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EVALUATION OF ELITE JU-JITSU ATHLETES' PHYSICAL FITNESS USING THE JMG TEST

ZAGGELIDIS GEORGIOS[1,*], ZAGGELIDIS CHRISTOS[1], MALKOGEORGOS ALEXANDROS[1]

ABSTRACT. The JMG test has been widely used since 1982 and has been included in performance testing in many national federations, especially judo's. The study was conducted using the JMG (Jose Manual Garcia) test, to evaluate the physical fitness of ju-jitsu international federation's elite ju-jitsu athletes, during a five days training camp (precompetitive period). The athlete performs three exercises for 1 minute each (a total of 3 minutes) and the goal is to measure ju-jitsu's functional capacities. Eighteen (No=18) athletes, aged from 16 to 22 years, 12 males and 6 females, were tested. Their fitness was assessed, according to the test, from poor to excellent. The test's results show that JMG test can be used by athletes of Fighting System (ju-jitsu international federation) which is articulated in a three-minute combat.

Key words: *ju-jitsu fighting, specific fitness test, JMG test*

Introduction

Ju-Jitsu is a discipline that has high-level requirements (Ambroży, Nowak, Mucha, Chwała, Piwowarski, & Sieber, 2014). Fighting in sport ju-jitsu is a combination of actions typical for karate and judo (Sterkowicz-Przybycień, Ambroży, Jasiński, & Kędra, 2014). Ju-jitsu fighting (JJF) can be described as a high-intensity martial art and modern competition sport, in which the aim is to defeat the opponent using punches, kicks, takedowns, throws and ground techniques (Staller, 2013a). JJF is one of three official competition systems of the Ju-Jitsu International Federation, and as such an official competitive sport at the World Games, which is organized and governed by the IWGA, under the patronage of the international Olympic Committee (Ju-Jitsu International Federation, 2011).

[1] School of Physical Education and Sport Sciences, Aristotle University of Thessaloniki, HELLAS
[*]Corresponding author: gzaggel@gmail.com

JJF is the most comprehensive discipline in ju-jitsu (Staller, 2013b), since the competitors have to engage in distance combat (Part 1), in throwing and takedowns (Part 2), and in ground-fighting (Part 3). The system is divided into several categories according to sex, age and weight. A fight consists of three parts, total 3-minute round and has to be fought in every part. Three referees reward successfully applied techniques with "ippon" (2 or 3 points) or "waza-ari" (1 point). In order to win, an athlete has to have more points than his opponent after the regular fighting time. Another option to win is by "full ippon", which means to have an "ippon" in every part. Penalties are divided into "light forbidden acts" ("shido": 1 penalty point) and "forbidden acts" ("chui": 2 penalty points). The addition of two forbidden acts results in losing the fight by "hansoku-make" (Ju-Jitsu International Federation, 2011).

The possibility to win with particular opponents is conditioned by the level of physical preparation, which is visible during attacks and counter-attacks during the fight. High changeability of a situation in the course of a competition requires as many muscular fibers as possible to be engaged in training (Ambrozy, et al., 2014). Many times, such confrontation takes place in tournaments where subsequent fights are organized after only a short break.

Great changeability of actions in the course of fight makes it necessary to develop not only speed and strength (of shoulders, legs, back, stomach and forearms), but also stamina (Ambrozy, et al., 2014). There are several tests which one can do with very little or no equipment or assistance in judo. Among these tests JMG test is the most popularly used as the fitness assessment test (García, 1999). A fitness test should be such, which can be administered with very few resources and in a very simple way (Yadav, 2015).

The JMG test is an evaluation technique specifically designed for those sports where force, resistance and speed is an important element of the sport (García, 1999; Rodríguez, Saborit, & Díez, 2008). The test is based on the capacity to produce a mixture of aerobic and anaerobic energy and to correlate of obtaining energy with force resistance at speed while performing the three exercises that make up the test lasting three minutes (one minute for each exercise). This test has been used since 1982 and has been included in the testing of performance in many National Federations especially Judo. The results coincide favorably with various laboratory controls and remain true with the specific performance of judokas in competitions of the highest category.

JMG Test comprised of three exercises viz. tunnel, sit ups and jumping from one side to the other of a 30 centimeter (cm) high bench, as explained under (García, 1999):

Tunnel: The helper stands with legs apart, trunk bent forward with the back at the height of subjects. The subject jumps on the helper, goes over through the back and comes back the way between helper's legs. This complete movement is one repetition (Note: for the test to be valid subject must complete at least 16 repetitions in one minute).

Sit ups (abdominals): Lying face up with the legs separated shoulder width apart and slightly flexed at the knee, with the hands behind the head. The subject without wasting time between the first and second exercises, start doing sit ups touching the elbow to the opposite knee. After touching the elbow to the opposite knee, both elbows must touch the ground (mate) while going back.

Jumping from one side to the other of a 30 cm bench: The subject jumps from one side to the other. The feet must leave and touch the ground at the same time but it is not essential for the feet to be together. Every time the floor touching is counted as one repetition.

At the command of 'now' the subject starts the tunnel exercise for one minute, at the end of one minute without any gap/ interval with command 'change' the subject starts the sit ups for one minute and immediately after second exercise without any gap/interval starts to execute the third exercise i.e. jumping from one side to the other of a bench. At the end of the test subject is stopped and recordings of immediate heart rate as P1, after one-minute recovery heart rate as P2 were recorded with the help of Polar Heart Rate Monitor.

The following data is necessary to establish the ratio JMG:

P1= Heart rate at the moment of termination of the test.

P2=Recovery heart rate after one minute of termination of the test.

N°rpt= Total number of complete repetitions executed (the total of the three exercises).

Kg = Weight of the subject in kilograms.

Age = Age of the subject in years.

The following equations are used when obtaining the ratio JMG:

A= [(P1 + P2) / 2]-[n°rpt + kg / 2]

B= [K- (P1 - P2)]-[n°rpt + kg / 2]

Thus resulting in the Ratio JMG = (A + B) / 2

Where, K= (220-age). In different studies carried on elite sportsmen, there was a tendency for this factor to be the number 200.

Table 1. Degree of aptitude (results of the ratio JMG)

Excellent	Very good	Good	Quite good	Fair	Not very good	Bad	Very bad
>-50	-40	-30	-10	0	+10	+30	>+50

The results of the ratio JMG give a clear idea of the functional state of the competitor from the point of view of the above-mentioned facts. Negative results of the ratio JMG (for example -30) indicate a good aptitude of force resistance at speed while obtaining aerobic - anaerobic energy. On the contrary, positive

results (for example +30) give us an indication of poor aptitude. This test is usually accompanied by a valuation of the fatigue level of the subject showing itself, at the end of the test on the Borg Scale of Perceived Exertion (Borg's category ratio/CR-10 scale) and level estimations that takes into account your fitness level (Borg, 1990). Ratio scaling methods are used to measure perceived exertion; functions for various workloads are obtained which can be compared with physiological responses, such as heart rate and blood lactate concentration.

Material and Methods

Sample. In the beginning of a five days training camp (pre-competitive period), eighteen (N=18) senior, 12 male and 6 female ju-jitsu athletes, who represented their countries for national and international championships, were selected to perform the JMG test.

Procedure. Age and body weight of subjects were recorded and once they became familiar with the procedure, they performed the three-minute JMG test. A polar 400M was used to record the heart rate immediately after completion of the test and one minute after the end of it.

Statistical Analysis. SPSS statistical package was used for data analysis. The collected data were subjected to mean and standard deviation computation and an independent t-test was used to compare men and women mean difference.

Results

The mean values of total number of repetitions (men 146.75 ±19.95 and women 117.67±20.22), of heart rate immediately after completion of test (PI) (men 187.67±6.08 and women 187.33±7.15), of heart rate after one minute of termination of test (P2) (men 152.08±5.81 and women 150.33±6.19) and Index for JMG test (men -13.73±20.20 and women 21.17±23.95). (table 2). Lesser mean values of JMG test, better condition. (Table 2)

Table 2. Descriptive Statistics of variables of JMG Test

Variables	Male (N=12)		Female (N=6)	
	Mean	S.D.	Mean	S.D.
Age	18.75	2.45	17.67	2.16
Weight	69.50	14.22	56.50	7.40
Total no. of reps (01+02+03)	146.75	19.95	117.67	20.22
PI of JMG Test	187.67	6.08	187.33	7.15
P2 of JMG Test	152.08	5.81	150.33	6.19
Index for JMG	-13.73	20.20	21.17	23.95

JMG Test= Jose Manual Garcia Test
P1= Heart rate immediately after completion of test
P2= Heart rate after one minute of termination of test

From the test results the men 1 (8.3%) was in excellent fitness, 1 (8.3%) in good, 7 (58.3%) in quite good, 2 (16.7%) in fair and 1 (8.3%) in not very good. Of the women, 1 (8.3%) was in quite good fitness, 2 (33%) in fair, 1 (16.7%) in not very good and 2 (33.3%) in bad. An independent t-test analysis showed that men was in better condition than women, t=-3.254 and p<0.05 (Graph 1).

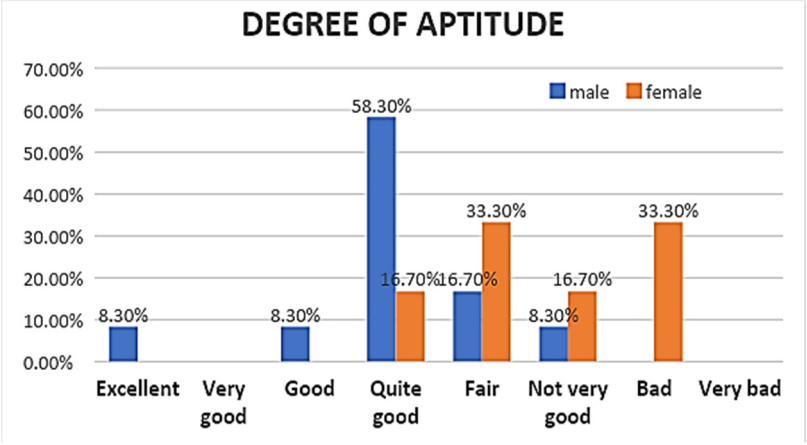

Fig. 1. Degree of aptitude

Discussion

The methodology of the sport training was always guided for the performance. In these terms, the physical evaluation becomes indispensable in the identification of the athlete's condition, as well as it supplies subsidies to the trainer for the prescription, planning and appropriate periodization of the sporting training (Ambroży, et al., 2014; Harris, Foulds, & Latella, 2019).

In this way, with the present study has for objective to analyze the ju-jitsu athletes' evaluation by means of a specific test composed of three exercises (non-specific actions): the JMG test (Rodríguez, Saborit, & Díez, 2008). The JMG test is widely used to evaluate especially judo athletes (Carvalho, 2000), and this work we wanted to recommend it for other similar combat sports such as ju-jitsu fighting. The results showed that it can be used as effectively as in judo (Yadav, 2015). The simple way of doing it allows us to use it at the beginning, during and at the end of the preparatory period, to evaluate the physical fitness in force, speed and endurance (aerobic and anaerobic condition) of athletes (Carvalho, 2000) in relation to the training program (e.g. circuit or functional circuit training).

Conclusions

JMG test was validated to specifically estimate for sporting purposes. Therefore, the JMG can be used to evaluate the aerobic and anaerobic conditioning of judo and ju jitsu practitioners and for prescribing adequate intensity training. The use of this test and classifications can be relevant for goal setting in terms of physical development either aiming at peaking for a specific competition. The responses to different types of periodization can also be monitored through the application of this test.

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