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A COMPARATIVE STUDY OF THE PHYSICAL PERFORMANCE LEVEL OF ELITE INDIAN WUSHU PLAYERS DURING SPECIFIC PREPARATORY AND PRE-COMPETITIVE TRAINING PERIOD

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To access the physical fitness of the athletes of the most comprehensive form of Chinese martial art, wushu, JMG (Jose Manuel Garcia) test was applied during the first micro-cycle training phase of Specific preparatory and pre-competitive period (SPP and PCP). To determine the functional capabilities of wushu and the combatants' performance level in different training phases, the JMG test was applied for the evaluation of the physical fitness of 31 elite Indian wushu players (21 male and 10 female), aged 20.28 ± 3.25 years, during national training camp in Meerut, India (preparatory phase and pre-competitive phase). The descriptive statistics models and tests enables the determination of the relationship between JMG test result and the combatants' performance in the first micro-cycle of SPP and PCP containing a 6 weeks of training period. Men players weighed 65.58 ± 6.28 (kg) and women players 56.33 ± 3.84 (kg) in SPP, 63.63 ± 7.98 (kg) and 53.31 ± 6.05 (kg) during PCP respectively, scored repetitions of in 3 exercises, with post-exercise heart rate in SPP and PCP has shown decreased HR recovery, decreased body weight and poor physical performance level in JMG. The tests' results imply that the poor aerobic and anaerobic conditioning in PCP than SPP may be induced by the improper recovery, over training during the pre-competitive phase. This study concludes with the requirement of training load quantification anddetection of adequate intensity training of wushu during different training periods.

Keywords: JMG Test, Wushu, Combat Sport, Training Periodization, Anaerobic Capacity, Performance Evaluation

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Introduction

In competitive combat sports, the issue of predicting sports performance and enhancing it through training periodization has always been a hot topic. The standards for specific physical performance evaluation tests have become more demanding because of the ongoing growth of martial arts requirements and the competition system**Funakoshi, (1973), Guan & W.M., (1992) and Zheng, Z. (1992)**.Many Asian combat sports, including judo, aikido, koreantaekwondo, and karate, have their roots in wushu, the most fundamental and complete form of Chinese martial arts**Draeger & Smith,(1975), Funakoshi, (1973), Winderbaum, (1977), and Zheng, Z. (1992)**. Wushu looks to be a fighting sport that requires a lot of anaerobic work **Wang, D. et al., (2021)**.

Traditional sport of competitive wushu routines involves judges' subjective evaluation of the movement's difficulty and aesthetic value.With stringent guidelines for movement stability, Wushu routine movements are primarily based on jumping, twisting, and single-leg stance. Coupled with the Olympic philosophy of "higher, faster and stronger", Wushu routine competition is growing more and more competitive. Professional Wushu players have been linked to high injury risks, particularly when it comes to back, knee, and ankle major non-contact injuries **Zhu & Zang, (2017) and Xing, (2017)**.

This research work proposes a method to determine the physical performance level of Wushu players during various training periods based on the characteristics of recovery of Wushu players in sports training competition.

Since 1982, the JMG (Jose Manuel Garcia) test has been used to gauge performance in several combat sports, most notably in judo **Zaggelidis et al., (2019)**. The JMG test is an evaluation method created especially for sports where force, resistance, and speed play a significant role in the game. The three exercises—jumping from one side of a 30 centimeter (cm) high bench to the other, sit-ups, and a tunnel—that make up the three-minute test are based on the ability to produce a combination of aerobic and anaerobic energy and to correlate of gaining energy with force resistance at speed.This test has been used since 1982 and has been included in the testing of performance

In many National Federations especially Judo**Garcia, (1999)** and **Rodriguez et al., (2008)**.

The Jose Manual Garcia (JMG) test was utilised in a study to assess the physical fitness of the top ju-jitsu athletes in the international federation, and it was found that these athletes could use the exam to gauge their readiness for a three-minute fight **Zaggelidis et al., (2019)**.

A physical performance monitoring based on training phases as well as the development of test batteries for competitive wushu players have not yet been documented in any studies. This study intends to determine the applicability and standard scores of the JMG test for wushu players considering the similarities of the sports category and physiological and kinesiological parameters to judo.

The players need to have a sufficient level of isometric strength for movement and gripping skills, which must be developed to the highest level and gradually combined with other motoric features**Bulca Y. et al., (2000)** towards the end of the preparatory phase for all elite players, taking into account that in this study JMG tests were conducted for the elite wushu players at the preparatory and competition levels.

Materials and Methods

To determine the functional capacity of physical performance and the training effect in Wushu, 31 elite Indian wushu players (21 male and 10 female) underwent the JMG test at a national training camp in Meerut, India (during the specific and pre-competitive phase, at a gap of 6 weeks). After resting for 48 hours from their previous training session during the micro-cycles of SPP and PCP, the players underwent the tests. Following body weight assessment, the following three JMG test activities were carried out **Garcia, (1999).**

Tunnel Jumps: The help (non-participant) stood with their legs extended and bowed until they reached the same height as the players who were competing. The players jumped upon the help, jumping up onto her from behind and coming back through her legs. This entire movement is repeated once. The exam must be successfully completed 16 times in one minute to be regarded validly finished. Sit-ups: The participants laid face

Up with their legs stretched and slightly bent at the knees while performing abdominal sit-ups. Behind their heads, they held their hands together. The individual immediately started doing sit-ups while touching one knee with the opposite elbow. Before both elbows touch the same knee during a successful repetition, the other elbow must first touch the opposite knee. Side Jumps: Participants had to jump from one side of a 30-centimeter bench to the other. Although it is required for the feet to split, it is not necessary for them to simultaneously touch the ground. One repeat is recorded for each time the feet contact the ground. When told to "now," the participant started the minute-long tunnel activity. Participants started doing sit-ups for one minute when told to "change," and they started the third activity without halting after finishing the second exercise.

The athletes' heart rates were recorded by a Polar Heart Rate Monitor at the end of the test (denoted as P_1) and after a minute of rest (denoted as P_2). To determine the ratio JMG Score and other parameters for estimations, the following information is required:

P_1= Heart rate at the termination of the test (bpm/beats per minute). P_2=Recovery heart rate after one minute of termination of the test (bpm). N°rpt= Total number of complete repetitions executed (total of the three exercises). M = Body Mass of the subject in kilograms and Age in years.K= Age Predicted HR_{max} = (220- Age in years). Thus, resulting in the Ratio JMG.

Results and Discussion

31 male and female Indian national Wushu competitors who competed in Sanda and Taolu are listed in Tables 1 and 2 together with the results of their physical examinations, body weight measurements, and JMG test. With a higher performance level during SP compared to PCP, they had completed repetitions of three exercises (JMG total number of repetitions). The physical examination becomes crucial in establishing the health of the player because sport training is continually performance focused. Also, it aids the coach in developing a training regimen and appropriate periodization **Ambroży, T. et al., (2014)**. The ratio JMG findings give a clear picture of the competitor's functional status in light of the aforementioned considerations.

The ratio JMG's negative values suggest a good aptitude for force resistance at speed while acquiring aerobic and anaerobic energy. Conversely, successful outcomes demonstrate a lack of aptitude. The results showed that it may be used in chin-ups for performance evaluation and training planning with the same effectiveness as in judo and Ji-jitsu. Its simple layout enables us to use it to evaluate aplayer's physical preparation in relation to different training regimens like interval, circuit, and functional circuit training, such as force, speed, and endurance (aerobic and anaerobic condition) **Carvalho, (2000)**.

Table 1: Demographic Profile, Physical performance and Scores of the Wushu Players

Enclosed as Annexure 01

Table 2: JMG Test Scores of Wushu Players in SPP and PCP (Men and Women)

Enclosed as Annexure 02

Figure 1: Heart Rate Recovery after JMG Test during SPP and PCP

Enclosed as Annexure 03

Figure 2: Physical Performance level in JMG Test in SPP and PCP. Series 1: Men Wushu players during SPP, Series 2: Women Wushu players during SPP, Series 3: Men Wushu players during PCP, Series 4: Women Wushu players during PCP.

Enclosed as Annexure 04

With decreases in body weight, the anaerobic and aerobic performance levels of wushu players have decreased from SPP to PCP. This can be because of insufficient recovery and greater fatigue brought on by the increased training load from SPP to PCP. Evaluation of training load outcomes, overloading in training, and measurement of training load become crucial in identifying such performance decrement during the PCP, to identify the super-compensation phase and coincide the same with the duration of the competition schedule. Such a result would indicate the need for monitoring the results of small-scale training cycles during PCP.

The physical proficiency of wushu players is now more important than ever in ensuring the high-load workout intensity for the multi-period competitive games. Together with training methods and tactical training, the fatigue recovery issuefaced

By Wushu Sanda players, has drawn increased attention in the quest to help players attain good sporting performance **Martini et al., (2006)**.

According to the Sanda mode, skeletal muscles in athletes serve as their primary source of ATP, which is primarily produced through the breakdown of CP and sugar glycolysis. As competition intensity increases and muscle glycogen depletes, there is a maximum accumulation of ATP and CP in the muscles, which coincides with maximum consumption. In wushu, a high number of impulses that excite corresponding nerve cells in the cerebral cortex can lead to an increase in lactic acid, which can lead to central fatigue as lactic acid levels rise and glycogen levels fall. Additionally, Sandaplayers perspire a lot during high-intensity competitions, which causes a decrease in body water and salt levels as well as an imbalance in the metabolism of water and salt. The blood circulation also decreases the internal environment of the body with the imbalanced metabolism, which can result in fatigue **Hou, Jun. (2015)** .

Conclusion

Sports exhaustion will cause a player's physical strength and athletic prowess to rapidly deteriorate, which can negatively impact the player's training effectiveness and significantly lower competition outcomes. To prevent fatigue, coaches and athletes must, to the greatest extent possible, comprehend the fundamental causes of an in-depth understanding of sports exhaustion. Monitoring player recovery in PCP is necessary for performance improvement, which may aid in player recovery. It is necessary to perform biochemical testing for aerobic and anaerobic capacity as well as for overloading to overtraining, recovery, and supercompensation. To enhance the competitive performance of the wushu players, anaerobic capacity testing, training load quantification, and modulation of training intensity with dietary intervention are required.

Annexure

Annexure 01

Table 1: Demographic Profile, Physical performance and Scores of the Wushu Players

Descriptive Statistics of the Physical Performance of the Wushu Players

Parameters (mean ± S.D.)	Men Wushu Athletes in SPP	Women Wushu Athletes in SPP	Men Wushu Athletes in PCP	Women Wushu Athletes in PCP
No. of athletes	N = 21	N = 10	N = 21	N = 10
Age (in years)	20.28 ± 3.25	19.5 ± 4.5	20.28 ± 3.25	19.5 ± 4.5
Weight (in kg)	65.58 ± 6.28	56.33 ± 3.84	63.63 ± 7.98	53.31 ± 6.05
Total No. of Repetitions	131.5 ± 22.35	123.3 ± 18.98	129.76 ± 25.16	134.14 ± 20.02
Pulse Rate immediate after the JMG test (bpm)	162 ± 22.03	166.4 ± 19.2	173.52 ± 20.75	173.71 ± 24.08
Pulse Rate after one minute of the JMG test (bpm)	123 ± 20.62	125.6 ± 26.48	148 ± 17.28	153.71 ± 19.1
JMG Test Ratio	-24.70 ± 36.02	-3.3 ± 29.06	3.02 ± 49.03	12.44 ± 39.77

SPP – Specific Preparatory Phase PCP – Pre-competitive Phase bpm – beats per minute S.D. – Standard Deviation

Annexure 02

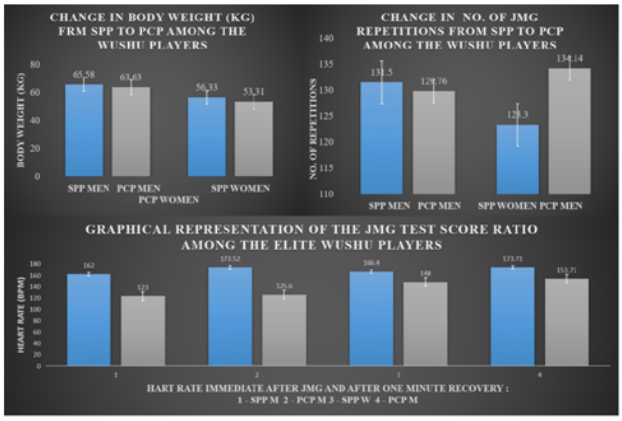
Table 2: JMG Test Scores of Wushu Players in SPP and PCP (Men and Women)

JMG Test Score of the Men and Women Wushu Players of SPP and PCP of Training

RATIO VALUE	Excellent >-50	Very Good -40	Good -30	Quite good -10	Fair 0	Not very good 10	Bad 30	Very bad >+50
SPP M (N = 21)	5	4	0	7	3	1	1	0
SPP W (N = 10)	0	1	1	2	3	1	1	1
PCP M(N = 21)	5	1	4	2	2	3	2	2
PCP W(N = 10)	0	2	1	2	1	1	1	2

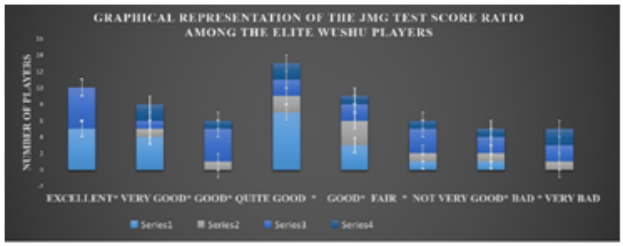
Annexure 03

Figure 1: Heart Rate Recovery after JMG Test during SPP and PCP



Annexure 04

Figure 2: Physical Performance level in JMG Test in SPP and PCP. Series 1: Men Wushu players during SPP, Series 2: Women Wushu players during SPP, Series 3: Men Wushu players during PCP, Series 4: Women Wushu players during PCP.



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