

RELATIONS BETWEEN FUNDAMENTAL MOTOR SKILLS AND SPECIFIC KARATE TECHNIQUE IN 5-7 YEAR OLD BEGGINERS

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Abstract

The aim of this study was to determine possible correlation of fundamental motor skills and specific karate skills in children age 5 to 7. A total of 31 children (21 boys and 10 girls) participated in this research and were subduced to two testing sessions: fundamental motor skills and specific karate skills. The fundamental motor skills were estimated with the use of the most commonly used test – TGMD-2. Three independent judges evaluated the performances of six specific karate elements watching the videotaped material. According to the high values of Cronbach alpha coefficients (0.91-0.98), Kolmogorov-Smirnov test and the results of the factor analysis we can conclude that the specific karate skills tests are a valid measurement for children age 5 to 7. Also, the absence of significant differences between boys and girls confirmed previous investigations in the area of fundamental motor skills. They do not differ significantly in the specific karate skills neither with girls having higher values. Karate skills are significantly positively correlated with the fundamental motor skills results (0.74). This correlation enables more appropriate selection process and the beginners training process organization were the aim is the fundamental motor skills quality development which proves to be the basis of specific karate technique learning in later stages.

Key words: preschoolers, martial arts, TGMD-2, motor proficiency

Introduction

Fundamental motor skills in preschoolers are one of the most studied areas (Fazzi et al., 2002; Levzion-Korach, Tennenbaum, Schnitzer & Omoy, 2000; Prechtel, Cioni, Einspieler, Bos & Ferrari, 2002; Tröster & Brambring, 1993; Tröster, Hecker & Brambring, 1994; Dummer, Haubenstricker & Stewart, 1996). However, those studies are highly oriented on motor deficiency detection in children with disabilities, while fundamental motor skills researches in healthy children are rare and often enclosing only a small part of the motor development. It is crucial to mention that children from age three to seven undergo a sensitive period for fundamental motor skills development (Gallahue & Donnely, 2003). These skills enable moving through space (Zittel, 1994) and allow reactions on a great deal of external stimuli (Krebs, 2000).

Mastering these skills is a postulate for successful introduction to specific sport disciplines (Burton & Miller, 1998; Gallahue & Ozmun, 1998; Jürimäe & Jürimäe, 2000). Inadequate level of fundamental motor skills in the early age can be negatively reflected on motor competitiveness in adult age (Gallahue & Ozmun, 1998). They comprise of those movement patterns which are focused on reaching a certain goal, and according to Burton & Miller (1998) those are locomotion skills and object control skills. The two areas mentioned can be measured with one of the most frequently used tools: "Test of Gross Motor Development" (TGMD). The first (Ulrich, 1985), as the second (Ulrich, 2005) version proved to be a reliable and valid measure for fundamental motor skills assessment.

In the last decade karate became a massive sport discipline as well as other martial arts. It is a very complex sport discipline which inquires the integration of substantial amount of physical and mental characteristics. Mastering karate technique with automatization and their efficient application in combat require long-term and hard training (Katić, Blažević, Krstulović & Mulić, 2005). But in the beginning of their sport career the goal is to acquaint the children with a number of different techniques. Basic karate technique consists of learning single strikes, kicks, blocks and stances. Those skills are upgrading and improving in time which results upgrading to a higher belt. But although important, the basic karate skills are still not properly studied, except few interested researchers (Katić, Jukić, Glavan, Ivanišević & Gudelj, 2009; Katić et al. 2005). Distribution of injuries (Pieter, 2010; Macan, Bundalo-Vrbanac & Romić, 2006; Pieter, 2005) and biomechanical analysis (Mori, Ohtani & Imanaka, 2002) are far more investigated. Although it could be assumed that children with a higher level of fundamental motor skills can learn specific karate skills better and quicker, it has not yet been proved in karate. Besides studies about relations of fundamental motor skills and motor abilities (Overlock & Yun, 2006) or physical activity (Fisher, Reilly, Kelly, Montgomery, Williamson, Paton & Grant, 2005), none were found when it comes to relations with specific karate skills. The aim of this research was to determine possible correlation of fundamental motor skills and specific karate skills in children age 5 to 7.

For that purpose we calculated:

- Differences between boys and girls in fundamental motor skills,
- Differences between boys and girls in specific karate skills,
- Correlation of each specific karate skill and fundamental motor skills,
- Correlation of fundamental motor skills with total karate skills.

Possible significant correlation could directly influence the selection process as training process organization for beginners.

Methods

Participants

A total of thirty-one child (5 to 7 year olds) volunteered for this study (21 boys and 10 girls). All of them were members of the Karate Club "OBI" from Split. They trained seven months in average, three times per week for one hour with the same training volume and intensity and by the same coach. Prior to the investigation the parents had to sign an approval for participation.

Measurements

For fundamental motor skills assessment we used a part of the TGMD-2 ("Test of Gross Motor Development-Second Edition") (Ulrich, 2005). This test is considered to be a qualitative measurement for children age range three to ten. The test is comprised of 12 motor skills arranged in two subtests: locomotor subtest (run, gallop, hop, leap, horizontal jump and slide) and object control subtest (striking a stationary ball, stationary dribble, catch, kick, overhand throw and underhand roll). Each skill is assessed by qualitative criteria (from 3 to 5 criteria, depending on a skill) and repeated 2 times. Every criterion is assessed with 0 (criterion not accomplished) or 1 (criterion accomplished). For example, if certain skill is assessed by three criteria, the result can vary from 0 to 6. The largest amount of points that can be obtained for each subtest is 48. Raw scores can be standardized according to participant's age with the use of accompanied tables. However, standardization was not used in this research because it only applies on the American population and is not necessarily valid for European children. It is important to emphasize that only locomotor subtest was used in this investigation based on karate not being a type of sport where object manipulation is present. The assessment was realized by a single judge because the test has proven to be a valid measure for preschoolers (Ulrich, 2000). Specific karate skills assessment was based on the same principles as the TGMD-2. Accordingly, 6 basic karate techniques: one punch (*choku zuki*), one kick (*mae geri*), three blocks (*gedan barai*, *age uke* and *ude uke*) and one stance (*zenkutsu dachi*); were rated by three criterions with the 0 and 1 marks. The maximum number of points was 36. The techniques were chosen and criteria were made according to the yellow belt exam program.

Three judges were involved in specific karate skills assessment because these tests have not yet been valued.

Procedure

The experiment consisted of two phases. The first one, which took place 2 months after children's initiation in the club, included videotaping the fundamental motor skills which were then assessed by a single judge. Second phase was held five months after the first one and included videotaping the specific karate skills during the yellow belt exam.

Data analysis

After calculating the *Cronbach alpha* coefficients for determining judge's objectivity in all of the six new tests of specific karate skills, Kolmogorov-Smirnov test was carried out for sensitivity determination. Validity of the tests was established by factor analysis and the following preliminary statistic parameters were calculated for both boys and girls: mean (AS), standard deviation (SD), minimum (MIN), maximum (MAX). Independent samples t test (t value) was used for determining gender differences. According to study aims, linear correlation analysis was calculated for determining the relationship between each specific karate skill and fundamental motor skills, as well as between fundamental motor skills and total karate skills (r).

Results

Since TGMD-2 has been validated on a sample of preschool children (Cronbach alpha from 0.85 to 0.91) (Ulrich, 2000) and since only one judge did the assessment, it was not necessary to revalidate the test. But validation had to be done for the new specific karate tests (Table 1). All the tests had high values of Cronbach alpha coefficients (0.91-0.98). According to Kolmogorov-Smirnov test there were no differences between the observed and expected distributions ($p < 0.05$), since the boundary for the d values was 0.24. When observing mean values of fundamental motor skills for boys and girls (Table 3) similar results appear and t test confirms the absence of significant differences ($p > 0.05$). Also, observing the same values but for the specific karate skills, it can be noted that girls perform better although the t test did not show significant differences ($p > 0.05$).

Table 1: Cronbach alpha coefficients and values of Kolmogorov-Smirnov test for each test

	Cronbach alpha	K-S
TGMD		0.13
ZENKUTSU DACHI	0.92	0.10
CHOKU ZUKI	0.96	0.14
GEDAN BARAI	0.93	0.14
AGE UKE	0.91	0.09
UDE UKE	0.98	0.16
MAE GERI	0.97	0.16

The girls dominate in the total karate skills as well but still with no significant differences. According to the presented, we can observe the girls and the boys as a unique sample for further analysis. Factor analysis of six specific karate skills revealed a single factor (Table 2) with 64% of explained variance. *Mae geri* kick had the highest projection (0.86) on the factor since it can be described as the most complex element.

Table 2: Results of factor analysis

	Factor 1
ZD	-0,80
CZ	-0,83
GB	-0,71
AU	-0,76
UU	-0,83
MG	-0,86
Expl.Var	3,83
Prp.Totl	0,64

Legend: ZD-Zenkutsu dachi, CZ-Choku zuki, GB-Gedan barai, AU-Age uke, UU-Ude uke, MG-Mae geri.

Table 3: Descriptive statistics: number of participants (N), mean value (Mean), standard deviation (SD), minimal result (MIN), maximal result (MAX); t test for independent samples: t-value (t).

	BOYS				
	N	Mean	SD	MIN	MAX
TGMD	21	29.81	5.90	17.00	40.00
ZD	21	3.98	1.09	1.33	6.00
CZ	21	3.95	1.48	1.33	6.00
GB	21	3.56	1.72	0.00	6.00
AU	21	3.60	1.36	1.00	6.00
UU	21	2.51	1.78	0.00	6.00
MG	21	1.86	1.67	0.00	5.67
TOT_K	21	19.46	7.50	6.33	32.00

	GIRLS					t test
	N	Mean	SD	MIN	MAX	t
TGMD	10	29.60	5.42	19.00	35.00	0.09
ZD	10	3.90	1.19	2.33	6.00	0.20
CZ	10	4.47	1.45	2.33	6.00	-0.91
GB	10	3.93	0.97	2.33	5.33	-0.65
AU	10	3.70	0.96	2.33	5.67	-0.20
UU	10	3.70	1.64	0.67	5.67	-1.79
MG	10	2.87	1.96	0.33	5.67	-1.49
TOT_K	10	22.57	6.18	14.67	32.67	-1.14

Legend: ZD-Zenkutsu dachi, CZ-Choku zuki, GB-Gedan barai, AU-Age uke, UU-Ude uke, MG-Mae geri, TOT_K-Total karate skills.

Table 4 contains the results of a linear correlation analysis which identifies the relation between the fundamental motor and specific karate skills. The values from the first column are the most interesting. When observing the karate skills separately, all of them are significantly positively correlated with the fundamental motor skills results. All specific skills included, the highest correlation was found between the TGMD-2 and the *mae geri* kick (0.68). If we focus on total karate skills, we find the highest positive correlation with the fundamental motor skills (0.74), as expected.

This relation can also be observed in Figure 1, where fundamental motor skills increase follows the increase of specific karate skills.

Table 4: Correlation between fundamental motor skills (TGMD) and specific (ZD, CZ, GB, AU, UU, MG) and total (UK_K) karate skills.

	TGMD	ZD	CZ	GB	AU	UU	MG	TOT
TGMD	1.00							
ZD	0.57	1.00						
CZ	0.51	0.65	1.00					
GB	0.61	0.42	0.60	1.00				
AU	0.51	0.59	0.57	0.36	1.00			
UU	0.62	0.59	0.58	0.48	0.50	1.00		
MG	0.68	0.56	0.55	0.59	0.61	0.79	1.00	
TOT_K	0.74	0.77	0.81	0.73	0.73	0.85	0.88	1.00

Legend: ZD-Zenkutsu dachi, CZ-Choku zuki, GB-Gedan barai, AU-Age uke, UU-Ude uke, MG-Mae geri, TOT_K-Total karate skills.

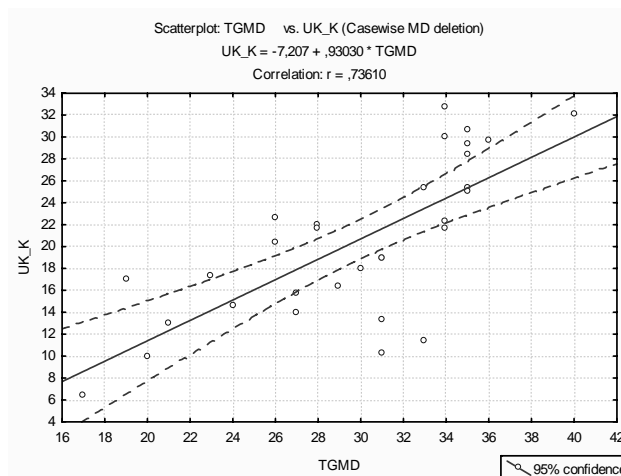


Figure 1: Correlation between fundamental motor skills (TGMD) and total karate skills (TOT_K)

Discussion and conclusions

According to the high values of Cronbach alpha coefficients in all tests we can conclude that the judges were objective. To determine the characteristics of the distributions and sensitivity Kolmogorov-Smirnov test was used. It revealed that all tests of specific karate skills, as the TGMD-2, have normal distributions and, therefore, are sensitive. As expected, factor analysis of six specific karate skills resulted in one factor extraction – karate skills factor. It is obvious that the highest projection has the *mae geri* kick while the other tests' projections are smaller but still significant. For this research purposes it can be concluded that the test are valid and that they measure what constructed for: karate skills. Similar results between boys and girls in fundamental motor skills confirm previous researches (Mazzardo, 2008; Simons, Daly, Theodorou, Caron, Simons & Andoniadou, 2007). Girls, however, dominate in the area of specific karate skills but with no significant difference. These results allowed us to consider the boys and the girls as a unique sample.

Karate skills are significantly positively correlated with the fundamental motor skills results. In other words, those children with higher level of fundamental motor skills also have a better karate technique, while others have difficulties in karate technique acquisition. Burton & Miller (1998) define specific motor skills as a combination or different manifestations of one or more fundamental motor skills. However, they believe that in order to learn specific skills, fundamental motor skills do not need to reach a certain level. They interpret that with a fact that a child in the age of 2, for example, can acquire a certain specific skill, like skating or rolling, although its fundamental motor skills haven't reached an optimal level yet.

A different situation occurs in children age 5 to 7, who are in the last stage of fundamental motor skills development (Gallahue & Donnelly, 2003), and have a higher level of motor proficiency and, therefore, a more coordinated and accurate movement patterns. In this stage combining fundamental motor skills with motor abilities can result in a useful application for learning a large amount of specific skills. So, motor programs in the age of 2 and 5 are completely different and cannot be compared because of a different development stage and different relations between the fundamental and specific skills. The highest correlation occurred in *mae geri* kick.

This probably because the mentioned skill is the most complicated technique for preschool children and it is clear those children with higher motor proficiency will perform better. Statistically significant correlation has also been determined between fundamental motor skills and total karate skills. That was the evidence of an assumption that children with higher fundamental skills learn the specific skills faster, easier and on a higher level. This correlation enables more appropriate selection process and the beginners training process organization with the aim of fundamental motor skills quality development which is the basis of specific karate technique learning in later stages. Results gained with this study are entirely in accordance with prior research in the area of motor skills. It is logical to conclude that specialized skills are nothing but a combination of different fundamental motor skills applied on the performance of a certain sport discipline. So, the correlation that was gained was expected, however, different combinations of those skills are the factors that differentiate successful athletes from those that are less successful. For better understanding of fundamental and specific skills relations long-term monitoring (longitudinal studies) is necessary. Also, physical activity and inactivity are the parameters that cannot be avoided since they are very important moderators of children's motor development.

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RELACIJE IZMEĐU TEMELJNIH MOTORIČKIH VJEŠTINA I SPECIFIČNE KARATE TEHNIKE KOD POČETNIKA UZRASTA 5 – 7 GODINA

Sažetak

Cilja ovog istraživanja je bio da se utvrde moguće povezanosti temeljnih motoričkih dimenzija i specifičnih karate vještina djece uzrasta 5 do 7 godina. Ukupno je 31 dijete (21 dječak i 10 djevojčica) sudjelovalo u ovom istraživanju i mjerenju u dvije testne sesije: temeljne motoričke dimenzije i specifične karate vještine. Temeljne motoričke dimenzije su procjenjivane korištenjem najšišće primjenjivanog testa – TGMD-2. Tri neovisna ocjenjivača vrednovali su izvođenje šest specifičnih karate elemenata gledanjem snimljenog materijala. Prema visokim vrijednostima Cronbach alfa koeficijentata (0.91-0.98), Kolmogorov-Smirnovljevog testa i rezultata faktorske analize može se zaključiti da su specifični karate testovi validne mjere za djecu uzrasta 5 do 7 godina. Također, nepostojanje značajnih razlika između dječaka i djevojčica potvrdilo je pethodna istraživanja u prostoru temeljnih motoričkih dimenzija. Oni se značajno ne razlikuju ni u specifičnim karate vještinama. Karate vještine su značajno pozitivno korelirane s temeljnim motoričkim dimenzijama (0.74). Ova korelacija omogućava odgovarajući proces selekcije kao i organizaciju trenažnog procesa početnika pri čemu je cilj kvalitetan razvoj temeljnih motoričkih dimenzija koji predstavlja bazu za učenje specifične karate tehnike u kasnijim razdobljima.

Key words: predškolci, borilačke vještine, TGMD-2, motoričko znanje

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