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STUDY ABOUT THE REACTION TIME RELATION TO SPORTS PERFORMANCE IN KARATE DO

MACOVEI SABINA[1], LAMBU ELENA-ANDREEA[1], LAMBU IOANA-SORINA[1]

Abstract

In karate do, the primordial motor quality is represented by speed, under all its manifestation forms. Among them, we shall approach the reaction time, because it is particularly important to athletes and its decrease by a few tenths or one hundredth of second may condition the achievement of a very good sports result. In order to efficientize the competitive results and to better manage the athletes' training, all these aspects should be taken into account.

Purpose. This paper represents a starting point for an ampler study related to the way in which the reaction time may become a prediction factor for the karate do athletes' competitive performances. It also proposes some individualized intervention strategies meant to improve the reaction time, with the final goal of increasing each athlete's performance level.

Methods. In order to develop our research, we used the case study method, the observation method and the graphical representation method. They consisted of administering the Reaction Time (RT) Test, included in the PSISELTEVA computerized battery created by RQ-Plus, to top performance senior athletes from the "Rapid" Sports Club of Bucharest, components of the WKC (World Karate Confluence) National Karate Squad. Testing was performed within the UNEFS Psycho-Pedagogy Lab.

Conclusions. Tests provide an important database that can be subsequently used to make a correlation between the test results, the top performance athletes' training and their competitive results.

Key-words: karate do, Goju-ryu, reaction time, sports performance.

Introduction

Sports performance is a bio-psycho-social value achieved within some official competitions, as a result of a multiply determined capacity assessed according to some rigorously established criteria or standards. Performance depends on the task-activity-result relationship.

Capacity is a multifactorial resultant determined by aptitudes, by the personality maturation degree, by learning and exercise: it can be educated, developed through exercise, or "atrophied" through demobilization, which occurs more often than the physiological function diminution due to the aging process.

Teodorescu (2009), by quoting Dragnea (1996), asserts that performance capacity results from the operational interaction of some bio-psycho-educogene systems and is concretized in recognized values that are classified according to some socio-historical criteria. It represents the complex manifestation of the individual's availabilities, being materialized in objective values or in values expressed through points, scored goals, lifted kilograms, ranks, classifications, earned rights etc.

The performance capacity structure is conditioned by two groups of determining factors:
internal factors – aptitudes, attitudes, characteristics of the functional activity and of the body structure;
external factors – ambiance, including in its structure both training and competition, as a special socio-educational environment, the general socio-educational environment and the natural environment, physical and climatic factors.
Aptitudes result from the interaction of the hereditary predispositions, the educative conditions for their development and the subject's activity. When aptitudes reach a higher development level, we speak about talent.

[1] National University of Physical Education and Sports, 140 Constantin Noica Street, Bucharest, ROMANIA
Email: sabina_macovei@yahoo.com, elenalambu@yahoo.com, ioana_lambu@yahoo.com

Attitudes represent a person's conception and philosophy of life, his preference for certain activities, which is determined by inner convictions or by external influences that characterize his personality. The types of attitudes specific to sports field are the cognitive, affective and conative ones.

Ambiance represents the environment in which the individual lives his life and which requires him to cope with.

Sports training is a complex long-term process that has for goal to maximally develop the athlete's performance capacity and personality (Epuran, 1990: 35-58).

Frédéric (1993: 7) considers that martial arts are a universe in itself, a captivating one, which couldn't be discovered in its whole complexity not even if man had been given to live many lives one after another!

Karate represents a system of fighting without weapons, performed at top level as a competitive sport, its practitioners being specialized in kicking and striking techniques, blocking techniques and defensive movements (Enoeda & Mack 1975: 4).

Karate is "a school of life and its principles, when transferred to physical and mental practices, help us gradually improve our spirit and expand our knowledge, by enriching our personality!" (Deliu, 2008: 121). At the same time, Kancho Kanazawa states that, although karate is a combat sport, the spiritual attitude is extremely important.

Goju-ryu is one of the four major styles composing the karate do branch, together with shotokan, wado ryu and shito ryu. The style name comes from the words "GO" = hard, "JU" = soft and "RYU" = style. This sports branch has continuously evolved due to the creative efforts of many masters, each one improving it according to his psycho-somatic specificity and to his social experience accumulated throughout the years (Mageriu, 1991: 20, 21).

Karate is a dynamic and acyclic sport that opposes unpredictable and combative athletes. It is extremely complex, because all the body functions are involved in, it is very stressful due to the acute time pressure specific to each competitive fighting (the last 30 seconds) and to the speed imposed by all the fighting actions, it is spectacular, heuristic etc.

Epuran (2001) by quoting Chappuis, presents a classification of sports based on the energetic expenditure and the nervous concentration criteria, according to which karate do is a combat sport that requires a high energetic expenditure and nervous concentration to win the supremacy.

In the combat styles, speed represents a primordial motor quality, if we refer to the fighting dynamism and unpredictable character, but also to the time pressure that characterizes any karate do fighting style.

In Goju-riu, speed has also priority over the other motor qualities, because this style places a strong emphasis on the very quick execution of the kicking and striking techniques, on the soft or hard defenses and on the sudden counter-attacks. In the fighting situation specific to Goju-ryu, the athlete who attacks faster and more unexpectedly than his opponent has the best chance to score a point (ippon).

According to the above-mentioned aspects, the motor quality indispensable to karate do is speed, under all its manifestation forms (execution speed, movement speed, repetition speed and reaction time). Among them, we shall approach the reaction time, because it is particularly important to the practitioners of any branch and even more important to the karate do athletes, because all the technical-tactical actions are performed at maximal speed, in order to accumulate the points necessary to win the victory, sometimes even before the statutory time expiration (2 minutes for women and 3 minutes for men, in senior class). The reaction time decrease often makes the difference between a world champion and a simple participant in a world championship. In order to efficientize the competitive results and to better manage the athletes' training, we should take into account all these aspects.

The reaction time in karate do

The motor reaction latency time represents the time interval between the subject's motor response and its stimulation (Deliu, 2008: 49).

The reaction time improves along with the athlete's brain maturation, according to an ascendant dynamics, starting from the age of 6-8 years old, and it reaches maximal values at the age of 20-30 years old, then it slowly decreases until the age of 65-70 years old (Manno, quoted by Dragnea, 1996), with 5 ms every 5 years, and significantly decreases after this age (Grouios, 1991, quoted by Deliu, 2001). The latter author also specifies that, at the age of 20, women have a latency that exceeds with about 50 ms men's latency.

The prerequisites for a quick reaction in Goju-ryu are represented by: a very good visual, acoustic, tactile and kinesthetic acuity, an optimal condition of the excitation, inhibition and cortical processes involved in the motor response, an appropriate psychic background, an optimal physical fitness, optimism and confidence in one's personal fighting capacities.

Athletes' reactions to different signals can be simple or complex.

Simple reaction is a concrete response to a familiar but unexpected stimulus (for instance, a flash, a very loud noise). This type of reaction is extremely important in sports and in daily life. The necessary time to respond to a stimulus may take many hundreds of milliseconds. "The development of the simple reaction speed is particularly important to athletes, because its decrease, even by a few tenth and one hundredth of second, may condition the achievement of a good result" (Dragnea, 1996).

Complex reaction is generated by two typical situations: the reaction to the moving

objects/body/body segments and the choice reaction. The former case can be exemplified by the reaction of a karate athlete who must evaluate and react to the opponent's kick (Deliu, 2001:64). In the latter case, the fighter must pick, from a multitude of responses, that which corresponds to his opponent's behavior. The latency time to such stimuli increases proportionally to the number of alternative responses and this relation is reflected by a supplementary cortical processing that requires the athlete to select the optimal program, appropriate to the concrete situation, and to put it into practice.

In top performance athletes, especially in karate do fighters, the choice reaction is so quick that it gets close, from the latency time point of view, to the simple reaction.

In karate do, the entropy should be as low as possible, almost close to zero, such in the case of the simple reaction (for one's own athletes), while for the opponents, the entropy should be as high as possible, so that their reactions are delayed or even tardive.

The reaction time to the complex stimuli of the competitive fighting decreases in the karate do athletes concomitantly with the increase of their motor experience through specific training sessions, in inverse ratio to their specific technical-tactical improvement (Deliu, 2001).

Purpose of the research

This paper represents a starting point for an ampler study related to the way in which the reaction time may become a prediction factor for the karate do athletes' competitive performances. It also proposes some individualized intervention strategies meant to improve the reaction time, with the final goal of increasing each athlete's performance level.

Methods

In order to develop our research, we used the case study method, the observation method and the graphical representation method.

The subjects of our research are top performance senior athletes from the "Rapid" Sports Club of Bucharest, components of the WKC (World Karate Confederation) RKF National Karate Squad.

The competitive activity considered by us for the development of this study refers to the national contests that took place in 2012, namely:
- Transylvania Cup;
- National Championship;
- Dojokan Cup;
- Unirea Cup;
- European Champions Cup;

Results

Results were tabulated and graphically represented in the table

- Romanian Cup;
- Ippon Cup.

On the international level, the competitive calendar included the following contests:
- Five Nations Tournament, developed on five stages (Belgium, Ukraine, England, Romania, Italy);
- Italy's International Competitions (Italy);
- 3 Borders Championship (Belgium);
- International Shikon Cup (England);
- European Senior Championship (Scotland, Glasgow);
- World Club Championship (Italy).

We shall approach in our study only the top level competitions, where the participants are considered to be have reached their peak sports shape, namely the National Championship and the European Senior Championship.

In our research, we administered the Reaction Time (RT) Test included in the PSISELTEVA computerized battery created by RQ-Plus.

Testing was performed within the UNEFS Psycho-Pedagogy Lab, under the supervision of Assistant Lecturer Radu Predoiu, Doctor of Psychology.

The RT Test is conceived as a dynamic pattern made up of 50 sequences. It consists in the emission of pre-established responses to a generated signal-stimulus and takes place within an imposed time frame. In the test construction, we had in view to create problem situations through:
a variable rhythm of the signal-stimuli generation;
a limited time frame for the signal-stimuli generation.

The test involves the following aspects:
- prompt reactions;
- constant attention;
- optimal dosage of the inhibitor process.

From the diagnosis perspective, this paper aimed at measuring the simple reaction time. The test has many parameters that pursue the following aspects:
- number of correct responses;
- number of anticipated responses;
- number of delayed responses; omissions; error rate = (anticipated responses + delayed responses + omissions) / 50; reaction time mean (rtm_mean);
- mean standard deviation (std_dev).

The final testing phase is assessed through a series of coefficients, namely:
- reaction time mean (rtm_mean);
- coefficient of performance (Cperform).

The psychomotor information offers two components: simple reaction time; test performance.

The table 1 presents our athletes' results in the National Championship held in Bucharest (from 21 to 22 April 2012) and in the European Senior Championship held in Glasgow, Scotland (from 29

May to 3 June 2012). The athletes tested by us are aged between 18 and 25 years old. Therefore, two of them are juniors, because juniorship includes the age category from 18 to 21 years old, that is why they couldn't participate in the European Senior Championship, seniorship including athletes above 21 years old.

According to table 1, the subjects of our research are elite athletes, with remarkable results in the big competitions.

Table 1. Sports results 2012

Crt. no.	Surname and name	National Championship	European Senior Championship
1.	A.G.	1st place	No participation
2.	B.D.C.	3rd place	No participation
3.	B.F.	1st place	1st place
4.	I.V.R.	1st place	1st place
5.	L.E.A.	1st place	1st place
6.	L.I.S.	1st place	1st place
7.	S.D.M.	1st place	3rd place

The reaction time test is represented in table 2. The resulted data are directly interpreted by the PSISELTEVA battery software.

The number of stimuli represents 50 sequences of responses to some generated signal-stimuli, within an imposed time frame.

The simple reaction time mean (ss) represents one of the test parameters and, as we can see in table 2, our athletes' reaction time mean is comprised between 15 and 20 ss.

The same table shows us that all the athletes emitted correct responses to the 50 signal-stimuli, which can be correlated to the competitive fighting in karate do as follows: during a competitive match, all the opponent's attacks will be blocked by our athletes or all the attacks initiated by our athletes will be successful.

Table 2. Reaction Time Test

Crt. no.	Surname and name	Number of stimuli	Simple RT mean (ss)	Correct responses	Corresponding class	Coefficient of simple RT	Coefficient of performance
1.	A.G.	50	15	50	3	0.178	5.618
2.	B.F.	50	15	50	5	0.153	6.553
3.	B.D.C.	50	16	50	3	0.164	5.116
4.	I.V.R.	50	19	50	3	0.188	5.319
5.	L.E.A.	50	16	50	4	0.160	6.258
6.	L.I.S.	50	15	50	4	0.148	6.360
7.	S.D.M.	50	20	50	2	0.203	4.916

The coefficient of simple RT and the coefficient of performance obtained by the tested athletes positioned them in classes corresponding to levels from 1 to 5, where 1 represents the poorest class and 5 represents the best class. The table 2 shows us that one of the athletes (S.D.M.) is positioned in the lowest class (2), which is also reflected by his international competitive activity: in the 2012 European Championship, he was ranked 3rd, as compared to his teammates who were gold medalists within the same competition.

Three athletes (A.G., B.D.C. and I.V.R.) are positioned in class 3 (mean level), two of them being juniors, respectively the age category comprised between 18 and 21 years old, which indicates a performance potential that can be maintained and, in optimal conditions, improved in the course of time, which would help them achieve very good results in the big senior competitions (above 21 years old). As to the third athlete belonging to class 3 (I.V.R.), we can notice that he was ranked 1st in the European Championship, so we can consider that, at the test administration, he wasn't in his best sports shape, which was however reached by him in the European Championship.

Other data provided by table 2 indicate that three athletes (B.F., L.E.A. and L.I.S.) are positioned in superior classes, respectively 4 (good level) and 5 (very good level), which means that they are the most

valuable athletes of our sample, with a rich competitive experience and excellent competitive results. Their very good results in the Reaction Time Test and their promotion to higher classes are also positively reflected by their competitive activity: they are elite athletes with outstanding results on the national and international levels, being ranked 1st in the big competitions of the year 2012, respectively the National Championship and the European Championship.

From the graphical interpretation of the reaction time results, we can see that three athletes (L.I.S., B.F. and L.E.A.) obtained the best times in this testing, which positioned them in superior classes, namely 4, respectively 5. They are the most skilled athletes of our sample, who have been practicing karate do for more than 15 years, and they have excellent results in the national and international competitions, which can be noticed in table 1 that presents their competitive results in 2012, when they were ranked 1st in the National Championship and the European Championship.

At the same time, in the graphical interpretation we can see that the two junior athletes (A.G. and B.D.C.) are positioned in class 3, which indicates their mean level. In senior class, the competition is more strenuous by far and top performances are much more difficult to

reach due to the sports elite at this level and to the extremely high competitive level, but the athletes' positioning in class 3 gives us the hope that, by knowing these results and by implementing an appropriate scientific management in their sports training, they will be able to improve their performances and, consequently, this will have a positive influence on their future activity, as senior athletes.

The third athlete positioned in class 3 (I.V.R.), who passed from junior to senior class about one year ago, is a gifted and very ambitious athlete, with competitive results that ranked him 1st in both the National Championship and the European Championship.

The graphical interpretation shows us that one of our athletes (S.D.M.) is positioned in a less valuable class, respectively 2, from the perspective of his reaction time, and in class 3, if we take into account his coefficient of performance. This positioning is also reflected by his competitive activity: in the European Championship he was ranked 3rd, as compared to his teammates who achieved more valuable results, but we shouldn't ignore that this athlete has recently been promoted to senior class. We think that, through a rigorous scientific training, his results can be improved.
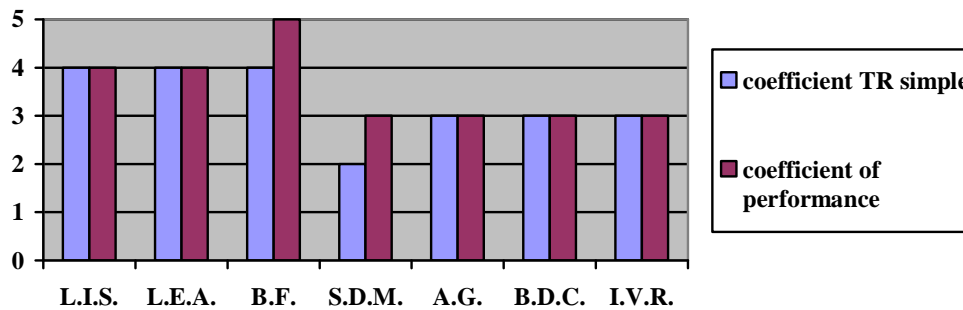
Reaction Time Test

Figure 1. Graphical interpretation of the reaction time

Discussions

According to the previously mentioned aspects, the primordial motor quality in karate do is represented by speed, under all its manifestation forms. We approached the reaction time because it is particularly important to the practitioners of any branch and even more important to the karate do athletes, where everything is performed at maximal speed. The reaction time decrease by a few tenths or one hundredth of second may both condition the achievement of a very good sports result and insure the points necessary to win the victory, even before the statutory time expiration (2 minutes for women and 3 minutes for men, in senior class). In order to

efficientize the competitive results and to better manage the athletes' training, all these aspects should be taken into account.

Many foreign authors and romanians as well had performed studies regarding the reaction time and revealing important aspects such as: the reaction time improves along with the athlete's brain maturation, according to an ascendant dynamics, starting from the age of 6-8 years old, and it reaches maximal values at the age of 20-30 years old, then it slowly decreases until the age of 65-70 years old (Manno, quoted by Dragnea, 1996), with 5 ms every 5 years, and significantly decreases after this age (Grouios, 1991, quoted by Deliu, 2001).

We tried to highlight the practical aspects of reaction time on high-performance karate do athletes, and we consider that the prerequisites for a quick reaction in Goju-ryu style, are represented by: a very good visual, acoustic, tactile and kinesthetic acuity, an optimal condition of the excitation, inhibition and cortical processes involved in the motor response, an appropriate psychic background, an optimal physical fitness, optimism and confidence in one's personal fighting capacities.

In karate do, the entropy should be as low as possible, almost close to zero, such in the case of the simple reaction (for one's own athletes), while for the opponents, the entropy should be as high as possible, so that their reactions are delayed or even tardive.

Following the statistical data processing and interpretation, we can notice that the most valuable athletes of our sample, with a rich competitive activity and outstanding results in the big competitions, obtained the best times, which positioned them in superior classes, respectively 4 and 5. Athletes who have recently been promoted to senior class, where the competition is strenuous by far and top performances are much more difficult to reach due to the sports elite at this level, achieved poorer results, being positioned in a mean value class, respectively 3.

The administered test has provided us an important database that can be subsequently used to make a correlation between the test results, the top performance athletes' training and their competitive results.

Conclusions

1. We found out that tests provide an important database that can be subsequently used to make a correlation between the test results, the top performance athletes' training and their competitive results.

2. We can notice that the most valuable athletes of our sample, with a rich competitive activity and excellent competitive results in the big contests, obtained the best times, which positioned them in class 5.

3. The primordial motor quality in karate do is represented by speed, under all its manifestation forms.

4. In top performance athletes, especially in karate do fighters, the choice reaction is so quick that it gets close, from the latency time point of view, to the simple reaction.

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