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Biomotor Status and Kinesiological Education of Students Aged 13 to 15 Years – Example: Karate

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A B S T R A C T

The aim of this paper was to obtain information relevant for efficient selection in karate, based on comparison of biomotor status of male/female7th and 8th grade students in primary school »Bijaći« from Kaštel Novi and karate practitioners and non-practitioners (cadets) in Croatia. For this purpose, a sample was drawn of 352 primary school students (150 males and 152 females) and 50 karate practitioners (25 males and 25 females), all aged 13 to 15 years, and 2 morphological measures (body height and body mass) and a battery of 6 motor tests was used. A biomotor system which determines the situation efficacy in male and female karate practitioners was defined based on the comparison of test results of students from Kaštela, Croatian karateka and Croatian standards, factor analysis of applied variables and discriminant analysis of those variables between karate athletes and students from Kaštela. In male karate athletes, general motor efficacy in karate is based on explosive strength of jumping type, repetitive strength of the trunk and coordination, followed by flexibility, static strength of the arms, and movement frequency speed. In female karate athletes, integration of force, coordination, muscle tone regulation and speed is dominant for achieving success in karate. Female karate athletes use speed and fine muscle tone regulation in motor functioning more than male karate athletes, who use basic strength more.

Key words: *biomotor status, male karate-cadets, female karate-cadets, selection*

Introduction

Physical education class represents a prerequisite for achieving all goals and objectives of educational work but it is inadequate in satisfying primary biotic needs for movement. The primary goal is defined by enabling students for the application of theoretical and motor knowledge which allow individual physical exercise in order to improve the quality of life. At the same time, physical education efficiently changes personal traits and develops abilities, directly ensuring promotion of health as the irreplaceable factor of all human activities.

The key subject in the execution of major and specific objectives of physical education is the teacher who, by using properly selected educational contents, variety of methods and methodical organisational forms of work, has a goal of satisfying all guidelines and all types of educational areas. Educational work in the area of physical and health education is divided into educational, kinantrophological and upbringing guideline, and, according to the type of educational work in the area of physical and health education, it is divided into classroom work, extracurricular activities and out-of-school activities[1].

If we add to this the existence of different development stages in children, the role of teacher/kinesiologist becomes even more complex. Each development stage matches the age to a greater or lesser extent. Students in the 7th and 8th grade of primary school represent the fifth development stage which covers puberty, during which important changes occur, determining physical, psychological and social development.

As opposed to body height, body mass usually increases also during adolescence. Transition from one development stage to the next is roughly the same for all children, but it is not the rule for every individual child[2].

Changes in most body (anthropometric) measures, besides subcutaneous fat tissue and head and face measures, follow the general growth and development curve. In their longitudinal studies, Malina and Bouchard (1991)[3]

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proved that the differences between boys and girls in most of the anthropometric characteristics measured (body heigth, body weigth, sitting heigth, leg length, lip width, shoulder width) were almost imperceptible up to the age of thirteen or fourteen, when entering puberty leads to significant differences.

Up to the age of ten, boys and girls are almost the same height. Growth spurts occur usually between the ages of 10 and 12 in girls, and between the ages of 12 and 14 in boys. At the age of 11 to 14 girls are on average taller than boys. A few years later, that ratio is permanently reversed.

Accelerated growth and development, presence of disproportion in the growth of skeletal system and muscle-connective tissue system, disturbance of coordination and flexibility, decreased aerobic and anaerobic endurance (especially in girls) need to taken into consideration during the development of motor abilities and, according to that, educational contents that will influence the development and/or maintenance of speed need to be chosen. Emotional instability and sensitivity of pubertal students, finding ways of fitting in the world of grown-ups and decreased motivation for kinesiological engagement can be qualitatively reduced by developing positive opinions, attitudes and feelings, as well as by physical education teachers choosing simple, varied and interesting educational contents.

Only knowledgeable, planned, programmed and implemented teaching can satisfy numerous general and specific goals of physical education[4].

At the beginning of every school year teachers identify the initial status of each student, thus creating an important set of information to be used in designing the curriculum of the immediate classroom teaching.

General objectives of physical education are also permanently oriented towards the effective use of free time and including students into sport clubs and developing an interest for personal improvement in different sport activities. Extracurricular activities that are acceptable and available to each student maintain optimum development of all dimensions of kinanthropological characteristics. Quantitative defining of motor abilities and achievements of each student provides a sufficient set of information to be used by a kinesiologist to properly guide the students in choosing extracurricular activities which will eventually make a selection of students with outstanding results towards a certain sport activity in school or outside-of-school clubs.

All students who want to and are free from respective health restrictions should preferably be offered an opportunity to practice karate. Selection is a process rather than an instantaneous action.

This study is an example of direction, selection and orientation of male/female students aged 12–14 towards karate through all three types of educational work in the area of physical education.

With the goal of evaluating the efficacy of learning methodology and improving the karate technique, and finding a better pedagogical and didactical approach, systematization of karate techniques is made which divides the karate technique into: movement, punching, kicking, blocking, throwing, falling and combination of techniques in defense and offense.

A number of individual techniques that can be used in a fight in classic karate vary between twenty and thirty, but the overall number of technical tactical elements is much higher, which can be seen in kate. Kate in modern karate is composed of a series of previously composite techniques (movements) which are meant to demonstrate the proper form in defense and offense.

Sports development in striking sports, therefore in karate as well, is carried out through phases: initiation phase (6–10 years), athletic formation (11–14 years), specialisation (15–18 years) and high performance phase (19 years and older). During the first two phases training is oriented towards the general multiple anthropological development as a basis for the development of specific motor abilities, which will result in transition to the specialisation phase.

Years of hard training are necessary for acquisition of motor skills (techniques) in karate and their efficient application in a fight. Fight dynamics and movement frequency in a fight are particularly emphasized, which requires a high level of motor and functional abilities in karateka, especially of speed and strength[5], as well as coordination[6].

Fights, although of relatively short duration, have maximum intensity, and only the entities that can endure all that can sustain in elite karate. Hard work is often not sufficient for achieving results in this sport, having predispositions is also important. This has repercussions on forming an adequate anthropological system of a karate athlete. Karate training leads to adaptation of the morphological sub-segment of the anthropological system, optimizing the morphological structure with demands of this sport[7].

Regarding the genetic determination of the longitudinal and transversal dimensionality of the skeleton, karate training will influence the muscle mass growth to that extent which is optimal in relation to skeleton development, as well as influence the reduction of fat tissue[7].

Mesomorph and ectomorph constitutional types of karate athletes dominate quality and elite selections[8,9]. As opposed to this, the endomorph somatotype is rare even in the highest weight category of karate athletes.

Katić et al.[7] state that longitudinal development of the skeleton is one of the predictors of performance in karate. Moreover, elite karateka have greater development of the vertical body build, highlighted by an average somatotype (mesomorphic – ectomorphic)[10]. In this context, in a sport which requires a body to move as fast as possible, being more endomorphic is suggested to be detrimental to performance[7,9,10]. Peter and Bercades[11] found that karate athletes were more ectomorphic, which confirms the findings of Giampietro et al.[10], for Italian male karate athletes.

Furthermore, it was found that people who practice karate have a higher bone mineral density than people of the same age who don't practice karate[12]. Drozdowska et al.[13] state that karate is a sport which has a positive impact on the skeletal status, with the most significant benefits occurring in adults.

In comparison to other top level athletes in different sports, VO2max of top level athletes in karate was very similar to that established in taekwando athletes[14,15] and wrestlers[16], but lower that the values reported in boxers[17].

Aerobic capacity is necessary to prevent fatigue during training, during the breaks between subsequent bouts of fighting activity within a fight and improve the recovery process between consecutive matches[18,19].

High intensity intermittent sports rely mostly and anaerobic energy sources, with determinant actions being a function of explosive movement[20]. Thereby karateka's decisive actions depend mainly on anaerobic energy pathways[18,21].

Reaching the highest performance in karate is possible by imparting to one segment a very high kinetic energy in the shortest period of time. Thereby, the muscle explosive power plays a major role to achieve top Karate results[22–24]. According to the World Karate Federation[25], kumite performance depends on the speed and the power of the karateka actions. Indeed, maximal velocity as well as explosive strength represents the main determinant muscle mechanical factors involved in karate performance[26,27].

Flexibility is crucial in karatekas in order to execute high kicks and perform full range movements at high speed. Therefore karatekas have greater flexibility of in right and left hip flexion as well as in right and left knee flexion[27].

Reaction time, or the speed at which a person moves in response to a stimulus, is a critical element in most sports especially in karate since high level performance is based essentially on explosive techniques. There is a significant difference between high level and novice karate athletes regarding the choice reaction time. Furthermore, Karate is a good example of a competitive sport with high levels of temporal and spatial constraints which require fast reaction[28].

Top results in karate can be achieved only by those karatekas who potentially have motor abilities developed above average, primarily explosive strength, speed and coordination which can be seen especially in realisation of karate kicks performed in combination: jaku zuki--mawashi geri and kizame zuki-jaku zuki[7]. Precisely the speed and quality in performance of these actions (techniques) directly affect the efficacy of offense in karate.

Of all the techniques used (kicks), quality of jaku zuki kick was the most important factor in predicting performance in competitions in karate athletes aged 11 and 12, and quality of combination of jaku zuki-mawashi geri and kazame zuki-jaku zuki in karate athletes aged 13 and 14[29].

The aim of this study was to determine the biomotor status of male/female 7th grade and 8th grade students of »Bijaći« primary school in Kaštel Novi, and to compare it to the Croatian norms. The specific goal was to determine the differences in anthropometric characteristics and motor abilities between male/female students who chose karate as extracurricular activity (participate in Croatian cadet karate competition) and those who didn't.

Materials and Methods

Study subjects

The sample of subjects was defined by 352 entities aged 13–15, divided into four subsamples. The first subsample is composed of 150 boys, 7th and 8th grade students of primary school »Bijaći« in Kaštel Novi, with mean BMI=19.8 (body mass index). The second subsample included 152 girls of the same age, also students of primary school »Bijaći«, with mean BMI=19.9. The third subsample was represented by 25 male students of the same age who chose karate as extracurricular activity, with mean BMI=20.50, and the fourth subsample of 25 female students of the same age with mean BMI= 20.40 who also chose karate as extracurricular activity.

TABLE 1
DESCRIPTIVE STATISTICS OF BIOMOTOR VARIABLES IN BOYS AGED 13–15 YEARS (KAŠTELA, KARATE AND CROATIAN STANDARDS)

Variable	Kaštela (N=150)		Karate (N=25)		Croatian standards	
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD
Body height (cm)	168.06	8.53	170.97	10.08	162.65	7.20
Body weight (kg)	56.12	10.90	60.12	12.21	51.15	9.35
Arm plate tapping (freq.)	36.90	4.20	35.72	5.08	28.50	3.70
Standing broad jump (cm)	191.40	30.72	182.81	23.33	189.00	17.90
Obstacle course backwards# (s)	11.30	3.04	12.05	3.52	12.65	3.35
Crossed-arm sit-ups (freq.)	43.80	8.90	51.84	10.54	33.00	7.75
Seated straddle stretch (cm)	75.90	9.70	63.71	16.56	50.50	8.10
Bent-arm hang (s)	36.44	26.13	34.80	23.30	40.50	17.10

#variable with opposite metric orientation

Instruments

A total of 8 variables were used to assess the biomotor status. Measures of anthropometric characteristics were represented by body height and body weight variables. The space of basic motor abilities was defined by a set of 6 basic motor abilities tests which consisted of the following variables: hand tapping to assess frequency of movement, standing long jump to assess explosive strength of horizontal jumping type, obstacle course backwards to assess coordination, crossed-arms sit-ups to assess repetitive strength, seated straddle stretch to assess flexibility and bent-arm hang to assess static strength. All measuring instruments used to record the kinanthropological status of subjects are integral parts of methodology, monitoring and evaluating in the area of physical and health education.

Data analysis

Data analysis methods involved calculating descriptive statistical parameters: arithmetic mean ($\overline{X}$), standard deviation (SD), minimum (Min) and maximum (Max) result, coefficient of asymmetry (Skew), coefficient of kurtosis (Kurt) and determining MaxD value to assess normality of variable distribution using KS-test.

Factor analysis was used to analyze the structure of morphological characteristics and motor abilities and within the analysis a varimax rotation of principal components of the inter-correlation matrix was conducted, and to determine the differences between all four groups of subjects, canonical discriminant analysis was used, calculating the structure of discriminant function (DF), group centroids and canonic discrimination coefficient (CanR).

Results

For efficient orientation and selection in primary school kinesiological education, it is necessary to know the anthropological status of students and the complexity of kinesiological activities. Therefore, it is necessary first to identify the factors (biomotor) which are the determinant of success in a certain activity (success in karate), and then to establish the latent anthropological structure of students. Finally, based on the results obtained, orientation and selection of students is performed in those activities which, in their complexity, correspond to students' biomotor characteristics.

In this study, based on students' reactions measured, quantitative and qualitative indicators were determined of the biomotor development of male and female students who are karate practitioners and those who are not. Latent structure of biomotor status for karate cadets was established, as well as the factors which predominantly determine success in karate according to gender.

Table 1 shows quantitative indicators of biomotor status in boys: students from Primary school »Bijaći« in Kaštel Novi, Croatian Karate-cadets and boys who represent the general population of Croatia. Generally, it can be concluded that the biomotor development of students from Kaštela and Karateka was much more prominent in comparison to Croatian standards.

Students from Kaštela are particularly superior in relation to other groups in flexibility, psychomotor speed (arm plate tapping), coordination and explosive strength. Results of previous studies have established that success in most sports, and especially in karate, depends on these basic motor abilities. These results cannot be fully explained by genetic factors, i.e. predisposition, but also by processes of conditioning as well as by quality of physical education classes. That is why the curriculum of kinesiological education for students of this Primary school is presented.

Kinesiological education curriculum for seventh and eighth grade students of primary school »Bijaći« from Kaštela:

Kinesiologic contents	Number of lessons *per* year	Frequency
Athletics	10	40
Sports gymnastics	12	50
Basketball	8	24
Volleyball	8	24
Handball	8	24
Football	8	24
Dance structures	4	16
Figthing structures	4	8
Initial, transitive and final measurment	8	
Total	70	210

Karate athletes in Croatia have significantly greater values of body height and body mass, especially in comparison to Croatian norms, and in motor abilities, greater values of repetitive strength of the trunk.

However, karate athletes have above-average results in static strength of the arms and explosive strength of jumping type, probably because the overall body mass has a negative impact on manifestation of relative strength. As a rule, karate competitions are organized according to weight categories so that fighting matches would be fair in relation to strength and agility[30,31].

Table 2 presents latent structures of biomotor status of boys in primary school »Bijaći« from Kaštela and of karateka. In both groups two significant factors of similar structure were found: the motor factor and the morphological factor, which account for 59% of the total variability in students from Kaštela, and almost 67% in Karateka students.

In Kaštela students, the first factor defines the general motor efficacy predominated by the intensity of energy mobilization (explosive strength) and whole body coordination, followed by muscle endurance (static strength of the arms), basic strength of the trunk (repetitive strength of the trunk) and muscle tone regulation (flexi-

TABLE 2
VARIMAX FACTORS OF THE BIOMOTOR AREA (V) IN BOYS AGED 13–15 YEARS

Variable	Kaštela (N=150)		Karate (N=25)	
	V1	V2	V1	V2
Body height (cm)	0.18	0.88	0.23	0.84
Body weight (kg)	–0.20	0.91	–0.21	0.91
Arm plate tapping (freq.)	0.55	0.04	0.61	0.06
Standing broad jump (cm)	0.82	0.09	0.87	0.11
Obstacle course backwards# (s)	–0.70	0.19	–0.74	0.04
Crossed-arm sit-ups (freq.)	0.69	–0.02	0.80	–0.30
Seated straddle stretch (cm)	0.63	0.27	0.70	0.36
Bent-arm hang (s)	0.70	–0.36	0.69	–0.46
Eigenvalues	2.91	1.83	3.40	1.96
% of Variance	36.35	22.82	42.47	24.52
Cumulative %	36.35	59.17	42.47	66.99

bility), and to a lesser extent, psychomotor speed (speed of movement frequency).

In karate athletes, the first factor is even better in defining general motor efficacy predominated by explosive strength, repetitive strength of the trunk and coordination, followed by flexibility, static strength of the arms, and speed of movement frequency. Thus defined motor structure is conducive for the realisation of all karate techniques (Figure 1).

The second factor is responsible for the morphological development both in Kaštela students and karate athletes, and it is defined by very high projections of body weight and body height variables.

Table 3 shows quantitative indicators of biomotor status in female students: students from Primary school »Bijaći« in Kaštela, Croatian Karate-cadets and female students who represent the general population of Croatia. Generally, it can be inferred that the biomotor development of female karate athletes is much more prominent in comparison to Croatian norms, but also in com parison to Kaštela female students. Female students from Kaštela, in comparison to Croatian norms, have higher values of body mass and body height, and in motor abilities higher values of movement frequency speed, flexibility, repetitive strength of the trunk and coordination. These differences are contributed by, along with the genetic component, the quality of applied kinesiological treatments in physical education classes and extracurricular activities.

Fig. 1. Boran Berak (2012). Croatian representative, member of karate club »TAD«, Rijeka, multiple junior cadet state champion; (body height 168.00 cm, body weight 57.30 kg, arm plate tapping 37 freq., standing broad jump 225 cm, obstacle course backwards 6.42 s, crossed-arm sit-ups 52 freq., seated straddle stretch 88.00 cm, bent-arm hang 37.73 s).

Kinesiological education curriculum for seventh and eighth grade female students of primary school »Bijaći« from Kaštela:

Kinesiologic contents	Number of lessons *per* year	Frequency
Athletics	10	40
Sports gymnastics	12	50
Rythmcal gymnastics	4	16
Basketball	8	24
Volleyball	8	24
Handball	8	24
Football	4	16
Dance structures	4	16
Figthing structures	4	8
Initial, transitive and final measurment	8	
Total	70	218

More than 80% of male and female students participate in extracurricular activities: volleyball, gymnastics, karate, judo, taekwondo, tennis, rowing, swimming, handball, football, basketball, dancing, majorette dancing, sailing, rollerblading.

Table 4 presents latent structures of biomotor status of girls in primary school »Bijaći« from Kaštela and of

TABLE 3
DESCRIPTIVE STATISTICS OF BIOMOTOR VARIABLES IN GIRLS AGED 13–15 YEARS (KAŠTELA, KARATE AND CROATIAN STANDARDS)

Variable	Kaštela (N=152)		Karate (N=25)		Croatian standards	
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD
Body height (cm)	165.40	6.13	165.01	5.86	161.15	6.30
Body weight (kg)	54.50	9.42	55.84	7.35	51.35	8.80
Arm plate tapping (freq.)	38.11	3.50	38.00	5.55	28.50	6.45
Standing broad jump (cm)	166.80	18.20	167.16	2.14	170.00	16.50
Obstacle course backwards# (s)	13.54	2.96	13.20	3.95	15.05	2.30
Crossed-arm sit-ups (freq.)	39.20	5.73	50.48	7.15	28.50	4.75
Seated straddle stretch (cm)	79.93	11.01	80.29	14.43	61.00	9.15
Bent-arm hang (s)	20.50	12.92	32.18	15.10	24.50	15.40

#variable with opposite metric orientation

karateka. In both groups two significant factors of similar structure were found: the motor factor and the morphological factor, which account for 54% of the total variability in students from Kaštela, and almost 67% in Karateka students which is significantly higher.

In Kaštela female students the first factor defines general motor efficacy predominated by explosive strength and whole body coordination, which is, to some extent, followed by other motor abilities.

In female karate athletes, the first factor is much better in defining general motor efficacy predominated equally by explosive strength and coordination, followed by flexibility and speed of movement frequency, all of which is followed, to a certain extent, by static strength of the arms and repetitive strength of the trunk. Therefore, integration of mechanisms, which are based on coordinated performance of movements, regulation of force, muscle tone regulation and speed regulation, is the basis for success in female karate sport.

Results of canonical discriminant analysis in biomotor status variables between students from »Bijaći« and cadet karate competitors for both males and females are presented in Table 5.

Significant but moderate coefficients of canonical discrimination between karate practitioners and non-practitioners were obtained: 0.56 in males and 0.62 in females. In males, discriminant function mostly differentiates karate athletes with above-average repetitive strength of the trunk from students from »Bijaći« who have above-average flexibility. In females, discriminant function differentiates female karate athletes with greater repetitive strength of the trunk, and, to a lesser extent, greater static strength of the arms in relation to female students from »Bijaći«. It is obvious trat karate training has influenced the development of repetitive strength of the trunk, especially in karate practitioners, and above-average repetitive strength of the trunk facilitates realisation of all karate techniques.

TABLE 4
VARIMAX FACTORS OF THE BIOMOTOR AREA (V) IN GIRLS AGED 13–15 YEARS

Variable	Kaštela (N=152)		Karate (N=25)	
	V1	V2	V1	V2
Body height (cm)	–0.06	0.78	0.35	0.84
Body weight (kg)	–0.23	0.83	–0.30	0.88
Arm plate tapping (freq.)	0.53	0.45	0.73	0.05
Standing broad jump (cm)	0.74	0.01	0.92	0.01
Obstacle course backwards# (s)	–0.74	0.21	–0.90	0.27
Crossed-arm sit-ups (freq.)	0.58	–0.09	0.52	0.16
Seated straddle stretch (cm)	0.43	0.53	0.81	0.46
Bent-arm hang (s)	0.66	–0.27	0.56	0.16
Eigenvalues	2.43	1.87	3.70	1.74
% of Variance	30.43	23.31	46.16	21.70
Cumulative %	30.43	53.74	46.16	67.76

TABLE 5
CANONIC DISCRIMINATION ANALYSIS BETWEEN KARATE PRACTITIONERS AND NON-PRACTITIONERS

Variable	Boys	Girls
	DF	DF
Body height (cm)	0.17	–0.03
Body weight (kg)	0.18	0.07
Arm plate tapping (freq.)	–0.14	–0.01
Standing broad jump (cm)	–0.15	0.01
Obstacle course backwards# (s)	0.13	–0.05
Crossed-arm sit-ups (freq.)	0.46	0.84
Seated straddle stretch (cm)	–0.58	0.01
Bent-arm hang (s)	–0.03	0.39
CanR	0.56*	0.62*
Wilks' Lambda	0.69	0.62
Chi-square	63.99	83.25
Functions at Group Centroids		
Karateka	1.65	1.94
Students from Kaštela	–0.28	–0.32

#variable with opposite metric orientation, *p<0.01
DF – discriminant function, CanR – canonic discrimination coefficient

Fig. 2. Damira Oremuš. (2012), member of karate club »FORTITER«, Kaštela, multiple junior cadet state champion; (body height 152.00 cm, body weight 37.20 kg, arm plate tapping 31 freq., standing broad jump 190 cm, obstacle course backwards 10.80 s, crossed-arm sit-ups 55 freq., seated straddle stretch 75.00 cm, bent-arm hang 37.29 s).

Discussion

Establishing the subjects' status and identifying the transformation processes related to subjects' status is basic in kinesiological education of primary school students. The result which shows that students are not significantly differentiated by indicators of biomotor status from karateka of the same age group implies that these students have predispositions which are important for achieving success in karate. Testing physical fitness usually include: cardio-respiratory endurance, muscle power, muscle endurance, flexibility and body build[32].

Factors of biomotor functioning of male and female students from primary school »Bijaći«, as well as of male and female karate athletes, were established by using factor analysis. Isolated factors structures indicate the complexity of karate, which is supported by numerous studies. Namely, most fighting sports require a combination of technique, strength, aerobic fitness, force and speed. Generally, there is not a single characteristic of performance that dominates a fighting sport[33]. Karate athletes must perform several high intensity actions during a match. Top level karateka have a high level of body fitness, and, according to Becker and Bell[34], fight in karate is considered a high intensity competition. A study conducted by Roschel et al.[24] indicates that karate performance is more dependent on muscle power at low loads than at high loads. Also, karate success is more dependent on speed of contractions than muscle strength/power[26].

In male karate-cadets two regulators in manifestation of force and speed are present: cortical regulation of movement in terms of motor coordination and muscle tone regulation in terms of flexibility. Cognitive information processing also takes part in the integration of these motor abilities[35].

In female karate-cadets the ideal biomotor system for achieving success in karate was defined. This system is dominated by integration of force, coordination, muscle tone regulation and speed. Female karate athletes use speed and fine muscle tone regulation in motor functioning more than male karate athletes, who use basic strength more (Figure 2).

That is why top results in karate can only be achieved by the karateka with potentially above-average motor abilities, primarily explosive strength, speed and coordination, which are then integrated in the general motor efficiency through karate training. This integration is the basis for the development of motor functioning in kinesiologic education[36–37] and sports[38–40].

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BIOMOTORIČKI STATUS I KINEZIOLOŠKA EDUKACIJA UČENIKA OD 13 DO 15 GODINA – PRIMJER KARATE

S A Ž E T A K

Cilj rada je da se na temelju usporedbe biomotoričkog status učenika/ca 7. i 8. razreda OŠ »Bijaći« iz Kaštel Novog i karataša i karatašica (Kadetskog uzrasta) Republike Hrvatske (HR) dobiju informacije važne za efikasnu selekciju u karateu. U tu svrhu na uzorku od 352 učenika osnovne škole (150 muškog i 152 ženskog spola) i uzorku od 50 karataša (25 muškog i 25 ženskog spola), svi uzrasne dobi od 13 do 15 godina, primijenjene su 2 morfološke mjere (tjelesna visina i tjelesna masa) i skup od 6 motoričkih testova. Temeljem usporedbe testovnih rezultata učenika grada Kaštela, Karataša HR i normativa Republike Hrvatske (HR), faktorske analize primijenjenih varijabli i diskriminativne analize tih varijabli između karataša i učenika Kaštela, definiran je biomotorički sklop koji determinira situacijsku efikasnost u karateu kod karataša i karatašica. Kod karataša generalna motorička efikasnost u karateu temelji se na eksplozivnoj snazi tipa skoka, repetitivnoj snazi trupa i koordinaciji, što prati fleksibilnost, statička snaga ruku, te brzina frekvencije pokreta. Kod karatašica za postizanje uspjeha u karateu dominantna je integracija sile, koordinacije, regulacije mišićnog tonusa i brzine. Karatašice u motoričkom funkcioniranju više koriste brzinu i finu regulaciju mišićnog tonusa u odnosu na karataše koji koriste više bazičnu snagu.