competencies that lead to enhanced confidence and the resiliency they will need to face future challenges (Erikson, 1985; Band & Weisz, 1988; Hurwitz, 2003). Physical education lesson and play are two areas that are alarmingly neglected in the public school system.

Teaching physical education and play are as crucial to a child's development as any academic endeavor (Pangrazi, 2009). Perceptual motor skill development is directly related to central nervous system and how it processes information received from sensory organs throughout the body. Trained children can better process information regarding their place in space and time. Positive experiences of play and physical education lessons can also enhance children's mental health by building up their confidence, self esteem and resilience (Bernstein, Phillips & Silverman, 2011). It is also through play, both in the community and at school, that children develop friendships and a sense of belonging to a peer group (Coolahan, Fantuzzo, Mendez & McDermott, 2000; Harrist & Bradley, 2003). The insightful Rumbold report (Department of Education and Science, 1990) recorded that children need talk, play and first-hand experiences because these are powerful in the child's development and learning. The physical education programme which provides a wide variety of movement activities builds on these early experiences of the child. The physical education lesson should answer the needs of the child who looks forward to it with a sense of anticipation and excitement (Zhang et al, 2011). As far back as 2001, the British Medical Journal reported that the main solution to the obesity crisis should be to reduce television viewing and promote playing (Dietz, 2001). Play is integral to the academic environment. It ensures that the school setting attends to the social and emotional development of children as well as their cognitive development. It has been shown to help children adjust to the school setting and even to enhance children's learning readiness, learning behaviors, and problem-solving skills (Fisher, 1992; Coolahan, Fantuzzo, Mendez & McDermott, 2000). Social-emotional learning is best integrated with academic learning; it is concerning if some of the forces that enhance children's ability to learn are elevated at the expense of others. Play and unscheduled time that allow for peer interactions are important components of social-emotional learning.

Physical Education in a Child Centered Curriculum

When implementing the programme, the school, building on the principles of variety and diversification, should consider:

- The importance of enjoying physical activity (Zhang et al, 2011). The child who associates fun and enjoyment with physical education lessons and who gains a sense of achievement will develop the positive attitudes so necessary for continued participation in physical education lessons and physical activity (Cryz & Toriola, 2012).
- The importance of play in its many forms in the learning and developmental process. Through play the child learns to move effectively, to think, to interact socially with others and to express feelings (Cohn, 1990; Timken & McNamee, 2012).
- Maximum participation by all children in the physical education lesson.

The desire by children for active participation can be seen as the starting-point for the teacher when planning and implementing physical education lessons. Lessons which can be identified as successful in achieving the pre-determined objectives will inevitably be those where the children were active throughout the entire lesson (Whitehead & Hendry, 1976; Pangrazi, 2009; Zhang et al, 2011).

- The development of skills and increasing understanding of the activities which the children are experiencing. As the skills are developed there should be an emphasis too on increasing the child's understanding of the activities is engaged in (Zhang et al, 2011; Cryz & Toriola, 2012). This can be achieved by adopting appropriate teaching methods where discussion is an essential part of the process.
- Providing a balance between competitive and non-competitive activities. Activities incorporating some elements of competition can benefit the child as he/she progresses towards the achievement of his/her potential. The positive opportunities presented include the development of respect for opponents, rules and classmates as officials.
- Providing a balance between contact and non-contact activities. The needs of the individual child should be considered when selecting suitable activities. A balance should be sought which, for example, allows the child who favors non-contact activities to enjoy those activities and yet be able to engage in contact activities, where possible modified to suit his/her needs.
- Providing opportunities for achievement for each child. It is essential that the child be presented with achievable tasks, regardless of the activity he/she is engaged in.

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The satisfaction of achievement is the factor that motivates many children to continue to participate in physical activity (Atkinson, 1964).

- Providing activities equally suitable for girls and boys. Activities which have traditionally been associated with either sex can be presented, sometimes with modifications, to a mixed class. Single-sex classes should be exposed to a range of activities from all six strands where possible, thus ensuring that a balanced programme is presented to them (Alderman, 1974).

Conclusion

School physical education (PE) classes provide the best opportunity to fulfill the motor and health related fitness needs of virtually all children. PE teachers, in particular, have the potential to influence public health by promoting pupil participation in physical activity and assisting students to establish a lifetime habit of regular involvement in physical activity (Burdette & Whitaker, 2005). Participation in physical activity during childhood can aid the development of motor abilities and lay the foundation for good health, especially cardiovascular health (Zhang et al, 2011). Play is essential to the healthy physical, social and emotional development of all children, and a fundamental part of childhood.

Positive experiences of play and physical education lessons can also enhance children's mental health by building up their confidence, self esteem and resilience (Alderman, 1974; Cryz & Toriola, 2012). It is also through play, both in the community and at school, that children develop friendships and a sense of belonging to a peer group.

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RELACIJE IZMEĐU IGRE I NASTAVE TJELESNOG ODGOJA

Sažetak

Igra je esencijalna za razvoj zato što doprinosi kognitivnoj, fizičkoj, socijalnoj i emocionalnoj dobrobiti djece i mladih. Pravo na igru je dječji prvi zahtjev u zajednici. Igra je prirodni trening za život. Nema zajednice koja može oduzeti to pravo bez dubljeg ulaska i istrajanja na šteti koja se vidi na pameti i tijelu njenih građana. Igra također nudi idealnu mogućnost roditeljima da potpuno sudjeluju s djecom. Neovisno o koristi deriviranoj iz igre za oboje, za roditelje i djecu, vrijeme za slobodnu igru je značajno reducirano za neku djecu danas. Igra je integralni dio akademskog okruženja. Osigurava da škola postavlja brigu za socijalni i emocionalni razvoj djece baš kao i njihov kognitivni razvoj. Tjelesni odgoj i igra su dva područja koja se alarmatno zanemaruju u javnim školskim sustavima. Pozitivna iskustva igre i tjelesnih aktivnosti mogu također i obogatiti mentalno zdravlje djece i mladih izgrađujući njihovo samopouzdanje, samoprocjenu i fleksibilnost. Također, kroz igru u zajednica i u školi, takvo dijete razvija prijateljstva i osjećaj pripadnosti ravnopravno u grupi.

Ključne riječi: motivacija, igra, tjelesna aktivnost, dječji razvoj, tehnike učenja

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THE LEVEL AND DIFFERENCES OF AEROBIC CAPACITY IN THREE DIFFERENT YOUNG SOCCER TEAMS IN THE U17 CATEGORY

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Abstract

The purpose of this study was to determine and compare parameters of aerobic capacity as an indicator of physical predispositions in three youth soccer teams of different performance levels in Yo-Yo IRT1 (Yo-Yo intermittent recovery test level 1). The screened sample consisted of the national team ($n=14$, age: 16.5 ± 0.3 years, body weight: 68.3 ± 7.9 , body height: 177.2 ± 7.1 and body fat: 9.2 ± 1.9 %), the best league team ($n=16$, age: 16.4 ± 0.3 years, body weight: 70.6 ± 8.3 kg, body height: 178.8 ± 6.4 cm and body fat: 9.5 ± 2.1 %) and the worst league team ($n=14$, age: 16.6 ± 0.4 years, body weight: 65.6 ± 8.2 kg, body height: 176.1 ± 6.4 cm and body fat: 8.8 ± 2.4 %). To evaluate aerobic parameters, Yo-Yo intermittent recovery test (Yo-Yo IRT1) was used. Based on post-hoc analysis of means in the observed groups we found out significantly longer run distances in NT (national team) and BLT teams (best league team) when compared to WLT team (worst league team) ($p < 0.01$). Comparison of maximum heart rate (HR_{max}) or heart rate recorded 1 minute after load, respectively, did not indicate any significant difference. Conversely, when comparing the percentage decrease in HR_{max} we revealed significant differences between the groups ($p < 0.05$). The assumption of significant difference in VO_{2max} between players of higher performance level (NT and BLT) in comparison to players of lower performance level (WLT) was confirmed at a significance level of $\alpha \leq 0.01$. The study showed differences in levels of monitored parameters in Yo-Yo test between the team of different performance levels. A high level of monitored parameters is necessary for performing high-intensity physical activities on intermittent character throughout the match.

Key words: field test, HR_{max} , recovery, soccer, VO_{2max} , Yo-Yo IRT1, youth soccer players

Introduction

To improve players' physical preparedness, it is important to create specific training and test batteries, monitor their progress and load response on players (Impellizzeri et al., 2006; Rampinini, Coutts, Castagna, Sassi, & Impellizzeri, 2007). Diagnostics of youth players is carried out in order to monitor performance progression during the training process (Stratton, Reilly, Williams, & Richardson, 2004). Young players testing serves as feedback for coaches to assess player's strength and weaknesses (Bangsbo, Mohr, Poulsen, Gomez, & Krstrup, 2006; Stratton, Reilly, Williams, & Richardson, 2004; Svensson & Drust, 2004), whether the training process improves players' physical preparedness (Bangsbo, Mohr, Poulsen, Gomez, & Krstrup, 2006; Stratton, Reilly, Williams, & Richardson, 2004) or full-featured return of the player after injury (Bangsbo, Mohr, Poulsen, Gomez, & Krstrup, 2006; Newton, Cormie, & Cardinale, 2011; Stratton, Reilly, Williams, & Richardson, 2004). Other factors of diagnostics of youth players are increased motivation to greater effort in training, creating a competitive environment or optimization of training programme (Bangsbo, Mohr, Poulsen, Gomez, & Krstrup, 2006). We distinguish two main categories of testing – laboratory and field tests. Laboratory tests provide important and exact information on the current state of a player (Billat, Flechet, Petit, Muriaux, & Koralsztejn, 1999; Noakes, 1988).

Their disadvantage is that they often lack ecological validity (Da Silva et al., 2011, 2011) or specific movements throughout the match, for instance eccentric muscle work when changing direction (Curell & Jeukendrup, 2008). An advantage of field tests is when performing specific movements at certain load intensity (Balsom, 1994) and in a specific environment. A soccer match is characterised by an intermittent load, in which high intensity periods alter with lower intensity periods. Studies (Bangsbo, 1994; Bangsbo, Norregaard, & Thorsoe, 1991; Mohr, Krstrup, & Bangsbo, 2003), carried out within the past 20 years, found out, by means of time – spatial analysis, that adult professional players run 9 – 12 km at different paces during a match. Helgerud, Engen, Wisløff & Hoff (2001) add that the distance run by young elite players during a match is similar to that in adult players which is approximately 10.3 km. Therefore, requirements on young players are similar to the adult category (Stratton, Reilly, Williams, & Richardson, 2004). Young soccer players should not be considered as little adults and their training should be constantly directed towards future top performance. An important milestone in a player's development is the transition into the adult category and further adaptation to training and match load (Reilly, Williams, Nevill, & Franks, 2000). In the physical training of young players, technique and tactical skills should be discovered and constantly developed.

To assess physiological parameters, several intermittent tests up to *vita maxima* were suggested (Carminatti, Lima-Silva, & De-Oliveira, 2004; Krstrup et al., 2003; Léger & Lambert, 1982). These tests copy, to a certain extent, the movement structures of players on the field and enable us to test more players at once (Ahmaidi, Collomp, Caillaud, & Préfaut, 1992; Barbero-Álvarez & Barbero-Álvarez, 2003; Carminatti, Lima-Silva, & De-Oliveira, 2004; Krstrup et al., 2003). To assess aerobic capacity, we used Yo-Yo IRT1 according to Bangsbo (1994), Bangsbo, Iaia & Krstrup (2008), Krstrup & Bangsbo (2001) and Krstrup, Mohr, Steensberg, Bencke, Kjaer & Bangsbo (2006). Players perform running activity at high intensity at a distance of 2 x 20 m with a short rest interval (10 s) and incomplete recovery for energy restoration. Yo-Yo IRT1 indicates the internal (heart rate) as well as external (total run distance) load of young soccer players (Coutts, Rampinini, Marcora, Castagna, & Impellizzeri, 2009). The ability to produce and accelerate regeneration processes after high intensity load during a soccer match is important for performance quality in terms of physical abilities (Bangsbo, 1994; Ekblom, 1986; Fitzsimmons, Dawson, Ward, & Wilkinson, 1993). Performance of players carrying out more high intensity activities during the match requires a larger share of energy produced in an aerobic way since they use energy from 80 to 90% of aerobic energetic system. Thus the player can work at a higher intensity for a longer period of time (Bangsbo, Iaia, & Krstrup, 2008). One of the most important determiners of aerobic capacity is the value of VO_{2max} (Helgerud, Ingjer, & Stromm, 1990; Hoff, Gran, & Helgerud, 2002). Players with a high level of VO_{2max} have high glycogen stores which are necessary for energy release during activities performed at high load intensities or in sprints (Bangsbo & Mizuno, 1988). Smaros (1980) adds that the value of VO_{2max} is crucial especially towards the end of a match (the last 20 minutes), which is considered to be a crucial and decisive phase of the match. The value of VO_{2max} also affects regeneration processes after the match or intensive training (Bangsbo & Mizuno, 1988; Ekblom, 1986). The aim of the study was to determine and compare parameters of aerobic capacity as an indicator of physical predispositions in three youth soccer teams of different performance levels in Yo-Yo IRT1. We assume a significantly different level of aerobic capacity indicators (total distance and VO_{2max} parameters) in teams at the higher performance level.

Methods

Subjects

The screened sample consisted of the national team (NT), best league team (BLT) and worst league team (WLT) in the highest Czech competition of the U17 category. The tested group was composed of 14 player (age: 16.5 ± 0.3 years, body weight: 68.3 ± 7.9 , body height: 177.2 ± 7.1 and body fat: 9.2 ± 1.9 %), the best league team ($n=16$, age: 16.4 ± 0.3 years, body weight: 70.6 ± 8.3 kg,

body height: 178.8 ± 6.4 cm and body fat: 9.5 ± 2.1 %) and the worst league team ($n=14$, age: 16.6 ± 0.4 years, body weight: 65.6 ± 8.2 kg, body height: 176.1 ± 6.4 cm and body fat: 8.8 ± 2.4 %). Prior to testing, the players got familiar with the testing protocol. The study was approved by the ethical committee of the Faculty of Physical Education and Sport, Charles University in Prague and measurements were performed according to the ethical standards of the Helsinki Declaration.

Data collecting and processing

Field testing was carried out outdoors on second generation artificial grass. The average temperature ranged from 20 to 24 °C and humidity was around 50 – 60 %. Prior to testing, a warm-up instructed by a coach was conducted for 15 min and was composed of running and changes of directions, stretching and six sprints up to 10 m. The interval between the warm-up and measurement was 45 min. The training unit before the test up to *vita maxima* focused on speed and agility exercises. Throughout the training, players' HR was recorded by means of the Polar RS400 heart rate monitor (Polar, Kempele, Finland). Measurements were held in the mid-competition period. The day before testing, players had a day off and did not perform any demanding physical activities. To determine parameters of aerobic capacity, Yo-Yo IRT1 according to Krstrup et al. (2003), Bangsbo et al. (2008) and Castagna, D'Ottavio & Abt (2003) was used. Field tests assessed aerobic capacity, namely the following parameters: total distance, VO_{2max} , HR_{max} and recovery period one minute after the test. Each player performed the test in his own area that was 2 m wide, 20 m long and 5 m for active recovery (Figure 1). The area was marked with cones. Total testing time did not exceed more than 20 minutes.

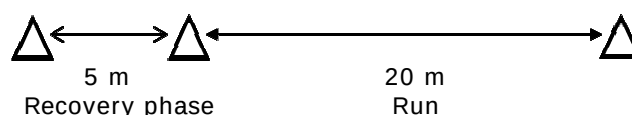


Figure 1 Yo-Yo IRT1 scheme

After completing 2x20 m, players always have 10 seconds for active recovery which consists of 2 x 5 m walking or jogging. Yo-Yo IRT has two different levels (level 1 and 2). In the study, we used level 1, which consists of four runs (2x20 m) at velocities between 10 – 13 km.h⁻¹ (0 – 160 m), seven runs at velocities 13.5 – 14 km.h⁻¹ (160 – 440 m). Subsequent velocity is increased by 0.5 km.h⁻¹ after 8 runs (i.e. after 760, 1080, 1400, 1720 m etc.) up to *vita maxima*. The test is finished when the player does not reach the line on time twice or when he is exhausted. After the test, total run distance (m), HR_{max} and decrease of HR one minute after the test is recorded for each player. To calculate VO_{2max} we used a prediction equation (Bangsbo et al., 2008) (1):

$$(1) \quad VO_{2max} \text{ (ml.kg}^{-1}\text{.min}^{-1}\text{)} = IR \text{ distance (m)} \times 0,0084 + 36,4$$

Statistical analysis

The results were expressed in absolute values and percentages, and the evaluation was made with the use of basic statistical characteristics (Arithmetic Mean, Standard Deviation). To discover significant differences between the observed teams analysis of variance was used (One - Way ANOVA).

In cases of significance between groups we used Bonferroni's post hoc test. When the criterion of sphericity, as one of the conditions of ANOVA, which was assessed by the Mauchly's test (χ^2), was not met, degrees of freedom were adjusted by means of Greenhouse-Geisser's (GG) sphericity correction and then the statistical significance was assessed according to particular degrees of freedom.

Rejection of the null hypothesis was assessed at the level of $p < 0.05$. Effect size was assessed using the „Eta square“ coefficient (η^2), which explains the proportion of variance of the monitored factor. Effect size was examined as follows: $\eta^2 = 0.20$ – a small effect, $\eta^2 = 0.50$ – medium effect and $\eta^2 = 0.80$ – large effect (Cohen, 1992). The statistical software IBM® SPSS® 19.0 version was used for processing the results.

Results

Results indicated significant differences ($p < 0.01$) in total run distance between the tested teams (Table 1). Based on a post-hoc analysis of means of the monitored groups we found out significantly higher total distance in the NT and BLT when compared to the WLT ($p < 0.01$). The difference between NT and WLT was 451.4 m (23.3 %). A similar situation was found in comparison of BLT and WLT when the difference was 464.4 m (23.8 %). On the contrary, the difference between NT and BLT was only 12.9 m (0.7 %). When comparing maximum heart rate (HR_{max}) or heart rate frequency 1 minute after test load (HR_{rec}), respectively, neither significant difference nor effect size were detected. Conversely, when comparing percentage decrease of HR_{max} we found out significant differences between the groups ($p < 0.05$). Post-hoc analysis of this indicator showed significant difference between NT and BLT ($p < 0.05$). HR recorded 1 minute after the measurement decreased by 17.7 % in NT and by 11.2% in BLT. The assumption of significant difference in VO_{2max} between players of higher performance level (NT and BLT) and players of lower performance level (WLT) was confirmed at significance level of $\alpha \leq 0.01$.

Table 1 Description profile and statistical differences between observed teams

Parameters	National team		Best league team		Worst league team		F	p	Eta	Bonferroni
	Mean	S.D.	Mean	S.D.	Mean	S.D.				
Distance (m)	1940	360.43	1952.94	380.85	1488.57	369.01	7.372	0.002	0.26	N,B vs. W $p < .01$
Count of stage	48.5	9.01	48.82	9.52	37.21	9.23	7.372	0.002	0.26	N,B vs. W $p < .01$
HR_{max} (beat.min ⁻¹)	197.21	5.73	195.29	6.11	194	8.41	0.792	0.459	0.036	
Recovery (%)	17.71	8	11.24	6.07	16.73	6.22	4.21	0.022	0.167	N vs.B $p < .05$
Recovery (beat.min-1)	162.43	18.79	173.28	11.68	162.36	17.31	2.467	0.097	0.105	
VO_{2max} (ml.kg ⁻¹ .min ⁻¹)	52.69	3.02	52.79	3.2	48.89	3.09	7.418	0.002	0.261	N,B vs. W $p < .01$

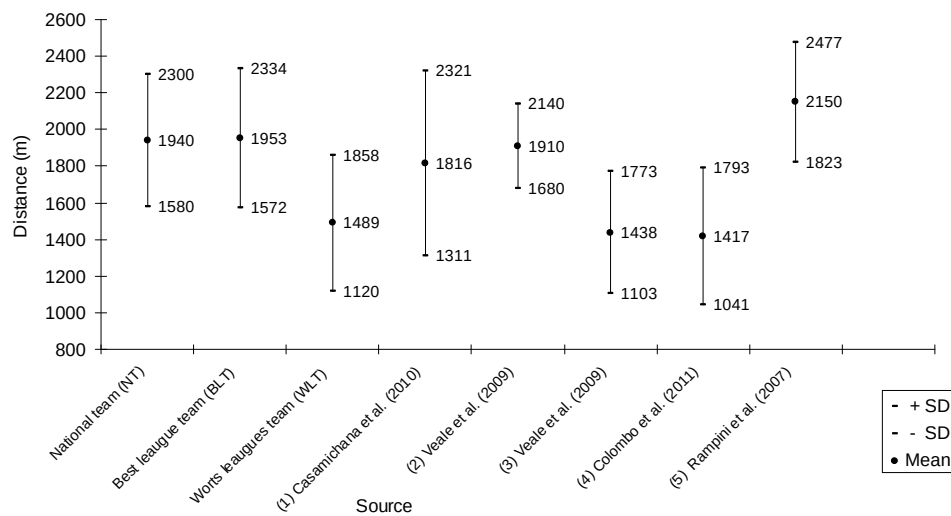
(S.D. – standard deviation, N – national team, B – best leagues team, W – worst league team)

Discussion and conclusion

The aim of the study was to compare parameters of aerobic capacity as an indicator of physical predispositions in three youth soccer teams of different performance levels in Yo-Yo IRT1. Players from the national and best league teams reached similar total distances which was significantly higher than in the worst league team. These results confirm the fact that Yo-Yo IRT1 and physical performance in the match significantly correlate in the amount of run intervals at high intensity ($> 15 \text{ km.hod}^{-1}$) during a soccer match ($r = 0.71$, $n = 18$, $p < 0.05$) (Krustrup et al., 2003). Mohr et al. (2003) points out that demands on high intensity performance with short rest intervals put on the players during the match are the main and crucial difference between elite and average players. We also may notice that players are selected to national team on the basis of excellent physical capacity. Studies dealing with evaluation of total distance in Yo-Yo IRT1 divide adult players according to total run distance. Players at international level (national teams, European cups) reach the greatest distance in Yo-Yo IRT1 (2420 m), elite players (the best teams in national

competitions – 2190 m), average performance players in national competitions (2030 m) and semi-professional players (1810 m) (Castagna et al., 2006; Krustrup et al., 2003; Mohr, Krustrup, & Bangsbo, 2003). Youth players of the national and best league teams achieved results comparable with average and semi-professional players. Players of the least successful team are not approaching levels of any of the adult teams. In young players, demands on the pace of game and thus on the intensity of physical activity in the match are increasing along with increasing age; therefore, total run distance in Yo-Yo IRT1 increases as well (Stroyer, Hansen, & Klausen, 2004). Players of the U14 category are able to run 842 m in Yo-Yo IRT1 ($n=29$) (Castagna, Impellizzeri, Cecchini, Rampinini, & Barbero-Álvarez, 2009). Casamichana & Castellano (2010) found the total run distance in the U16 category to be $1816 \pm 505 \text{ m}$ ($n=10$).

Elite players of Australian soccer in the U16 category run 1910 m ($n=20$) or 1438 m at a lower level, respectively, ($n=20$) (Veale, Pearce, & Carlson, 2009). The comparison of total run distance (mean and variability) between our teams and some other teams are presented in Figure 2.



Groups (category, level): (1) U16, regional level, (2) U16, elite Australian footballers, (3) U16, subelite Australian footballers, (4) U17, amateur level, (5) U18, professional players

Figure 2 Comparison of performance (distance) in Yo-Yo IRT1 test in different teams

Young players spend 63% of the match in the anaerobic zone and 37% of the match in the aerobic zone or, respectively (Billows, Reilly & George, 2003). These values are different in the adult category as adult players spend 66% of the match in the anaerobic zone and 34% of the match in the aerobic zone, respectively (Stratton, Reilly, Williams, & Richardson, 2004). Yo-Yo IRT1 compared to graded running test up to *vita maxima* is not so accurate in terms of determination of $\text{VO}_{2\text{max}}$ (Bangsbo, Iaia, & Krstrup, 2008; Castagna et al., 2006). Values obtained from Yo-Yo IRT1 assess mainly repeated anaerobic load with a short rest interval (10 s) and incomplete recovery during which energy restoration processes take place (Krstrup & Bangsbo, 2001; Krstrup et al., 2003). The results may serve as a continuous indicator of fitness but not as an indicator for load individualisation (Dupont et al., 2010). Stølen, Chamari, Castagna & Wisløff (2005) state that younger players show lower values $\text{VO}_{2\text{max}}$ ($<60 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) than adult players, however, some exceptions may appear. For instance, Reilly et al. (2000) examined $\text{VO}_{2\text{max}}$ in youth elite and average soccer players aged 16 – 18 years and the results were 59 and 55 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, respectively. In pre-season training, professional adult players ($n=9$) completed Yo-Yo IRT1 and values of $\text{VO}_{2\text{max}}$ were 55.3 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ (Barbero-Álvarez, Barbero-Álvarez, & Granda, 2007; Casamichana & Castellano, 2010; Stølen, Chamari, Castagna, & Wisløff, 2005) or ($n=10$) 51.3 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ (Krstrup et al., 2003). Results of our study are closer to values by Krstrup et al. (2003). Kelly & Drust (2009) tested club of the English U19 ($n=8$) Championship and values of $\text{VO}_{2\text{max}}$ were $50 \pm 3.2 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. HR_{max} reached in the match was about 98 % HR_{max} and the mean value of HR was around 85 % HR_{max} (Ali & Farally, 1991; Bangsbo, 1994; Ekblom, 1986; Krstrup, Mohr, Ellingsgaard, & Bangsbo, 2005). HR does not decrease under 65

% HR_{max} in elite players during the match (Bangsbo, Gibala, Krstrup, González-Alonso, & Saltin, 2002; Krstrup, Hellsten, & Bangsbo, 2004). HR gradually increases during the test and also reflects gradual increase of oxygen consumption. After completing Yo-Yo test, HR_{max} ranges with the standard deviation $99 \pm 1 \%$ ($97 - 102 \%$) or similar to HR_{max} measured on a treadmill in the graded test up to *vita maxima* (Krstrup et al., 2003; Krstrup et al., 2006). A study by Kelly et al. (2009) presents values of HR_{max} $204 \pm 9 \text{ bpm}$ and Ngo, Tsui, Smith, Carling, Chan & Wong (2012) state that players ($n=12$) of the U17 category reached HR_{max} $205 \pm 6 \text{ bpm}$. Different values of HR_{max} can be caused by individual variations in physiological parameters of participants in the monitored groups. Another factor can be a limitation of values caused by volitional effort. The advantage of Yo-Yo IRT 1 is the possibility to obtain HR_{max} during a training unit without demanding equipment or organisation. In terms of recovery processes, we found a significant difference between NT and BLT ($p<0.05$). The difference was 6.5%. This parameter may be an indicator of fitness capacity and specific adaptation of a player on intermittent load in the match. Mohr et al. (2003) state that players' performance throughout the match decreases after high intensity activities which results in fatigue and exhaustion. Efficiency of recovery processes after short high-intensity physical activity can be a prerequisite for performing physical activity throughout the whole game. The study confirmed that performance reached in Yo-Yo IRT1 is significantly different in successful and less successful teams. High parameters of aerobic capacity (distance, $\text{VO}_{2\text{max}}$) may create better predispositions for achieving success. Players of the national team must be sufficiently prepared in terms of physical abilities since the international level places more requirements on high-intensity performances than the national level.

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RAZINE I RAZLIKE AEROBNOG KAPACITETA KOD TRI RAZLIČITA TIMA MLADIH NOGOMETAŠA U17 KATEGORIJE

Sažetak

Švrha ove studije je bila utvrđivanje i sporedba parametara aerobog kapaciteta kao indikatora fizičkih predispozicija za tri mlade nogometne ekipe različitih razina izvedbe u Yo-Yo IRT1 (Yo-Yo intermittent recovery test level 1). Praćeni uzorak bio je sastavljen od nacionalne selekcije ($n=14$, uzrast: 16.5 ± 0.3 g., mase: 68.3 ± 7.9 kg, visine: 177.2 ± 7.1 cm i masnog tkiva: 9.2 ± 1.9 %), zatim najbolja ekipa lige ($n=16$, uzrast: 16.4 ± 0.3 g., mase: 70.6 ± 8.3 kg, visine: 178.8 ± 6.4 cm i masnog tkiva: 9.5 ± 2.1 %) te najlošije ekipe lige ($n=14$, uzrast: 16.6 ± 0.4 g, mase: 65.6 ± 8.2 kg, visine: 176.1 ± 6.4 cm i masnog tkiva: 8.8 ± 2.4 %). Za procjenu aerobnog kapaciteta korišten je Yo-Yo intermittent test (Yo-Yo IRT1). Temeljem post-hoc analize prosječnih vrijednosti grupa pronađene su značajno dulje distance kod NT (nacionalni tim) i BLT ekipe (najbolja ekipa lige) u usporedbi s WLT ekipom (najlošija ekipa lige) ($p < 0.01$). Usporedba maksimalne frekvencije srca (HR_{max}) ili frekvencije snimljene jednu minute nakon rada respektivno, nisu pokazale značajne razlike. Suprotno, kad se usporedi postotak smanjenja HR_{max} otkrivene su značajne razlike između grupa ($p < 0.05$). Pretpostavka o značajnoj razlici u VO_{2max} između igrača više razine izvedbe (NT i BLT) u usporedbi s igračima niže razine izvedbe (WLT) je potvrđena na razini značajnosti $\alpha \leq 0.01$. Studija je pokazala razlike praćenih parametara u Yo-Yo testu između ekipa različite razine izvedbe. Potrebna je viša razina praćenja parametara za provedbu visoko-osjetljivih tjelesnih aktivnosti s intervalnim aktivnostima, tj. aktivnostima s prekidima za vrijeme sportskog susreta.

Ključne riječi: terenski test, HR_{max} , oporavak, nogomet, VO_{2max} , Yo-Yo IRT1, mladi nogometaši

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PHYSICAL EDUCATION INCLUSION ASSESSMENT – CRITICAL INCIDENT TECHNIQUE

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Original scientific paper

Abstract

Inclusion of students with disabilities is considered as the current trend of the school education. Real situation in inclusion of student with disabilities into regular physical education (PE) lessons is not highly developed. Assessment of real together communication and exercising among school-mates and included student should be realized as the background of successful inclusion. Process of inclusive PE lessons is influenced with many determinants: the age, diagnoses of child and the content of lesson seem to be very important (Obrusníková et al., 2003, Meek 2000; Dinold & Valkova, 2004). Purpose of the research study was to get the objective and real picture about PE integration. Ten PE inclusive lessons in elementary school level were assessed with instrument Didactic Inclusive Categories – Critical Incident Techniques, abbrev. DIC- CIT. Two independent observers were trained in this technique. The DIC- CIT is based on observation and categorical scaling combined with chronometry. Basic categories are: inclusive (Academic Learning Time - ALT, activity with-without modification), parallel, separated.. First version of verification the DIC-CIT instrument showed 91,0 % of congruency between two observers. Special attention was paid to external conditions (environment, content of inclusive PE lesson, number of children, assistant support) and internal conditions (child diagnoses).

Key words: *inclusion, inclusive PE assessment, critical incident technique*

Introduction

Inclusion, or its earlier conceptualization, has affected Adapted Physical Activity (APA) practice for over 50 years. Empirical research should play significant role in evaluation the effectiveness of APA inclusion practices. The topic can be described from several aspects: - school policy, legislation and historical incidents; - the findings in literature; - reality in practice and quality of practice; - education and training of professionals. In spite of the various recommendation for successful inclusion in lifespan context or school context the basic question is opened: can we formulate which specific indicators are crucial for successful inclusion? (Reid, 2010, 18). One of the important topics of the APA domain is integration in school setting (Van Coppenolle and De Potter, 2004). Inclusion of students with disabilities can be considered as the current trend of the school education. The trend is supported by European (world) school legislation, in Czech Republic, too. (Czech School Law Act No 561, 2003; www.msmt.cz). A majority of published research studies covers teachers' and peers' attitudes toward the included children. Only limited information has been reported regarding the attitudes of included children toward inclusive process (Block and Obrusnikova, 2007). Real situation in inclusion of student with disability into regular PE lessons is not developed: real activity of included student as well other school-mates, their acceptance, satisfaction with PE related to the school level, the student age, diagnoses of the student, the content of the PE lesson, in the end of interpersonal relation among students in the class seem to be very important. Opposite the class environment and atmosphere can influence the determinants of successful PE inclusion (Dinold & Valkova, 2004; Meek, 2000; Obrusníková et al., 2003; Válková, 2003).

So that we can assess interpersonal attitudes toward PE inclusion, the quality of inclusive PE lessons (from the aspect both inclusive child and the schoolmates). we need to know how many time (minutes, seconds) of PE lesson students spend within the real time in inclusive, parallel or separated activities during PE lesson persisting 45 minutes. The instrument for mapping the data of real situation in PE lectures is missing, too. The purpose of this research study was to see level of integrated students activity during PE, teachers capability to accommodate lesson to physically disabled student, allowing us to analyze and compare time effect formulated in "didactic categories" in regular/inclusive PE lessons related to: - school level; - the characteristics of inclusive child/student; - the content and the goal of PE lesson. The instrument for assessment and scaling of didactic categories in PE lessons, called DIC-CIT (Didactic Inclusive Categories – Critical Incident Techniques) is presented in the article.

Methods

Background of the instrument: didactic category of inclusive lesson can be formulated as inter-active relation among included student, class-mates students and PE teacher in PE process. Observation and chronometric recording of didactic categories was used. The source of definitions of didactic categories during PE lessons came from the principals of Critical Incident Techniques (CIT) which is categorical scaling of preciously formulated items of the process (Flanagan 1954). A basic differentiating criterion is definition of bipolar areas of units regarding the aim of the process, e.g.: - positive – negative; promoting – interfering; verbal – non-verbal; existing – non-existing.

The categories are recorded related to time units (seconds, minutes). The principles were used in pedagogy and sport pedagogy (Flanders, 1967; Piéron & Cheffers, 1973), in Czech environment within analyses of PE process in the ADI design (Analyses of Didactic Interaction) (Dobrá and Svatoň, 1978). The CIT principle was used for assessment of sports games process, particularly basketball match (Válková, 1974) and effect evaluation of basketball players (Válková, 1990). The intention to verified the instrument relevant to inclusive PE lessons environment set in the end of 90ies at Olomouc University (Kudláček, 1997; Obrušniková, 1998). *DIC-CIT categories*: the instrument of inclusive PE lessons assessment DIC-CIT consists from didactic categories (Halamičková and Válková, 2003; Válková, Ahmetasevic and Bartonová, 2010a). • Integrative (all-together): - ICE Integrative – Cognitive-Emotional, equal like ALT (passive), - I-M Integrative, motor/movement active, without Modification (MINUS), - I+M Integrative, motor/movement active, with Modification (PLUS): student or class, - ISU Integrative, Supportive (referee assistant, equipment keeping), - I+MA Integrative, modification through assistant support, - I-MA Integrative, without modification through assistant support, • Parallel (alongside), - PCO Parallel, complementary, additional, like others, - Pex Parallel, extra exercises (more intensive), • Separate, - SNO Separate, NO activity (not possible to include due to health, safety), - STO Separate, Time-Out (student needs break, his/her independent decision), - SOP Separate, Other Program (out of PE lesson).

Training of observers: so that the instrument can be used in evaluation of inclusive PE process and the results can be considered as valid and appropriate, the observers has to pass minimal training. The steps of training includes training in: - knowledge of precise content of didactic categories, -memory training of categories, - video-training within advisory – no less than 5 lectures in different conditions, - life-training with advisory and “coach” feedback – no less than 5 lectures in different setting, - knowledge and practice with protocol recording (training during mentioned video and life training) and time-piece, - knowledge and skills in system of summary counting.

Administration of observation: observation and assessment process is realized in consent of the teacher. The goal and the content of PE lecture should be announced to all class students and observer. Observer (recorder) is located in the gym (inclusive PE facility) on the secure place for observer and class students, appropriate for observing and recording complete process. View on timer or clocks is necessary to provide. The observer records the real didactic categories in sheet of protocol related to time. Additional remarks is recommended to write up into protocol. Immediate data evaluation and summarization is advantage for results analyses, discussion with the teacher.

Results

Ten PE inclusive lectures on the level of elementary school were observed with two independent and trained observers according to described process. Assessing of PE lectures were realized at several different schools in different cities. The classical structure of PE lesson was made, like: warming, main part, relaxation. The goals of observed lessons were focused on movement games and basic locomotion (walking, running, jumping, crawling, throwing, targeting).

Autistic (1 child), cerebral palsy (5 children), hemiparesis (2 children), neuropatie (2 children), were included in the classes, only one child in class with maximum 20 children in class. Recorded time in observed categories was: inclusive – ICE = 34 %; inclusive without modification – I-M = 36,8 %; inclusive with modification – I+M = 5,5 %. The found percents seem to be highly positive. Results can be associated with other authors (Meek, 2000; Halamičková and Válková, 2003; Obrušniková et al., 2003; Válková & Kudláček 2009) and confirm theses: inclusion in PE lessons is possible, diagnoses of child is important predictor, elementary PE and basic games do not need too much modifications. The summary of DIC-CIT processed in percents is considered as the result of congruency. Congruency between two evaluators assessment is presented in the table 1.

Discussion and conclusion

The instrument adapted for special purpose of assessment of inclusive PE lessons called DIC-CIT is usable in practice in situation of trained observers. The observed time in each category, compared in percents, showed 91,0 % of congruency between two independent observers in the first version of verification process (Valkova, Ahmetasevic and Bartonova, 2010a). In spite of the fact the different time in the categories was found the congruity between observers was confirmed.

Respected problems which has to be solved are: a) related to the type of disability of included children only couple didactic categories were found, not complete spectrum. More lectures with different type of inclusive child (e.g. wheelchair users, child with hearing problems) has to be assessed. Precise didactic categories formulation is possible to find in Manual of DIC-CIT (Válková, Bartoňová and Ahmetašević, 2012b) in recent time in Czech language only. In spite of positive results of congruency between observers more assessed inclusive PE lessons and more lectures with different conditions, different type of inclusive children is necessary to include in verification process.. Even first version of Manual of DIC-CIT is prepared corrections will be provided, data of congruency processed with statistical evaluation and the Czech version to English and Bosnian language transformed.

Table 1. Congruency between two evaluators assessment

Did. categ. DIC	class	A	B	C	D	E	F	G	H	CH	I	total
ICE	1.evaluator.(sec.)	845	755	805	530	1080	1150	1125	895	995	1040	9220
	2.evaluator.(sec.)	985	755	805	530	1140	1290	1165	940	970	1030	9610
	Congrue. (%)	85,7	100	100	100	94,7	89,1	96,5	95,2	97,4	99	95,9
I-M	1.evaluator.(sec.)	1730	705	1605	1690		1205	1225	995	1220	1000	11375
	2.evaluator.(sec.)	1505	270	1400	1700		1045	1175	975	1240	1010	10320
	Congrue. (%)	87	38,3	87,2	99,4		86,7	95,9	97,9	98,4	99	90,7
I+M	1.evaluator.(sec.)	30	250	115	80	255			190		560	1480
	2.evaluator.(sec.)	70	250		70	325	50	50	165		555	1535
	Congrue. (%)	42,9	100		87,5	78,5			86,8		99,1	96,4
I-MA	1.evaluator.(sec.)		435	115				45				595
	2.evaluator.(sec.)			315				50				365
	Congrue. (%)			36,5				90				61,3
I+MA	1.evaluator.(sec.)				10	890	120		60			1080
	2.evaluator.(sec.)					780	100		50			930
	Congrue. (%)					87,6	83,3		83,3			86,1
ISU	1.evaluator.(sec.)											
	2.evaluator.(sec.)											
	Congrue. (%)											
PCO	1.evaluator.(sec.)					55						55
	2.evaluator.(sec.)					35						35
	Congrue. (%)					63,6						63,6
Pex	1.evaluator.(sec.)		1005									1005
	2.evaluator.(sec.)	20	1005									1025
	Congrue. (%)		100									98
STO	1.evaluator.(sec.)	40					25					65
	2.evaluator.(sec.)	40					25					65
	Congrue. (%)	100					100					100
Sep	1.evaluator.(sec.)											
	2.evaluator.(sec.)											
	Congrue. (%)											
Sum.	1.evaluator.(sec.)	2645	2715	2525	2310	2280	2495	2395	2140	2215	2600	24320
	2.evaluator.(sec.)	2620	2715	2520	2300	2280	2510	2390	2130	2210	2595	24270
	Congrue. (%)	99	100	99,8	99,6	100	99,4	99,8	99,5	99,8	99,8	99,8

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PROCJENA INKLUZIJE U TJELESNOM ODGOJU – TEHNIKA KRITIČNOG INCIDENTA

Sažetak

Uključivanje učenika s teškoćama u razvoju predstavlja trenutni trend školskog obrazovanja. Realna situacija je takva da uključivanje učenika s teškoćama u razvoju u redovnu nastavu tjelesnog odgoja (PE) nije jako razvijeno. Realna je procjena da bi zajednička komunikacija i vježbanje među školskim kolegama i uključenim studentima trebala biti realizirana kao pozadina uspješnog uključivanja. Proces inkluzije u nastavi TiZO je pod utjecajem mnogih odrednica: dob, dijagnoza djeteta i sadržaj lekcije čini se da su vrlo važni (Obrusníková i sur, 2003; Meek 2000; Dinold i Valkova, 2004.). Svrha istraživačke studije bila je da se dobije objektivna i stvarna slika o integraciji tjelesnog odgoja. Deset TiZO (PE) inkluzivih lekcija u osnovnoj školi je ocijenjeno instrumentom Didaktičke Inkluzivne Kategorije - Critical Incident Tehnike, kratica DIC-CIT. Dva neovisna promatrači su obučena u ovoj tehnici. DIC-CIT se temelji na promatranju i kategoričkom skaliranju u kombinaciji s kronometrijom. Osnovne kategorije su: inkluzija (Vrijeme Učenja - ALT, aktivnost sa-bez izmjena), paralelno, odvojeno.. Prva verzija provjere DIC-CIT instrumenta pokazala je 91,0% sukladnosti između dva promatrača. Posebna pažnja posvećena je vanjskim uvjetima (okoliš, sadržaj inkluzivnog PE lekcije, broj djece, pomoćnik podrška) i unutarnjih uvjeta (dijete dijagnoze).

Ključne riječi: inkluzija, procjene inkluzije u TiZO, Tehnika Kritičnog Incidenta

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LIFE SATISFACTION AND GENERAL LIFE EXPERIENCE IN JUDO AND OTHER SPORT COACHES

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Original scientific paper

Abstract

The goal of our study was find the differences between judo coaches and coaches in other sports, in the dimensions of life satisfaction and general life experience, as well as according to the demographic variables and in variables directly linked with a coaching. We have examined a total of 132 coaches of various sports in Croatia (43 judo coaches and the rest were from other sports) during the seminar for coaches in Croatian Olympic Academy. For measuring satisfaction with life, we used Extended Satisfaction With Life Scale (modification of Pavot's & Diener's (1993) Satisfaction With Life Scale) and the Questionnaire about General Life Experience (Andrijašević, 2009). Judo coaches showed higher education level, more medals achieved on national championships, more memberships in cadet and junior national team, comparing with the coaches from other sports. They are older, more work experienced in general as well as a coach, longer active in a top sport, later ended their professional carrier. In life satisfaction and general life experience, judo coaches have higher life achievement, lower daily fatigue but higher level of negative emotions and stress.

Keywords: coaching, differences, personality, positive selection

Introduction

Coaches and other professional staff are very important factors of quality in sport. The main determinant of the quality of the sport are, without doubt, the professional staff (Milanović et al, 2006). Basic professional staff are coaches in the sport, as the persons with extensive professional pedagogical and coaching-methodological knowledge and those who understand the scientific and professional work. Coach directs the preparation and training of athletes for its comprehensive development and achieving the highest sports betting. Coaches immediately determine and manage the training process and represent the first and most important factor in the strategic commitment to the quality of the sport (Milanović et al, 2006). Adequate professional qualifications of trainers and other experts in the sport are the basic premise of quality work in the sport (Milanović et al, 2006). Coaching job has the increasing demands and needs of modern sport, the only possible quality conducted if the coach feels the safety and job satisfaction. In the period between the 1990 and 1998, the number of employees in the sport in the EU countries increased by 57%. The primary purpose of investing in knowledge, which ultimately always manifests itself as a rational investment (Skoko, 2000) maximize the use of human resources and capital, i.e., achieving excellence. Two of the most prominent models of coaching effectiveness in sport are the multidimensional model of coaching (Chelladurai, 1993) and the mediational model of coaching (Smoll & Smith, 1989). These models have served as the frameworks for studying the coaching efficacy. Elements of both models have been combined to form a third model, the working model of coaching effectiveness (Horn, 2002). Using this model the coach is able to evaluate his effect upon the athlete and introduce a varied approach to his/her coaching methods.

Consensus differs on what constitutes effective coaching (Webber & Collins, 2005). Gleeson (1967) suggested that we first have to look at the ingredients of the coach to find out what is good coaching. Schinke & Tabakman (2005) believe that a healthy coach-athlete relationship is where both people learn to co-ordinate their respective skills by appreciating each other's technical and disposition attributes. Jones et al. (2004) in their review suggested one of the most important coaching issues is the belief in working with players and to get the best out of them. Successful coaches are not only well versed in the technical and tactical skills of their sport, but they also know how to teach these skills to people of all ages. Such coaches not only teach players their sport skills, but also teach and model skills that players need to live successfully in our society (Martens, 2004). Terry (1992) compared two successful soccer coaches, who performed a similar list of coaching functions and he found that they have different personalities, relationships with their players and different styles of coaching. Successful coaches should be highly motivated, reflective and develop a coaching style that is consistent with personality. Barić & Bucik (2009) describe that there were at least two types of coaches within different team and individual sports: more autocratic coaches have the motivational structure predominantly defined by a high ego goal orientation and intrinsic-extrinsic motivation, with high interest in coaching, high perception of competence, high feeling of pressure, moderate effort investment (Amorose & Horn, 2000; Smoll & Smith, 1989); democratic coaches were more autonomy supportive and use an athlete-centered approach (Mageau & Vallerand, 2003). Coach personality and his perceived role as a coach, leads to the development of a genuine coaching style that takes advantage of your personal strengths (Gilbert & Jackson, 2004).

Many coaches are knowledgeable about coaching methods and have opinions about which methods are successful and which are not. Coaching is a way to encourage players to believe in themselves. It is not essential to reach top line championship competitor status to become an effective coach. However, without reasonable experience and knowledge of competition this qualification would be very difficult to achieve (Webber & Collins, 2005). Without such experience, it would be very difficult to know and understand the feelings of the competitors and to be able to accept some of the incidents, which occur during a contest between individuals or in team game situations (Webber & Collins, 2005). This kind of experience cannot be replaced and is of the greatest value to anyone wishing to qualify and officiate in these particular areas of any sport. Lane (2006, from Collins, 2009) believed that having experience as a boxer, contributed in building a solid relationship with coaches and boxers. Judo, like many martial arts has been stereotyped over the years, with the main focus on myths of the self-defense and a belt system. Martial Arts are a wonderful alternative to team sports that will provide an excellent physical workout, but also a mental and emotional workout as well (Wolf, 2004). Here are some reasons why martial arts could be a lot better for young children than team sports: they are more convenient for developing self-defense, self-confidence (everything depends only on oneself), belts and ranking, discipline, emphasis on individual achievement, gender equity, exercise, respect for strength, competition (blaming only himself), the coach can exercise with the athletes, the never-ending competition season. Collins (2009) describes in his study that judo coaches express clear views on what constituted an effective judo coach. The traditional practice of coaching judo is held by a majority of coaches, and this attitude will make it difficult to alter coaching practices in the future. Elite coaches indicated winning to be more important, and importantly suggested aspects of judo coaching that warranted changing. Club coaches were more accepting on the effectiveness of the current judo belt system, The study looked at relationships between judo coaching and emotional intelligence. Correlation It is suggested that emotional intelligence is a concept worth developing in both coaches and players alike. Elite coaches reporting higher emotional intelligence scores than club coaches (Collins, 2009). The goal for coaching in judo should be to guide, inspire and empower the judoka to develop his or her highest potential. To do it, most qualified judo coaches have an in-depth understanding of judo from the fundamental skills to advanced tactics and strategy: they should know the progressive nature of training adaptation and the rules for judo. Coaches should be able to provide a structured environment for judoka to succeed as well as continuing to learn and develop new technical, tactical and training skills. Despite the variety of coaching methods that coaches could demonstrate, subjective evidence suggests that the majority of the methods adopted by judo coaches could be

classified as authoritarian (Collins, 2009). Personality is a good predictor of behavior that is not possible to predict general mental skills, knowledge, skills or specific situations (Barrick & Mount, 2005; Ones, Viswesvaran & Dilchert, 2005). Individual's behaviors determined by the characteristics his personality and situational factors, which may change over time. To understand and predict job satisfaction are essential knowledge about personality traits individual and his environment. Latent personality dimensions cause increasing interest of the researchers (Ivanović & Ivanović, 2010). Subjective well-being (hereinafter SWB) is a field of psychology that attempts to understand people's evaluations of their lives. These evaluations may be primarily cognitive (e.g., marital satisfaction) or may consist of the frequency with which people experience pleasant emotions (e.g., joy, as measured by the experience sampling technique) and unpleasant emotions (e.g., depression). Although temperament appears to be strongly related to SWB, demographic factors are often only weakly correlated with it. For example, Campbell, Converse, & Rodgers (1976) found that all demographic factors together accounted for less than 20 percent of the variance in SWB. Variables such as education, ethnic status, and age often correlate at very low levels with reports of SWB. Nevertheless, some demographic variables do consistently predict SWB. For example, married people of both sexes report more happiness than those who are never married, divorced, or separated (e.g. Lee, Seccombe, & Shehan, 1991). Perhaps growing up in a conflictual or distrusting environment interferes with one's later social relationships because of the cognitive templates it builds for relating to other people. In this study, we wanted to find the differences between judo coaches and coaches in other sports, in the dimensions of life satisfaction (SWB) and general life experience, that comprises few aspects related with SWB. Additionally, we have compared judo coaches with coaches in other sports, according to the demographic variables and in variables directly linked with a coaching.

Methods

Participants

We have examined a total of 132 coaches of various sports in Croatia during the seminar for coaches in Croatian Olympic Academy. The average age of a coach was 37 years (range 17-72 years), with average 15 years coaching experience (range 0-45 years). On average, the coaches were more than 13 years involved in sport at the top level (range 0-52 years), while an average of 20 years engaged in the professional sports (range 0-46 years). As a coach, on average, coaches work seven years (range 0-50 years). In relation to the type of sport, most coaches were judo coaches (43, i.e. 33%), 19 (14.4%) were tae kwon do coach, 16 (12%) were the coaches of riding and swimming, 12 (9%) were the coaches of handball, 11 (8%) gymnastics coaches, 6 (8%) volleyball coaches,

while two were karate coaches and one trainer of table tennis, rowing, diving, football, mountain guide, mountain guide. By gender, 84 (64%) coaches were men and 48 women (36%). In relation to their education level, 70 trainers (53%) had secondary school education, 9 (7%) higher education, 46 (35%) university graduates and 7 (5%) master's degree or doctorate. In terms of marital status in a sample of 53 trainers (40%) there were unmarried, 69 (53%) were married, while 9 (7%) divorced. After finishing sport career, 75 (57%) coaches worked as a coach in sports that are practiced at the level of athlete (the others were not involved in sport at top level). During their sport career, 86 (65%) coaches have medals from state championships. Only 17 (23%) thought that the senior professional athletes have to stop play competitive sports if they do not win a medal, at least at the national championships. Only a small number of trainers, i.e. 18 (14%) were members of the national cadet team, 36 (27%) of the national junior team, and 46 (35%) of the national senior team. The reasons why they stopped the career in the professional sport were: voluntary ('saturation', age) 56 coaches (42%), sports injury or illness 30 (23%), disagreement with the club 9 (7%), disagreement with their coaches, 14 (11%), critical life events (e.g. marriage, child birth, relocation, employment, etc.) 37 (28%), greater ambitions than the possibility of the club 16 (12%). Coaches who have their own child (46 coaches or 35% have no children) are intended to include it in this sport when the time comes for 47 (36%) coaches, while only 20 (15%) do not want. If their child becomes involved in sport in which the coach had his own career, 42 coaches (32%) would like to coach their own child. Even 45 (34%) of coaches thought that a good coach can be the one who was not involved in professional sport that he coach, 58 (44%) think this is partly so, while 20 (15%) believe that a good coach may be the one who himself was a top athlete. Also, 36 (27%) of coaches thought that a good coach can be the one who has not completed the appropriate coaching school, 67 (51%) thought that it only partially, and 20 (15%) believe that a good coach must complete coaching education.

Instruments

The usual method of measuring satisfaction with life is through self-report surveys in which the respondent judges and reports his life satisfaction, the frequency of her pleasant affect, or the frequency of his unpleasant emotions. Pavot and Diener (1993) review evidence on the Satisfaction With Life Scale, using the 1 - 7 scale. Total score on the scale is the sum of the results of all five variables and indicates the degree of life satisfaction with higher scores indicate greater satisfaction. The internal consistency of this questionnaire was high at $\alpha = 0.79$. We have extended the original Satisfaction With Life Scale (SWL), with additional 12 items and got three dimensions of the Extended Satisfaction With Life Scale (ESWL): Business and social life (8 items, $\alpha = 0.86$: I like my job; I effectively carry out my job; I am satisfied with my social status; I have good

family relationships; I am socially well accepted; I have loyal friends; Basically I'm in a good mood; My life's problems I largely successfully resolve.); Fitness (4 items, $\alpha = 0.76$: I'm satisfied with my physical image; I have a good health; I am satisfied with my eating habits; I am in good physical condition; In most ways my life is close to my ideal.); Life achievement (4 items, $\alpha = 0.74$: The conditions of my life are excellent; I am satisfied with life; So far I have gotten the important things I want in life; If I could live my life over, I would change almost nothing). All participants anonymously filled out a Questionnaire about General Life Experience (Andrijašević, 2009, non-published): Satisfaction and optimism (10 items; $\alpha = 0.909$), Negative emotions and stress (5 items; $\alpha = 0.888$) Life quality (5 items; $\alpha = 0.744$), Daily fatigue (2 items; $\alpha = 0.813$). The subjects answered to the questionnaire statements using the estimation scale with a six-degree assessment ('0' means a minimal or zero degree of intensity of the estimated variable; '5' means maximal intensity).

Results and discussion

As we see in the Table 1 (results of Chi-Square tests), judo coaches are very similar to the coaches of other sports in demographic variables and in variables linked with a coaching. However, judo coaches (comparing with non-judo coaches) have statistically significant: higher education level, more medals achieved on national championships, more memberships in cadet and junior national team. In the Table 2 (results of t-tests for independent samples) could be seen that judo coaches (comparing with the coaches of other sports in continuous demographic variables and in variables linked with a coaching) are statistically significantly: older, more work experienced in general as well as a coach, longer active in a top sport, later ended the professional carrier. In the Table 3 (results of univariate two-tailed ANOVA) could be seen that judo coaches (comparing with the coaches of other sports) in life satisfaction variables and in variables linked with general life experience have statistically significantly: higher life achievement, lower daily fatigue but higher level of negative emotions and stress. The main finding in our research were that the sample of judo coaches is not the same as the sample of other coaches. In general, judo coaches are more positively selected in many characteristics, comparing with group of coaches in other sports, in two life satisfaction aspects and in their sport achievements during their carrier (as same as in their education level and work experience). The simplest explanation of the differences in life achievement can be in initially positively selected sample of judo coaches, who are more experienced, more educated and previously more successful in their sport when they were active athletes. However, the explanations of lower daily fatigue at judo coaches can be only speculative, because among all the coaches is relative small number of professionals. Daily fatigue (as we can assume) is mostly the result of other sources of tiredness, rather than coach job.

Table 1: Differences in categorical demographic variables and in variables linked with a coaching (judo / other sport coaches)

Dependent variables	Categories	Judo	Other	Total	c2-test
Gender	Male	32	50	82	4,286
	Female	10	37	47	
	Total	42	87	129	
Education level	High	11	57	68	30,146**
	College		9	9	
	University	27	19	46	
	Mr/Dr	4	2	6	
	Total	42	87	129	
Marital status	Unmarried	11	41	52	5,462
	Married	27	40	67	
	Divorced	4	5	9	
	Total	42	86	128	
Medals on state championships	No	5	39	44	13,661**
	Yes	37	48	85	
	Total	42	87	129	
Career without medals	No	34	73	107	0,175
	Yes	8	14	22	
	Total	42	87	129	
Cadet national team	No	31	80	111	7,767**
	Yes	11	7	18	
	Total	42	87	129	
Junior national team	No	25	68	93	4,890*
	Yes	17	19	36	
	Total	42	87	129	
Senior national team	No	21	63	84	2,067
	Yes	21	24	45	
	Total	42	87	129	
End of career – free will (saturation)	No	27	48	75	0,967
	Yes	15	39	54	
	Total	42	87	129	
End of career – injury or illness	No	29	70	99	2,067
	Yes	13	17	30	
	Total	42	87	129	
End of career - disagreements with the club	No	41	79	120	2,027
	Yes	1	8	9	
	Total	42	87	129	
End of career - disagreements with your coach	No	39	76	115	0,886
	Yes	3	11	14	
	Total	42	87	129	
End of career - critical life periods	No	26	66	92	2,698
	Yes	16	21	37	
	Total	42	87	129	
End of career – lack of ambitions	No	34	79	113	2,531
	Yes	8	8	16	
	Total	42	87	129	
You want your child practicing your sport	No	6	12	18	0,823
	Yes	17	30	47	
	Total	23	42	65	
You want to coach your child	No	11	20	31	0,534
	Partially	15	27	42	
	Yes	1		1	
	Total	27	47	74	
The coach who wasn't a top athlete	No	4	14	18	0,741
	Partially	15	43	58	
	Yes	14	30	44	
	Total	33	87	120	
Coach without a coaching school	No	5	14	19	0,899
	Partially	16	49	65	
	Yes	12	24	36	
	Total	33	87	120	

Similar interpretation can be given for undesirable negative emotions and stress, which are more emphasized at judo coaches than at the others. Those emotions can't be easily explained by the nature of the judo or judo coaching, as well as with demographic factors. Only rational based hypothesis can be in relation between the age and level of negative emotions (judo coaches are older). The shortcomings of study are mainly arising from the fact that judo coaches are positively selected in many relevant factors, mostly connected with the experience in judo and coaching. Some research questions could be reformulated, in order to obtain relevant data (for example, we can use MANOVA in data analysis, trying to find interactive variables that affect differences between the coaches).

Table 2: Differences in continuous demographic variables and in variables linked with a coaching (judo / other sport coaches)

Dependent variables	df	Mean (Std. Dev.) judo (42)	Mean (Std. Dev.) other sports (87)	t-test (2-tailed)
Age	127	45,2619 (14,3494)	33,0115 (8,5038)	5,116**
Work experience	127	22,500 (13,8322)	10,8810 (8,1926)	5,021**
Years in top sport	127	19,1667 (0,7619)	12,1513 (1,0539)	4,050**
End of professional career	127	26,5000 (11,4769)	17,0345 (12,5044)	4,262**
Years of coach career	127	12,0476 (12,2792)	4,2907 (5,49624)	3,907**

On the other hand, the sample of coaches from other sports is very heterogeneous. In future studies we can expand and improve our research, examining a larger and more representative sample (especially at the coaches of other sports), better equalize the samples of judo and other coaches.

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Table 3: Differences in life satisfaction variables and general life experience (judo – other sport coaches)

Dependent variables	Between/ Within Groups (sum of squares)	df	Mean (Std. Dev.) judo (42)	Mean (Std. Dev.) other sports (87)	F-test (ANOVA)
Business and social life	0,107 129,552	1, 127	0,0440 (0,6270)	-0,0175 (1,1485)	0,105
Fitness	2,119 127,394	1, 127	0,1736 (0,7806)	-0,0999 (1,0913)	2,112
Life achievement	9,551 119,315	1, 127	0,4043 (0,7619)	-1,17634 (1,0539)	10,166**
Satisfaction and optimism	0,125 109,849	1, 127	0,0788 (1,1378)	0,0073 (,8835)	0,135
Negative emotions and stress	22,325 97,655	1, 127	0,7000 (1,0027)	-0,2556 (0,8659)	27,205**
Life quality	0,233 117,125	1, 127	-,0488 (1,1535)	0,0489 (0,9227)	0,237
Daily fatigue	28,390 90,309	1, 127	-0,7587 (0,7250)	0,3189 (0,9946)	37,410**

Means and Std. Dev. are expressed in regression factor scores

Conclusion

Judo coaches have statistically significant higher education level, more medals achieved on national championships, more memberships in cadet and junior national team. comparing with the coaches from other sports. Judo coaches are older, more work experienced in general as well as a coach, longer active in a top sport, later ended their professional carrier.

According to the life satisfaction and general life experience, judo coaches have statistically significantly higher life achievement, lower daily fatigue but higher level of negative emotions and stress.

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ŽIVOTNO ZADOVOLJSTVO I OPĆE ŽIVOTNO ISKUSTVO TRENERA U JUDOU I U DRUGIM SPORTOVIMA

Sažetak

Cilj istraživanja bio je pronaći razlike između judo trenera i trenera drugih sportova, u dimenzijama zadovoljstva životom i općeg životnog iskustva, kao i prema demografskim varijablama i varijablama izravno povezanim s treniranjem. Ispitano je ukupno 132 trenera različitih sportova u Hrvatskoj (43 judo trenera i preostalih iz drugih sportova), tijekom seminara za trenere Hrvatske olimpijske akademije. Za mjerenje zadovoljstva životom, korištena je Proširena skalu zadovoljstva životom (modifikacija skale Pavota i Dienera, 1993) i Upitnika općeg životnog iskustva (Andrijašević, 2009). Judo treneri bili su obrazovaniji, osvojili više medalja na državnim prvenstvima te češće bili članovi kadetske i juniorske reprezentacije, u usporedbi s trenerima iz drugih sportova. Stariji su, iskusniji u radu i trenerskom radu, dugotrajnije aktivni u vrhunskom sportu te su kasnije završili svoju profesionalnu karijeru. U zadovoljstvu životom i općeživotnom iskustvu, judo treneri imali su bolje životno postignuće, manje izražen dnevni umor, ali pokazuju višu razinu negativnih emocija i stresa.

Ključne riječi: treniranje, razlike, osobnost, pozitivna selekcija

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THE EFFECTS OF BASIC FENCING STUDIES AND VELOCITY TRAINING ON REACTION TIME IN THE 9–12 YEAR-OLD BEGINNERS OF FENCING

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Abstract

The aim of this study was to investigate the effects of basic fencing and velocity training on reaction time in the 9-12 year-old beginners of fencing. The 45 beginners (17 female, 28 male, total age means: 11.04 ± 0.93 years, height means: 142.76 ± 10.71 cm, weight means: 39.64 ± 10.13 kg) who applied to the Mersin Büyükşehir Municipality Fencing Sports Club (MBMFSC) volunteered to participate in this study. The beginners were randomly divided into three groups; Basic Fencing Group (BFG); Velocity Group (VG); and Control Group (CG). Each group was consisted of 15 children. During the study, BFG participated in a 8-week basic fencing training program (3 days per week, 50 minutes per session). Under the same conditions, velocity training program was performed by VG. The CG did not participate in any of the activities regularly. At the baseline and at the end of 8 week-programs, the lower extremity reaction time of all groups was measured with the Newtest Automatic Performance Analyzer. Reaction time of the upper extremity in all groups was also recorded with the apparatus of upper extremity reaction time measurement. All analyses were made using the SPSS statistical package, version 13.0. ANOVA test was used for the comparison of three groups (BFG, VG, CG). Paired- samples t-test was used the comparison of baseline and at the end of 8 week for each group. The level of significance was accepted as $p < .05$ and the reliability level as %95. At the baseline and at the end of 8 week-program, the upper extremity reaction time of BFG showed the significant difference ($p = 0.002$). At the baseline and the end of that 8 week-program, the upper and the lower extremity reaction times of VG showed the significant difference (the upper $p = 0.011$, the lower $p = 0.022$). At the end of 8 week-program, there was significant differences between groups ($p = 0.03$). In conclusion, the 9-12 year-old beginners of fencing are performed not only basic fencing training program but also velocity training program for their reaction times. As a result of this, we emphasize multi-model program which include both basic fencing training program and velocity training program contribute to improve to the reaction time in the 9-12 year-old beginners of fencing.

Key Words: training, fencing, reaction time

Introduction

At the present days, the international successes in sport can be affect the level of moral of societies positively. Achievement of athletes is very important for presentation of their country. Characteristics and physical fitness components (strength, flexibility, endurance, velocity etc.) are very important role on success of athletes. There were shown a lot of studies about characteristics and physical fitness parameters of athletes in different sport branches (Ricarte, Freire, & Oliveira, 2008; Marques, Tillaar, Vescovi, & González-Badillo, 2008; Oxyzoglou, Kanioglou, Rizos, Mavridis, & Kabitsis, 2007; Moore, & Fry, 2007; Tsolakis, Bogdanis, Vagenas, & Dessypris, 2006). In these studies, researches had stated the physical, physiological and psychological evaluations of athletes. These evaluations included individual sports as well as team sports. They can be assist to be elite of athletes in the future. Fencing is an open skill combat sport requiring the execution of complex body movement and efficient game strategies (Tsolakis, Kostaki, & Vagenas, 2010) In addition, fencing is a complex, dynamic as well as technical and tactical, multidimensional sport (Vertopoulos, Tsolakis, & Remoundou, 2010). Dynamic movements, such as steps and jumps of different direction as well as lunges performed to hit the opponent, depend on muscle strength and

power (Tsolakis, Kostaki, & Vagenas, 2010). In fencing, the success and performance of the athletes depend on many factors. Besides the technical and tactical training, the power of the aerobic and anaerobic, velocity, endurance, body fat (%), flexibility, coordination and skill are the basic factors effecting success. Knowledge of the levels of all these factors is guided for the trainers to adequately assess the level of performance in athletes. Accordingly, these factors are being used by trainers in order to define the performance levels of athletes in qualitative and quantitative manner. Fencing requires rapid and accurate decision-making while competing and experiencing gradual perceived effort (Mouelhi, Bouzaouach, Tenenbaum, Ben, Feki, & Bouaziz, 2006). Velocity in fencing is defined as the ability of the completion of the motor movement in a shortest possible time (Arseven, 1983). The reaction time, which is one of the effective factors in velocity, has become the leading role to get the achievement in fencing (Çolakoğlu, Akgün, Yalaz, & Ertat, 1987). When literatures were investigated, a lot of studies were found about reaction time and fencing (Williams, & Walmsley, 2000b; Hunter, Thompson, & Adams 2001; Levitt 1971; Welford 1980; Zhang, Yan, & Yangang 2009; Neto, Bolander, Pacheco, & Bir 2009; Collardeau, Brisswalter, & Audiffren 2001; Tsorbatzoudis, Barkoukis, Danis, & Grouios 1998; Sterkowicz-Przybycien 2009; Williams, & Walmsley,

2000a; Poulis, Chatzis, Christopoulou, & Tsolakis, 2009), but there are no any literatures about the training programs of reaction time that are the most effective in fencing. In conclusion, this study was designed, and aimed on the question of which of the training programs can increase the success of the beginners of 9-12 years old teenagers of fencing sport, on their reaction time by investigating the effects of the basic fencing trainings and velocity trainings.

Material and Methods

Table 1. Training Program Context of Basic Fencing Group

WEEKS	PROGRAM CONTEXT
1ST WEEK	Description of basic characteristics of fencing, introduction of equipments, basic position and faults, repeated actions in play format, forward movement and stepping.
2ND WEEK	Repetition of movement from basic position to forward. All sportsmen were paid attention one by one in order that all reach at the same level. Backward movement was performed in basic position. Movements were intensified by exercises of forward and backward movements from basic position.
3RD WEEK	Forward-backward movements from basic position were repeated till being performed without any fault. Exercises for distance were performed. Distance was exercised by normal walking movements. Forward-backward movements from basic position and distance were together exercised. In basic position the movement "show with arm" was performed without any sabre. Attack movement was performed.
4TH WEEK	In basic position without any fault, forwards, backwards and attack movements were performed with visual commands (without verbal commands). Foot coordination exercises were performed. Combined movement exercises (show forwards show forwards exercises) were performed. These exercises were performed in couples. Ending was performed by distance exercises in pair work.
5TH WEEK	Thrusts were used in pair works. In attacks with distance exercises, principal movement orders and in thrusts accuracy of the target was paid attention. General repetition of the exercises in other weeks was performed.
6TH WEEK	"Disengagement" exercise in place was performed. "Disengagement" movement was combined with forwards and backwards movements performed. These movements were performed till being intensified.
7TH WEEK	"Disengagement" movement was performed after attack movement was added. Faults in these movements were corrected and it was greatly repeated.
8TH WEEK	One-two exercise was performed with forwards backwards movement. Coordinative work of all taught movements was executed.

Demographical Characteristics of the Participant Groups: 45 children in ages of 9-12 applying to MBMFSC (17 are female, 28 are male; age mean: $11,04 \pm 0,93$ years, height mean: $142,76 \pm 10,71$ cm, weight mean: $39,64 \pm 10,13$ kg), participated in the study. This study was carried out on 45 children who had given their informed consent prior to participating in this project. The research was performed following the declaration of Helsinki Principles. 45 children were randomly divided into 3 groups consisting of 15 subjects: I st Group: Basic Fencing Group (BFG), II nd Group: Velocity Group (VG) and III rd Group: Control Group (CG), consisting of children who are apply to MBMFSC but they were not performing regular sport activities 8 week. At the end of the 8 weeks, they joined all training of MBMFSC.

Baseline lower and upper extremities reaction times were measured for all three groups. Participant of CG were trained as athletes in MBMFSC after this study.

Training Programs

Subjects in the BFG and VG performed the exercise program, which lasted 8 weeks (3 days per week, 50 minutes per session). BFG performed basic fencing training and VG was got to perform velocity training. Training programs were trained by using gym and equipments of MBMFSC. CG was not participated in any activity.

Table 2. Definitions, Daily Repetition Numbers and Weeks of Training Of Basic Fencing Movements

TRAINING MOVEMENTS	DEFINITIONS OF MOVEMENTS	DAILY REPETITION NUMBERS OF MOVEMENTS	WEEKS OF TRAINING
EN GARDE	The fencing position; the stance that fencers assume when preparing to fence.	50 REPETITION	ALL WEEKS
ADVANCE	A movement forward by step, cross, or balestra	100 REPETITION	ALL WEEKS
RETREAT	Step back; opposite of advance.	100 REPETITION	ALL WEEKS
EXTEND	Extending the arm forward	200 REPETITION	3.4.5.6.7.8 WEEKS
LUNGE	An attack made by extending the rear leg and landing on the bent front leg	50 REPETITION	4. 5. 6. 7. 8. WEEKS
ADVANCE LUNGE	A movement forward by step and lunge	50 REPETITION	4. 5. 6. 7. 8. WEEKS
RESTRICTED DISTANCE TRAINING (MEASUREMENT TRAINING)	The distance between the fencers were fixed by the fencer.	50 REPETITION	3.4. WEEKS
DISENGAGEMENT TRAINING	A circular movement of the blade that deceives the opponent's parry, removes the blades from engagement, or changes the line of engagement.	100 REPETITION	6.7.8. WEEKS

Training Program of Basic Fencing Group

The basic fencing program was divided into 3 periods (warming-up: 15 minutes = 5 minutes jogging + 5 minutes stretching exercises + 5 minutes special warming-up, main period: 25 minutes basic fencing movements, cool down: 10 minutes = 5 minutes jogging + 5 minutes stretching exercises). Duration of Training Program: 8 Weeks. Training Period: 50 Minutes. Number of Weekly Training: 3 Days. Place of Training: MBMFSC Gym. Context and Definition of Training: Basic Fencing Trainings (Table 1, Table 2). Total of 8 basic fencing movements were trained during the basic fencing training by trainer.

Definitions, daily repetition numbers and weeks of training of these movements were showed Table 2. All fencer were used epee weapon of certificated FIE during the training Training with epee weapon of fencing was started at the 4. week.

Training Program of Velocity Exercise

Period of Training Program: 8 Weeks. Intensity of Training: Maximum. Training Period: 50 Minutes. Number of Training Weekly: 3 Days. Place of Training: MBMFSC Gym. Main Period: 25 Minutes. Alactic Anaerobic Velocity: A) Starts (Start distance is maximum 5 metres), High start sprint, Low start sprint, Start from different positions (The Position of Lying on Back), Throwing to wall with ball: 5 shooting through the wall consecutively, Skipping with rope (5secs): At maximum speed; B) Basic Movement Starts in Fencing (Between the Lines), Forwards, Attack, Forward Attack, Flash; C) Velocity of Movement in Various Situation. Quality of Intensity: 1 Set = Four Repetition. Resting: Between of Repetitions: 15-20 seconds. Between of Sets: 1,5 minutes. Post 3 Sets: 5 minutes. In both trainings, the same warming-up and cooling down programs were used. WARMING-UP: 15 minutes. General Warming-Up: 10 minutes. Jogging: 5 minutes, each person runs in heart-beat tempo, which is determined by 60-75% of their maximal heart beat numbers. Stretching: 5 minutes, 14 stretching exercises (Table 3). Special Warming-Up: 5 minutes. Alactic Polymetrics: A) Skipping (Exercising Arms and Legs at Maximum Speed), B) Bouncing (Pulling Knees to Abdomen by Bouncing), C) Jumping over set (One and Pair Feet Forwards over the 3 Fences), D) Jumping Forwards (One and Pair Feet). Cool-down: 10 minutes. 5 minutes of jogging. 5 minutes of stretching exercises.

Table 3. Stretching Exercises

1. Forwards and backwards head stretch,
2. Sideways head stretch,
3. Chest and sholders stretch, Deltoid muscle stretch,
4. Triceps muscle stretch,
5. Overhead stretch,
6. Lateral trunk muscles stretch,
7. Arched back stretch,
8. Leg extensors and pelvic flexors stretch,
9. Spinal twist stretch,
10. Paravertebral muscles stretch,
11. Loosen up stretch,
12. Upper back prayer
13. Double knee-to-chest stretch

Measurements

Measurement of Height and Body Weight: Heights and weights were measured with Nan Scale (1500 kg), which was calibrated before each measurement. Measurements of Lower Extremities Reaction Times: Reaction times of lower extremities in all groups at the baseline and at the end of 8 weeks were recorded by New Test automatic performance analyzer. Dominant foot of participant was put on the newtest mat in basic position. Participant was lunge with dominant foot in order to pass in front of optical sensor after light and sound simultaneous warning. All participants were stated that the technique is not important in lunge movement.

Mean of five measurements was recorded for each participant. Measurement of lower extremities reaction times of participants was shown in the Figure 1. Measurements of Upper Extremities Reaction Times: Reaction times of upper extremities in all groups at the baseline and at the end of 8 weeks were recorded by measurement device for reaction times of upper extremities developed in our university. Computer software of measurement device for reaction times of upper extremities works with time crystals of computers (Intel Pentium M 1.70 GHz, HP manufactured). Participant's epee weapon is 15 cm far away from the target mat. Researcher submitted the signal which operates the warning sign on target mat after subject was concentrated by researcher. By the time subject perceived the light, he thrust to touch the platform without considering any target (Sabre's standardization was made according to FIE). Mean value of five measurements was recorded for each subject. Measurement of upper extremities reaction times of participants was shown in the Figure II.

Statistical Assessments of Data

All analyses were conducted using the SPSS statistical package, version 13.0. Descriptive statistics were used for the means and standard deviations. ANOVA test was used for the comparison of three groups (BFG, VG, CG). Paired- samples t-test was used for baseline and at the end of 8 week the comparison of within-group. The level of significance was accepted as $P < .05$ and the reliability level as %95 (SPSS, 1993).

Results

Table 4. Characteristics of Subjects with Basic Fencing Group, Velocity Group and Control Group

GROUPS	Number of Participants		Age (year)	Height (cm)	Weight (kg)
	Female	Male	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
BFG	6	9	11.07 $\pm$ 0.96	148.13 $\pm$ 11.43	43.47 $\pm$ 10.99
VG	6	9	11.13 $\pm$ 0.83	134.93 $\pm$ 11.32	38.07 $\pm$ 8.77
CG	5	10	11.93 $\pm$ 1.03	140.07 $\pm$ 11.73	37.40 $\pm$ 10.06
TOTAL	17	28	11.04 $\pm$ 0.93	141.04 $\pm$ 12.50	39.64 $\pm$ 10.13
t	0.09		0.17	2.94	1.67
p	0.92		0.84	0.06	0.20

SD:Standard deviation

Table 5. Comparison of the Mean Values at the Baseline and after 8 Weeks for Lower Extremities Reaction Times of Basic Fencing Group of Subjects

Measurements of Lower Extremities Reaction Times	n	Mean $\pm$ SD (ms)	t	p
Baseline	15	806.87 $\pm$ 95.90	2.063	NS
After 8 weeks	15	800.04 $\pm$ 98.18		

NS:not significant, SD:Standard deviation

Table 6. Comparison Of the Mean Values at the Baseline and After 8 Weeks for Upper Extremities Reaction Times of Basic Fencing Group of Subjects

Measurements of Upper Extremities Reaction Times	n	Mean±SD (ms)	t	p
Baseline	15	413.25±30.00	3.832	0.002*
After 8 weeks	15	390.92±21.47		

*p<0.05 (significant), SD:Standard deviation

Table 7. Comparison of the Mean Values at the Baseline and After 8 Weeks for Lower Extremities Reaction Times of Velocity Group of Subjects

Measurements of Lower Extremities Reaction Times	n	Mean±SD (ms)	t	p
Baseline	15	810.80±89.57	2.578	0.022*
After 8 weeks	15	801.89±92.52		

*p<0.05(significant), SD:Standard deviation

Table 8. Comparison of the Mean Values at the Baseline and After 8 Weeks for Upper Extremities Reaction Times of Velocity Group of Subjects

Measurements of Upper Extremities Reaction Times	n	Mean±SD (ms)	t	p
Baseline	15	423.43±38.31	2.943	0.011*
After 8 weeks	15	405.41±33.91		

*p<0.05(significant), SD:Standard deviation

Table 9. Comparison of the Mean Values at the Baseline and After 8 Weeks for Lower Extremities Reaction Times of Control Group of Subjects

Measurements of Lower Extremities Reaction Times	n	Mean±SD (ms)	t	p
Baseline	15	838.53±65.33	1.618	NS
After 8 weeks	15	825.93±67.46		

NS=not significant, SD:Standard deviation

Table 10. Comparison of the Mean Values at the Baseline and After 8 Weeks for Upper Extremities Reaction Times of Control Group of Subjects

Measurements of Upper Extremities Reaction Times	n	Mean±SD (ms)	t	p
Baseline	15	421.65±26.17	-0.670	NS
After 8 weeks	15	433.37±61.63		

NS=not significant, SD:Standard deviation

Table 11. Comparison of the Mean Values at the Baseline and After 8 Weeks for Lower Extremities Reaction Times of Within Groups of Subjects

Groups	n	Baseline	After 8 Weeks
		Mean±SD (ms)	Mean±SD (ms)
BFG	15	806.87±95.90	800.04±98.18
VG	15	810.80±89.57	801.89±91.52
CG	15	838.53±65.53	825.93±67.46
t		0.62	0.42
p		NS	NS

NS=not significant, SD:Standard deviation

Table 12. Comparison Of the Mean Values at the Baseline And after 8 Weeks for Upper Extremities Reaction Times of Within Groups of Subjects

Groups	n	Baseline	After 8 Weeks
		Mean±SD (ms)	Mean±SD (ms)
BFG	15	413.25±30.00	390.92±21.47
VG	15	423.43±38.31	405.41±33.91
CG	15	421.65±26.17	433.37±61.63
t		0.44	0.65
p		NS	0.03*

*p<0.05(significant), NS=not significant, SD:Standard deviation

The results of this study showed that there were not any significant differences among the groups in means of demographical characteristics ($p>0.05$) (Table 4). Age means of TEG: 11.07 ± 0.96 , height means: 148.13 ± 11.43 cm, weight means: 43.47 ± 10.99 kg. Age means of SG: 11.13 ± 0.83 , height means: 134.93 ± 11.32 cm, weight means 38.07 ± 8.77 . Age means of KG: 11.93 ± 1.03 , height means: 140.07 ± 11.73 , weight means 37.40 ± 10.06 . Comparison of the mean values at the baseline and after 8 weeks for lower extremities reaction times of basic fencing group of subjects, were showed in the Table 5. There were no significant differences in the baseline (806.87 ± 95.90 ms) and at the end of 8 weeks (800.04 ± 98.18 ms) ($p=0.06$) (Table 5). Comparison of the mean values at the baseline and after 8 weeks for upper extremities reaction times of basic fencing group of subjects were showed in the Table 6. There were significant differences in the baseline (413.25 ± 30.00 ms) and at the end of 8 weeks (390.92 ± 21.47 ms) ($p=0.002$) (Table 6). Comparison of the mean values at the baseline and after 8 weeks for lower extremities reaction times of velocity group of subjects were showed in the Table 7. There were significant differences in the baseline (810.80 ± 89.57 ms) and at the end of 8 weeks (801.89 ± 92.52 ms) ($p=0.002$) (Table 7). Comparison of the mean values at the baseline and after 8 weeks for upper extremities reaction times of velocity group of subjects were showed in the Table 8. There were significant differences in the baseline (423.43 ± 38.31 ms) and at the end of 8 weeks (405.41 ± 33.91 ms) ($p=0.011$) (Table 8). Comparison of the mean values at the baseline and after 8 weeks for lower extremities reaction times of control group of subjects were showed in the Table 9. There were no significant differences in the baseline (838.53 ± 65.33 ms) and at the end of 8 weeks (825.93 ± 67.46 ms) ($p=0.128$) (Table 9). Comparison of the mean values at the baseline and after 8 weeks for upper extremities reaction times of control group of subjects were showed in the Table 10. There were no significant differences in the baseline (421.65 ± 26.17 ms) at the end of 8 weeks (433.37 ± 61.63 ms) ($p=0.128$) (Table 10). Comparison of the mean values at the baseline and after 8 weeks for lower extremities reaction times of within groups of subjects were showed in the Table 11. There were no significant differences in the baseline (BFG= 806.87 ± 95.90 ms, VG= 810.80 ± 89.57 ms and CG= 838.53 ± 65.53 ms) and at the end of 8 weeks (BFG= 800.04 ± 98.18 ms,

VG=801.89±91.52ms and CG=825.93±67.46ms) (at the baseline $p=0.54$, after 8 weeks $p=0.66$) (Table 11). Comparison of the mean values at the baseline and after 8 weeks for upper extremities reaction times of within groups of subjects were showed in the Table 12. There were no significant differences in the baseline (BFG=413.25±30.00ms, VG=423.43±38.31ms and CG=421.65±26.17ms) but there were significant differences at the end of 8 weeks (BFG=390.92±21.47ms, VG=405.41±33.91ms and CG=433.37±61.63ms) (at the baseline $p=3.87$, after 8 weeks $p=0.03$) (Table 12).

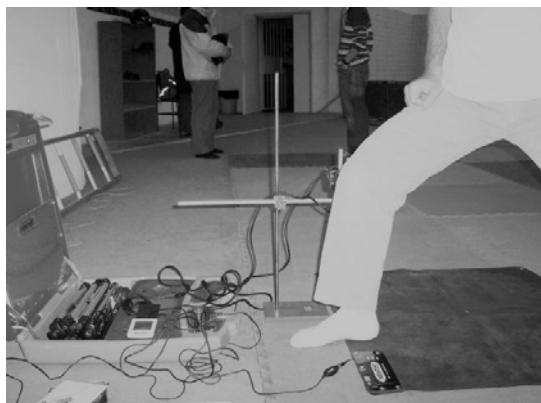


Figure I. Measurement of Lower Extremities Reaction Times

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Discussion and Conclusion

Total of 45 students were involved in this study as volunteers, who applied to MBMFSC mean age is 11.04±0.93 years, mean height is 142.76±10.71 cm and mean weight is 39,64±10.13 kg. They were divided into three groups as BFG, VG and CG. Each of three groups has similar demographical characteristics. It has been indicated that visual, auditory and tactile reaction times are important in games and combat sports (Bhavanani et.al 2003). We can be emphasized that reaction trainings in technical workout of fencing shall contribute to performance of athletes. The findings of this study showed that there were significant improvements in measurements of reaction times at the end of 8 weeks (upper extremities of BFG and VG, lower extremities of VG) in subjects who participated in velocity training and basic fencing training. The results revealed that there were no statistically significant differences between the BFG's baseline means of lower extremities reaction times and at the end of 8 weeks' means of lower extremities reaction times ($p=0.06$), although there were improved BFG's means of lower extremities reaction times at the end of 8 weeks (baseline means: 806.87±95.90ms, after 8 weeks: 800.04±98.18ms). Extra pyramidal system controls the movements learned by the help of cerebral cortex and later the movement become automatic (stereotype).

Cortex only changes these automatic movements if necessary. For example an athlete can repeat a movement many times and later the movement becomes automatic. However, during running, if one steps on an unfamiliar surface, cortex interferes immediately and makes the foot to place its normal position (Dere et.al 1994). There were no significant differences between baseline and 8 week's values of the reaction times for BFG's lower extremities. This may be attributed to the necessity of long period for making automatic movements (Arseven 1983). It seems that training technically accurates lunge movement. 8 weeks is not enough to make accurate lunge movement. It also may be attributed that BFG subjects' concentration change into the technical of the movement instead of velocity of the movement. Technically learning of the lunge movement is consulted to be the first step of performance parameters. It can be pointed that learning this motion accurately may contribute to improvement of motor skills. Besides, if an athlete focuses on performing the movement technically accurate, reaction time shall be prolonged (Montes et.al 2000). There were a significant differences at the level of 0.02 between the reaction times at the baseline ($x=413.25±30.00ms$) and at the end of 8 weeks ($x=390.92±21.47ms$) of BFG's upper extremities. This significant difference may result from that the techniques of lunge movement at lower extremities are more complex than thrusting movement performed at upper extremities. In this study showed that there were significant difference between the VG's lower extremities' reaction times at the baseline (810.80±89.57ms) and at the end of 8 weeks (801.89±92.52ms) ($p=0.02$). The reaction times at the end of 8 weeks of VG were faster than the reaction times at the baseline. The comparison of the baseline (423.43±38.31ms) and at the end of 8 weeks (405.41±33.91ms) values for reaction times of upper extremities in VG were showed significant improvements ($p=0.01$). From these results, it can be considered that the VG subjects should perform velocity training in the preparation period. Baur et. al emphasized that 8 elite racing drivers and 10 physically active controls matched for age and weight were tested in a reaction and determination test requiring upper and lower extremity responses to visual and audio cues. The reaction time of the racing drivers was significantly faster than the controls (Baur et.al 2006). In addition, Bhavanani revealed that individuals' visual and audio reaction times were improved with yoga trainings (Bhavanani et.al. 2003). These studies supported our study. The comparison of the baseline (421.65±26.17ms) and the end of 8 weeks (433.37±61.63ms) values for reaction time in CG' upper extremities showed no statistically significant differences ($p=0.128$). In a study, it is reported that reaction times of athletes who trained were better than the athletes who not trained (Montes et.al 2000). Besides, Ando et.al. emphasized that soccer and non-soccer players were measured visual reaction times. They found that visual reaction times of soccer players were better than non-soccer players (Ando et.al 2000).

Our study also gave support to these findings of these studies by Montes et. al. and Aldo et. al. The comparison of the baseline (BFG=806.87±95.90 ms, VG=810.80±89.57ms and CG= 838.53±65.33 ms) and after 8 weeks values (BFG=800.04±98.18 ms, VG=801.89±91.52 ms and CG=825.93±67.46ms) for lower extremities reaction times in BFG, VG, CG showed no statistically significant differences (at the baseline $p=0.54$, after 8 weeks; $p=0.66$). The comparison of the baseline (BFG=413.25±30.00ms, VG=423.43±38.31 ms and CG=421.65±26.17 ms) and after 8 weeks values (BFG=390.92±21.47ms, VG=405.41±33.91 ms and CG=433.37±61.63 ms) for upper extremities reaction times in BFG, VG, CG showed no statistically significant differences in values at the baseline but, there were significant differences in values after 8 weeks (at the baseline $p=3.87$, after 8 weeks; $p=0.03$). Montes et.al. reported the comparison of eye-hand and eye-foot visual reaction times of 53 young male soccer players and 60 young male non-soccer players. Their results indicated the significant differences between soccer and non-soccer players, with the soccer players demonstrating faster reaction times (Montes et.al 2000). In our study, there were significant differences between reaction times' means of upper extremities and lower extremities. Reaction time is the time in which impulse reaching to eye and ear are processed in MSS and then orders are

transported by peripheral nerve and passes through motor endplate and motor responses are formed (Dere et. al 1994). If the athlete pays his attention to one impulse, reaction time shall be faster. Attention is concentrated to impulse by the help of thalamus which filters other senses. The reason why the values of the reaction time become different in both extremities is that visual impulse is only used in upper extremity test, but in both visual and audio impulses are used in lower extremities. The reason why different stimulus is used results from characteristics of test measurement instrument. There were stated that a positive improvement between reaction times of VG's lower and upper extremity at the baseline and after 8 weeks. However improvement VG upper extremities' reaction time values after 8 weeks (18.02ms) was lower than the values of BFG's upper extremities (22.33ms). This result would indicate that BFG training program might be more useful than VG training program in the improvement of reaction time. However, lower extremity reaction times of BFG training program was improved less than VG training program. For that reason, the velocity training should be added to BFG lower extremities' study for reaction time improvement. As a result, we suggest that the new multi-model programs (velocity+basic fencing training programs) should be applied to children in ages of 9-12, for the improvement of the reaction times of lower and upper extremities.

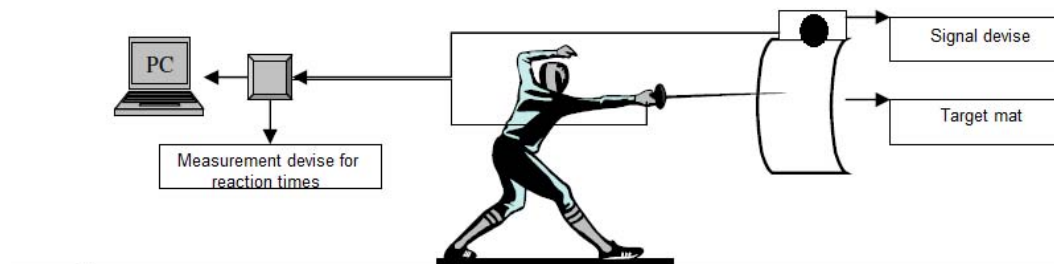


Figure II Measurement of Upper Extremities Reaction Times

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EFEKTI BAZIČNE STUDIJE MAČEVANJA I TRENINGA BRZINE NA VRIJEME REAKCIJE KOD POČETNIKA U MAČEVANJU UZRASTA 9-12 GODINA

Sažetak

Cilj ove studije bio je istraživanje efekata bazičnog mačevanja i treninga brzine na vrijeme reakcije kod početnika uzrasta 9-12 godina. Ukupno 45 početnika (17 djevojčica, 28 dječaka, prosječno starih 11.04 ± 0.93 g. Prosječne visine 142.76 ± 10.71 cm, i mase 39.64 ± 10.13 kg) koji su pristupili Mersin Büyükşehir Municipality Mačevalačkom sportskom klubu (MBMFSC) dobrovoljno je sudjelovalo u istraživanju. Ispitanici su slučajnim odabirom podijeljeni u tri skupine: temeljna (BFG), grupa za brzinu (VG) i kontrolna (CG). U svakoj je bilo po 15 djece. Za vrijeme studije, BFG su sudjelovali u 8-tjednom trenažnom programu (3 dana tjedno, 50 minuta po treningu). Pod istim uvjetima primjenjen je program brzine za VG grupu. Grupa CG nije regularno sudjelovala ni u jednom od ova dva programa. Na početku i nakon 8 tjedana, kod svih grupa je izmjereno vrijeme reakcije uz pomoć Newtest Automatic Performance Analyzera. Vrijeme reakcije gornjih ekstremiteta kod svih grupa je također snimljeno uređajem za mjerenje reakcije gornjih ekstremiteta. Sve analize su izvršene uz pomoć SPSS statističkog paketa, ver. 13.0. ANOVA test je korišten za usporedbu triju grupa (BFG, VG, CG). Paired-uzorkovani t-test je korišten na početku i nakon 8 tjedana kod svih grupa. Razina prihvatljive značajnosti je postavljena kao $p < .05$ i razina pouzdanosti od 95 %. Na početku i nakon 8 tjedana programa, vrijeme reakcije gornjih ekstremiteta kod BFG grupe pokazalo je značajnu razliku ($p = 0.002$). Na početku i nakon 8 tjedana programa, vrijeme reakcije gornjih i donjih ekstremiteta kod VG grupe pokazalo je značajnu razliku (gornji $p = 0.011$, donji $p = 0.022$). Na početku i nakon 8 tjedana programa, dobivene su značajne razlike između grupa ($p = 0.03$). Zaključno, kod početnika uzrasta 9-12 godina u mačevanju pokazuje se ne samo bazični trenažni program nego i program treninga brzine za njihovo vrijeme reakcije. Kao rezultat toga, naglašava se multi-model programa rada koji uključuje oba, i temeljni mačevalački trenažni program, al i program treninga brzine koji doprinose vremenu reakcije kod početnika u mačevanju uzrasta 9-12 godina.

Ključne riječi: trening, mačevanje, vrijeme reakcije

EFFECTS OF SIX WEEKS DEPTH JUMP AND COUNTERMOVEMENT JUMP TRAINING ON AGILITY PERFORMANCE

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Original scientific paper

Abstract

The purpose of this investigation was to compare the effects of six weeks of depth jump and countermovement jump training on agility performance. Eighteen male collegiate students participated in the present study and were randomly assigned to two groups: depth jump (DJ) and countermovement jump (CMJ). Subjects in the DJ and CMJ groups performed 5 sets of 20 repetition jumps from an 18-inch box at two days a week for six weeks. The Illinois agility test and T test were measured a week pre and post six weeks of training. A 2×2 analyses of variance was used for the statistical analyses. Both groups indicated significant improvement than pre training in Illinois agility test and T test ($P < 0.05$); likewise, there were no significant differences between the DJ and CMJ training on agility performance after 6 weeks of training ($P > 0.05$). In conclusion, the DJ and CMJ training improved agility performance, and it can be recommended that, coaches and athletes design these types of plyometric training for improving the ability of acceleration, deceleration and agility movements.

Key words: stretch shortening cycle, quickness, jumping

Introduction

Plyometric training such as jumping, bounding, and hopping exercises that exploit the stretch-shortening cycle have been shown to enhance the performance of the concentric phase of movement and increase power output (Gehri, et al., 1998). Plyometric exercises evoke the elastic properties of the muscle fibers and connective tissue in a way that allows the muscle to store energy during the deceleration phase and release that energy during the acceleration period (Asmussen & Bonde-Peterson, 1974). Several studies reported that, plyometric training can contribute to improvements in vertical jump performance, leg strength, muscular power, increase joint awareness, and overall proprioception (Harrison & Gaffney, 2001; Bobbert, et al., 1996; Stemm & Jacobsen, 2007; Saez Saez de Villarreal, et al., 2009; Hewett, et al., 1996; Myer, et al., 2006). Plyometric drills usually involve stopping, starting, and changing directions in an explosive manner. These movements are components that can assist in developing agility (Miller, Hilbert, & Brown, 2001). Agility is the ability to maintain or control body position while quickly changing direction during a series of movements (Twist & Benicky, 1996). Agility requires rapid force development and high power output, as well as the ability to efficiently utilize the stretch shortening cycle in ballistic movements (Plisk, 2000; Thomas, French, & Philip, 2009). Plyometric training has been shown to improve these requirements (Stemm & Jacobse, 2007; Pilsk, 2000; Thomas, French, & Philip, 2009). Although plyometric training has been shown to increase performance variables, little scientific information is available to determine if plyometric training actually enhances agility. Moreover, previous studies (Thomas, French, & Philip, 2009; Miller, et al., 2006; Parsons & Jones, 1998; Renfro, 1999; Robinson & Owens, 2004) used general plyometric training such as,

squat jump, single leg bounding, double leg hops, and etc on agility, but the effects of stretch shortening cycle (SSC) plyometric training like depth jump (fast SSC) and countermovement jump (slow SSC) (Saez Saez de Villarreal, et al., 2009) on agility performance are unknown. Therefore, the purpose of this study was to determine the effects of a 6-week depth jump and countermovement jump training on agility performance in healthy male students.

Methods

Subjects

Sixteen healthy college male students volunteered to participate in this study. Subjects were randomly assigned either depth jump (DJ; $n = 8$, age 20.2 ± 1.2 yr; weight 73.6 ± 3.4 kg; height 177.6 ± 5.8 cm) or countermovement jump (CMJ; $n=8$, age 20.3 ± 1 yr; weight 71.5 ± 4.7 kg; height 176.4 ± 5.7 cm). Subjects were informed about the nature, benefit, and potential risks of the study, and signed a written informed consent form before beginning the study and the University Human Subjects Institutional Review Board approved all testing and training protocols. Subjects were screened for any medical or orthopedic concern that would limit participation. No subject performed strength training or plyometric exercises for the lower body during the study period.

Plyometric protocols

Plyometric training was performed 2 days a week for 6 weeks (on Sunday and Wednesday). The training program was based on recommendations of intensity and volume from Miyama & Nosaka (2004) and Ebben (2009). Training sessions for both groups lasted 35 min; and began with a standard 10 min warm-up, 5 min of jogging, 5 min ballistic exercises and stretching; 20 min DJ or CMJ training, and 5 min cool-down.

Both group subjects were instructed to perform exercises in each training session with maximal effort. During the training, all subjects were under direct supervision and were instructed on how to perform correct technique of exercise. The DJ group began by standing on an 18-inch box and was instructed to lead with one foot as they stopped down from the box and land with two feet on the land. After contact, subjects were instructed to explode off the land by jumping as quickly and as high as possible (Thomas, French, & Philip, 2009). Participants in the CMJ group stood on the box and were instructed to drop on the land with two feet. After contact, subjects were instructed to flex their knees (countermovement, approximately 90°) and then rebound upward in a maximal vertical jump (Thomas, French, & Philip, 2009). A 2 min rest was given for the sufficient recovery between sets.

Agility testing

Agility were assessed using standard Illinois agility test and T test. The Illinois agility test was used to determine the ability to accelerate, decelerate, turn in different directions, and run at different angles (Figure 1). A hand-held stopwatch was used to take the subjects' time to the nearest 0.01 sec. The run started with a standing start on the command "Go" and subjects sprinted 10 m, turned, and returned to the starting line. When the subjects reached the starting line they zigzagged in between four markers and completed two 10 m sprints (Bloomfield, Ackland, & Elliot, 1994). The fastest time of the three trials was noted as the final agility time. A 5-minute rest period was allowed between each trial. The T test was used to determine speed with directional changes such as forward sprinting, left and right side shuffling, and backpedaling (Figure 2). The subjects were instructed to sprint from a standing starting position to a cone 10 m away, followed by a side-shuffle left to a cone 5 m away. After touching the cone the subjects side-shuffled to the cone 10 m away and then side-shuffled back to the middle cone. The test was concluded by back-peddalling to the starting line (Vanheest, et al., 2002). The test score was recorded as the best time of three trials, to the nearest 0.01 s. A 5-minute rest period was allowed between each trial. Subjects were disqualified if they failed to touch the base of any cone, crossed the one foot in front of the other or failed to face forward for the entire test.

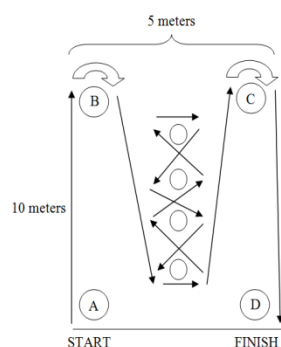


Figure 1. Illinois agility test procedure

Statistical analyses

Descriptive statistics (mean $\pm$ SD) were reported for all dependent variables. A 2×2 analysis of variance was used to analyze Illinois agility test and T test. Tukey's post hoc analyses were used to determine pairwise differences when significant main effects or interactions were observed. Statistical significant was set at $P < 0.05$.

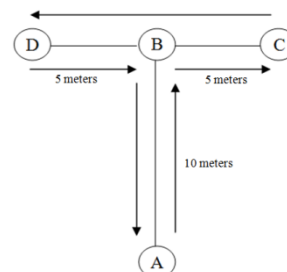


Figure 2. T test procedure

Results

Changes in Illinois agility test and T test are presented in Figure 3. Illinois agility test increased significantly in DJ (from 19.63 ± 1.1 to 17.94 ± 0.7 sec, %8.6) and CMJ (from 19.53 ± 1.1 to 17.4 ± 0.9 sec, %10), with no difference observed between groups. Likewise, T test performance increased significantly in DJ (from 12.3 ± 0.4 to 11.3 ± 0.5 sec, %8.3) and CMJ (from 12.5 ± 0.8 to 11.2 ± 0.7 sec, %10), with no difference observed between groups.

Discussion and conclusions

However, little has been known about the response of plyometric training especially depth jump (DJ) and countermovement jump (CMJ) on agility performance, therefore, this study was designed to examine the effects of six weeks of DJ and CMJ training on Illinois agility test and T test. In this investigation, participants who underwent DJ and CMJ training were able to improve their times significantly on both the Illinois agility test and T test. These findings are in agreement with Miller, et al. (2006) who examined the effects of 6 weeks plyometric training on T test and Illinois agility test, and found 4.86 and 2.93% improvement, respectively.

Another studies reported plyometric training can lead to significant improvement on agility performance (Parsons & Jones, 1998; Renfro, 1999; Robinson & Owens, 2004). In a study of tennis players, the authors used a T test and dot drill test to determine speed and agility. They found that the players became quicker and more agile; enabling them to get to more balls and be more effective tennis players (Parsons & Jones, 1998). Renfro (1999) measured agility using the T test with plyometric training, while Robinson & Owens (2004) used vertical, lateral and horizontal plyometric jumps and showed improvements in agility. There was a little information about the effects of DJ and CMJ plyometric training on agility.

In this study, positive effects of DJ and CMJ training on agility performance were found. Agility improvement requires rapid force development and high power output, and it seems that DJ and CMJ training can improve these requirements (Thomas, French, & Philip, 2009). In addition, the DJ and CMJ training may have improved the eccentric strength of the thigh muscles, a prevalent component in change of direction during the deceleration phase (Sheffard & Young, 2006).

Neural adaptations and enhancement of motor unit recruitment are other mechanisms can lead to increase for the agility tests (Thomas, French, & Philip, 2009; Miller, et al., 2006). Moreover, agility tasks require a rapid switch from eccentric to concentric muscle action in the leg extensor muscles (the SSC muscle function). Thus, it has been suggested that SSC training (DJ and CMJ) can decrease ground reaction test times through the increase in muscular force output and movement efficiency, therefore positively affecting agility performance (Marković & Mikulić, 2010).

However, we could not exactly determine that neural adaptations occurred or better facilitation of neural impulse to spinal cord; therefore, further studies are needed to determine mechanisms of agility improvement by plyometric training. Overall, these findings demonstrate the necessity of plyometric training program especially DJ and CMJ for enhancing performance in activities which involve acceleration, deceleration and a change of direction. In summary, the result of this study highlights the potential of using DJ and CMJ plyometric training to improve agility. It is recommended that, coaches design DJ and CMJ plyometrics, because these types of training can be effective for improving agility. In addition, our results support that improvements in agility can occur in as little as 6 weeks of plyometric training which can be useful during the last preparatory phase before in-season competition for athletes. Since coaches and athletes are often restricted to a short preseason, this is beneficial for coaches or athletes before competition such as collegiate or logical competitions.

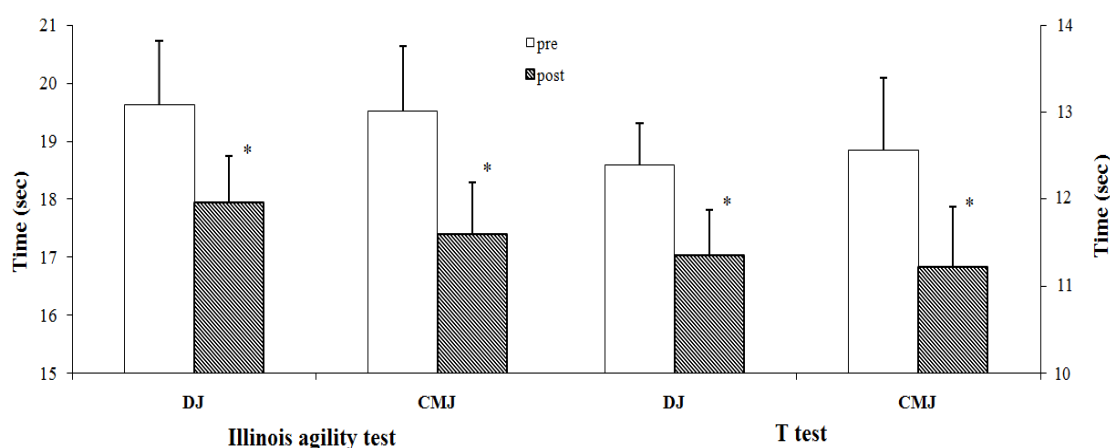


Figure 3. Changes in Illinois agility test and T test following 6 weeks plyometric training. Values are mean $\pm$ SD. * significantly different ($P < 0.05$) from the corresponding pre training value.

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EFEKTI ŠEST TJEDANA TRENINGA DUBOKIH SKOKOVA I POV RATNIH SKOKOVA NA IZVEDBU AGILNOSTI

Sažetak

Svrha ove studije bila je usporedba efekata treninga šest tjedana dubokih skokova i povratnih skokova na izvedbu agilnosti. Osamnaest muških studenata koledža sudjelovalo je u prikazanoj studiji i slučajno su raspoređeni u dvije grupe: duboki skok (DJ) i povratni skok (CMJ). Subjekti u DJ i CMJ grupama izveli su 5 serija po 20 ponovljenih skokova 18-inčne kutije dva puta tjedno u trajanju 6 tjedana. Illinois test agilnosti i T test su izmjereni tjedan prije i nakon 6 tjedana treninga. Analiza varijance 2x2 je korištena za statističku analizu. Obje grupe su pokazale značajan napredak u odnosu na stanje prije treninga u Illinois testu agilnosti i T testu ($P < 0.05$); također, nije bilo značajnih razlika između DJ i CMJ treninga u izvođenju agilnosti nakon 6 tjedana treninga ($P > 0.05$). Zaključno, DJ i CMJ trening poboljšava izvođenje agilnosti i može se preporučiti da treneri i sportaši dizajniraju njihove tipove pliometrijskog treninga za poboljšanje sposobnosti ubrzanja, usporjenja i agilnih gibanja.

Ključne riječi: rastezanje skraćivanja ciklusa, brzina, skočnost

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BASIC MOTOR ABILITIES OF YOUNG HANDBALL PLAYERS FROM MONTENEGRO**Duško Bjelica¹, Georgi Georgiev² and Aldijana Muratović¹**¹ Faculty for sport and physical education, Nikšić, Montenegro² Faculty for Physical Education, Skopje, Republic of Macedonia*Original scientific paper***Abstract**

This research has been conducted on 100 young handball players aged from 14 to 15, from Montenegro. They were divided into 2 (two) groups according to their regional belonging. The first group consists of 50 players from the continental region, and the second group - 50 players from the Mediterranean region. They were tested by 21 motor tests for estimating 7 motor abilities, with the aim to compare basic motor abilities between the two groups. Of the motor abilities the following were tested: frequency of movement; flexibility; explosive power of legs; explosive power of arms and shoulders; repetitive power; coordination and equilibrium. After processing the data with the basic descriptive methods, and having established the differences by t-test and discriminative analysis, the conclusion is that the handball players from the continental region have achieved far much better results than those of the Mediterranean players.

Key words: athletes aged 14-15, motoric, tests, continental region, Mediterranean region

Introduction

Montenegro is a country of diversity regarding all and even the climatic view. This is a consequence of its position, separations and dissections of the relief, relocations and confrontations of air masses of different physical characteristics, proximity to the sea, character of the soil and other factors. The motive of this research was to try in its own community to give importance and contribution to that branch of sport that gave Montenegro most trophies. Regarding that Montenegro is divided into Mediterranean and continental region, the very idea was to be conducted a research in that area on the younger population of boys-who are actively involved in the handball sport. By acquisition of the state independence and the performances of our national team, was given a right opportunity to show Europe and the world what kind of potential Montenegrin handball has. Games, especially sport's games, which operate using a large number of players who are in constant motion simultaneously confronting on the individual, group and collective level, are a unique phenomenon that is not easy to analyze (Rogulj, 2000). Handball, as one of the most popular sports games, belongs to a set of very complex, complex sport's activities dominated by cyclic and acyclic structures of the movement. It takes place in the intermittent stress mode. In the sport's activities during the training and competitions in the handball great importance have general and basic motor skills. Contemporary approach to the basic and specific anthropological characteristics of handball players and the specific requirements and characteristics of handball game requires scientifically based analysis and insights that can be reached only on the basis of scientific - research projects. At the sport's training the greatest emphasis is placed on developing biomotor dimensions. The elementary biomotor dimensions are the force, speed and endurance. All other dimensions are either of the constitutional nature, or are derived from the elementary dimensions (Bjelica, 2007).

In Montenegro, there are seven clubs that compete in an organized cadet league.

Problem and aim

The problem of this research is the determining of the differences at the level of motor skills of young handball players, from the Mediterranean and continental regions that are organizationally involved in the handball training. The object of this study were the handball players of age 14-15 years, as well and their motor abilities. The main goal of this study was to determine possible differences at motor abilities among handball players from the continental regions and the handball players from the Mediterranean region. Starting from the goal, the following research tasks were set: - determination of the level of motor abilities at the handball players from continental regions; - determination of the level of motor abilities at the handball players from the Mediterranean region; - to compare motor abilities among handball players from the continental regions and handball players from the Mediterranean region in the manifested space; - to compare the motor skills among handball players from the continental regions and handball players from the Mediterranean region in the latent space. Based on the formulation of the problem, objects, set goal and tasks, the general hypothesis of this paper could be formulated as follows: Ho - statistically significant differences are expected in the motor skills at the young handball players from the continental and Mediterranean region; H1 - statistically significant differences are expected at the motor abilities in the manifested space among the handball players from the continental and Mediterranean region, in favor of the handball players from the continental regions; H2 - statistically significant differences are expected at the motor skills in the latent space among the handball players from the continental and Mediterranean region, in favor of the handball players from the continental regions.

Methods

The measurement was conducted in Nikšić (RK "Sutjeska") and Berane (RK "Berane") – continental region, and Danilovgrad (RK "Danilovgrad") and Bar (RK "Mornar") – Mediterranean region. The sample was divided into two subsamples (groups), as follows: The first group (50), handball players from continental regions. The second group (50), handball players from the Mediterranean region. The sample of measurement tools for assessing motor abilities:

- For movement frequency: 1. Taping by hand (MBFTAP); 2. Taping by leg (MBFTAN); 3. Taping by foot against the wall (MFTAZ);
- For flexibility: 4. Bent straddle (MFLPRR); 5. Deep bent on the bench (MFLPRK); 6. Flexibility with bat (MFLISK);
- For estimation of the explosive leg power: 7. Jumping forward from a place (MFESDM); 8. Jump vertically from a place (MFESVM); 9. Running at 20 m-from a high start (MFT20V);
- For explosive power estimation of the hand and shoulder area: 10. Throwing a handball ball from straddle sitting on the ground (MFEBRL); 11. Throwing a basketball from a chest and sitting position on a chair (MFEBKL); 12. Throwing medical ball from lying on the back (MFEBML);
- For estimation of the repetitive power: 13. Raising the trunk for 30 seconds (MRCPRE); 14. Push-ups on the ground (MRCSKL); 15. Knuckle on the gymnastic bar using hanging position (MRCZGV);
- For estimation of the coordination: 16. Eighth with bending (MAGOOS); 17. Agility in the air (MKTOZ); 18. Side steps (MAGKUS);
- For estimation of the balance: 19. Standing on two legs lengthwise on the bench for balance with open eyes (MBAU20); 20. Standing on two legs crosswise on the bench for balance with closed eyes (MBAP2Z); 21. Standing on one leg lengthwise on the bench for balance with closed eyes (MBAP1Z).

The data obtained by testing were analyzed by the procedures of basic (primary) descriptive statistics: The normality of results' distribution was tested by the method of Kolmogorov and Smirnov. The quantitative differences between the two groups of respondents in the motor and motor- situational skills were determined by the t-test for large independent samples. The qualitative differences in general and motor situational abilities were processed by discriminative analysis between the groups according to the region.

Results

According to the results in table 1 which shows motor skills (21 variables), of the handball players from the continental regions, can be observed that the values of arithmetic mean (Mean), minimal (Minimum) and maximal (Maximum) results, as well as the standard deviation (Std.Dev.) and standard error (Standard Error). Based on the values of the asymmetry (skewness) on the distribution of the results we see that the more pronounced asymmetry was found at the variables: throwing a basketball from the chest from sitting position on a chair (MFEBKL), Knuckle on the gymnastic bar using hanging position (MRCZGV), agility in the air (MKTOZ), standing on two legs longitudinally on the bench for balance (MBAU20), standing on two legs crosswise on the bench for balance with closed eyes (MBAP2Z) and standing on one leg lengthwise on the bench for balance with closed eyes (MBAP1Z). At five of these variables they are dominated the results of respondents who have smaller values than the values of arithmetic means, while only at the variable maneuverability in the air (MKTOZ) most of the results achieved are in the area of larger values than the arithmetic mean value.

Table 1. The basic descriptive parameters of the applied variables at the handball players from the continental regions

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.	Std Error	Skewness	Kurtosis	K-S
MBFTAP	50	37.82	27.00	54.00	6.41	0.91	0.55	-0.43	0.37
MBFTAN	50	38.52	31.00	45.00	3.44	0.49	-0.64	-0.21	0.47
MFTAZ	50	22.74	18.00	30.00	2.81	0.40	0.55	0.49	0.26
MFLPRR	50	56.43	35.50	76.50	10.31	1.46	0.11	-0.17	0.38
MFLPRK	50	44.62	31.00	58.00	7.18	1.01	-0.10	-1.03	0.46
MFLISK	50	80.50	30.00	106.00	17.42	2.46	-0.53	0.54	0.83
MFESDM	50	2.10	1.70	2.40	0.20	0.03	-0.47	-0.84	0.38
MFESVM	50	43.56	31.00	55.00	7.19	1.02	-0.05	-1.29	0.18
MFE20V	50	4.04	3.40	4.84	0.31	0.04	0.46	-0.03	0.17
MFEBRL	50	17.82	12.00	27.00	3.81	0.54	0.59	0.14	0.70
MFEBKL	50	9.07	5.90	18.60	2.24	0.32	1.40	5.18	0.85
MFEBML	50	9.75	5.00	15.27	2.80	0.40	0.21	-0.53	0.87
MRCPRE	50	23.30	18.00	32.00	3.43	0.49	0.18	-0.73	0.22
MRCSKL	50	19.76	5.00	38.00	8.77	1.24	0.41	-0.57	0.59
MRCZGV	50	4.82	0.00	16.00	3.63	0.51	1.25	2.03	0.20
MAGOOS	50	18.99	16.56	22.56	1.33	0.19	0.38	-0.01	0.97
MKTOZ	50	4.69	3.50	8.82	0.88	0.12	2.23	9.04	0.08
MAGKUS	50	9.84	8.56	11.45	0.77	0.11	0.18	-0.74	0.63
MBAU20	50	6.44	1.17	55.75	8.24	1.17	4.85	27.07	0.00
MBAP2Z	50	3.63	1.37	9.60	1.88	0.27	1.83	3.16	0.03
MBAP1Z	50	9.85	1.11	58.80	15.04	2.13	2.34	4.47	0.00

Table 2. Basic descriptive parameters of applied variables at the handball players from the Mediterranean region

Variables	Valid N	Mean	Minimal	Maximal	Std.Dev.	Std Error	Skewness	Kurtosis	K-S
MBFTAP	50	32.06	26.00	39.00	2.68	0.38	0.59	0.67	0.26
MBFTAN	50	40.40	35.00	48.00	2.78	0.39	0.38	-0.11	0.24
MFTAZ	50	22.04	10.00	27.00	3.35	0.47	-1.04	2.22	0.30
MFLPRR	50	50.26	29.00	69.00	9.05	1.28	-0.27	0.11	0.70
MFLPRK	50	41.92	12.00	54.00	7.49	1.06	-1.66	4.96	0.17
MFLISK	50	86.99	40.00	125.00	18.85	2.67	-0.44	0.20	0.75
MFESDM	50	1.98	1.50	2.35	0.18	0.03	-0.67	0.55	0.18
MFESVM	50	39.80	30.00	55.00	7.01	0.99	0.31	-0.50	0.38
MFE20V	50	3.62	3.16	4.33	0.31	0.04	0.44	-0.77	0.68
MFEBRL	50	14.31	8.50	23.00	3.49	0.49	0.56	-0.32	0.32
MFEBKL	50	8.69	5.50	13.00	1.87	0.26	0.41	-0.26	0.65
MFEBML	50	10.42	6.50	13.80	1.96	0.28	-0.09	-1.13	0.55
MRCPRE	50	23.62	9.00	30.00	3.52	0.50	-1.31	4.67	0.79
MRC SKL	50	17.54	0.00	38.00	10.45	1.48	-0.16	-0.88	0.34
MRCZGV	50	4.66	0.00	13.00	3.66	0.52	0.64	-0.49	0.32
MAGOOS	50	19.53	16.75	22.56	1.43	0.20	0.37	-0.12	0.82
MKTOZ	50	4.87	3.59	8.70	1.07	0.15	1.92	4.89	0.20
MAGKUS	50	10.51	8.47	13.20	1.07	0.15	0.23	-0.20	0.99
MBAU20	50	5.02	1.56	43.31	6.18	0.87	5.11	30.86	0.00
MBAP2Z	50	2.63	1.03	10.37	1.71	0.24	2.46	7.98	0.00
MBAP1Z	50	3.78	1.50	11.31	2.63	0.37	1.61	1.62	0.01

A positive value of the asymmetry at this variable is treated as a negative value (it has an inverse interpretation) because the lower result (lower value of obtained results) is a better achievement. Less time spent for execution of this test is a better result. Based on the value of flattening (Kurtosis) results distribution we can see that more pronounced kurtosis is determined at the variables: throwing a basketball from the chest from sitting position on a chair (MFEBKL), agility in the air (MKTOZ), standing on two legs lengthwise on the bench for balance (MBAU20) and standing on one leg lengthwise on the bench for balance with closed eyes (MBAP1Z). Their values are above 3.00, and it is in favor of the constatation that these variables have more expressed peak sharpness of the normal distribution. The exception is the variable, standing on two legs crosswise on the bench for balance with closed eyes (MBAP2Z), which has a shape of the schedule that is closest to the normal schedule (value 3.16), at the other applied variables, the kurtosis values are less than 3.00 and therefore, their distribution is platikurtic i.e. these variables have a flatter shape than the normal. In relation to the normal distribution of treated motor skills and motor -situational skills of the handball players from the continental region that has been tested by Kolmogorov-Smirnov test, at only two variables was found a significant deviation from the normal distribution. These are the variables for assessment of balance (MBAU20) and (MBAP1Z). According to the results at table 2 which shows motor skills (of the first 21 variables) of the handball players from the Mediterranean region, for all applied variables (tests) are logical and within the expectations. This is the same conclusion as at the handball players from the continental regions. Based on the values of the asymmetry (skewness) distribution's results can be noted that the more expressed asymmetry

was determined on the variables: deep bend on the bench (MFLPRK), raising the trunk for 30 seconds (MRCPRE), agility in the air (MKTOZ), standing on two legs lengthwise on the bench for balance with open eyes (MBAU20), standing on two legs crosswise on the bench for balance with closed eyes (MBAP2Z) and standing on one leg lengthwise on the bench for balance (MBAP1Z). At the variables: MFLPRK, MRCPRE and MKTOZ the majority of the achieved results are in the area larger than the arithmetic means value. At the variables for balance assessing MBAU20, MBAP2Z and MBAP1Z dominate results of subjects which are characterized by smaller values than the values of arithmetic means. Based on the value of flattening (Kurtosis) distribution of results can be noted that pronounced kurtosis is determined at five variables: deep bent on the bench (MFLPRK), raising the trunk for 30 seconds (MRCPRE), agility in the air (MKTOZ), and the variables for the equilibrium (MBAU20) and (MBAP2Z). Their values are above 3.00, and therefore we can note that these variables have a pronounced peak sharpness of the distribution. At the other applied variables, the kurtosis values are less than 3.00 and therefore, their schedule is platikurtic and these variables have a flatter shape than normal. In relation to the normal distribution of treated motor skills and motor situational skills of the handball players from the Mediterranean region, which has been tested by Kolmogorov-Smirnov test, only at the variables for balance assessment was found significant deviation from the normal distribution. These variables were: standing on two legs lengthwise on the bench for balance with open eyes (MBAU20), standing on two legs crosswise on the bench for balance with closed eyes (MBAP2Z) and standing on one leg lengthwise on the bench for balance with closed eyes (MBAP1Z).

Table 3. T-test between the arithmetic means of handball players from the continental region - G₁ and the Mediterranean region - G₂

Variables	Mean G ₁	Mean G ₂	t-value	df	p
MBFTAP	37.82	32.06	5.86	98	0.00
MBFTAN	38.52	40.40	-3.01	98	0.00
MFTAZ	22.74	22.04	1.13	98	0.26
MFLPRR	56.43	50.26	3.18	98	0.00
MFLPRK	44.62	41.92	1.84	98	0.07
MFLISK	80.50	86.99	-1.79	98	0.08
MFESDM	2.10	1.98	3.22	98	0.00
MFESVM	43.56	39.80	2.65	98	0.01
MFE20M	4.04	3.62	6.81	98	0.00
MFEBRL	17.82	14.31	4.81	98	0.00
MFEBKL	9.07	8.69	0.93	98	0.35
MFEBML	9.75	10.42	-1.37	98	0.17
MRCPRE	23.30	23.62	-0.46	98	0.65
MRC SKL	19.76	17.54	1.15	98	0.25
MRCZGV	4.82	4.66	0.22	98	0.83
MAGOOS	18.99	19.53	-1.96	98	0.05
MKTOZ	4.69	4.87	-0.95	98	0.35
MAGKUS	9.84	10.51	-3.60	98	0.00
MBAU20	6.44	5.02	0.97	98	0.33
MBAP2Z	3.63	2.63	2.78	98	0.01
MBAP1Z	9.85	3.78	2.81	98	0.01

For determining significance of the differences between the arithmetic means of handball players from the continental region and the Mediterranean region was applied t-test for large dependant samples, while the difference is treated for statistical significance at the level of 0.05 (5%). According to the gained results, among the treated groups of respondents, statistically significant difference between them was found at 11 variables of the 21 applied. There was also determined and certain differences at the other 10 variables among them, but this difference was not statistically significant. Respondents from the group of handball players from the continental region (G₁) achieved significantly better results than the group of handball players from the Mediterranean region (G₂) at 9 variables: taping by hand (MBFTAP), bent straddle (MFLPRR), jump forward from a place (MFESDM), vertical jump from a place (MFESVM), throwing a handball ball from the ground using straddle position (MFEBRL), making eighth with bending (MAGOOS), side steps (MAGKUS), standing on two legs crosswise on a bench for balance with closed eyes (MBAP2Z) and standing lengthwise on one leg on the bench for balance with closed eyes (MBAP1Z). The respondents from the group of handball players from the Mediterranean region (G₂) achieved significantly better results than the group of handball players from the continental region (G₁), and only at 2 variables: leg taping (MBFTAN) and sprint from a standing position at 20m (MFE20V). In the other variables that do not show any statistically significant difference, handball players from continental regions (G₁) had better results than groups of handball players from the Mediterranean region (G₂) at 8 variables: leg taping against a wall (MFTAZ), deep

bend on the bench (MFLPRK), flexibility with a bat (MFLISK), throwing a basketball from the chest sitting on a chair (MFEBKL), push-ups on the floor (MRC SKL), Knuckle on the gymnastic bar using hanging position (MRCZGV), agility in the air (MKTOZ) and standing on two legs longitudinally on a bench for balance with opened eyes (MBAU20). Respondents from the group handball players from the Mediterranean region (G₂) had better results than group of handball players from the continental region (G₁) only at 2 variables: throwing medical ball from lying position on a back (MFEBML) and raising the trunk for 30 seconds (MRCPRE). According to the gained results referring to testing the differences between the arithmetic means of the handball players from the continental regions and the Mediterranean region by using the t-test for large dependent samples, lead us to the conclusion that the handball players from the continental regions are generally better regarding the motor skills in relation to handball players from the Mediterranean region. This is a result of having a much larger number of tests G₁ which had better and statistically more significant achievements than G₂. According to the gained results of the general hypothesis H_g - statistically significant differences are expected in motor skills at the young handball players of continental and Mediterranean region is partially accepted.

Table 4. Discriminant analysis of motor tests among handball players from the continental and Mediterranean region

Eigen-value	Canonicl R	Wilks' Lambda	Chi-Sqr.	df	p-level
4.94	0.91	0.17	155.88	21	0.00

By the discriminative analysis were detected differences in motor tests among handball players from the continental and Mediterranean region. According to table 8, the values of the correlation canonical coefficient (0.91), chi-square test (Chi-Sqr. = 155.88), with 21 degrees of freedom, was found a statistically significant difference between the treated groups of handball players according to the region at the level of 0.00. In the table 5 is shown the single discriminant function for handball players from the continental and Mediterranean region. According to its values, more evident discrimination, we can say that there is at the variable sprint from a standing position (MFE20V) - 0.31. For other variables, their projections are below the set value (0.30) and we cannot conclude that they are significant. In the table 6 in which are displayed the groups of centroids, the higher the value of the centroids is at the handball players of the continental region (G₁ = 2.20) compared to handball players from the Mediterranean region (G₂ = -2.20). This leads to the conclusion that in the treated motor area handball players from the continental regions have achieved significantly better results compared to handball players from the Mediterranean region.

Table 5. The structure of discriminative function of motor tests among two groups of handball players

Variables	Root 1
MBFTAP	0.27
MBFTAN	-0.14
MFTAZ	0.05
MFLPRR	0.14
MFLPRK	0.08
MFLISK	-0.08
MFESDM	0.15
MFESVM	0.12
MFE20V	0.31
MFEBRL	0.22
MFEBKL	0.04
MFEBML	-0.06
MRCPRE	-0.02
MRC SKL	0.05
MRCZGV	0.01
MAGOOS	-0.09
MKTOZ	-0.04
MAGKUS	-0.16
MBAU20	0.04
MBAP2Z	0.13
MBAP1Z	0.13

According to the gained hypothesis results H2 - are expected statistically significant differences in motor abilities at the latent space among handball players from the continental and Mediterranean regions, in favor of the handball players from the continental regions is accepted.

Table 6. group centroids - continental region (G_1), and the Mediterranean region (G_2)

Groups	Root 1
G_1	2.20
G_2	-2.20

Conclusion

Based on studies realized on a sample of 100 respondents - a handball players by region (50 from the continental and 50 from the Mediterranean region) where were applied a total number of 21 variables (tests) from the basic motorics, we can conclude the following: 1. The general conclusion would be that in the treated motor area the handball players from continental regions have achieved better results than handball players from the Mediterranean region. 2. The results achieved in the treated variables for both groups of respondents are logical and in accordance with the expectations. 3. Respondents, handball players from continental regions have achieved statistically more significant and better results than the handball players from the Mediterranean region in 9 variables. 4. Respondents, handball players from the Mediterranean region have achieved statistically more significant and better results than the handball players from the continental regions in 2 variables. 5. In the latent motor space, using discriminant analysis, we can conclude or confirm the conclusion that the established differences were inclined in favor to the group of handball players from the continental regions.

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BAZIČNE MOTORIČKE SPOSOBNOSTI MLADIH RUKOMETAŠA IZ CRNE GORE**Sažetak**

Ovo istraživanje je realizirano sa 100 mladih rukometaša uzrasta od 14 do 15 godina iz Crne Gore. Oni su bili podijeljeni u 2 (dvije) grupe prema regionalnoj pripadnosti. Prva grupa je bila sačinjena od 50 igrača iz kontinentalne regije, a druga grupa – 50 igrača iz mediteranske regije. S njima je primijenjen 21 motorički test za procjenjivanje 7 motoričkih sposobnosti, s ciljem da se usporede bazične motoričke sposobnosti između dvije tretirane grupe. Od motoričkih sposobnosti tretirane su: frekvencija pokreta, fleksibilnost, eksplozivna snaga nogu, eksplozivna snaga ruku i ramenog pojasa, repetitivna snaga, koordinacija i ravnoteža. Nakon obrade podataka osnovnih deskriptivnih metoda i nakon utvrđivanje razlika t-testom i diskriminativnom analizom, zaključeno je da su rukometaši kontinentalne regije postigli značajno bolje rezultate od rukometaša mediteranske regije.

Ključne riječi: sportaši uzrasta 14-15 godina, motorika, testovi, kontinentalna regija, mediteranska regija

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DIFERENTIAL ANALYSIS OF THE EXTERNAL ATTACKER ROLE IN THE TEAM TACTICS IN WATER POLO (MALE)

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Abstract

Collective tactics is based on the division of the roles in all phases of the game. Positions, either role in the water polo, are instrumentality in realization of collective tactics. Roles in water polo are: center forward, guard, wing, external attacker and goal keeper. The aim in this study was describes the role on the position of the External attacker (E. A.) and compare it with other roles. The subject of this investigation is description of all activities in the game without contact off the ball (all swimming's, duels, play with player more or less). Data collection was performed by registration of player's activity on official games of the International Adriatic Water polo League in the season 2009/10. Main units of measuring, entities, was position-player-quarter. The results were reiterated by 21 indicators and main statistics was performed. Differential analysis for position E.A. regarding other players (positions) was performed on the base of testing the model of binary logistic regression equitation. To this proportion contribute frequencies of back stroke swimming's in maximal intensities (0.2:0-1) and frequencies swam by crawl techniques in maximal intensity (2.9:2.3) as well as frequencies of breast swimming in light intensity (1.45:1.0). In total swam meters E.A. is statistically equal with other players. Statistically significant hi is different from other players in meters swam in maximal intensity (32.1:21.6) wherefore, statistically significant, contribute meters swam in crawl technique in maximal intensity (31.4:21.3). In the play with unequal number of players (player more/les).there are no significant differences regarding the players in other roles in the play. Statistically significant and remarkable E.A. defers from other players as in frequencies (3.1:2.6) so in the time (21.8:14.1) spent in duels. By application of binary logistic regression we defined differential characteristics of the E.A. regarding other roles in the game and that typified in equitation of play structure on the position E.A. Solitary contributions in prediction of role E.A. are representing in linear equitation for position E.A. Results of this investigation will be contribution in elaboration of water polo game model in the domain of situational play without ball (realization of the collective tactics without respect against choice the type of tactics in attack either defense). A result brings statistical descriptions of the role E.A. besides, in unusual analysis, brings comparative properties of the role E.A. regarding others.

Key words: water polo, game, external attacker, statistics, model, logistic regression

Introduction

The tactic of collective Olympic sport game water polo is a plan which is count on the partition of the player's roles in the game. The water polo team consists of the 7 players with allocated roles: center forward, wing, guard, external attacker and goal keeper. Depending to the development of the play given roles can download any player, but it is usual that players play given role (Lozovina et al., 2002, 2003, 2007, Lozovina 2009.). Collective tactics in the defense divide on the two main types: /zone defense/, defense man on the man on the own half, on the whole playground and pressing as a drastic profile of such type of defense (Pavičić, 1991; Lozovina, 2009). In attack the tactics are focused on the efficiency on the goal acquirement. In the simplest tactics formed attack is performed as an attempt counter attack and subsequently as a positional attack. For any position (role in the game) tactics appointed playground area in which carry out activities of the players equal as the types of tasks in attack as well in defense. In such a manner players realize own tactical role in the game. Situations with player more or les, in the sense of the tactic in the game are specially interesting and considerable.

Situation with player more or less arise as a result penalty expulsion (20 seconds). Such situations are great advantage or handicap for teams and representing extraordinary fragment of tactics. Actions which are carrying out in moving are defined by horizontal positions (horizontal phase in the game). All situations with player more or les, as well as duels are defined by vertical position (vertical phase in the game), regarding the surface of water line in swimming pool (Lozovina, 1979, 1985; Bratuša et al., 2002, 2003; Platonou & Geladas, 2006; Lozovina & Lozovina, 2009). In the total game duration it is possible to settled two main phases of player's activity: active and idle phase. Idle phase are situation in which player own active participation actualized by the overlooking the development of the game, but in situ and without contact with a ball. Idle phase directly raise the time spent in the quarter, and of course belong to vertical phase of the game. Idle phase are not include in this investigation. After attempt counter attack and unrealized chance for successful shot on the goal, usually in the time rested for limited ball possession, team in attack organized positional attack.

Main formation in that moment are with a center forward on the two meters in front of the goal, two wings on the 3-4 meters sideways and three players on eight meters in second attack line, one allocate centrally and two sideways somewhat wider from goalpost. These three players are external attackers (Lozovina & Pavičić, 2000; 2004; Lozovina et al., 2004; Lozovina et al., 2006). Theirs tactical task, in positional attack, by singly inswimmings either by simultaneous twain or triplet inswimmings realize capacious advantage for the receiving, pass on or shoot on the opponents goal. In these attempts of advantage realization they applied different actions and techniques as well as: water polo bicycle, water polo crawl, starts, water polo jumps out, inswimmings and cross-swimming, diving's, uncovers, ball manipulations, passes, quotation or intersect blockages and shootings. All of these actions run in the strait area upon the maximal speed and intensities, besides active obstruction of the opponents' defenders. With well implementation of mentioned action, in precise timing, it is possible realize capacious advantage and improve it for successful shoot. From the standpoint of probability to realize capacious advantage always is better attack with a three E.A. apart from one. In the case of the ball possession loss follows pernicious counter attack of opponents in formation from 1:0 to 3:2 with great chances for goal achieving. For carry out these tasks E.A. must have extraordinary specific psychophysical state. It is usual that first division teams dispose with up to five players prepared for this role.

Each of them must give his own maximum in the time spent in the play. In the cases when team forced positional attack only through center forward in the final moments of attack E.A., constrain must shoot on the goal. The shoots are most often routed in upper angles of the goal, in order that, if not with a goal, at least with a corner, is possible retain the ball possession. Following the counter attack of the opponents E.A., most frequently remain, in the role of defender, in the second attack line of opponents. On this position he plays as untypical defender. ((Pavičić 1991; Bratuša et al., 2002, 2003; Platonou & Geladas, 2006; Lozovina et al., 2007; Lozovina & Lozovina, 2009; Lozovina V, 2009). In experimental phase we registries activities of players on the official water polo games. It is placed and verified model for the play for one position (role in the game) by virtue of comparison model elements of one position with all others. Article cultivated basic tactical aspects E.A. play in differential analysis with other positions. (H1) It assumes that in indicators of DUEL (frequencies and duration) E.A. will have statistically significant lower values regarding the players with other roles in the game. (H2) It assumes that activities of the E.A. explained by frequencies of the total swam meters in all intensities will be similar or same with activity of players in other roles in the game. (H3) It assumes that the E.A. significantly defer from others in the meters swam in back stroke swimming in all intensities.

Methods

In experimental phase objectively are registered: quantities, means, frequencies and intensities of player's activities in the roles: wing, guard, center forward, and external attacker, during the official water polo games. That is achieved by monitoring and registration players' activity on the official games of International Adriatic Water polo League in season 2009/10. The basic statistics are calculated for: frequency of actions, quantities according to techniques of swimming in three intensities, for the phases where the players was in horizontal position. For vertical phase register was duels and play with unequal number of players. Activities were monitored by the system of 21 indicators on the 28 official matches. In this experiment was not reiterated play wit a ball, phase of the neither play nor types of tactic. The entities in this investigation are players – in given roles – in one quarter. Totally was reiterated 665 such entities. As well as the indicators values in the model was reiterated in frequencies, meters and seconds, expected values find oneself on the real and ordinal scale with expected normal and Poisson distribution. Placed is the model for guards role express by binary logistic regression equitation:

$$\ln[\text{odds}(Y=1)] = Y = b_0 + b_1X_1 + b_2X_2 + \dots + b_mX_m + e \quad (1)$$

Were the Y are play on the position external attacker, b coefficient of the ponder for variable X

Measurements

Experiment was carried out on the official games of International Adriatic Water polo League in season 2009/10. Registration and data sampling was performed by five qualified surveyors, professors of kinesiology, and experienced water polo trainers. In the game, during the time the player spends in the play, all his movements, intensities and positions of the body (horizontal and vertical) were recorded. The criteria for estimation of work intensity, namely of burden, are: maximal, sub maximal and slight, were determined on the basis of swimming speed in the course of actions.

Measurers were trained, measuring the same player on 10 games. The experiment was carried out only after a complete concordance among surveyors was achieved. They were positioned on a high-placed stand, which enabled optical coverage of the whole playing field. Standard water polo markers (2 m, 5 m, goal out line, center, etc.) enabled precise recording of swimming distances at various intensities of players. Each official recorded all activities of their designated player. At every moment, they had full view of the official time clock, which showed a down count of the official, clean game time and smaller time clocks that showed ball possession and attack time. Each official consecutively recorded every action taken by his designated player. In case a player was thrown out of the game or had not been in the game (excluding time either change of players,), time was measured when the player exited the game and reentered the game.

Data analysis

All variables are presented by statistics: Min, Max, Med, A.M. and S.D (Table 1,2,3, Graphs 1,2 and 3). For testing the normality of distributions K.S.-test was performed (Table 5). In the scope of identification of the structure, respectively to comparative relevance of individual measures, for differentiation of the role E. A. from others, regression algorithm was applied, namely, in respect with metric characteristics of results on indicators (Table 4). The Binary Logistic Regression Model was implemented. Adequacy of placed model is tested by Hosmer and Lemeshow tests (Table 6), quantity of explained variance is obtained by Cox & Snell R Square i Nagelkerke R Square coefficient determination (multiple correlation) (Table 5). Calculated and present are Table 7 with frequencies and guess percents of Model. For any variable B (Logistic beta), Wald (Sig.), (Odd Ratio – Exp (B), i 95% CI Exp (B) are calculated (Table 8). In graphics are plotted all results (E. A. against other roles), given as relation expected probabilities on the Y axis, and expected standardized residuals on the X axis (Graphs 1,2 and 3). For the purposes of interpretation the E. A. activity was calculated additions of indicators per swimming techniques (crawl and back stroke) in intensities (maximal, sub maximal and light), total number of actions frequencies and swam meters. These results are presented in histograms. For statistical conclusions we used lower rigorous criteria $p < 0.05$ and more $p < 0.001$ (LaValley, 2008; Lames, 2006; Waal, 2010).

Results and discussion

On the indicators which express activities across frequencies E.A. statistically significant differentiates from players in other roles, with higher results (Total frequencies-Fukupno 21.61:17.97). Analyzing frequencies according the intensities E.A. is not statistically significant different form other players in sub maximal swimming's, is statistically significant different form other players in maximal swimming's but with low values and drastically statistically significant different form others in frequencies of the breast swimming in light intensity (10.8:8.16). In the frequencies of the maximal swimming's E.A. statistically significant differentiates from players in other roles (2.82:2.49). Analyzing in the context of swimming techniques it is perceive that from other players did not differ in breast swimming in light intensity. In the frequencies swam in crawl technique, calculating all intensities E.A. have considerably higher results (17.02:14.92). In the context of intensities there is no differences in indicator for crawl submaximal swimming's, small but statistically significant difference exists in crawl swimming's in maximal intensity- In the crawl swam in light intensity E.A: statistically significant differentiates form other players, express by great values (7.11:5.74). In total back stroke swimming E.A. is statistically significant different form others (3.37:1.96). Statistically significant differences are in all of intensities.

In maximal back stroke swimming E.A. have lower values than others (0.08:0.15) and higher then others in sub maximal and light intensities (0.83:0.48 and 2.46:1.33). Total back stroke swimming E.A., over vice is statistically significant different form others, achieved on the count of sub maximal and light back stroke swimming where higher results from other players have. Versus, significantly lower results E.A. has in back stroke swimming upon maximal intensity. Back stroke swimming E.A. applied on the short distances in positional attack, when pick good position for passing the ball or shooting. These positions enable him very good optical control of the situation development. In the first phase in defense (transition phase) applying back stroke technique, E.A. provide good overview and potential take ups in the defense tasks in the middle of the court. There are no differences in the breast swimming in light intensity between E.A. and others. Breast swimming technique E.A. applied in attack requesting the best positions for receiving, and transferring the ball to center forward, or in the ultimate moment for shoot on the goal. Markedly high frequencies swam in crawl in light intensity E.A. achieved by follow the counter attacks of opponents. It is interesting that there are no statistically significant differences in total sub maximal swimming between of E-A- and others. Total sub maximal swimming E.A. generates on the base back stroke sub maximal swam, what is in the function of situation controlee. In total quantity of swam meters E.A. statistically significant did not differ from other players (200.3:179.6). Regard the intensities, statistically significant differences are in the meters swan in light intensity (81.1:64.8). In other intensities there are no statistically significant differences. In the meters swam in crawl technique there's no statistically significant differences between E.A. and others. But, in total back stroke swimming these differences is statistically significant (17.7:8.4), thus recently double. In the meters swam with breast swimming technique. E.A. is equal wit others. E.A. totally swam more than other players. In the context of intensities, in sub maximal swimming E.A. is with lower results from others. Analyzing all sub maximal swimming only in the crawl swimming E.A. is wit lower results regarding others, but statistically insignificant. E.A. has statistically significant lower results in the meters swam in back stroke technique. In all other indicators E.A. is with greater values. Differences of the swimming in sub maximal intensity are smallest and in the account of other players. That is a consequence of E.A. tactics role and position in the playground. In defense E.A. take a place in the second defense line (away from the goal) and in positional attack, after attempt counter attack, as a player in second attack line (away from opponent's goal: Such formation implicated swims on the short distances because is a short distance between positions in the second defense line and second attack line, approximately (10-15m). In the frequencies and duration of duels E.A. is statistically significant different from other players, with lesser values on indicators.

The frequencies of duels are twice minor against others (1.5:3.1). In the duration of the duels differences are higher expressed and are threefold less (6.2:19). The main tactical characteristic of E.A. are that did not enter in contact play. If that happened in the game, that must be in the defense mission, who task E.A. did not play as classic guard. In the play with unequal number of players (player more/les) E.A. is not statistically significant different from other players. Statistically significant and different from other players hi is in the total time spent in the game (324.6:291.9). Despite the fact that he spent more effective time in the play his situation are this that did not bring him in situations to make heavy fouls. On the base of expose indicators it seams that is light impose play area of E.A., frame between second defense and second attack line, over playground length, and strait over sideways of playground, because E.A. did not enter in the zone of the wings. In that way bounded space four a walk of E.A. are space four transitions, with thickest traffic of players. In the situation of positional attack cases are contrary; the area is with minimized traffic. By application of binary logistic regression are defined differential characteristics of the E.A. regarding other roles in the game and that typified in equitation of play structure on the position E.A. Adequacy of placed model is tested by Hosmer and Lemeshow tests. We conclude: The Model is very well calibrated ($\chi^2 = 3.709$ with 8 degrees of freedom and $p=0.882$). Coefficients of determination, (R^2) Cox & Snell (0.239) i Nagelkerke (0.359), are quite low, provided predict 35.9% of variance. Total percent of the correct predictions, which enable placed model amounts (78.9%), for E.A., relatively low (33.8%) and for other roles (94.3%) (Table 4). Watching the position E.A. regarding others it is notable les percent of correct predictions of E.A. Possibly, so is, partly, due to great disproportion in the number of E.A. regarding other players. Solitary contributions in prediction of role E.A. are representing in (Table 5.). Linear equitation for position E.A. (prognosis equitation) is:

$$\ln[\text{odds}(Y=1)=Y = -1.111 + 0.114 * x_{\text{Mlesmax}} + 0.053 * x_{\text{Mlelag}} - 0.105 * x_{\text{Mduel}}$$

Three indicators in equitation typified the play structure on the position E.A. By inspection of results, regression coefficients (B), and Wald-test (approximation of the Chi-square-test) and its significance level, we establish that for a model and prediction statistical significance provided indicators Mlesmax, Mlelag and Mduel. Values of Ods show different direction in contribution of indicator Mduel, regarding other in equitation. Wit he increasing of the value on this indicator for a player on the position E.A., for one standard deviation (SD =16.04), reduces (decrease) the chance for 100*(OD-1), in these case 9.9% that the player will be recognized as a E:A. In other two relevant indicators by the increasing of one standard deviation chances increasing for 12% on indicator Mlesmax (SD=4.26) and 5.5% in Mlelag (SD=8.06).

Conclusion

Analyzed position of the E.A. are statistically described by indicators of frequencies, types and quantities of movements, intensities in various modalities as well in horizontal phase so in vertical phase in the game, without respect at the type of tactics and phase of the play (attack, transition, defense). It is noted that the frequencies in the swimming techniques in all intensities and frequencies of total swimming, E.A. differentiate statistically significant from players in other roles. Statistically significant differences are not noted in frequencies of breast swimming in light intensity and frequencies of all swimming in maximal intensity. In the context of frequencies E.A. is dominantly defined by frequencies of total swimming, frequencies of the light swimming and frequencies of back stroke swimming in all intensities. In the meters swam in all techniques E.A. statistically significant defers from others, dominantly in the meters swam in back stroke technique, in all intensities, something lower, but significant, in maters swam in light intensity, what achieved by swimming of crawl technique in light intensity. It is interesting that in total swimming existed difference against other players, about 20m pro quarter, but not statistically significant. In the vertical phase in the game, playing with unequal number of players (player more/les) on the maximal intensity are not noted differences regarding other players. Statistically significant E.A. spends more time in vertical phase than other players. This time are fulfilling wit duels pronouncedly in frequencies and duration. However statistically significant difference are not pronounced in frequencies, but in duration yea. Putting the given results in the context of tactics it is possible to conclude that Back stroke swimming E.A. applied on the short distances in positional attack, when pick good position for passing the ball or shooting. These positions enable him very good optical control of the situation development. In the firs phase in defense (transition phase) applying back stroke technique, E.A. provide good overview and potential take ups in the defense tasks in the middle of the court. Breast swimming technique E.A. applied in attack requesting the best positions for receiving, and transferring the ball to center forward, or in the ultimate moment for shoot on the goal. Markedly high frequencies swam in crawl in light intensity E.A. achieved by follow the counter attacks of opponents. Total sub maximal swimming E.A. generates on the base back stroke sub maximal swam, what is in the function of situation controlee. Differences of the swimming in sub maximal intensity are smallest and in the account of other players. That is a consequence of E.A. tactics role and position. In defense E.A. take a place in the second defense line (away from the goal) and in positional attack, after attempt counter attack, as a player in second attack line (away from opponent's goal: Such formation implicated swims on the short distances because is a short distance between positions in the second defense line and second attack line, approximately (10-15m).

Table 1 Minimum, Median, Maximum, Mean and Std. Deviation Statistics of Frequencies

	0					1					Total				
	Min	Median	Max	Mean	Std. Dev	Min	Median	Max	Mean	Std. Dev	Min	Median	Max	Mean	Std. Dev
FKRMAX*	0	1,50	17	2,34	2,60	0	2	13	2,75	2,43	0	2	17	2,44	2,57
FKRSMAX	0	6	26	6,84	4,01	0	6	20	7,17	4,49	0	6	26	6,92	4,13
FKRLAG**	0	5	20	5,74	3,80	0	6	20	7,11	4,44	0	5	20	6,06	4
FKraul**	0	14	45	14,92	7,10	1	17	38	17,02	7,52	0	15	45	15,42	7,25
FLEMAX*	0	0	4	0,15	0,49	0	0	2	0,08	0,31	0	0	4	0,13	0,46
FLESMA**	0	0	6	0,48	0,96	0	0	5	0,83	1,17	0	0	6	0,56	1,02
FLELAG**	0	1	10	1,33	1,58	0	2	9	2,46	1,97	0	1	10	1,60	1,75
FLed**	0	1	14	1,96	2,14	0	3	12	3,37	2,39	0	2	14	2,29	2,28
FPRLAG	0	1	12	1,10	1,56	0	1	11	1,22	1,69	0	1	12	1,13	1,60
FMax*	0	2	21	2,49	2,86	0	2	13	2,82	2,53	0	2	21	2,57	2,78
FsMax	0	7	27	7,31	4,45	0	6	23	7,99	5,20	0	7	27	7,48	4,65
FLag**	0	7	29	8,16	5,35	1	10	39	10,80	6,01	0	8	39	8,78	5,62
FUkupn**	0	17	71	17,97	9,06	1	21	49	21,61	9,67	0	17	71	18,83	9,33

*/**KS – normal distribution at $p>0.05/0.01$ + / ++ significant - Mann-Whitney U at $p>0.05/0.01$

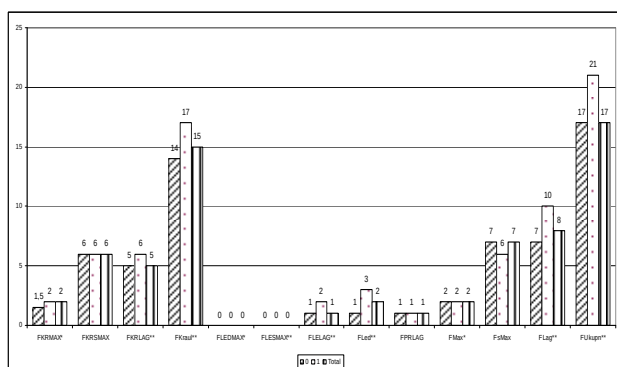
Table 2 Minimum, Median, Maximum, Mean and Std. Deviation, Statistics meters swum in various intensities – horizontal phase

	0					1					Total				
	Min	Median	Max	Mean	Std. Dev	Min	Median	Max	Mean	Std. Dev	Min	Median	Max	Mean	Std. Dev
MKRMAX	0	15	191	23,45	29,60	0	19	141	24,64	24,62	0	15	191	23,73	28,49
MKRSMAX	0	81	398	88,24	55	0	75	211	82,98	50,56	0	79	398	87	53,99
MKRLAG*	0	46	213	53,53	38,45	0	53	183	62,61	41,46	0	49	213	55,67	39,34
MKraul	0	159	463	165,21	75,72	8	169	304	170,23	70,26	0	162	463	166,40	74,45
MLEMAX*	0	0	20	0,50	1,76	0	0	8	0,25	1,08	0	0	20	0,44	1,63
MLESMA**	0	0	25	1,95	4,26	0	0	67	4,80	9,05	0	0	67	2,63	5,88
MLELAG**	0	3	58	5,96	8,06	0	10	75	12,50	11,01	0	5	75	7,51	9,26
MLed**	0	5	71	8,42	10,14	0	15	75	17,55	13,41	0	7	75	10,57	11,66
MPRLAG	0	2	47	5,28	7,47	0	5	39	5,97	7,83	0	2	47	5,44	7,55
MMax	0	15	191	23,95	30,31	0	19	141	24,89	24,97	0	15	191	24,17	29,12
MsMax	0	81	400	90,20	55,90	0	78	222	87,78	52,59	0	81	400	89,63	55,11
Mlag**	0	58	215	64,77	44,01	4	69	216	81,08	48,45	0	60	216	68,62	45,59
MUkupno	0	173,50	499	179,60	81,37	8	198	397	200,27	83,07	0	179	499	184,48	82,18

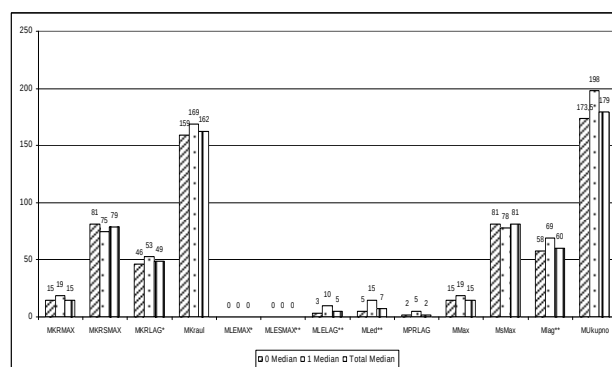
*/**KS – normal distribution at $p>0.05/0.01$ + / ++ significant - Mann-Whitney U at $p>0.05/0.01$

Table 3 Minimum, Median, Maximum, Mean and Std. Deviation, Statistics duels, unequal number of players, total time in the play – vertical phase

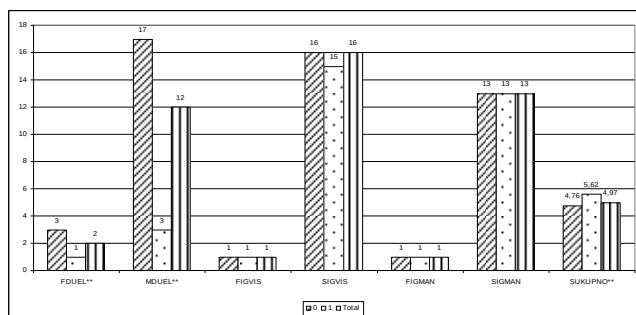
	0					1					Total				
	Min	Median	Max	Mean	Std. Dev	Min	Median	Max	Mean	Std. Dev	Min	Median	Max	Mean	Std. Dev
FDUEL**	0,00	3,00	10,00	3,12	2,29	0,00	1,00	9	1,50	1,75	0	2	10	2,74	2,28
MDUEL**	0,00	17,00	78,00	18,98	16,04	0,00	3,00	40	6,20	8,03	0	12	78	15,96	15,53
FIGVIS	0,00	1,00	7,00	1,24	1,14	0,00	1,00	5	1,29	1,13	0	1	7	1,25	1,14
SIGVIS	0,00	16,00	106,00	18,10	17,82	0,00	15,00	89	18,24	17,69	0	16	106	18,14	17,77
FIGMAN	0,00	1,00	4,00	0,91	0,91	0,00	1,00	5	0,97	0,97	0	1	5	0,93	0,92
SIGMAN	0,00	13,00	77,00	14,20	15,45	0,00	13,00	72	14,85	15,71	0	13	77	14,36	15,50
SUKUPNO**	24,00	285,50	480,00	291,93	120,22	61,00	337,00	480	324,62	127,85	24	298	480	299,65	122,75

*/**KS – normal distribution at $p>0.05/0.01$ + / ++ significant - Mann-Whitney U at $p>0.05/0.01$ 

Graph 1 Histogram of Medians – frequencies of actions in various intensities – horizontal phase



Graph 2 Histogram of Medians – meters swum in various intensities – horizontal phase



Graph 3 Histogram of Medians – vertical phase

Table 4 Indicators Test Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
FKRMAX+	34703.5	163989.5	-2.503	.012
FKRSMAX	38880.0	168166.0	-.476	.634
FKRLAG++	33065.0	162351.0	-3.249	.001
FKraul++	33443.5	162729.5	-3.062	.002
FLEDMAX	37719.0	50122.00	-1.929	.054
FLESMAx++	32802.0	162088.0	-4.120	.000
FLELAG++	24669.5	153955.5	-7.453	.000
Fled++	24214.5	153500.5	-7.570	.000
FPRLAG	37988.5	167274.5	-.961	.337
FMax	35284.0	164570.0	-2.220	.026
MKRMAX	36457.5	165743.5	-1.634	.102
MKRSMAX	38403.0	50806.0	-.701	.483
MKRLAG	34899.5	164185.5	-2.367	.018
MKraul	37395.5	166681.5	-1.180	.238
MLEMAX	37729.0	50132.0	-1.918	.055
MLESMAx++	32043.0	161329.0	-4.546	.000
MLELAG++	22426.5	151712.5	-8.450	.000
Mled++	20684.5	149970.5	-9.190	.000
MPRLAG	37630.5	166916.5	-1.131	.258
MMax	36639.5	165925.5	-1.547	.122
MsMax	39592.5	51995.5	-.136	.892
Mlag	32063.5	161349.5	-3.714	.000
MUKupno	33825.0	163111.0	-2.877	.004
FsMax	37819.5	167105.5	-.981	.326
FLag	29062.0	158348.0	-5.150	.000
FUKupn++	31041.5	160327.5	-4.203	.000
FDUEL++	22634.5	35037.5	-8.288	.000
MDUEL++	19415.5	31818.5	-9.769	.000
FIGVIS	38767.0	168053.0	-.550	.583
SIGVIS	39490.5	168776.5	-.187	.852
FIGMAN	38768.0	168054.0	-.562	.574
SIGMAN	38793.5	168079.5	-.531	.596
SUKUPNO++	33825.0	163111.0	-2.884	.004

a. Grouping Variable: external attacker

Table 5 Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	545,412 ^a	,239	,359

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than ,001

Table 6 Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	3,709	8	,882

Table 7 Classification Prediction

	Observed		Predicted		
			External Attacker		%Correct
			,00	1,00	
Step 1	E A	,00	479	29	94,3
		1,00	105	52	33,1
		Overall %			79,8
a. The cut value is .500					

a. The cut value is ,500

Table 5 Indicators Test Statistics^a

	Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
	Absolute	Positive	Negative		
FKRMAX	.117	.117	-.035	1.278	.076
FKRSMAX	.091	.091	-.045	.996	.275
FKRLAG	.127	.127	.000	1.395	.041
FKraul**	.169	.169	-.006	1.849	.002
FLEDMAX	.054	.000	-.054	.596	.870
FLESMAx**	.170	.170	-.002	1.860	.002
FLELAG**	.287	.287	-.002	3.138	.000
Fled**	.317	.317	-.002	3.476	.000
FPRLAG	.047	.047	-.002	.512	.956
FMax	.105	.105	-.031	1.148	.143
MKRMAX	.097	.097	-.036	1.058	.213
MKRSMAX	.069	.017	-.069	.761	.608
MKRLAG	.111	.111	-.002	1.219	.102
MKraul	.086	.086	-.047	.939	.341
MLEMAX	.054	.000	-.054	.596	.870
MLESMAx**	.182	.182	.000	1.990	.001
MLELAG**	.360	.360	.000	3.947	.000
Mled**	.390	.390	.000	4.267	.000
MPRLAG	.088	.088	-.008	.962	.313
MMax	.089	.089	-.041	.972	.301
MsMax	.052	.038	-.052	.568	.903
Mlag**	.162	.162	-.002	1.775	.004
MUKupno**	.162	.162	-.012	1.773	.004
FsMax	.102	.102	-.029	1.112	.168
Flag**	.198	.198	.000	2.168	.000
FUKupn**	.188	.188	-.003	2.059	.000
FDUEL**	.354	.000	-.354	3.880	.000
MDUEL**	.410	.000	-.410	4.486	.000
FIGVIS	.036	.036	-.010	.396	.998
SIGVIS	.050	.050	-.044	.543	.930
FIGMAN	.021	.021	.000	.228	1.000
SIGMAN	.040	.040	-.014	.433	.992
SUKUPNO**	.174	.174	-.009	1.900	.001

a. Grouping Variable: external attacker

Table 8 Results of Binary Logistic regression (B-beta, S.E.-standard error, Wald -Chi-square test, P- level of significance, Exp(B) – Exp-beta, Ci – confidence interval 95%)

	Variables in the Equation					
	B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)
						Lower Upper
FKRMAX	,061	,095	,413	,520	1,063	,883 1,280
FKRSMAX	,068	,073	,859	,354	1,070	,927 1,235
FKRLAG	,037	,075	,249	,618	1,038	,896 1,203
FLEDMAX	-,353	,550	,413	,521	,703	,239 2,063
FLESMAx	-,298	,226	1,745	,187	,742	,476 1,155
FLELAG	-,056	,132	,180	,672	,946	,731 1,224
FPRLAG	,099	,178	,307	,580	1,104	,779 1,564
MKRMAX	-,005	,009	,349	,555	,995	,977 1,012
MKRSMAX	-,006	,005	1,677	,195	,994	,984 1,003
MKRLAG	-,001	,008	,032	,858	,999	,984 1,014
MLEMAX	-,133	,159	,695	,405	,876	,641 1,197
MLESMAx**	,114	,041	7,622	,006	1,120	1,033 1,214
MLELAG*	,053	,024	4,744	,029	1,055	1,005 1,107
MPRLAG	-,011	,036	,092	,761	,989	,921 1,062
FDUEL	,081	,131	,384	,536	1,084	,839 1,400
MDUEL**	-,105	,024	18,535	,000	,901	,859 ,945
FIGVIS	,005	,204	,001	,980	1,005	,673 1,500
SIGVIS	-,014	,013	1,089	,297	,986	,960 1,012
FIGMAN	-,391	,314	1,549	,213	,676	,365 1,252
SIGMAN	,018	,019	,901	,342	1,018	,981 1,056
SUKUPNO	,002	,002	1,185	,276	1,002	,998 1,006
Constant	-1,111	,283	15,377	,000	,329	

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DIFERENCIJALNA ANALIZA ULOGE VANJSKOG NAPADAČA U EKIPNOJ TAKTICI U VATERPOLU (MUŠKARCI)

Sažetak

Kolektivna taktika, u svim sportskim igrama pa tako i u vaterpolu, zasniva se na podjeli uloga u svim fazama igre. Pozicije ili uloge u igri, instrument su u realizaciji taktika. Postoji nekoliko uloga odnosno pozicija u vaterpolu: centar, branič, krilo, vanjski napadač i vratar, od kojih je svaki instrument u realizaciji kolektivne taktike. Cilj ovog istraživanja bio je opisati igru na poziciji vanjskog napadača (EA) i komparirati je sa ostalim ulogama u igri. Predmet ovog istraživanja jest deskripcija svih aktivnosti u igri van kontakta s loptom (sva plivanja, dueli, i situacije s igračem više/manje). Prikupljanje podataka obavljeno je registracijom igračevih aktivnosti na službenim utakmicama Internacionalne Jadranske vaterpolo Lige u sezoni 2009/10. Osnovne jedinice mjerenja ili entitete predstavljali su: pozicija-igrač-četvrtina. Rezultati su registrirani preko 21 indikatora nad kojima su izračunate osnovne statistike. Diferencijalna analiza za poziciju vanjskog napadača u odnosu na ostale igrače (uloge u igri) napravljena je na osnovi testiranja modela binarne logističke regresijske jednadžbe. Ovim proporcijama doprinose frekvencije leđnog plivanja pri maksimalnom intenzitetu (0.2:0.1) i frekvencije metara isplivanih kraul tehnikom pri maksimalnom intenzitetu (2.9:2.3) kao i frekvencije prsnog plivanja pri laganom intenzitetu (1.45:1.0). U ukupno isplivanim metrima vanjski napadač jednak je igračima u ostalim ulogama u igri. Statistički značajno vanjski napadač od igrača u drugim ulogama u igri razlikuje se u metrima isplivanim pri maksimalnom intenzitetu (32.1:21.6) čemu statistički signifikantno doprinose metri isplivani kraul tehnikom pri maksimalnom intenzitetu (31.4:21.3). U igri s nejednakim brojem igrača (igrač više/manje) nema statistički signifikantnih razlika između vanjskog napadača i igrača u ostalim ulogama u igri. Statistički signifikantno i upečatljivo vanjski napadač se od igrača u ostalim ulogama razlikuje u frekvenciji akcija koje poduzima (3.1:2.6) kao i u vremenu koje provede u duelima (21.8:14.1). Primjenom binarne logističke regresije definirali smo diferencijalne karakteristike vanjskog napadača u odnosu na ostale uloge u igri, što je rezultiralo jednadžbom strukture igre na poziciji vanjskog napadača. Pojedinačni doprinos u predikciji uloge vanjskog napadača predstavljen je linearnom jednadžbom za tu ulogu. Rezultati istraživanja doprinijet će objašnjenju modela vaterpolo igre u situacijskim uvjetima u igri bez kontakta s loptom (realizacija kolektivne taktike u odnosu na izbor tipa taktike kako u napadu tako i u obrani). Rezultati donose statističku deskripciju uloge vanjskog napadača kao i specifične karakteristike njegove uloge u usporedbi s drugim ulogama u igri.

Ključne riječi: vaterpolo, igra, centar, statistike, model, logistička regresija

THE EFFECT OF PNF STRETCHING COMBINED WITH A RESISTANCE TRAINING ON STRENGTH, MUSCLE VOLUME AND FLEXIBILITY IN NON- ATHLETE MALE STUDENTS

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Abstract

The purpose of this study was to determine the effects of PNF stretching combined with resistance training on performance during an 8-week training protocol in non-athlete male students. Twenty healthy non-athlete males (age 21.3 ± 1.3 years, height 174.7 ± 2.9 cm, weight 71.1 ± 2.4 kg) college students were randomly divided into a resistance training (RT) group ($n=10$), or resistance training combined with Proprioceptive neuromuscular facilitation (PNF) stretching (RT + PNF) group ($n=10$). The resistance training program was performed 3 days (Sunday, Tuesday and Thursday) each week for 8 weeks. The resistance training consisted of 3 lift (triceps pushdown, bench press and lateral pull down), 3 sets of 8 repetitions, and the initial weight was 80% of the pre-1RM. The 8 weeks stretching program consisted of 15 different PNF stretches designed to stretch all of the major upper-extremity muscle groups (pectoralis major, triceps, biceps, teres minor & major, deltoidus). Subjects were tested for performance before and after the 8-week period. The results of this study indicated significantly ($P < 0.05$) improvements in strength, muscle volume and flexibility from Post test occurred for both RT and RT + PNF groups when compared to Pre test. There were also no significant differences ($P > 0.05$) between groups. However, findings showed the RT + PNF group had slightly more improvements in strength, muscle volume and flexibility when compared to RT group. It can therefore, be concluded that within 8 weeks PNF stretching combined with resistance training was found can not necessarily be effective on muscle volume, strength and flexibility more than RT only.

Key words: resistance training, PNF, stretching, flexibility

Introduction

Athletes are searching for ways to improve their performance to provide them with an advantage over their opponent. Increasing one's muscle mass, flexibility or strength is the most common way athletes are able to give themselves an advantage over other competing athletes. Resistance training has become a frequently chosen method for increasing strength, flexibility, muscle mass, power and speed, local muscular endurance, balance and for improving athletic performance (American College of Sports Medicine, 2001). Also stretching is commonly promoted as a method to improve flexibility, power, speed and performance in various sports and recreational activities (Surburg, Schrader 1997; Shrier, 1999). In practice, there are 4 different protocols for stretching training –static, ballistic, dynamic and proprioceptive neuromuscular facilitation (PNF) (Thomas et al 2004). In a recent review (Shrier, 2004), Shrier reports that only nine studies had examined the effects of regular stretching, with seven finding beneficial effects and two showing no effect. The no-effect studies dealt with tests of running economy, whereas the positive studies mainly dealt with improved joint range of motion. Of those factors related to performance (i.e., strength, speed, power, and endurance), the majority of studies have found improvements in strength. For example, Worrell et al. (Worrell, Smith & Winegardner, 1994), and Handel et al. (Handel et al, 1997) found increases in hamstring isokinetic torque.

Godges et al. (Godges et al, 1989) found increased trunk strength, and Wilson et al. (Wilson, Murphy & Pryor, 1994) found improvements in the bench press. In addition, Dintiman (Dintiman, 1964) reports improved sprint performance, and Hunter and Marshall (Hunter, Marshall, 2002) saw increases in a countermovement vertical jump. Unfortunately, neither Dintiman (Dintiman, 1964) nor Hunter and Marshall (Hunter & Marshall, 2002) report strength changes. Today, PNF along with static and ballistic stretching is commonly used to lengthen the musculotendinous unit and as a result increase the range of motion of a specific joint (Etnyre & Abraham 1986; Funk et al., 2003). Proprioceptive neuromuscular facilitation (PNF) comprises patterns and techniques specifically designed to treat neurologically impaired patients (Knott, Voss, 1956).

These techniques and variations thereof were later used in the treatment of orthopedic impairments, and today PNF stretches are widely used in sports medicine (Surburg & Schrader 1997; Shrier, 1999). A study conducted by Feland and Marin, showed significant improvements in hamstring flexibility via submaximal contractions using PNF stretching (Feland & Marin, 2004). A study conducted by Giordano, Sikora, and Jones concluded that one session of PNF stretching prior to participating in a 40-yard dash and vertical jump test showed no significant improvement in performance (Giordano, Sikora & Jones, 2005).

In correlation, information from a study done by Mayer et al. (Mayer, Pederson & Simons, 2005) indicated that PNF stretching was an effective way of increasing flexibility. Church et al. (Church, Wiggins, Moode & Crist, 2001) and Bradley et al (Bradley, Olsen & Portas, 2007) noted a significant reduction in the vertical jump performance after PNF. However, other authors did not report significant PNF-induced decreases in muscle performance in activities involving maximal muscular contraction, explosive strength and jumping (Hunter & Marshall, 2002; Young & Elliot, 2001). Bieze et al., by a study indicated the chronic PNF stretching program there is some improvement in forty yard dash time (.06 sec) and vertical jump (.61 in) however, according to the p value; these was not significant differences (Andrew, Mike, Aaron & Stephanie, 2006). Notwithstanding strength and flexibility exercises being common components of many exercise programs, it is not clear at this time how best to include both of these elements in a single training program or if it is even prudent to do so. It has not been shown however whether resistance training combined with stretching training results in an alteration in the magnitude of strength gains when compared with a resistance training-only program. In addition, resistance training has been shown to increase flexibility (Leighton, 1964; Massey & Chaudet, 1956). This prompted us to investigate into that issue, i.e. into the effects of PNF on strength, flexibility and muscle volume, in order to gather information which would enable teachers, coaches, physical instructors and physiotherapists to better orient their students, athletes and patients. The responses to stretching and resistance training are similar, it is possible that if both resistance training and stretching are included in a training program, their effects could be additive. Thus, the purpose of this study was to determine the effects of PNF stretching combined with resistance training on strength, muscle volume and flexibility in non athlete male students.

Materials & Methods

Subjects

Twenty healthy non athlete male students (age 21.3 ± 1.3 years, height 174.7 ± 2.9 cm, weight 71.1 ± 2.4 kg) of University of Guilan volunteered to participate in this study. Subjects were randomly assigned to either a resistance training (RT) group (n=10), or resistance training combined with Proprioceptive neuromuscular facilitation (PNF) stretching exercises (RT + PNF) group (n=10). Before undergoing the tests, the subjects were given explanations about the assessment procedures, study objectives, and the possible benefits and risks. The Institutional Review Board of the University approved the research protocol. All subjects based on medical information questionnaire were healthy and none of hypertension, cardiovascular disease, diabetes, lipid disorders, kidney disease, liver disease, respiratory and bone injuries and did not exercise any supplement use in past 6 months.

None had not continuous exercise history. They were non athlete male students and did not follow a specific diet. Study protocol was explained to the volunteers and all the written consent for study entry signed. Before the study, subjects of type, severity and number of days in a week and time activities were started and they were asked during the study period, diet and intensity of its activities are kept constant and the use of any dietary supplement fail.

Experimental design

Randomized study was employed using two experimental groups (RT and RT + PNF) who underwent 8 weeks' training protocol. Before starting the training, pre-1 repetition maximum (1RM) values were obtained on the following exercises: bench press, triceps pushdown and lateral pull down. The resistance training program consisted of 3 lift: triceps pushdown, bench press and lateral pull down. The training consisted of 3 sets of 8 repetitions, and the initial weight was 80% of the pre-1RM. Rest times between sets were 2-3 minutes, and 3-5 minutes elapsed between the 3 different lifts. The resistance training program was performed 3 days (Sunday, Tuesday and Thursday) each week for 8 weeks. After the 8-week training program, post-testing for 1RM were repeated in the same manner in which they were performed during pre-testing. Also, The PNF stretching protocol designed to stretch all of the major upper-extremity muscle groups (pectoralis major, triceps, biceps, teres minor & major, deltoidus) and consisted of four series of exertions in which the muscles were contracted isometrically for 5 s and sustained, motionless, for 30 s in the movement position (beyond the discomfort threshold), The series were spaced by 20-s intervals. PNF stretching session lasted approximately 30 min and was performed 3 days (Saturday, Monday, Wednesday) each week for 8 weeks.

Strength measures

Upper body maximal strength was assessed by using 1RM actions. During testing session subjects performed a 1-repetition maximum (1-RM) strength test for the bench press exercises. The 1 RM tests were conducted as described by Hoffman(Hoffman, 2006). Each subject performed a warm-up set using a resistance that was approximately 40-60% of his perceived maximum, and then performed three to four subsequent attempts to determine the 1-RM. A 3- 5 minute rest period was provided between each lift. No bouncing was permitted, as this would have artificially boosted strength results. Bench press testing was performed in the standard supine position: the subject lowered an Olympic weightlifting bar to midchest and then pressed the weight until his arms were fully extended (Arazi, Hakimi& Hoseini, 2011).

Flexibility

Upper body flexibility measured by Two- armed "back scratch" Test. This test is done in the standing position.

Place one hand behind the head and back over the shoulder, and reach as far as possible down the middle of body back, your palm touching body and the fingers directed downwards. Place the other arm behind body back, palm facing outward and fingers upward and reach up as far as possible attempting to touch or overlap the middle fingers of both hands. An assistant is required to direct the subject so that the fingers are aligned, and to measure the distance between the tips of the middle fingers. If the fingertips touch then the score is zero. If they do not touch, measure the distance between the finger tips (a negative score), if they overlap, measure by how much (a positive score). Practice two times, and then test two times(Thomas et al, 2004).

Muscle volume

Upper body muscle volume was assessed by using upper arm muscle size. Upper arm circumference (millimeters) was measured to the nearest millimeter with a steel tape with the right arm hanging relaxed. The measurement was taken midway between the tip of the acromion and olecranon process. Triceps skin fold (millimeters) was measured to the nearest tenth of a millimeter with a large skin- fold caliper having a pressure 10 g/mm² of contact surface area. The measurement was taken on the back of the arm and midway between the point of the acromion and olecranon process while the arm was hanging relaxed(Frisancho, 1974). Estimates of muscle size were derived: 1) Arm muscle diameter (millimeters) = arm circumference (mm)/ π - triceps skin fold(mm), 2) Arm muscle circumference (mm)= arm circumference (mm)- π (triceps skin fold, 3) Arm muscle area (mm²)= $\pi/4$ (arm diameter²).

Statistical analyses

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) for Windows software (version 17.0; SPSS Inc.). Descriptive statistics were calculated as the mean and standard deviations (Mean $\pm$ SD). In addition, PRE – POST comparisons between groups(RT and RT+PNF) in performance measures were analyzed with independent student's t-tests. The level of significance for this investigation was set at $P < 0.05$.

Results

The mean changes in muscle volume, flexibility and muscular strength performance in RT and RT+ PNF groups are shown in table 1. Significant increases from PRE occurred for both RT and RT+ PNF in the upper body strength, muscle volume and flexibility. The average ($\pm$ SD) 1RM values are presented in table 2. There was no significant difference between RT and RT + PNF for upper body strength 1RM ($p = 0.22$), muscle volume ($p = 0.97$), or flexibility ($p = 0.72$). However, results showed the RT + PNF group greater improved their strength, flexibility and muscle volume when compared to RT group.

Discussion

This study compared the effects of PNF stretching combined with resistance training (RT+ PNF) vs. a resistance training group (RT). The present research study results demonstrate that statistically ($P < 0.05$) improved their strength, flexibility and muscle volume from Post test occurred for both RT and RT + PNF groups when compared to Pre test. There was also no significant difference ($P > 0.05$) between groups but results showed the RT + PNF group greater improved their strength, flexibility and muscle volume when compared to RT group. PNF stretching is more effective in the RT+ PNF group is of great interest. Likely that small non-significant difference was observed related to the effects of PNF stretching. The basis for PNF stretching is theorized to be through neural inhibition of the muscle group being stretched. The proposed neural inhibition reduces reflex activity, which then promotes greater relaxation and decreased resistance to stretch, and hence greater range of movement (Hutton, 1993). These findings were consistent to the some other studies) Surburg, Schrader 1997; Thomas et al 2004; Hunter, Marshall .2002; Church, Wiggins, Moode & Crist, 2001; Granit. 1950). However, other studies(Shrier, 2004; Bradley, Olsen & Portas, 2007) reports significant reduction in the performance after PNF stretching. Previous literature reviewed during the project did not parallel the study, thus comparing methods and results was difficult. The success of PNF stretches has largely been attributed to neurophysiologic mechanisms (Etnyre. 1989; Guissard, Duchateau & Hainaut 1988; Holt, Travis & Okita. 1970; Markos. 1979; Sady, Wortman & Blanke, 1982). Most of them are credited to the muscle spindle and the Golgi tendon organs and their reflex activity: Activation of the muscle spindle elicits contraction of the agonist and inhibition of the antagonist, sometimes referred to as the myotatic reflex or stretch reflex(Mayer, Pederson & Simons, 2005).

Activation of Golgi tendon organs elicits inhibition of the agonist (autogenic inhibition, or inverse myotatic reflex (Granit. 1950; Miyahara et al, 2005) while facilitating the antagonist (Enoka. 2002; Plowman and Smith; 2002). The mechanism by which autogenic inhibition is purported to contribute to PNF efficacy. Increased inhibition from Ib-inhibitory interneurons, a result of the amplified Golgi tendon organs input, results in a reduced level of excitability of the homonymous target muscle, there by facilitating additional stretch (Ulrik et al. 2009). Autogenic inhibition (historically known as the inverse myotatic reflex or autogenetic inhibition) refers to a reduction in excitability of a contracting or stretched muscle, that in the past has been solely attributed to the increased inhibitory input arising from Golgi tendon organs within the same muscle (Laporte, Lloyd, 1952). The reduced efferent (motor) drive to the muscle by way of autogenic inhibition is a factor believed to assist TM elongation (Etnyre & Abraham, 1986; Markos. 1979; Prentice, 1983; Tanigawa, 1972).

Table 1: Measures of strength, muscle volume and flexibility in the RT (N=10) and RT+PNF (N=10) groups during the pre and post-training protocol. Data presented as mean $\pm$ SD.

	Pre	Post	Pre	Post
variables	RT		RT+PNF	
Upper body Strength(kg)	79.25 $\pm$ 2.74	86.25 $\pm$ 2.69 *	82.75 $\pm$ 5.58	92.25 $\pm$ 5.58*
Muscle volume (mm ²)	302.2 $\pm$ 21.3	324.2 $\pm$ 21.3 *	298.2 $\pm$ 17.5	320.1 $\pm$ 15.5*
Flexibility(cm)	1.63 $\pm$ 0.57	1.98 $\pm$ 0.50 *	1.38 $\pm$ 0.46	2.17 $\pm$ 0.36 *

RT: Resistance training group, RT+PNF: Resistance combined with PNF stretching group. * Significantly different from corresponding to pre training value.

Table 2: Comparisons of strength, muscle volume and flexibility in the RT (N=10) and RT+PNF (N=10) groups during the pre and post-training protocol.

variables	Leven's Test for Equality of Variances		Mean difference	t	df	Sig
	F	Sig				
Upper body Strength(kg)	3.509	0.077	6.00	1.86	18	0.22
Muscle volume(mm ²)	0.51	0.48	4.00	0.51	18	0.97
Flexibility(cm)	1.89	0.186	0.19	0.96	18	0.72

RT: Resistance training group, RT+PNF: Resistance training combined with PNF stretching group.

The current study is important because of the common requirement for muscle volume, flexibility and strength in athletics. Finding ways to increase muscle volume, flexibility and strength is valuable to both players and coaches when trying to find ways to advance performance.

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Exploring the additional benefits of PNF stretching is also worthwhile because of the prevalence of issues within the body such as pain, instability, and injuries as a whole. PNF stretching is designed to maximize improvements in flexibility which aid in preventing or recovering from these issues. Finally, muscle volume, strength and flexibility pertain to assisting the vast majority of the population regardless of age, gender, or athletic skill level. Furthermore, variables such as the participants' comfort levels, muscle soreness or fatigue from PNF exercises, diet, and rest were not controlled, which may have slightly affected the results. Another disadvantage of PNF stretching is that a partner is required to assist with the stretch (Prentice ,William ,1999). According to the results of this study, there was no significant difference between groups. Therefore, we cannot necessarily suggest that PNF stretching exercises combined with resistance training is effective. On the other hand, greater improvement (but not significantly) was observed in strength, muscle volume and flexibility of the RT + PNF group when compared to RT group. This observation is important because, nowadays the high level of muscular fitness can aid to achieve best performance. On this basis, coaches are searching ways to improve performance. However, these results have need to further study at future.

Conclusions

In conclusion, the results of this investigation suggested that 8-week resistance training combined with the PNF stretching increase muscle volume, flexibility and muscle strength (upper body strength) in non-athlete male students. But given that there was no significant difference between the applied methods. Thus, the PNF stretching combined with resistance training can not necessarily be effective on muscle volume, strength and flexibility.

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EFEKTI PNF ISTEZANJA KOMBINIRANI S TRENINGOM IZDRŽLJIVOSTI NA SNAGU, MIŠIĆNI VOLUMEN I FLEKSIBILNOST KOD STUDENATA NESPORTAŠA

Sažetak

Svrha ove studije bila je utvrđivanje efekata PNF stretchinga kombiniranog s izvedbom treninga izdržljivosti u trajanju 8 tjedana po protokolu za muškarce studente nesportaše. Dvadeset zdravih nesportaša studenata koledža (uzrasta 21.3 ± 1.3 g., visine 174.7 ± 2.9 cm, mase 71.1 ± 2.4 kg) slučajno su raspoređeni u grupu treninga izdržljivosti (RT, $n=10$) i grupu treninga izdržljivosti kombiniranog s proprioceptivnom neuromuskularnom facilitacijom i istezanjem (RT+PNF, $n=10$). Trenažni program izdržljivosti provodio se 3 dana svakog tjedna (nedjelja, utorak, četvrtak) kroz 8 tjedana. Sastojao se od tri podizanja (triceps pushdown, bench press, lateral pull down), tri skupa od po osam ponavljanja, s inicijalnom težinom od 80 % od jednog maksimalnog pokušaja. Program u trajanju 8 tjedana sa stretchingom sadržavao je 15 različitih PNF istezanja dizajniranih da istegnu sve veće mišićne skupine gornjih ekstremiteta (pectoralis major, triceps, biceps, teres minor & major, deltoideus). Ispitanici su testirani u izvođenju prije i poslije razdoblja od 8 tjedana. Rezultati ove studije pokazuju značajno ($P < 0.05$) poboljšanje snage, mišićnog volumena i fleksibilnosti u odnosu na prvo mjerenje i to za obje grupe, i RT i RT+PNF. Također, nije bilo značajnih razlika između grupa ($P > 0.05$). Međutim, rezultati su pokazali da je RT+PNF grupa bila ipak nešto bolja u snazi, mišićnom volumenu i fleksibilnosti u odnosu na RT grupu. Može se dakle zaključiti da kroz 8 tjedana istezanje kombinirano s treningom izdržljivosti nije značajno bolje od samog treninga izdržljivosti.

Ključne riječi: trening izdržljivosti, PNF, istezanje, fleksibilnost

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MOTOR DEVELOPMENT: EXPLORING MAIN MOTOR SKILLS OF 6 YEAR OLD KOSOVAR CHILDREN

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Original scientific paper

Abstract

With the aim to highlight the movement skill levels of 6 years old children of Kosovo, a set of motor tests was conducted with 178 children, 105 boys and 73 girls. The set contained five tests that measure agility, static balance, dynamic balance, strength and coordination. Tests, which are consistent with their level of development, were fun and easily implemented from children. The results obtained have provided an overview of the stage of development of some motor skills of 6 years old children. Along with the descriptive analysis of data, was presented the latent structure of motor space, in which case it was possible to extract two factors: the factor of dynamic balance and coordination, and the factor of strength, agility and static balance.

Keywords: motor skills, preschool children, motor tests, motor factor

Introduction

Children love the movement. The move is a part of their lives from the beginning. Through it they not only get satisfaction, but the movement helps to increase their optimal development. It has already been proved that first learning and growth are enabled through movement (Andress, 1991). Physical and motor development is quite rapid in the first three years of the child's life, during which the child's bones and muscles develop more. Also, coordination skills, strength or balance are developed so rapidly, causing them to do their daily activities with energy. While at ages from 3-6, due to the consolidation and maturation of the skeletal system, the body of preschool children receives a more regular shape, with an athletic appearance, characteristic for these children. Their locomotor abilities become more refined, the movements are more coordinated and balance skills develop significantly. All children enter preschool with a variety of luggage and motor skills they have acquired and perfected during their early childhood, and which include the right attitude of sitting, straight posture and walking. During the first years of life, children refine their movement skills (the displacement) and their manipulative skills thus becoming able to find in their environment. With time starts to develop what is called the general structure of the movement, which includes dancing, jumping, seizures, running (which are already learned). Numerous studies have already confirmed the close relationship that exists between the fields of development in the preschool age and the huge impact that these areas have at each other, but also the many benefits that movement activities provide. So Barnett, (2002) in his study estimated that preschool education has a positive impact on children development, but also in enhancing their skills to learn. Also the results of a research conducted by Shonkoff and Phillips (2000), showed that effective and qualitative preschool programs affect positively in the development of children and also in the growth of learning skills.

Meanwhile, the results from the study of Bushnell and Boudreau (1993), showed that there is a general relationship between motor and cognitive behavioral and that motor development can determine the sequence in which appear some perceptual and cognitive skills. Through participation and engagement in oriented, structured movement activities, but also in leisure activities, preschool children learn about themselves and about the surrounding environment (Bredecamp & Copple, 1997). Movement activity serves as a catalyst that promotes and supports the pre-environment interaction (Smith, 1989). In fact, the right development in the movement field in children, also positively affects the development of other fields such as social, emotional, psychological and educational activities which are very significant in the overall development of children (Payne & Isaacs, 1999; Loss of others, 1991; Wassenberg and others, 2005). For these reasons, an as fair and accurate knowledge of the level of development of movement skills of preschool children is very important.

The aim of the research

This research aims to evaluate and present the level of development of basic movement skills in 6 years old children of Kosovo.

Methods

Defining the sample

Research sample were children aged 6 years $\pm$ 3 months. These children have attended the program offered by the Ministry of Education, Science and Technology, in public preschool institutions, in several cities of Kosovo like Prishtina, Gjiilan, Gjakova, Prizren, Mitrovica and Ferizaj. Even so the sample is random, during the preparation for research it was taken into account that children were able to follow the preschool curriculum that institution offers, which do not suffer from various chronic diseases and to respect the criteria of age settled for selection.

For all children it was taken preliminarily the written consent for participation in research. The total number of children is 178, and 73 of these children are girls and 105 boys.

Measuring instruments and their description

As a result of a research conducted by Shala (2007), it was set a battery of tests that movement achievability of preschool children in Kosovo, thus the same tests are applied in this research. Agility test (*Jumping of hurdles*); static balance test (*One foot standing*); dynamic balance test (*walking in straight line*); strength test (*throwing of medicine ball*); coordination test (*jumping in squares*).

Procedure

Before the tests were applied at each institution involved in research, there has been developed a preliminary discussion with management staff and teachers of this age group. Conversation has been aimed at recognizing the reason for the development of tests and also to respect the ethical aspects of research, and the agreement from parents and educators of children participating in research was reached successfully. The tests were developed in environments of each institution during morning hours foreseen for physical activities. The implementation of tests is administered by the authors of the research assisted by the students.

Statistical analysis

In accordance with the aims of the research project, sample characteristics and the nature of measuring instruments for quantitative data processing, these methods were applied: • for each variable were calculated basic statistical indicators and the absolute difference between actual and theoretical cumulative frequency. • To prove the latent structure of motor space it was used the factor analysis. For elaboration of these results statistical program SPSS for Windows was used.

Results

Table 1 shows the results of children for each variable motor. Basic statistical indicators of motor values are given with these signs: Number (N), Mean (MA), the minimum score (Min), maximum score (Max), standard deviation (DS), Asymmetric curve (Skew), insights the curve (Kurt) and the absolute difference between actual and theoretical cumulative frequency (Max D). Values presented are indicative of a normal distribution of variables in general, except for 'static balance' and 'dynamic equilibrium' variables, in which MaxD value is greater than the value of the test, while all other variables values are smaller than the value of the test. Mass distribution of the results is within the normal and is known as such based in the values of asymmetry (skewness) and acuity of the curve (Kurtosis). Only dynamic balance variable, has a tendency to skew toward abnormality, however it is still smaller (-2.02) than the criteria value which is 3. This can be explained by the dynamic balance measurement unit (we have only 1 value in the unit, and a number of entities).

Table 1. Main statistical results

Variables	N	MA	Min	Max	Ds	Skew	Kurt	Max D
MSHKATH [in seconds]	178	7.26	5.56	8.96	0.85	0.06	-0.87	0.07
MEKSTA [in seconds]	178	54.3	22.6	100.6	20.66	0.45	-0.72	0.13
MEKDIN [nr. of errors]	178	0.49	0	1	0.50	0.02	-2.02	0.34
MHEMED [in cm.]	178	340	170	520	78.17	-0.26	-0.40	0.10
MKERKA [in seconds]	178	7.31	4.91	11.87	1.48	0.51	0.25	0.05
TEST = 0.12								

Table 2. Eigenvalues

Component	Total	% of	Cumulative	Total	% of	Cumulative
1	1.272	25.443	25.443	1.272	25.443	25.443
2	1.179	23.576	49.019	1.179	23.576	49.019
3	.992	19.840	68.859			
4	.898	17.958	86.816			
5	.659	13.184	100.000			

Table 2 Here are shown the eigenvalues (LAMBDA), also partial contribution (%) and their cumulative overall explanation of variability. According to the method of Hotelling and GK criteria (Gutman-Kaiser), there were extracted two principal components, which explain 49.01% of the total variance. The first eigenvalue explains 25.44% of the total variance of the system, while the second explains 23.57% of it.

Table 3. Principal components and communalities

	1	2	H ²
MSHKATH	.353	-.562	.441
MEKUSTA	.035	-.406	.166
MEKUDIN	.708	.375	.641
MHEMED	-.325	.706	.605
MKCKAT	.735	.241	.598

In the first principal component (Table 3) important projections have conducted the variables: dynamic balance and the coordination (.708 - .735). Both these variables have high projections on this component. The second component, which includes the 23.57% of total variance is defined with variables such as agility, static balance and strength with coefficients of -.406-.706. To make information clearer and more complete latent structure of morphological space key components are transformed into solutions "OBLIMIN". As a result of these transformations two matrix were created. The Pattern matrix which contains parallel projections of vectors of variables on factors, structure matrix which contains orthogonal projections of variables on factors and the component correlative matrix between the extracted factors. Main importance in explaining the latent space has pattern matrix. The first OBLIMIN factor is defined by variables: dynamic balance and the coordination with coefficients .773 - .796. According to such projections, the first factor could be interpreted as a factor of dynamic balance and coordination.

Table 4. Pattern Matrix

	1	2
MSHKATH	123	- 657
MFKIISTA	- 115	- 387
MFKIININ	796	064
MHFMEF	- 045	778
MKCKAT	773	- 070

In the second factor, the higher projections were conducted by throwing the medicine ball and agility (.657-778), while static balance has a lower projection which may have been due to saturation of this variable with error variance, which can be seen from communality value (Table 3) which is very low. According to projections of variables, the second factor can be defined as: factor of strength, agility and static balance. There is no significant correlation between them meaning that factors are independent of each other ($r=0.034$).

Discussion and conclusion

Since the preschool age is considered as one of the periods in which the most rapid development of individual and movement development occurs, it is very important to know what are the parameters of the development of movement skills of preschool children to us. This with the main purpose of the program to provide different activities to further develop these skills.

For this reason, our research was focused on evaluating and presenting the results of movement achievement of children 6 years old (boys and girls). From the results presented it is obvious that our 6 years old children have developed motor skills level that allows them to complete daily activities and create very good predisposition for completion of additional activities.

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MOTORIČKI RAZVOJ: ISTRAŽIVANJE GLAVNIH MOTORIČKIH VJEŠTINA ŠESTOGODIŠNJE DJECE NA KOSOVU

Sažetak

S ciljem da naglasi razinu vještine pokreta djece od 6 godina na Kosovu, skup motornih testova proveden je sa 178 djece (105 dječaka i 73 djevojčice). Skup sadrži pet testova koji mjere agilnost, statičku ravnotežu, dinamičku ravnotežu, snagu i koordinaciju. Izvođenje testova, koji su u skladu sa stupnjem razvoja djece, bilo je zabavno i jednostavno. Dobiveni rezultati su dali pregled stupnja razvoja nekih motoričkih sposobnosti djece od 6 godina. Osim deskriptivne analize podataka, predstavljena je latentna struktura motoričkog prostora, u kojem slučaju je moguće izdvojiti dva faktora: faktor dinamičke ravnoteže i koordinacije, i faktor snage, agilnosti i statičke ravnoteže.

Ključne riječi: motoričke sposobnosti, predškolska djeca, motorički testovi, motorički faktori

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MANAGEMENT MODEL OF EDUCATIONAL INSTITUTION ACCORDING TO BASIC FUNDING SOURCES

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Review paper

Abstract

The purpose of this article is the definition of a general model and pointing to substantial differences in the management and disposal the necessary resources between public and private higher education institutions. The analysis is an assumption about where the differences are generally generated and the resulting products if any other differences that reflect the total range. Design and approach in the article was to compare authors own copyright research, consulting other literature citations, and articulation of conclusions related to these issues. The results of the comparison and logical conclusion execution led to the conclusion that there is and would not even supposed to be some specific differences in all aspects relating to the relevant institutions that approve action in higher education institutions. With this direct connection, of course, also there should be no significant difference in the structure of the program that is in the content value of the realization of goals, which means neither the structure of learning outcomes. Finally, there is no difference in the segment which is the resultant response to the balance sheet that is implemented and demonstrates the mandatory part of the competent authorities. Differences, however, can certainly register the mode of action of management, since the private institution respects market as short-term and public institutions as long-term activity modulator. The value of this work can be seen in sending a clear message that there are important differences between public and private institutions and that is precisely the difference in management, which makes important strategic, and operational decisions, and consideration should essentially be focused on this crucial point. The findings of this study can be easily interpolated into sports associations, and certainly to other forms of organized labor in the social community, where you meet budget, market, mixed and otherwise specified funding.

Key words: management, model, funding, public, private

Introduction

In recent years, often appearing in the current public opinion about the opposite sense, the importance and benefits existence of private to public higher education institutions and various newspapers, abundant scientific and unscientific reports about their differences and harmful both to the detriment of others. Students complain, and the 'rise of the revolution', silent majority of professors, professionals and those who do not - think, argue journalists looking for problematic cases, all along trying to get some benefit, then put it mildly - a troubled public (Bogler, 1994; Branković & Pisker, 2010). Since the primary goal of higher education institutions - a shaping young men and turning it into a functional segment of society, one cannot but wonder that what is the real situation? What is the difference between public and private higher education institutions and what does it have a private and public schools do not (and vice versa)? Finally, to which institution to enroll my own child? It is still a lot of questions but this two to three are quite sufficient for a headache which incidentally causes the issue to everyone, and especially the important is just funding and allocation of resources (Chan and Soong, 2011; van Gelderen, 2010). As can be seen, there is no level that is not in contact with this theme and that is not directly concerned - the internet is full of forums, blogs, web portals deeply interested in similar topics and contradictory opinions and a general concern and uncertainty in the center of the story (Gordon, 1995).

But it all boils down to roughly the following: in Bosnia and Herzegovina society, there was a visible lack of confidence towards the newly opened private universities and colleges that are considered to be elitist, "wild", "or illegal", at least, unnecessary. Such perceptions of private education in Bosnia & Herzegovina lives because colleges "spring up like mushrooms" and some recognize it that such universities serve for those who complete their education in the "line of least resistance" because it failed to state universities are social institutions to buy social peace or be enrolled in the B&H lead to popular prejudice "If it is expensive, must be good" (Mehmedić-Donlić, 2011). Furthermore, no matter what or you'll end up and what it is to educate (Jebaraj et al., 2011).

According to Citizens Initiative point of Europe, among other things, it is necessary to adjust the curriculum to provide the knowledge and skills needed in the labor market and establish and enforce professional orientation of students that must be standardized and focused on identifying students' affinity for the needs of the modern workplace power (Branković & Pisker, 2010). This opinion is worth much in today's world of market-oriented modern era (Lozano, 2011). And that's what's for sure. The population living in the moment, in these areas, as well as populations in other parts of the world forgets that today the market and according to their own rules (Alho & Salo, 2000).

For those who do not know, who have forgotten or do not want to admit to themselves and others, the fact is that except for the finish, what drives profit world. It's getting out, if it ever existed, and idealistic vision of the ultimate goal of education was as noticeable as the knowledge is in itself, which tends to final form Humboldt University. At least, the rule is: "Knowledge? OK, but what would you know without a material / financial and other satisfactions. "Maybe this one will look different, but the fact remains that the modern economy requires well-educated, privileged labor force. How can this be provided? Just with appropriate competent educational institutions, that studies too (Margherita & Secunda, 2011). How should institutions be competitive in the international market, it is in the process of development and must be carried out market research needs to be innovative in production processes, etc. (Pojskić, 2006). Institutions that do not progress - tends dystrophy and disarray. What does higher education institutions must have in order to achieve your goal? As each institution: vision, mission, business plan and resources. First of all, the general resource - the people (carriers of the process), time (which we are limited) and information / knowledge that represent content that is transmitted in the educational process. Then the material and financial resources (Bonacin, 2011th / Sports Management - lectures). Thus, to compare: public higher education institutions (JUV) have a vision, mission, and a business plan. It also has private higher education institutions (PVU). JUV have competent human resources (from managers to cleaners), and PVU also. JUV have a space in which to place the education process, and also PVU.

JUV has the necessary requisites for the exercise of all processes (computers, laboratories, brooms, etc), and PVU also. Both operate on the basis of approval of the competent legislative body and since they received approval, it is to assume that they get the necessary time. Both work to achieve the ultimate goal - the transfer of knowledge that is 'produced' psycho-physical largely completed, an able-bodied, functional person who will continue to transmit social values (Parker et al, 2011; Parkin et al., 2011). So where's the difference?

Problem and aim

From the above, as the subject of this paper are in addition to public and private higher education institutions that exist as an important segment of society that have a very important goal - the transfer of knowledge and social values to new generations and support them in forming a healthy, happy, able-bodied young men who will hold a social structure and values. For purposes of this paper is based on pre-defined models and subsequent relationships that exist in society (Bonacin, Bonacin & Rađo, 2009) and the model of globalization, individualization and group determination (Bilić, 2005) and other related research, established a model of governance in higher education institutions.

The problem consists of determining the differences that exist in the whole formed a model of management in higher education (or other) institutions with regard to funding of public and private institutions with the aim of defining the actual state of management in the same society.

Methods

Methodologically, the material in this review, it is about assessing the situation on the basis of comparison of available adequate resources on the basis of which is formed by a management model in higher education institutions.

Model and legislation

The market is just one segment of society around which is now broken spear no matter what was said and what is the aspect watched. Each, even the least action of any institution is the way to follow market trends. It is therefore very important, especially from the functional point of view to recognize and identify the processes taking place in all around us, even on the market. Firstly there is the constant exposure of any building that is on-line process (persistence), then an object's interaction with the environment that includes other entities that common process (synergy) and the realization of their own thinking (vision, mission) entities within a wider area that surrounds it that is a batch process or development (Bonacin, Bonacin & Bilić, 2010) According to Bonacin, Bonacin & Bilić (2009) just hierarchical structure is the natural order of relationships formed on the basis of internal relations, so it is logical to start any form of research adequate models of each organization and therefore the higher education institution has a local and global interaction within society on the basis of which is formed (figure 1). Each educational and sports organizations / institutions exist within a social community and its relation to the interaction of global and local level where there are three models of relationships: a structural network, hierarchical positioning and real relationships based on equality (Bonacin, Bonacin & Rađo, 2009). According to the results of other studies in reality there is a clear set of entity types of action together and directed towards three main functions in the organization: Logistics (Management), Product (Drive) and Support (Maintenance) and any organization / institution functions best if it is structured as follows (Bonacin, Da., 2008). As for management, Bonacin, Da., Mujkić & Rađo (2007) were given two types of managers which facilitate the selection of managers and provides a clearer picture of what is happening "on top". First - a stable type of manager who works under the established network of communication and financial flows and the other guy - unstable, which is bipolar, stratified to younger people and propulsive, focused on their own sources of funding and other resources. And the elderly are almost maximally oriented sources funding from the relevant ministries (Instability in these cases because of the relatively uncertain position in which both type found).

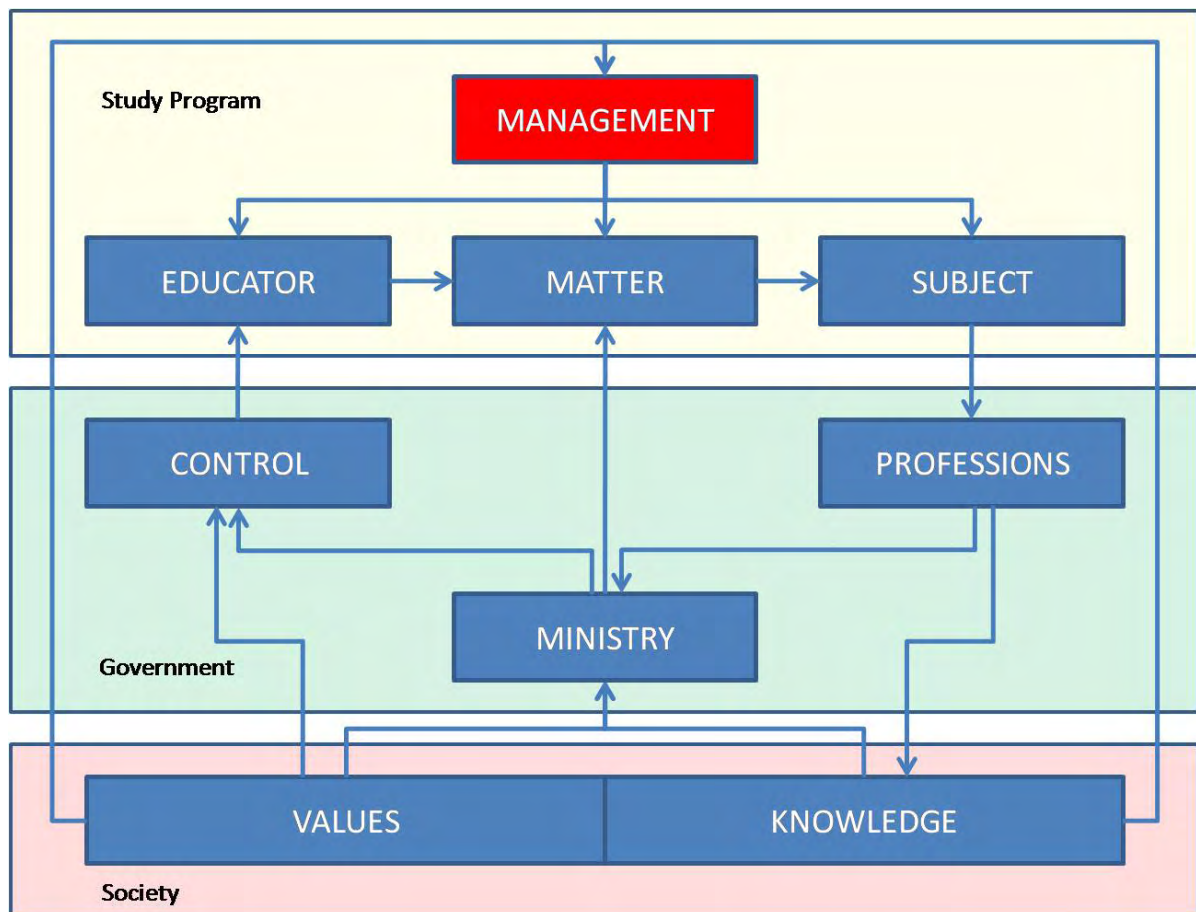


Figure 1. The general integral education management model
[Source: authors]

Why is it good to know? According to Bonacin & Bonacin (2008) target setting changes the selected entities to the top of the structure would cause a number of important changes in relation to the initial status quo. The whole system can then weigh the various orientations. According to Bonacin and Bonacin (2007) there are three levels of managerial work: 1) the short space of entities that own entity (athlete, student), 2) the area of system support (management) and 3) control that entity and the area surrounding the subject (complete environments) in which the subject is immersed. Between all three areas there are interactions and exchanges of information and the basis of the model is the accumulation of knowledge that is systematically increasing. In this way, management has a key position because it is the systematic support of all actions and in no matter who manages. However, they are often targets of programming as the most important segment in the default management models outside of the subject and therefore it is impossible to express creativity as long as programming is not inherent part of every subject (Bonacin & Bonacin, 2007). All this talk about the importance of management with the highest levels. Finally, one of the most important questions, of which started all this thinking is that the financial question. How is this issue important? When a top manager comes into the institution and take responsibility, an important part of the picture on the state institutions will give him just financial indicators.

Based on the current situation, he / she will make important decisions about how to operate on. Of course it is necessary to know something more of many parameters and conditions that led to this situation, but part of that information can be collected "on the fly." That is the basic information that can provide at least initial decision, which depict a picture as possible to begin a systematic and serious planning. Indicators of liquidity, leverage, activity, efficiency, profitability, can help to conclude whether the higher education institutions (egg, sports organization) in the state, for example, to meet its current obligations, then as to what extent financed from the funds of others, how to effectively use their resources, how much revenue is generated per unit of expenditure, how it operates, etc. The ultimate goal is profit, and possibly superior scientific and educational (or sporting) achievement, which should go "hand in glove" with each other, and allow the placement of educational or sports product that is educated and functionally capable individual athletes (Bonacin, Dacić & Bonacin, 2008). All the above applies to JVU and PVU. Where then are the differences? We have already determined: both have a vision, mission, a business plan, competent human resources who can transmit knowledge (from managers to cleaners), the space in which to place the process of education, props needed for the realization of the process (computers, brooms, etc.).

Both act upon the approval of the competent legislative body and since they received approval to assume that they get the necessary time. Both work to achieve the ultimate goal - the transfer of knowledge that is produced physically completed, an able-bodied, functional person who will continue to transmit social values. Thus, the difference is in the way of financing and disposal of these funds. In order to finance higher education today?

According to the Law on Higher Education (revised text) of Canton Sarajevo, University is an institution that deals with the activities of higher education in accordance with the law (Article 3) and can be established as a public institution or institution and has legal personality (Article 17). A higher education institution acquires assets, manages it and uses it in accordance with the law. Real estate and other property provided by the founders, the founders of the property. Assets acquired from performing its activity, higher education institutions, as well as assets acquired based on endowments and gifts, or otherwise lawfully owned property is an institution that has acquired the property. Such assets may be acquired only for the purpose of performing, developing and improving core business and cannot be used in order to change the status of higher education institutions or usurpation of the rights of the founders of other subjects or the university. The property cannot be alienated or otherwise encumber without the prior consent of the founder, and can only be used for the purpose of performing its activities in accordance with this Act (Article 42). Higher education institutions founded or co-founder of Canton, financed or co-financed from the budget based on the criteria for the funding of universities as public institutions, on the proposal of the Ministry is determined by the Government. According to Article 136 of this Act are defined ways of earning income.

According to the Law on Higher Education of the Republic of Srpska 08th July 2010 higher education institutions are Universities and Colleges. They are nonprofit and do their business as a public service and the profit realized by use of the development and improvement of its core activities of higher education. Higher education institutions can be public or private where the public is the founder of the National Assembly of Republic of Srpska and the founder of the private can be a domestic legal or natural person or foreign legal or natural person together with the domestic. In accordance with the Act, manages resources funding for the performance of public higher education institutions of higher education ensure: a) The budget of the Republic, b) their own revenues, c) local government budgets, d) donations and e) other sources. Funding for the performance of higher education Private institutions of higher education ensures the founder of the following sources: a) own revenue, b) donations and c) other sources. Higher education institutions may be financed only from those sources that do not affect their autonomy (Article 135).

In order to meet public needs in the field of higher education may establish cooperation between public and private sectors, in accordance with the regulations governing public-private partnership (Article 140).

In Bosnia and Herzegovina, where the cantonal parliament has passed a law on higher education institutions, is a framework law or in Middle Bosnia Canton 'Instruction ... "(dated 06 April 2007) IV, Article 3, paragraph d, where congruently to laws very similar to the way insurance is regulated and dispositions of assets, as well as their specific purpose.

According to regulations, egg in the Republic of Croatia unless funding from state funds (which include the central government budget, the budget funds and local units of the National Foundation for Science and Higher Education), sources of funding are: the founder, own revenue of institutions of higher education, university and other foundations and donations (domestic and foreign), other sources, and the private sector and individuals (ZZDVO, article 107). According to data collected Hunjak (2008), based on the financial statements of universities in the period since 2003 to 2007, the proportion of the budget in relation to their own resources was 70:30. The structure is dominated by its own revenues tuition charged students at the undergraduate, graduate and postgraduate studies, and part-time students.

According to the Act of 2003, Article 107., Institutions of higher education can be financed from: "...the founders of the funds, the Croatian budget, the budgets of counties, cities and municipalities, the National Foundation for Science, Higher Education and Technological Development of the Croatian, own market revenues from tuition, research, artistic and research projects, studies, expertise, publishing and other industries, universities and other foundations, profits of companies and other entities under Article 66 this Act, direct investments of individuals, companies and other entities, donations and other sources. "Furthermore, paragraph 2 Articles. 107th states that institutions of higher education can be financed "only from those sources that do not affect their independence and dignity." As regards the financing of higher education in Croatia and in nine countries of the European Union (Austria, Czech Republic, Finland, Germany, Hungary, Ireland, Slovenia, Sweden and United Kingdom) and for possible comparisons, the data are available on the website of the Institute for Social Research in Zagreb - Centre for educational Research and Development (see links in the literature).

Discussion and conclusion

It is to conclude that the financing of public higher education institutions, directed towards a purposeless variability. The process is rigid because it is harder to come up with financial resources and the complete system is reminiscent of mechanic organization - it is less prone to change.

While in the case of private institutions of higher education financing market determines who will finance it, how, how much, when, depending on the needs and the whole system similar to the organic type of organization because it is variable and flexible depending on those needs. As we have already concluded, the internal structure and JUV and PVU are equal. And both type of institutions must satisfy the market in terms of issues of interest to educate and be segmented and analyzed the market. Obviously make both parties, with the company over the long term it works JUV, the PVU as a concrete result must be as soon as possible. JUV does not depend on whether the market this year, requires so much of certain experts, and while the whole process of changing plans and programs initiated, but the market will again ask the same profile. But PVU depend on the market and how important they are the result achieved and whether it meets the market. However, the goal is one and the same to others – knowledge results and financial profits. If both have the same structure, same staffing requirements, the same goals, then what is the matter? Obviously the management. It is the knowledge that ensures a manager to educate and control its ability to manage resources. Why? For the simple reason that the "expert" with very little (resources) can do a lot, but "ignorant" would degrade the institution of an abundance of resources, or at best - stagnate until it shuts down or until it is replaced by someone more capable. Specific differences that we observe in the beginning between public and private higher education institutions and speaking with managers work as a few. First of all, the difference in variable amount of available funds with JUV is relatively constant and stable amount of funding because it comes from a safe source (state) while PVU solely depends on the success of their managers (how to find money, how much, when, where). The JUV manager could stagnate for years supported the government rather than something radically changes. But also gravitates JUV "lower limit" the amount of funds budgeted for and therefore in a constant battle for their share of the cake among other users of the budget while PVU directly depends on the success of managers. This of course means that JUV encourages the creation of management but really does not provide adequate conditions while providing PVU requirements for creation and in turn depends on the success of managers. But on the other hand PVU has greater risks as mentioned above because it depends on the market now – immediately, and must be flexible.

But, it means also that it has the ability to facilitate transformation, if necessary, in relation to JUV. As can be seen, most of it applies to a one and it is valuable to others and the difference is actually deleted by a successful manager. But why should we ultimately are interested in the general quality and method of forming a higher education institution?

From the very simple reason - it takes place within the processes important for man as a thinking being, a being who teaches and being in interaction with others (Bonacin, Da., May, 2011. / Sports Management - lectures). Within it takes the process of knowledge transfer - the share of human capital as the company survives thanks to transfer these values to new generations. Is it not clear to very important need to manage everything related to this knowledge? People who carry it, the space in which transfers, quantity and quality of knowledge that is passed, defining the vision, mission and business plan of such transfer - and no less important - the funding. And it is an educational institution is a place where everything is combined, in the case of a higher education institution built on the very high level of finalizing. And not in any way. The knowledge that is transmitted is structured and comprehensive. It has a cause and effect (causality), composed of a variety of events, information and changes that pervade (multidimensionality), was created in the same time, in different areas and different conditions (integrity), all this happens in certain historical framework that have their own rules (Bonacin & Bonacin, 2008. / Sports History - Lectures), and finally, a man of his origin control everything around him with respect to the level of knowledge on which it actually is (Bonacin, Da., 2008). In society there is a total amount of knowledge, that knowledge is not of yesterday and the man was passing, and passing various changes (biological, socio-political changes, educational changes, changes in management, scientific change, and moral change). Such changes in different shape place today too (Bonacin & Bonacin, 2009), so we need to implement new insights into existing and combine them to the desired "optimal" conditions - optimize (Bonacin, Da., 2008). To manage anything, important is the requirement to possess the knowledge and education as the area as complex, demanding and important, and therefore the objectives of educational management and educational institutions at all levels must be high - the highest! And regardless of whether it is public or private institution.

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MODEL UPRAVLJANJA OBRAZOVNIM INSTITUCIJAMA U SKLADU S TEMELJNIM IZVORIMA FINANCIRANJA

Sažetak

Svrha ovog članka je definicija općeg modela i ukazivanje na suštinske razlike u upravljanju i raspolaganju potrebnim sredstvima između javnih i privatnih visokoškolskih institucija. Analizirana je pretpostavka o tome gdje se razlike uopće generiraju i temeljem toga proizvodi li to eventualne druge razlike koje se reflektiraju na ukupni domet. Dizajn i pristup članku je komparacija vlastitih autorskih istraživanja, konzultiranje drugih literaturnih navoda, te artikulacija zaključaka vezanih uz tu problematiku. Rezultati usporedbi i izvođenja logičkih konkluzija doveli su do zaključaka prema kojima nema i ne bi ni trebalo biti nekih posebnih razlika u svim segmentima koji se tiču mjerodavnih institucija koje odobravaju djelovanje visokoškolskih ustanova. S time direktno u vezi, naravno, također ne bi trebalo biti bitnih razlika ni u strukturi programa tj. u sadržajnoj vrijednosti realizacije ciljeva, što znači niti u strukturi ishoda učenja. Konačno, razlika nema ni u segmentu koji je posljedični odgovor na financijsku bilancu koja se realizira i predočava u obveznom dijelu prema nadležnim tijelima uprave. Razlike se, pak, sigurno mogu registrirati u načinu djelovanja menadžmenta, budući je kod privatnih institucija tržište kratkoročno, a kod javnih institucija dugoročni modulator aktivnosti. Vrijednost ovog rada može se očitovati u upućivanju jasne poruke da postoji bitna razlika između javnih i privatnih institucija i da je ta razlika upravo u menadžmentu koji donosi važne strategijske, ali i operativne odluke, te promišljanja u suštini trebaju biti usmjerena na tu ključnu točku. Spoznaje ovog rada moguće je lako interpolirati i na sportske udruge, a zasigurno i na druge oblike organiziranog rada u socijalnoj zajednici, gdje se susreću budžetsko, tržišno, mješovito i drugačije definirano financiranje.

Ključne riječi: upravljanje, model, financiranje, javno, privatno

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ANALYSIS OF MOST OFTEN RESULTS IN THE BOXING BY CATEGORIES (LIGHT, MEDIUM, HEAVY) AND AGE (CADET, JUNIOR, SENIOR)

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Abstract

This study was applied according to interesting problem of tactics in boxing and possible types of match ending by cadets, juniors and senior fighters. In the most common results of combat veterans classified in a category, lightweight (MANOVA .000) exists significant difference between age 3 times, winning on points (WP) (.012), interrupt the judge-scoring difference (RSCO) (.023). The difference was not observed at the termination of the judges in the ring (RSC) (.357), teacher-trainer (RET) (.631), interrupt the judge-scoring difference (RSCO) (.061), interrupt the judge in the ring (RSC) (.020) and handing-coach (RET) (.008). In the most common results of combat athletes classified as middle (MANOVA.979) there is no difference between the three human ages. In the most common results of combat athletes classified as severe (MANOVA.307) there is no difference between the three human ages.

Key words: boxing, match end, differences

Introduction

Often considered as boxing toughest, most complex and most specifically the Olympic disciplines. Favorite name among his supporters is "Noble skill". Advantage over the opponent and points are realized and obtained a good, visible and well-placed blow. In any other Olympic sport, a deliberate blow to the opponent is severely punishable by a warning, and usually a disqualification. Only boxing entails a deliberate blow to the opponent, the stronger (on the rules defined impact area) in the head and body, the front side, above the waist. Sufficient talent, psychological balance, optimum power, speed, stamina, agility with the necessary perseverance in boxers, taking part together in the realization of the set and the desired task. In order to most efficiently reach the target it is necessary to adopt and implement, together with athletes agreed tactics. It should be noted the level of its achievements and potential, both physical and technical, and motivational - willingly - psychological. When it comes to tactical preparation, in addition to knowledge about their own form (the general state of the organism at a given time and moment), preferred are also aware of the opponent, its characteristics, constitution, style, method of engagement, the results achieved so training and improvement in technical elements box, and progression in primary, general physical properties and characteristics, to obtain better conditions for the implementation and realization of prepared and adopted tactics. Good tactic involves achieving the greatest impact on competition, with less risk and effort. For successful training, development and application of tactics, the decisive role is played by a good tactical thinking boxer.

To properly and meaningful impact on development, it is necessary to know all the elements, to sport, and the specifics of the fight in the ring. It is very important to the proper pedagogical and gradually affect the development of athletes, given the current level of his sporting achievements (forms) competition which is being prepared and we have set a goal that so (designed sports results). Expected result implies the realization of responsible well thought out plan. Gradual in the preparatory period, the wealth of techniques and practical application should be based on specific characteristics and individual characteristics of the individual. Common techniques, individual benefits and specialty were not always equally applicable to any opponent (in style). Very often we have called delayed implementation of technical training, and adoption and implementation of individual achievements and benefits of the respective opponents. This is often caused by individual characteristics, competitors, or the unity of physical, technical, psychological and motivational preparedness. To choose the best tactics in the fight, it is the more relevant information about the opponent: recent results, the style of engagement, experience, constitution, psychological status, good and bad characteristics, techniques commonly used in attack, defense, etc. Information about the opponent is collected and analyzed in order to reach the best and most rational strategy of managing tactical battle in the ring. During performance testing conducted in the preparation of training, athletes are required to perform different techniques, both attack and defense, and counter-attacks. Thus we can clearly assess the level at which the diversity of technical elements, and the rate of change of plan and actions themselves fighting in the ring.

Successful application depends on the talent (the assembly of all the features), the volume of its technical sophistication, and level of efficiency and practical application. Development of tactical opinion is controlled by examining the speed of the new assessment of the situation, the efficiency of pronounced bumps and implementation requires in relation to different sparring partners. And combination of tactical tasks are far smaller in scope than the overall technical achievements of athletes. There is often an opportunity to see training of tactical elements of a perfect application, versatility, imagination and timeliness of actions, while the meeting is often absent and action are mostly monotonous, slow and inefficient. It talks about the poor tactical preparedness, as well as low motivational levels and poor form. Since boxing is one of the acyclic sports, does not mean, if we failed in the first or second attempt to realize a particular idea, it will be next and that should not be more trying. The application of technical-tactical elements during the fight, it is essential for success in combat. Higher levels of performance and capacity of technical elements to a better realization of the given variant of tactical combat in the meeting. A small variety of technical elements to facilitate the implementation of the strategy the opponent defense. This speaks to the diverse and well-trained technique based implementation and execution of tactical elements, both in defense and in attack. Uncertain and unpredictable dynamics of the battle in the ring often changes the agreed tactics. It may not be the stencil, but it is very often caused during the performance of the combat. The application of technical-tactical elements during combat is closely linked and mutually dependent than the general and specific physical fitness, psychological stability and motivation fighter. Constitution, the level of sports mastery (technical skills) and the character of the basic prerequisites of forming individual peculiarities boxer, or his style of training and the leadership struggle, and the finality and its overall success.

Aim and methods

The aim is to emphasize the importance of boxing tactics, and its application through the movement of results during the struggle. This paper covers the results of athletes with two European Championships, held in Sombor 2007 (Junior). and in Novi Sad, 2008 (Cadet). and with an international tournament for seniors" winner" Belgrade in Belgrade 2007. It will also determine which are the most common stop fighting in relation to age, as well as movement between Boxers results classified into groups in which is concentrated in several weight categories: lightweight (Paper 48, flies 51, bantam 54 and featherweight 57), medium (light 60, half-welter 64, welter 69 and middle 75) and heavy: (half-heavy 81, heavy 91 and super-heavy +91 kg category). The Cadet European Championships in Novi Sad 2008 was attended by 149 fighters from 20 countries. There were 133 fights.

At the European Junior Championships, Sombor 2007th attended by 209 fighters from 37 countries. There were 198 battles. The international tournament for seniors Belgrade Winner" 2007" was attended by 73 fighters from 13 countries. There were 63 fights. 4 results were processed with the most fighting ended. International labels that are applied to the box are: WP (Win on Points) - victory on points, or points, RSC (Win by Referee Stop Contest) - Termination by the judge in the ring, RET (Retired) - (withdrawal), the termination of the coach - RSCO (Referee Stop Contest Overscore), interruption of more than 20 points difference. Will analyze a sample of 147 soldiers belonging to the category of light, divided into 3 subgroups according to ages: Cadets (52), juniors (66), seniors (29). Then a sample of 176 soldiers belonging to the category srednjih divided into 3 subgroups according to ages: Cadets (50), juniors (90), seniors (36). Finally, the sample of 106 soldiers belonging to the category of heavy divided into 3 subgroups according to ages: Cadets (31), juniors (40), seniors (35). A sample of 133 cadets is divided into 3 subgroups according to the categories: light (52), medium (50), heavy (31). A sample of 196 junior is divided into 3 subgroups according to the categories: light (66), medium (90), heavy (40). A sample of 100 seniors is divided into 3 subgroups according to the categories: light (29), medium (36), heavy (35). Results were obtained using analysis of multivariate variance analysis and discriminant analysis.

Results

Category light

In accordance with previously established draft research analyzes the results of the most topical units fighting at lightweight boxer. The analysis is performed on the 4 most common results of the battle: victory on points (WP), interrupt the judge in the ring (RSC), interrupt the judge-scoring difference (RSCO) and handing coach (RET), all on a sample of 393 fights, held on Cadet and Junior European Championship and the senior International tournament" Belgrade winner". The analysis included three human ages of competitors: Cadets (133), junior (198) and seniors (63). Feature victory on points (WP) has 2 modes: other decisions and the victory on points (WP). The characteristic fine judges in the ring (RSC) has two modes: other decisions, fine judges in the ring (RSC). Feature fine judge-scoring difference (RSCO) has 2 modes: other decisions, rating difference (RSCO). Feature legends trainer (RET) has 2 modes: other decisions, handing-coach (RET). It is possible to note that the pupils (pupils) represented the most wins on points (WP) consisting of 34 fights (65.4%) of 52, which is significantly higher than the frequency of other decisions (18 fights 34.6%, $p = .002$). In junior representation victory on points (WP) (53 fights 80.3%), which is significantly higher than the frequency of other decisions (13 fights 19.7% $p = .000$).

Table 1 Victory on points (WP)

	Other decisions		(WP)	
	n	%	n	%
Cadets	18.	34.6*	34.	65.4
Juniors	13.	19.7	53.	80.3*
Seniors	2.	6.9	27.	93.1*

With senior representation of the victory on points (WP) (27 fights 93.1%), which is significantly higher than the frequency of other decisions (2 fights 6.9% $p = .000$). The difference between the ages: the modality most other decisions are represented by pupils (34.62%), which is significantly higher than juniors (19.70% $p = .070$) and seniors (6.90%, $p = .007$). The victory on points (WP) was most common for senior citizens (93.10%), which is significantly higher than pupils (65.38% $p = .007$). Since $p = .013$ c^2 - test, $ac = .237$ with a confidence interval (105, .369), which does not contain zero, one can say that there is low correlation between the ages of competitors and win on points (WP).

Table 2 Interruption by the judge in the ring (RSC)

	Other decisions		(RSC)	
	n	%	n	%
Cadets	46.	88.5	6.	11.5
Juniors	63.	95.5	3.	4.5
Seniors	27.	93.1	2.	6.9

It is possible to note that the most frequent interruption of school children in relation to other decisions, which makes the fight, or 46 (88.5%) of 52, which is significantly higher than the frequency of interruption of the judges in the ring (RSC) 6, or fighting (11.5%, $p = .000$). In junior representation interruption in relation to other decisions of 63 fight (95.5%), which is significantly higher than the frequency of interruption of the judges in the ring (RSC) 3 or fighting (4.5%, $p = .000$). With senior representation interruption for other decisions than 27 fights is (93.1%), which is significantly higher than the frequency of interruption of the judges in the ring (RSC) 2 or fighting (6.9%, $p = .000$). The difference between the ages of competitors by landmarks: the most characteristic of other decisions is represented by junior (95.45%), characteristic of fine judges in the ring (RSC) is the most frequent in school children (11.54%). Since $p = .355$ can be said that by C^2 - the test is not significant link between ages and breaks judges in the ring (RSC).

Table 3 Judge-break points the difference (RSCO)

	Other decisions		(RSCO)	
	n	%	n	%
Cadets	41.	78.8	11.	21.2*
Juniors	58.	87.9	8.	12.1*
Seniors	29.	100.0*	0.	.0

It is possible to note that the most frequent interruption of pupils to other decisions, which makes the fight or 41 (78.8%) of 52, which is significantly higher than the frequency points the difference (RSCO) 11 or fight (11.2%, $p = .000$).

In junior representation interruption for other decisions of 58 was fighting (87.9%), which is significantly higher than the frequency points the difference (RSCO) 8 or fight (12.1%, $p = .000$). The difference between the ages: stop fighting over other decisions is most prevalent in seniors (100.00%), which is significantly larger than the juniors, where (87.88% $p = .053$), and with the pupils (78.85% with $p = .009$). Break points the difference (RSCO) is most prevalent in schoolboy (21.15%), which is significantly larger than the representation of seniors where (.00% $p = .009$). Since $p = .024$ c^2 - test, $ac = .220$ with a confidence interval (.120, .320), which does not contain zero, one can say that there is low correlation between the ages of competitors and judges feature to break-points the difference (RSCO).

Table 4 Withdrawal-coach (RET)

	Other decisions		(RET)	
	n	%	n	%
Cadets	51.	98.1	1.	1.9
Juniors	64.	97.0	2.	3.0
Seniors	29.	100.0	0.	.0

It is possible to note that the most frequent interruption of pupils for making other decisions or fight 51 (98.1%) of 52, which is significantly higher than the frequency of handing-coach (RET) 1 fight or (1.9%, $p = .000$). In junior representation interruption modality for other decisions were 64 fights or (97.0%), which is significantly higher than the frequency of handing-coach (RET) 2 or fighting (3.0%, $p = .000$), which is significantly higher than the frequency of handing-coach (RET) 0 or battle (0%, $p = .000$). The difference between the ages: to end the fighting in relation to other decisions, most seniors are represented (100.00%), interruption of handing-coach (RET) is most prevalent in junior (3.03%). Since $p = .628$ can be said that by C^2 - the test is not significant link between ages and traditions-coach (RET).

Table 5 Multivariate differences

	n	F	p
MANOVA	4	5.23	.0

	γ	R	F	p
WP	0.237	0.244	4.582	0.012
RSC	0.118	0.119	1.037	0.357
RSCO	0.22	0.225	3.882	0.023
(RET)	0.079	0.08	0.462	0.631

	discr	Cadets	Juniors	Seniors
RSCO	0.061	RSCO	RSCO	Other
RSC	0.02	RSC	Other	Other

Since $p = .000$ rejects the hypothesis H1 and acceptance of alternative A1, which means that there are significant differences found between the 3 different fighting age. As the $pn > .05$ There is no reason not to accept the hypothesis H3, which means that no significant difference between the results of the struggle of different ages, with features: fine judges in the ring (RSC) .357, handing-coach (RET) .631.

Since the $p < .05$ accepts the alternative hypothesis A3, which means that there are significant differences between some of the results of the struggle of different ages with features: the victory on points (WP) (decision of judge .012), fine judge-scoring difference (RSCO) .023. Based on the results of common struggle with competitors grouped in a category, it can be easy to say that pupils have the following characteristics: Breaking Point fight the big difference was significantly higher compared to other Boxers ages, a fine judge in the ring is slightly higher in this category. This means that the riders of this age are different levels of tactical and technical preparations boxers and their general level of preparation. Also noted is that judges disposed towards this age group in order to protect their health and future development. For juniors, there are also similar precautionary characteristics in relation to the judge still totally untrained and unprepared physically individual competitors. For seniors, this decision are negligible since it is already well formed, and a trained competitors.

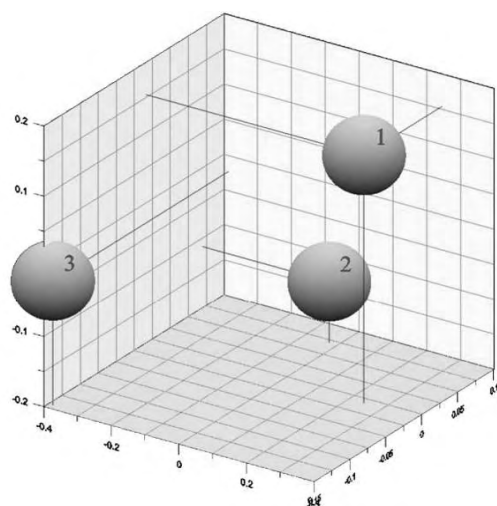


Figure 1 Relative position of groups

Category medium

It is possible to observe that for most pupils represented the victory on points (WP) consisting of 39 fights (78.0%) out of 50, which is significantly higher than the frequency of other decisions (11 fights 22.0%, $p = .000$). In junior representation victory on points (WP) is 71 fight (78.9%) and significantly higher than the frequency of other decisions (19 fights 21.1% $p = .000$). With senior representation of the victory on points (WP) is 31 fight as 86.1%, a significantly higher incidence of other decisions (5 fight, or 13.9% $p = .000$). The difference between age groups: modality fight other decisions, the most prevalent in school children (22.00%); a victory on points (WP) is the highest in seniors (86.11%). Since $p = .595$ can be said that by C2 - the test is not significant link between ages and the victory on points (WP). It is possible to note that the most frequent interruption of pupils other decisions, which makes the fight, or 45 (90.0%) out of 50.

Table 6 Victory on points (WP)

	Other decisions		WP	
	n	%	n	%
Cadetsi	11.	22.0	39.	78.0
Junioris	19.	21.1	71.	78.9
Seniors	5.	13.9	31.	86.1

Table 7 Interrupted the judge in the ring (RSC)

	Other decisions		RSC	
	n	%	n	%
Cadetsi	45.	90.0	5.	10.0
Junioris	85.	94.4	5.	5.6
Seniors	34.	94.4	2.	5.6

It is significantly higher than the frequency of interruption of the judges in the ring (RSC) (5 fight, or 10.0%, $p = .000$). In junior representation interruption in relation to other decisions were 85 combat or 94.4%, which is significantly higher than the frequency of interruption of the judges in the ring (RSC) (5 fight, or 5.6% $p = .000$). For seniors, the distribution of interruptions in relation to other decisions of 34 fights or 94.4%, which is significantly higher than the frequency of interruption of the judges in the ring (RSC), where we have 2 fights, or (5.6%, $p = .000$). The difference between age groups: modality other decision is the most prevalent in junior (94.44%); fine judges in the ring (RSC) is the most prevalent in schoolboy (10.00%). Since $p = .573$ can be said that by C2 - the test is not significant link between ages and characteristics of fine judges in the ring (RSC).

Table 8 Representation of judge-break points the difference (RSCO)

	Other decisions		RSCO	
	n	%	n	%
Cadets	44.	88.0	6.	12.0
Junioris	82.	91.1	8.	8.9
Seniors	34.	94.4	2.	5.6

It is possible to note that the pupils, the most frequent interruption in relation to other decisions, which is 44 fights, or (88.0%) out of 50, which is significantly higher than the frequency points the difference (RSCO) 6 or fight (12.0%, $p = .000$). In junior representation interruption in relation to other decisions the 82nd combat or (91.1%), which is significantly higher than the frequency points the difference (RSCO) where we have 8 or fighting (8.9%, $p = .000$).

With senior representation interruption in relation to other decisions of the 34 fights that (94.4%), which is significantly higher than the frequency points the difference (RSCO) where iman fight or two (5.6%, $p = .000$). The difference between the ages of competitors: other mode decision is the most prevalent in elderly persons (94.44%) points the difference (RSCO) was highest in schoolboy (12.00%). Since $p = .588$ can be said that by C2 - the test is not significant link between ages and features fine judge-scoring difference (RSCO).

Table 9 Representation of withdrawal-coach (RET)

	Other decisions		RET	
	n	%	n	%
Cadets	50.	100.0*	0.	.0
Junioris	84.	93.3	6.	6.7*
Seniors	35.	97.2	1.	2.8

It is possible to note that the most frequent interruption of juniors in relation to other decisions, which makes the fight 84 or (93.3%) out of 90 fights, which is significantly higher than the frequency of handing-coach (RET), where we have 6 fights or (6.7 % $p = .000$). With senior representation interruption in relation to other decisions that the fight is 35 (97.2%), which is significantly higher than the frequency of handing-coach (RET), where we have a fight or (2.8%, $p = .000$).

The difference between the ages of competitors: other mode decision is the most prevalent in school children (100.00%), which is significantly higher than juniors (93.33% $p = .064$). Stop fighting, withdraw competitors, surrender-coach (RET) is most prevalent in junior (6.67%), which is significantly higher than pupils (.00%, $p = .064$). Since $p = .141$ can be said that by C2 - the test is not significant link between the different ages and breaks, handing-coach (RET). In this chapter will be to prove or reject the claim that there are significant differences between the struggle of different ages (school children, juniors, seniors) in relation to the four most frequently found fighting group, secondary categories.

Table 10 Multivariate differences

	n	F	p
MANOVA	4	.255	.979

	γ	R	F	p
WP	.077	.077	.516	.598
RSC	.079	.080	.554	.576
RSCO	.077	.078	.528	.591
RET	.147	.149	1.977	.142

	n	F	p
Discriminative	2	.576	.680

Since $p = .979$ is no reason not to accept the hypothesis H1, which means that no significant difference between fighting with competitors, various ages. As the $pn > .05$ There is no reason not to accept the hypothesis H3, which means that no significant difference between the struggle of competitors, the different ages of characteristics: the victory on points (WP) (decision of judge .598), fine judges in the ring (RSC) .576, fine judge-scoring difference (RSCO) .591, handing-coach (RET) .142. Since $p = .680$ for 2 synthesized competitors, there is no reason not to accept the hypothesis H2, which means that no significant difference and clearly defined boundaries between the results of any fight different ages in relation to disruption of athletes classified in a category middle, to end the judges in the ring (RSC) and the termination of the judge-scoring difference (RSCO).

Based on previous considerations, a sample of 176 fights, in accordance with the methodology applied, can be logically derived characteristics of each of the three ages. Since $p = .680$ indicates that there is no clearly defined boundaries between ages, so it is not possible to determine the features of the group in relation to stop fighting with competitors grouped in a category middle.

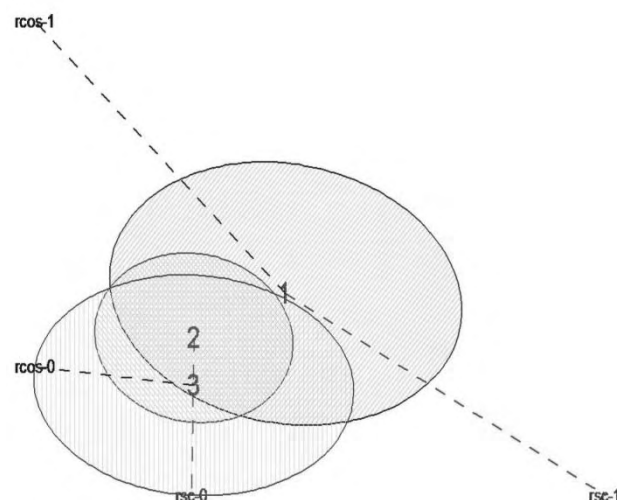


Figure 2 Ellipses represent different ages in relation to termination of the struggle of competitors, the features of the results: interruption of the judges in the ring (RSC) and the termination of the judge-scoring difference (RSCO)

By looking at the chart we can see that there are similarities of all ages in relation to termination of the fight referee decisions (RSCO) and suspension of judges of the fight in the ring (RSC), because the ellipse in large part overlap.

Category heavy

The table shows the numeric (n) and percentage (%) represented the most common result of the struggle with the athletes belonging to the category, teškiih for ages 3 levels in 4 break: the victory on points (WP), interrupt the judge in the ring (RSC), interrupt the judge -points the difference (RSCO), handing-coach (RET). We will address the important also differences between and within levels. Descriptive procedure is only possible nagovestiti some characteristics of individual level interrupts the fight, while a significant difference between ages later analyzed.

Table 11 Representation of the victory on points (WP)

	Other decisions		WP	
	n	%	n	%
Cadets	9	29	22	71
Junioris	12	30	28	70
Seniors	8	22.9	27	77.1

It is possible to observe that for most pupils represented the victory on points (WP) consisting of 22 fights (71.0%) out of 31, which is significantly higher than the frequency of other decisions where we have a fight or 9 (29.0%, $p = .002$). In junior representation victory on points (WP) is 28 or fight (70.0%), which is significantly higher than the frequency of other decisions where imamo12 fight, or (30.0%, $p = .001$). With senior representation of the victory on points (WP) is 27 or fight (77.1%), which is significantly higher than the frequency of other decisions or 8 fights (22.9%, $p = .000$). The difference between age groups: modality other decision is the most prevalent in junior (30.00%); victory on points (WP) is the highest in seniors (77.14%). Since $p = .763$ can be said that by c^2 - test revealed no correlation between ages and the victory on points (WP).

Table 12 Representation interrupted the judge in the ring (RSC)

	Other decisions		RSC	
	n	%	n	%
Cadets	27	87.1	4	12.9
Junioris	35	87.5	5	12.5
Seniors	32	91.4	3	8.6

It is possible to note that the most frequent interruption of school children in relation to other decisions, which consists of 27 or fight (87.1%) out of 31, which is significantly higher than the frequency, fine judges in the ring (RSC) (4 fights $p = 12.9\%$. 000). In junior representation interruption in relation to other decisions of 35 fights or 87.5%, which is significantly higher than the frequency, fine judges in the ring (RSC) (5 fight 12.5% $p = .000$). With senior representation interruption in relation to other decisions in 32 fights and 91.4%, which is significantly higher than the frequency, fine judges in the ring (RSC) (3 fights 8.6% $p = .000$). The difference between age groups in relation to the other mode of decision is most prevalent in elderly persons (91.43%), interruption of the judges in the ring (RSC) is the most prevalent in school children (12.90%). Since $p = .820$ can be said that by C^2 - the test is not significant link between ages and fine judges in the ring (RSC).

Table 13 The presence of fine judge-scoring difference (RSCO)

	Other		RSCO	
	n	%	n	%
Cadets	25	80.6	6	19.4*
Junioris	36	90	4	10
Seniors	34	97.1*	1	2.9

It is possible to note that the most frequent interruption of school children, other decisions, which makes up 25 fights (80.6%) out of 31, which is significantly higher than the frequency points the difference (RSCO) (6 fight 19.4% $p = .000$). In junior representation interruption in relation to other decisions in 36 fights and 90.0%, which is significantly higher than the frequency, rating difference (RSCO) (4 struggles 10.0%, $p = .000$).

With senior representation interruption in relation to other decisions of 34 fights or 97.1%, which is significantly higher than the frequency, rating difference (RSCO) (1 match 2.9% $p = .000$). The difference between age groups in relation to the mode of fighting, the other decision is the most prevalent in elderly persons (97.14%), which is significantly larger than the schoolboy (80.65% $p = .033$). Break points the difference (RSCO) is most prevalent in school children (19:35%), which is significantly higher than seniors (2.86%, $p = .033$). Since $p = .090$ one can say that there is an association with increased risk between the ages of conclusion and termination of judge-scoring difference (RSCO).

Table 14 Representation of withdrawal-coach (RET)

	Other decisions		RET	
	n	%	n	%
Cadets	31	100.0*	0	0
Junioris	37	92.5	3	7.5
Seniors	31	88.6	4	11.4*

It is possible to note that for most juniors represented a break in relation to other decisions, which makes 37 fights (92.5%) of 40, which is significantly higher than the frequency of handing-coach (RET) (3 fights 7.5% $p = .000$). With senior representation interruption in relation to other decisions of the (31 Fight 88.6%), which is significantly higher than the frequency of handing-coach (RET) (4 struggles 11.4% $p = .000$). The difference between age groups in relation to the mode of fighting, the other decision is the most prevalent in school children (100.00%), which is significantly higher than seniors (88.57% $p = .056$). Stop, surrender-coach (RET) is most prevalent in seniors (11.43%), which is significantly larger than the schoolboy (.00%, $p = .056$). Since $p = .168$ can be said that by C^2 - the test is not significant link between ages and traditions-coach (RET).

Table 15 Multivariate differences

	n	F	p
MANOVA	4	1.189	0.307

	γ	R	F	p
WP	0.071	0.071	0.267	0.766
RSC	0.061	0.061	0.195	0.823
RSCO	0.209	0.213	2.478	0.089
RET	0.18	0.183	1.81	0.169

	n	F	p
Discriminative	2	1.403	0.234

Since $p = .234$ for 2 synthesized competitor Since $p = .307$, there is no reason not to accept the hypothesis H1, which means that no significant difference between the struggles of different ages. As the $pn > .1$ no reason not to accept the hypothesis H3, which means that no significant difference between the struggle of different ages with features: the victory on points (WP) (decision of judge .766), fine judges in the ring (RSC) .823, handing-coach (RET) .169. Since the $p < .1$ accept the alternative hypothesis A3.

That means that there are significant differences between some of the different ages of features fine judge-scoring difference (RSCO) .089. Well, there's no reason not to accept the hypothesis H2, which means that no significant difference and clearly defined boundaries between the struggle of different ages in relation to the characteristics. Based on previous considerations and the sample of 106 fights, in accordance with the methodology applied, can be logically derived characteristics of each of three ages. Since $p = .234$ indicates that there is no clearly defined boundaries between ages, so it is not possible to determine the features of ages in relation to stop fighting with competitors grouped in a heavy category.

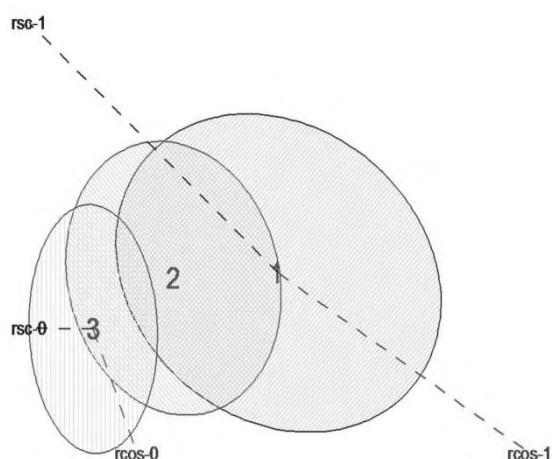


Figure 3 - Ellipses fight different ages in relation to termination of the characteristics of the competitors, judges break-points the difference (RSCO) and termination of the judges in the ring (RSC)

By looking at the chart we can see that there are similarities of all ages because of the large ellipse relative overlap. A sample of 147 boxers drawn from the population, defined as a population of light, which is divided into 3 subgroups according to ages, then sample of 176 boxers drawn from the population defined as population mean, which is divided into 3 subgroups according to age groups and sample of 106 athletes drawn from the population, defined as heavy populations that were divided into 3 subgroups, according to the ages. In the most common results of combat veterans classified in a category, lightweight (MANOVA .000) no significant difference between age 3 times, winning on points (WP) (.012), interrupt the judge-scoring difference (RSCO) (.023). The difference was not observed at the termination of the judges in the ring (RSC) (.357), teacher-trainer (RET) (.631), interrupt the judge-scoring difference (RSCO) (.061), interrupt the judge in the ring (RSC) (.020) and handing-coach (RET) (.008). In the most common results of combat athletes classified as middle (MANOVA.979) there is no difference between the three human ages. In the most common results of combat athletes classified as severe (MANOVA.307) there is no difference between the three ages.

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ANALIZA NAJČEŠĆIH REZULTATA U BOKSU PO KATEGORIJAMA (LAKE, SREDNJE, TEŠKE) I UZRASTU (KADETI, JUNIORI, SENIORI)

Sažetak

Ova studija je provedena u skladu sa zanimljivim problemom taktike u boks i mogućim tipovima završetka meča kod kadeta, juniora i seniora. Najčešći zajednički rezultat jest da kod lakih boksača (MANOVA 0.000) postoji razlika između uzrasta i kod pobjede na bodove (WP) (.012) i prekida sudije-bodovne razlike (RSC) (.023). Kod prekida sudije u ringu (RSCO) (.357) i predaje-trener (RET) (.631). Sa diskriminacijom također nema razlika prekid sudija-bodovna razlika (RSCO) (.061), prekid sudije u ringu (RSC) (.020) i predaja-trener (RET) (.008). Kod najčešćih rezultata srednjih i teških kategorija nije bilo razlika kroz uzraste.

Ključne riječi: boks, završetak meča, razlike

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