International Journal of Science Culture and Sport
September 2018 : 6(3)
ISSN : 2148-1148
Doi : 10.14486/IntJSCS752

Express Determination of the Level of Fatigue Athletes during the Competition and Its Reduction by Means of Kata[1]

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Type: *Research Article* (***Received:*** *16.04.2018* – ***Corrected:*** *12.07.2018* - ***Accepted:*** *14.07.2018*)

Abstract

In this work, an analysis of the level of fatigue of athletes - monitors during the participation in competitions with kumite in karate kyokushinkai.

More than twenty years of experience in competitions of different levels, refereeing and training of athletes in tournaments, analysis of victories and defeats led to the search for and development of new techniques to determine the level of weariness of the athlete in the participation in various types of tournaments and ways of their rapid recovery after significant psychophysical loads. Research questions the psycho-physical condition of the athlete during the competitions involved specialists in various sports, means, and methods of restoration devoted a lot of works as domestic and foreign experts. However, methods of rapid diagnostics of the level of weariness of the athlete during the competition and its rapid recovery in karate kyokushinkai were not investigated before.

The purpose of this work is to analyze the level of fatigue athletes - karate as in preparation for the competition and directly during participation in the competitions themselves. And also a decrease in the level of fatigue of the caretaker by means of kata.

To achieve this goal, the following tasks were solved: they determined the degree of fatigue of athletes - monoliths by non-invasive methods for heart rate (PAC "Omega-C"), using the method of the Japanese professor-psychiatrist Akioshi Kitaka, and the level of pH of the saliva, as in competitions from kumite in karate kyokushinkai and on training during preparation for matches.

The physical loads we have selected are similar (adequate) competitive on the body of the athlete, made it possible to investigate the level of weariness of the athlete, which is as close as possible to the competitor, directly in the training room, with the use of more equipment and specialists. The influence of some kata on reducing the level of psychosocial tiredness of an athlete is determined.

Keywords: Karate, kiokushinkai, kata, fatigue

[1] *This article was orally presented in the 6th ISCS Conference held in Lviv, April 2018.*

Introduction

The urgency of the research is due to the need to find means of restoration of karate after significant training, in the pre-adversary period, and significant competitive loads (kumite). Were simulated loads close to competitive conditions (kumite), the selection was made using PAC "Omega-C". The evaluation of heart rate and ECG athletes is conducted. The dynamics of changes in heart rate (pulsometry) indices were detected in karate sportsmen of high qualification of kyokushinkai style, performed by "Sanchin" kata, after considerable loads Kindzer B. Guziy O. (2013). The obtained research results confirm that proposed loads can serve as a model of competitive exercises. It was also found that the execution of the "Sanchin" kata allows accelerating the restoration of the cardiovascular system performance and can be used during training exercises during the preparation for responsible competitions in karate Kyokushin. Tests to quickly determine the level of weariness of an athlete directly during competitions are selected and successfully used (Luscher tests, Schulte tables, Akios Katiok's technique).

Formulation of the problem: Physical and mental qualities are interrelated parties of the same process of psychophysical development. With participation in high-level competitions quite often, all preliminary training is being overtaken by factors such as the "influence" of a more titled athlete, authoritative judges, the presence of famous people in competitions and spectators as a whole. Athletes who have reached a quarter-final match and then quite often fall into a difficult situation, as these stages have already been selected stronger and usually in battles, there is opponents level at almost all parameters. Therefore, in most cases, the duration of the bouts may be maximum in time according to the rules of the competition, which respectively leads to physical and psychological exhaustion of the athlete. The time to recover to the next sparring is becoming smaller. In this connection, there is a need for constant monitoring of the psychophysical state of the athlete, as well as the ability to use and apply different technologies for the rapid recovery of the body. An optimal way of self-control of an athlete is the ability to clearly and quickly determine the heart rate and, if necessary, to apply the method proposed by us to restore it. In order to improve the psycho-physical condition and training of a highly skilled athlete for various competitions including the main competitions (Championships of Ukraine, European Championships, etc.) various scientists are offered various means of psychophysical training. However, the possibility of harmonious physical and mental development of highly skilled athletes by means of kata (formal complexes) Kyokushinkai karate was not considered.

Analysis of recent research and publications: Problems of complex control over the psychophysical state of athletes in various sports are devoted to a number of scientific publications Iermakov, S.S., Podrigalo, L.V. & Jagiełło, W. (2016). The justification of the peculiarities of the functional state of the athlete's body is very well disclosed in work on athletics Korobeynikov, G., Korobeinikova, L., Mytskan, B., Chernozub, A. & Cynarski, W.J. (2017), sports games, boxing Savchin M.P (2003) various types of struggle, including the Eastern uniforms Nakayama M. (2001), Markov V. V. (2003); Oyama M.(2006) ; Saenko V.G. (2008), Berezhany V. Kindzer B (2015). In the works of domestic scientists, various aspects of the training process of kyokushinkai karate were investigated Royama H. (2002); Kindzer B. (2015), but the problem of the influence of kata on the functional state of the athlete's body when performing large psychophysical loads in karate kyokushinkai was not sufficiently studied.

Recovery processes play an important role after the athlete performs significant competitive loads. The high requirements for the functional state of athletes, the lack of coverage in the scientific literature, the possibility of using separate kata to accelerate recovery processes and correction of psychoemocentric condition, their use in the preparation for competitions on kumite, led us to research on the possibility of using the Sanchin kata at the pre-stage stage Preparation in Kyokushin Karate.

The aim is to study the effectiveness of the use of "Sanchin" kata as a means of accelerating recovery processes after significant physical activity at the stage of direct preparation for the main competitions of kumite in karate kyokushinkai. Choose a set of tests to quickly determine the level of athlete fatigue during the competition.

Method

Organization of the research

The studies were conducted in two stages. At the first stage, loadings were collected, which, according to their psychophysical load, were consistent with the adversary in the activities of karate. For this, the indicators were registered before the start of the competition (in a state of rest) and after a very high load - a battle in the mode of 1-time time (hikivake) + 2nd additional time (hikivake) -weight (difference in weight no more than 3 kg) +3 - additional time, as a rule, such a regime passes on the boundary of limiting psychophysical loads. To simulate the competitive load, we picked up physical exercises with a limiting load, similar in the duration of execution to the maximum duration of combat. The complex developed by us is called "Pyramid of endurance". The set of exercises has the following scheme of execution: 10 clicks on fists, after which 50 squatting exercises are performed alternately, then according to the presented (Table 1). The complex was performed continuously, at the expense of the coach, during 5 approaches, the dosage of exercises was changed Kindzer B. (2013)

Table 1. Complex "Pyramid of Endurance"

Approach No.	The name of the exercise	
	Pushing on fists (Saiken)	Squat with kick strokes (Kin-geri)
1	10	50
2	20	40
3	30	30
4	40	20
5	50	10

The duration of the complex (in continuous execution) takes 9-10 minutes and it is adequate in terms of its physical and emotional load of about 3 continuous battles (springs) with an equal partner. We have shown that the proposed load allows you to simulate the conditions of competitive activity. Therefore, at the second stage, it was used to study the restorative effect of the Sanchin kata. In the testing, control (KG) and experimental (EG) groups of 14 highly qualified athletes of karate of different age groups, age 18-25, at least 5 years of experience, sports qualification from 2nd Kyu to 3 given on the Japanese scale, KMS, MS on the scale of Ukrainian sports qualification. Indicators were researched in a state of tranquility, after completing the Pyramid of Endurance exercise, and after the Sanchin kata (EG) or passive rest of similar duration (CG).

To determine the performance of the cardiovascular system, the software-hardware complex "Omega-C" was used with the ability to examine 7 athletes at the same time, which made it possible to track the reliable changes that occurred in the body of athletes under the same testing conditions. We performed ECG recording in the 2nd standard excerpt using the Omega-C system and evaluated the amplitude and form of the T wave, the duration of the interval R-R, the interval S-T, and the heart rate. In addition, biochemical tests were carried out that confirmed our hypothesis about the positive effect of the execution of the Sanchin kata on the rapid restoration of the body of the athlete after considerable stresses.

Results and Discussion

From the level of fitness of the athlete to the main competitions, his subsequent successes in sporting activities, self-sufficiency, and well-being, which greatly affect his mental and physical health Dunets-Lesko, A., Vovkanych, L. & Kindzer, B. (2009), depending on him. Those athletes who have not reached the appropriate level of physical fitness, the process of adaptation to participate in the preparation for the competition is accompanied by the high tension of the physiological systems of the organism B. Dyky, L. Vovkanych, A. Vlasov, B. Kindzer (2013). Rapid recovery of the body after the loads in single events is very important, since the closer the athlete moves to the final bouts, the less time for rest between the battles and the restoration of the psychophysical state he remains. At the same time, self-control and self-regulation of a psychophysical state are extremely necessary for highly skilled athletes.

Our results indicate that competitive activity is accompanied by significant changes in the functional state of athletes-karate Kindzer B.(2014). An example of athlete testing results is provided in (Figure 1).

Figure 1. Test results after performing physical activity close to competitive

Note: A - the level of adaptation to physical activity,%; B - level of trenirovannosti organism,%; mark; C - level of energy supply,%; D -psychoemotional state,%; 100% corresponds to the maximum level of the relevant indicators.

A1 - the level of adaptation to physical activity after the complex,%; B1 - level of trenirovannosti organism after the complex,%; mark; C1 - level of energy supply after the complex,%; D1 - psychoemotional state after the complex execution,%; 100% corresponds to the maximum level of the relevant indicators.

A2 - level of adaptation to physical activity after performing EG kata and 5 minutes of rest KG,%; B2 - the level of trenirovannosti organism after the execution of kata EG and 5 minutes rest KG,%; mark; C2 - level of energy supply after execution of kata EG and 5 minutes rest of KG,%; D2 -physhomoetic condition after performing EG kata and 5 minutes resting KG,%; 100% corresponds to the maximum level of the relevant indicators.

To characterize the functional state of the cardiovascular system and to identify signs of physical strain on athletes, we evaluated the electrical processes that arise during the operation of the heart by electrocardiography. The athletes engaged in Kyokushin Karate investigated the parameters of the electrocardiographic examination in a state of rest after the use of the "Pyramid of Endurance" complex and after 2 minutes of passive rest (KG) or the execution of "Sanchin" kata (EG).

The processes of depolarization of the ventricular myocardium, on the ECG, recorded in the form of a QRS complex at athletes EG is within the normal range and lasts 0.08 ± 0.01 s, in a state of rest, at the peak of the load and after the execution of the kata, indicating that there is no conduction violation along the beam Gisa and his legs.

Tine T reflects the processes of rapid ultimate ventricular myocardial repolarization. Pathological changes of this tooth without simultaneous changes in the QRS complex indicate a violation of restorative, metabolic processes in the ventricular myocardium and may be the primary signs of violation of repolarization.

In athletes, the amplitude of the waveform T in the state of rest is 3.75 mm, which is 2.25 mm below the norm and indicates the absence of violations of processes in the contaminated contingent of the athletes

After loading, the amplitude of the T wave is 3.50 mm, which is 0.25 mm below the resting state, and two athletes have found asymmetrical tooth T, indicating signs of disruption of metabolic processes in the myocardium.

After performing the "Sanchin" kata by the athletes EG, the amplitude of the T wave increased by 0.8 mm in comparison with the resting state and by 1.13 mm in comparison with the peak of the load, indicating a positive effect of the kata on the processes of myocardial repolarization from 0, 5 - 1.0 mm. At athletes of the surveyed group (EG), the tooth T was normal, indicating no violation of the repolarization processes in the myocardium, both in a state of rest and during physical activity Kindzer B. Guziy O. (2013).

Table 2. Indicators of electrographic examination of qualified athletes (EG) were obtained with the help of PAC "Omega-C"

Indexes	**Normative value**	**The state of peace**	**After loading**	**After performing the kata**
R.(мм)	5-20 мм	6,50± 0,02	4,25 ±0,03	6,13 ±0,02
T, (мм)	5- 6 мм	3,75 ±0,05	3,50 ±0,02	4,63 ±0,05
QRS (с)	= 0,1 с	0,08 ± 0,01	0,08 ±0,01	0,08 ±0,01
S-T. (мм)	+ 0,5-1	0,06 ±0,01	0,01 ±0,03	0,01 ±0,01
P-Q	0.12 - 0.20	0,76 ±0,01	0,52 ±0,01	0,60 ±0,01
R-R	0,80 - 0,86	0,76 ±0,02	0,52 ±0,03	0,60 ±0,02
ЧСС	74 - 78	81,38 ±0,05	116 ±0,05	96,13 ±0,01

The S-T segment, which represents the initial period of ventricular repolarization, is normally located on the isolation or shifted up or down. Athletes of the study group showed no pathological bias of the S-T segment as in rest, at loading and after loading.

The amplitude of the R wave reflects the bioelectric potentials of the free walls of the left and right ventricles and tops of the heart. Normally, the amplitude of the tooth R in standard leads is more than 5 mm. In the examined individuals in the contingent, we observed a change in the ratio of the amplitude of the tooth R (state of rest, loading, after the execution of the kata). The amplitude of the R wave in the resting state is 6.5 mm, at the peak of the load there is a slight decrease in the amplitude of the wave R and is 4.25 mm, but after executing the kinematic amplitude, the tooth R returns to 6.13 mm.

Heart rate is correct, heart rate ranged from 81 beats/min. in a state of rest, to 185 bs / min. at peak load and up to 96 beats/min. after kata execution.

Thus, the amplitude indices of ECG in athletes-karate did not reveal signs of chronic physical strain on the side of CSS organs and proved the positive effect of kata on the processes of myocardial repolarization Bogdan Kindzer, Volodymyr Saienko, Anna Diachenko (2018).

Confirmation of positive influence of "Sanchin" kata gave the indexes of biochemical analysis of pH of saliva obtained using "pHep®+ Waterproof Pocket pH Tester" as shown in Figure 2.

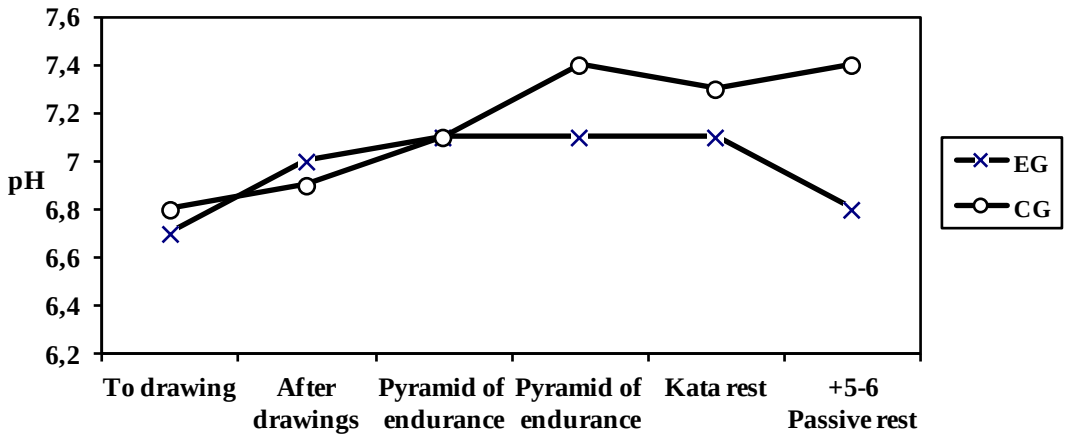
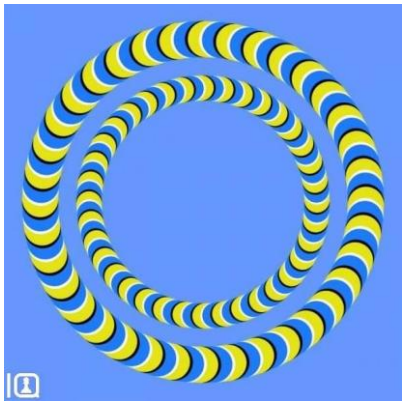


Figure 2. Indicators of biochemical analysis of pH of saliva athletes: EG (effect of Sanchin kata), CG (passive rest after significant physical activity)

In order to prevent the risk of high injury and significant damage to the athlete's health, it is essential to apply an express fatigue determination. One of the effective methods is developed by the Japanese psychiatrist Atoshi Katioka, which we used in our research. However, it requires a deeper study to obtain objective results precisely in the sport.



A test for mental and physical fatigue

This illusion was invented by the Japanese psychiatrist AkioshiKitaoka. According to him, "visual illusions" as nothing else help determine the mental state of a person at a given moment. Look at the static image above (this is not an animation).

• If the image is completely motionless - you do not have to worry about, mental health is in order. Such a result is possible in a person who is balanced, calm and rested.

• If the image is moving slowly - you need rest, both physical and moral. Especially important is full-fledged sleep, which is the best antidepressant.

• Active movement of the image serves as a symptom of accumulated fatigue, a high level of stress and deterioration of health. You need a rest - maybe even in a medical-preventive

institution. Perhaps you need to adjust your lifestyle or stereotypes a little to create harmony and health.

Akioshi Kitaoka, professor of psychology at Ritsumeykan University in Kyoto, Japan, specializes in visual perception and visual illusions. His optical illusion "The Rotating Snake" brought the talented psychologist world fame, and the works were repeatedly awarded prizes for original research.

Conclusions

The use of modern digital technologies has made it possible to reveal the real influence of Sanchin kata on the psycho-physical state of an athlete-karate player, which confirms our hypothesis and is recommended for use in the training process during the training of highly skilled athletes for kumite competitions. The heart rate in EG varied from 81 beats/min. in a state of rest, to 185 bs/min. at peak load and up to 96 beats/min. after kata execution. The pH of the saliva in the EG after the kata is reduced to the baseline level at the same time in KG it continues to be high for a long time.

The use of PAM "OMEGA-C" and "POLAR 800" for controlling the training process for the training of highly skilled athletes for the kumite competitions in Kyokushinkai karate gives a very significant effect. As it promotes the implementation of the athlete's and coach's intentions, the purpose of which is a significant result of the competitions. At the same time, it enables the operative correction of the training process individually for each athlete.

Further research should be devoted to a deeper and more detailed study of the influence of Kata on the formation of the required level of physical and mental readiness of highly skilled Karate sportsmen and their interrelation with the performance of performances at prestigious competitions with kumite in Kyokushinkai karate.

It has been experimentally verified and proved that performing Sanchin kata after accelerated recovery processes in the cardiovascular system at the stage of direct preparation for the main competitions of kumite in karate Kyokushin.

The given actual material can serve as a prerequisite for optimizing the training process of highly qualified athletes of Kyokushin Karate.

In addition, it is worth devoting to a more detailed study of the impact of other "higher" karate kata and their role in the formation of the necessary level of physical and mental readiness of highly skilled athletes at different stages of preparation for the main competitions.

Prospects for future research are the formation of a set of tests for the study of functional fitness of athletes kyokushinkai karate in laboratory conditions and in conditions of sports activities, in so-called "field conditions".

Conflict of Interest

The author has not declared any conflicts of interest.

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