"IDO MOVEMENT FOR CULTURE. Journal of Martial Arts Anthropology",
Vol. 11, no. 1 (2011), pp. 37–41

KINESIOLOGY OF FIGHTING SKILLS

Hrvoje Sertić[1], Tihomir Vidranski[2], Ivan Segedi[1]
[1] Faculty of Kinesiology, University of Zagreb (Croatia)
[2] Zagreb Karate Union (Croatia)

Construction and Validation of Measurement Tools for the Evaluation of Specific Agility in Karate

Submission: 2.02.2010, acceptance: 12.02.2010

Key words: karate, motor abilities, testing

Abstract: Coordination is understood as the ability to control movements of the whole body or parts of the locomotive system, and it is manifested through the rapid and precise performance of complex motor tasks or quick problem solving of motor requests. One phenomenal form (factor) of coordination is agility. It is responsible for the rapid changes in the direction of movement. The aim of this study is the construction and validation of metrical characteristics of a new measurement instrument (*MKUKS)* for the evaluation of specific karate agility. This study suggests that *MKUKS* test can be used as a good tool for the selection of respondents for the motor activities that require high agility because respondents differ on that ability.

Introduction

Coordination is understood as the ability to control movements of the whole body or parts of the locomotive system, and it is manifested through the rapid and precise performance of complex motor tasks or quick problem solving of motor requests.

The phenomenal form (factor) of coordination is agility. It is responsible for rapid changes in the direction of movement [Metikoš *et al.* 2003].

Motor coordination ability and its phenomenal form of agility occupies a high place in the specification equation for success in karate. Although there are some useful tests for evaluation of specific karate abilities [Sterkowicz, Franchini 2009], complex movements in karate as well as its polystructurality require as more as possible constructed and validated specific karate tests.

The construction of tests is a complex, kinesiometric process and as such it requires compliance of certain kinesiometric characteristics such as validity, reliability, sensitivity and objectivity [Dizdar 2006; Muratagić 1990]. Because the constructed test is easy for a karateka if he or she had overcome a certain level of karate techniques and can accomplish an ability of a quick shifts of movement similar to competition conditions, it is probable that the test is going to confirm its good metrical characteristics. Such a test will surely find its application in the analysis of specific fitness preparedness athletes in karate.

The aim of this study is the construction and validation of metrical characteristics of a new measurement instrument. The design is entered with the assumption that the instrument used for assessing one part of coordination-agility.

Research Methods

The sample of subjects consisted of the 65 participants of karate sport training in the karate club Princ Zagreb. Subjects were 12 ± 2.5 years old and had equal karate technical knowledge (minimum 5. kyu and a two-year training experience).

The sample of variables consisted of a standardized measurement instruments with known metrical characteristics for evaluation of coordination ability–agility: side steps test (MAGKUS) [Metikoš *et al.* 1989], figure of eight with a bend test (MAGOSS) [Metikoš *et al.* 1989.] and square movement test (MKRCET) [Metikoš *et al.* 1989]. During the construction of a new measurement tool it was assumed that

Picture 1.

the new test will also estimate phenomenal form of coordination-agility. The new measuring tool was named **MKUKS**-movement change in karate position–test for agility evaluation.

Description of the constructed measure instrument:

Movement change in karate position (**MKUKS)**-test for agility evaluation

Duration: evaluation of the complete duration of a test (time needed for performing the task three times with rest period) for one examinee is about one and a half minutes.

Number of measurers: 1 measurer

Equipment: one stop-watch, adhesive tape for the floor mark

Position of performance: a task is performed in a gym with minimum dimensions 5x2 meters. There are two parallel lines to the ground 1 meter long and 2 meters distant from each other. The examinee stands in a combat karate position (fudo dachi - gently bent legs with feet in a diagonal position, with arms in guard - one arm in front of the shoulder and other arm beside the belt (picture 1.) in front of the first line.

Performance: the exercise is performed in the standing position, and it is required that the examinee move on the 'hop' sign as fast as possible in hop-step movement sori ashi, without crossing the legs, moving towards the second line. When he or she steps with the front leg on the second line or crosses it, he or she stops, turns through 180 degrees and returns to the first line in the same way which he also has to touch with his/her foot or cross it . The movement is repeated six times.

Position of the examiner: the examiner sits next to the examinee and controls the validity of the performed assignment, measures and stores for further analysis.

Evaluation: time is measured in one-tenth of a second from the 'hop' sign until the end of the sixth crossing of the two-meter track. The assignment is performed three times with an adequate rest and all three performances are scored.

Guidelines to examinees: 'Stand in the left fudo dachi karate position (gently bent legs with feet in a diagonal position with one arm in front of the shoulder and other arm beside the belt (picture 1.) with your front leg on the marked line. On my sign 'hop' you will move in a hop-step movement sori ashi, without crossing your legs, towards the second line. When you step on the second line or cross it over, you will stop, turn through 180 degrees and go back the same way to the first line, which you also have to touch with your foot or cross it. You move repeatedly so that you have to cross the distance between the two lines six times in a short period of time, after that, the assignment is finished'.

Practice: the examinee is entitled to only one try before the test to avoid effect of motor learning.

For the purposes of the reliability of the analysis, subjects conducted three consecutive measurements (particles) in all trials the goal was to avoid differences between the results. All analyses were performed with the help of statistical systems *Statistica*, ver 7.1, (StatSoft, Inc., Tulsa, OK) and *Statistica* ver. 5.0 expanded program *RTT.stb* [Dizdar 1999].

GRAPH 1. Graphic image distribution of results in the *MKUKS* test (three-time measurement) for each particle (measurement) of the test

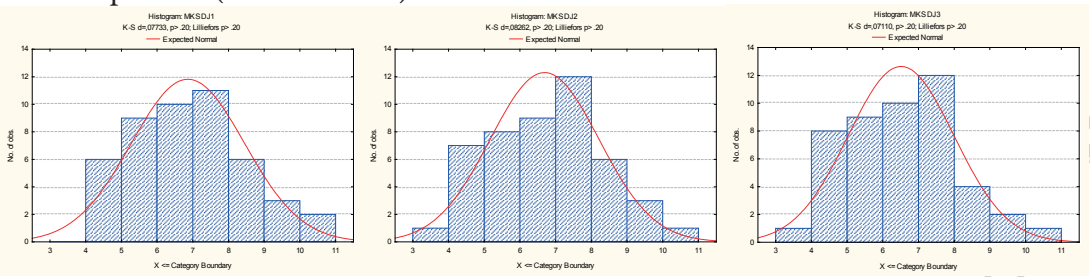

TABLE 1. Descriptive parameters of the *MKUKS* test

MKUKS	AM	SD	SKEWNESS	KURTOSIS
1	7,21	1,93	0,58	0,53
2	6,89	1,86	0,88	1,34
3	6,84	1,88	0,88	1,40

Legend: MKUKS 1 – 3 : number of particles of the test (number of repetition), AM – arithmetic means of the results in each particle, SD – standard deviation

TABLE 2. Test for the evaluation of normality of empirical distribution in the *MKUKS* test

	max D	K-S
MKUKS1	0,084	p > .20
MKUKS2	0,084	p > .20
MKUKS3	0,080	p > .20

Legend: MKUKS1 – first measurement (attempt), MKUKS2 – second measurement (attempt), MKUKS3 – third measurement (attempt), max D – maximal distance between detected and expected frequency, K-S – results of KS normality test

TABLE 3. Correlation between particles of the test MKUKS

	MKUKS1	MKUKS2	MKUKS3
MKUKS1	1,00	0,95	0,96
MKUKS2	0,95	1,00	0,97
MKUKS3	0,96	0,97	1,00

Legend: MKUKS – test Movement change in karate position

Results and Discussion

Since the Kolmogorov-Smirnov normality test (table 2) indicated that the noticed divisions do not differ from the normal ones, it can be concluded that the measure instrument MKUKS meets the standards of sensitivity, that is, ability of distinguishing entities according to the tested capability.

In the analysis of the reliability of the MKUKS test with method of internal consistency the following coefficients of reliability were obtained:

Cronbach α: 0,986 and standardized α: 0,986

Interclass Correlation Coefficient: 0,96

Thus the high coefficients of correlation, almost 1, point to the high reliability of the MKUKS test.

The reliability is calculated, and according to the Guttman's and Harris's model [Dizdar 1999] where the measurements from table 4. may conclude that they are given higher value coefficient RHO1 and RHO2. Concerning the lower and upper limits of reliability obtained under two different types of measurements, the superiority of Guttman model is obvious, specially lower limits of reliability (RHO2). Momirović's and Gredelj's coefficient of homogeneity (HOM1) was overpowering when estimating homogeneity on the basis of the average correlations of all. High average correlation among the three particles repeated measurements test MKUKS of 0.96 speaks of good homogeneity measurement instrument in the test.

In order to determine the validity of the test by the cross correlation matrix of the subjects, the results condensed to the first main component of the tests MAGKUS, MKRCET, MAGOSS and MKUKS is determined statistically significant correlation between these tests (Table 5). Factor analysis of the tests MAGKUS, MKRCET, MAGOSS and MKUKS according to the G-K (Guttman Keiser extract criteria), produced one common factor with very high correlations of variables with a factor (factor loadings >0,70) (Table 6). Based on these results it can be concluded that MAGKUS, MKRCET,

TABLE 4. Coefficient of reliability, representativeness and homogeneity of the MKUKS test

RTT	ALPHA	ALPHA1	ALPHA2	LAMBDA6	RHO1	RHO2	TAU	MSA	AVR	HOM1
0,98	0,98	0,43	0,88	0,98	0,965	0,999	0,96	0,99	0,96	0,99

Legend: RTT–reliability calculated under the circumstance of an equal share of all particles in the proper subject of measurement, ALPHA– reliability calculated on the basis of the first inherent matrix correlation value, ALPHA1–bottom reliability limit, ALPHA2– top reliability limit , LAMBDA6–Guttman-Nicewander's reliability measure, RHO1–bottom reliability limit, RHO2–top reliability limit, TAU-bottom reliability limit, MSA-Kaiser-Rice's representative coefficient, AVR-average correlation between the particles that can be used as a homogeneity standard, HOM1–Momirović and Gredelj's homogeneity coefficient.

TABLE 5. The cross correlation matrix of the subject results condensed in the first main component of the MAGKUS, MKRCET, MAGOSS and MKUKS tests (N=59) p < ,05

	MAGKUS	MKRCET	MAGOSS	MKUKS
MAGKUS	1,00	0,49	0,29	0,43
MKRCET	0,49	1,00	0,31	0,36
MAGOSS	0,29	0,31	1,00	0,60
MKUKS	0,43	0,36	0,60	1,00

Legend: MAGKUS, MKRCET, MAGOSS – alredy constructed and approved tests for agility evaluation, MKUKS – newly constructed test Movement change in karate position

TABLE 6. Factor loadings

	Factor
MAGKUS	-0,734910
MKRCET	-0,706001
MAGOSS	-0,739013
MKUKS	-0,815145

Legend: MAGKUS, MKRCET, MAGOSS – alredy constructed and approved tests for agility evaluation, MKUKS – newly constructed test Movement change in karate position

MAGOSS and MKUKS tests measure the same dimension and that MKUKS test was a factually valid test for agility evaluation.

Conclusion

Agility, and its specific presentation through movement in karate positions is of great significance for success in karate combat. The construction and validity of a new measurement tool for assessing specific agility, shown in this reaserch, stated the following: the test is highly reliabile, therefore measuring error is small, the test is sensitive and factually valid. The new test MKUKS estimates the dimension defined as specific agility and is statistically significantly correlated with tests that assess this motor ability.

This study, along with metrical characteristics, demonstrated that *MKUKS* test can be used as a good instrument for the selection of respondents for the motor activities that require high agility because respondents differ on that ability.

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Konstruowanie i uzasadnienie instrumentu pomiarowego do oceny sprawności specjalnej w karate

Słowa kluczowe: karate, sprawność motoryczna, testowanie

Streszczenie

Koordynacja jest rozumiana jako zdolność do sterowania ruchami całego ciała lub części układu ruchowego, objawiająca się poprzez szybkie i precyzyjne wykonywanie złożonych zadań ruchowych. Jedną z wyjątkowych czynników koordynacji jest zwinność. Jest ona odpowiedzialna za szybkie zmiany kierunku ruchu. Ma ona także duże znaczenie w odniesieniu sukcesu w karate.

Celem pracy jest budowa i weryfikacja charakterystyki metrycznej nowego przyrządu pomiarowego
MKUKS służącego do oceny szczególnego rodzaju zwinności w karate. Nowy test MKUKS ocenia wymiar definiowany jako szczególna zwinność i jest statystycznie znacząco skorelowany z testami, które oceniają tę sprawność motoryczną. Niniejsza praca wykazuje, iż test MKUKS może być użyty jako dobry instrument do doboru respondentów do wykonywania czynności motorycznych, które wymagają dużej zwinności ponieważ respondenci różnią się umiejętnościami. Test jest wysoce wiarygodny dlatego błąd pomiaru jest niewielki. Test jest czuły i obiektywnie uzasadniony.