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PHYSICAL FITNESS AND ANTHROPOMETRICAL PROFILE OF THE IRANIAN MALE ELITE AND NON-ELITE JUDO PLAYERS

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Short Profile

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ABSTRACT:
The objective of this study was to verify the differences between Elite (Iranian nation Team) and non-elite (those playing in the premier league) senior male judo players. For this purpose, the following tests and measurements were conducted: (a) skinfold thickness; (b) circumferences; (c) upper body Wingate test; (d) aerobic power.
Independent T Test was used to compare the two groups (significance level=5%). Elite group presented better results than Non-elite group in the following variables ($p<0.05$): circumferences (cm) - flexed arm, forearm, wrist; Wingate Test – Mean and Peak power; aerobic power. The other variables were not different between groups. It can be concluded that Elite judo players presented higher upper body and specific anaerobic power and aerobic power, higher circumferences (specially from upper body, indicating superior muscle mass in this area) and that skinfold, was similar in Elite and Non-elite judo players. Thus, these results suggest that training and talent identification of judo athletes should focus on the variables that were different between Elite and Non-elite athletes.

KEYWORDS
Judo – Anthropometrical Profile – Elite – Physical Fitness.

INTRODUCTION

Judo is a dynamic, high-intensity intermittent sport that requires complex skills and tactical excellence for success (Degoutte, Jouanel et al. 2003). As judo athletes have to perform a great number of actions during each match, the physical demand of a single match is high. Typically, judo medalists perform five to seven matches during international competitions, with each match having a 5-minute time limit. If a judo athlete obtains an ippon (full point), the match ends (Franchini, Del Vecchio et al. 2011). On the other hand, since 2003, when the time allotted for the contest finished and the scores/penalties are equal for both athletes (i.e. the match draws), the result of the contest is decided by a 'Golden Score'. If neither athlete obtains any score in the Golden Score period the match continues for another 3 minutes and is decided by the referees (Hantei decision) (Franchini, Del Vecchio et al. 2011). Thus, a judo match may last from a few seconds to 8 minutes, depending on the scores obtained by the contestants. However, a typical high-level periods of activity and 5–10 seconds of interruption (Castarlenas JL 1997, Van Malderen K 2006). Moreover, a significant portion of the matches last 3–4 minutes (Castarlenas JL 1997). To be effective, judo techniques should be applied with accuracy, within a good 'window of opportunity', with strength, velocity and power. This short burst of energy is supplied mainly by anaerobic metabolism. In contrast, the maintenance of the intermittent work performed during a match, as well as the recovery process during the short intervals, are mainly supported by aerobic metabolism. Additionally, aerobic metabolism is especially important for an effective recovery between matches (Franchini, Yuri et al. 2003). With these facts, it can be established that judo is a complex sport with demands comprising a number of specific characteristics to achieve a high level in competition. It is well known that understanding the characteristics of elite athletes can provide insightful information regarding what is needed for competitive success.

Thus, the purposes of this study were describe and compare morphological and functional features of the male judo players of the Iranian elite (Iranian nation Team) and non-elite (those playing in the premier league).

MATERIALS AND METHODS

Subjects. fourteen male judoists, with an average age, weight, and height of 24±1.68, 78±2.86, and 178±2.53, respectively, were selected by non-random and purposeful method and divided into two groups of elite (Iranian nation Team) and non-elite (those playing in the premier league).

Subjects: fourteen male judoists, including Iranian elite (members of Iranian nation Team n=7) and non-elite (those playing in the premier league n=7) participated in the study after having submitted their written consents. The procedures were approved by the local ethics committee. The subjects were examined on two consecutive days, with more than 3-h interval between tests or measurements. The order of tests and measurements was as follows: Day 1: Morning – anthropometric measurements; Afternoon – Aerobic capacity test. Day 2: Morning – upper body Wingate test.

Anthropometric measurements: After having recorded the height and circumference measurements and skinfold thickness (at least 3 times per site, using a Harpenden calliper) were taken at sites defined by Drinkwater and Ross (Drinkwater and Ross 1980). Body fat percentage was calculated as proposed by

these authors. All anthropometric measurements were done by an experienced evaluator.

Upper body Wingate test: – This test was performed on a Monark cycle ergometer adapted for upper body (load of 0.05 kg•kg-1 of body mass). Power was measured at each second by the Wingate Test software, which allowed calculating the following variables – mean power (average power during 30 s), peak power (highest power during the test), time to reach peak power and fatigue index (percent power decrease during 30 s).

VO2max level: the subjects carried out the test on a mechanical treadmill with a variable belt speed. Treadmill runs were preceded by a 2-minute warm-up during which the belt speed was 2.5 m/s. The test runs lasted up to point, that is until the time when the tested competitor subjectively felt too tired to continue. A series of respiratory and circulatory parameters were measured during each test run. The following were taken as the aerobic capacity indices determining competitors' endurance features: test-run time on the treadmill; and VO2max level for a minute oxygen uptake (in absolute terms, l/min, and in relative terms, ml/kg of body mass).

Statistical Analysis

The Statistical Package for Social Sciences (SPSS, Ins, Chigaco, IL) version 17 was used for all analyses. Statistical significance was set at a level of $P< 0.05$, and data were expressed as the mean ± SEM. The two groups were compared with the use of an Independent T Test.

RESULTS

The groups did not differ ($p>0.05$) in age (Elite =22.8±3.4 years old; Non-elite =24.2±4.5 years old), weight (Elite =80.5±16.4 kg; Non-elite =73.4±16.3 years old) or height (Elite =176.2±8.9 cm; Non-elite =175.3±7.0 cm) body Fat percentage (Elite =10.2±6.1 percentage; Non-elite =13.1±7.8 percentage).

Table 1 shows the main anthropometrical and Aerobic and anaerobic power results from elite and non-elite judo players shows that the aerobic power (VO2max) showed difference ($p<0.05$) between Elite (52.34±8.6 ml/kg/min) and Non-elite (41.25±9.2 ml/kg/min) athletes as well as anthropometrical measurers and mean and peak power significant difference ($p<0.05$) was found body Fat percentage, fatigue index and Time to peak power no significant difference between two groups.

Table 1 Variables of male judo players evaluated (n=14)

Variable		Elite	Non-elite
body Fat percentage		10.2±6.1	13.1±7.8
Relaxed arm circumference (cm)		36.12±4.1*	31.1±5.13
Contracted arm circumference (cm)		41.23±5.2*	35.5±7.3
Forearm circumference (cm)		32.71±4.2*	28.65±6.3
Wrist circumference (cm)		18.5±0.9*	16.2±1.1
VO2max ($ml \cdot kg^{-1} \cdot min^{-1}$)		52.34±8.6*	41.25±9.2
Upper body Wingate test	Mean power ($W.kg^{-1}$)	6.95±0.66*	5.11±0.98
	Peak power (W.kg-1)	8.56±0.77*	6.12±1.11
	Time to peak power (s)	5±1	6±2
	fatigue index (%)	49.7±9.11	46.9±12.13

*Significant difference between groups ($p<0.05$)

DISCUSSION

Ideally, a prospective judo athlete should employ sound nutrition and aerobic training principles to reach a steady-state fat percentage of 7–10% (Koury, de Oliveira et al. 2005). Since they compete at their weight categories, it is not surprising that they are very strong per kilogram of bodyweight. This means that they must have a very small percentage of body fat compared with an average male of the same height and age. Indeed, the range of fat percentage extends from approximately 4% to 9%, with the exception of the heavyweights (>78 kg for females and >100 kg for males). The only study found, which compared elite and non-elite judo athletes concerning body fat percentage, was conducted by Callister et al.(Callister, Staron et al. 1991). In that study, Callister et al. found a lower body fat percentage in better-ranked judo athletes compared with worse ranked judo athletes, which we did not observe in our study. However, in the study by Callister et al., it was not reported whether the athletes whom they had compared were of the same weight category, which may suggest that the comparison could have been done between athletes of different categories, which was reported to be different. Another possibility to explain this discordance could be that Callister et al. compared the very best athletes in the ranking, while we compared a wider variation of athletes in the present study (Callister, Staron et al. 1991).

The higher circumference in arm segments (flexed arm, forearm and wrist) for the elite athletes compared with non-elite judo athletes seems to be in keeping with the assumption that the high arm circumference is an advantageous factor in judo fight. The circumference of a body segment was used as an indication of muscle mass cross sectional area (Costill, Wilmore et al. 2012). Recently, more sophisticated techniques have been used (Ichinose, Kanehisa et al. 1998). However, the cost of this kind of evaluation is not practical for an evaluation of a big number of athletes. In this way, we can consider that the higher arm circumference of the elite judo athletes can be indicative of higher muscle mass cross-sectional area and consequently of higher power and force output for these segments. The higher calf circumference in elite athletes compared to non-elite athletes can help them in the biomechanics of many throws in which the final movement involves an ankle extension (e.g. seoi-nage) (Sacripanti 2010).

Relative mean power and peak power were higher in the elite compared to non-elite judo athletes,

confirming partially the hypothesis of higher power output for athletes with higher arm, forearm and wrist circumferences. Horswill et al. (Horswill C.A. 1989) also found higher mean and peak power output for elite wrestlers compared with non-elite ones. This result is in accordance with the assumption that the Wingate test performance is related to anaerobic power and capacity (Hudson, Loy et al. 1999) and those judo athletes should have a high glycolytic energy transfer system to support the fight requirements (Thomas, Cox et al. 1989) .It is important to note that the development of higher peak power is important to keep higher mean power, because the fatigue index was the same in both groups. However, it must be considered that the low effect size for mean and peak power, which indicated that the differences are not so evident. However, Borkowsky et al. (Claessens, Beunen et al. 1987) did not find any difference in lower body Wingate tests between Polish National winners and second and third placers. The difference between Borkowsky et al findings (Borkowski, Faff et al. 2001) and ours might be related to the following aspects: (1) they compared the very best Polish judo athletes among them while we compared medal winners in National/International Tournaments with nonmedallists in those competitions; (2) there is a possibility that elite judo players differ in upper body anaerobic performance as we found, but not in lower body anaerobic performance as reported by Borkowsky et al. (Borkowski, Faff et al. 2001).

Another important point is that the values presented by both the elite and non-elite judo athletes of the present study were lower than those presented by the Canadian Team (relative mean power=8.66±1.17 W•kg-1; relative peak power=11.3±0.8 W•kg-1) (Thomas, Cox et al. 1989) and by the British Team (relative mean power=8.50±0.50 W•kg-1; relative peak power=10.6±0.8 W•kg-1) (Sharp and Koutedakis 1987), confirming the high arm anaerobic power and capacity for elite judo athletes.

The aerobic fitness, as evaluated by aerobic power (VO2max), was different between the groups, suggesting that this variable is a discriminatory one or is so important during judo performance, as suggested Muramatsu et al(Muramatsu, Horiyasu et al. 1994).

Another explanation should be the fact that elite judo athletes presented this variables well developed for judo performance, because those values were similar to the ones found in high-level judo athletes (59.2±5.18 ml•kg-1•min-1) (Thomas, Cox et al. 1989). This last hypothesis seems to be more plausible, because Muramatsu et al. (Muramatsu, Horiyasu et al. 1994) found a good influence of aerobic power on high intensity intermittent performance in judo players. Gariod et al. (Gariod, Favre-Juvin et al. 1995) found that judo athletes with higher VO2max presented a faster CP resynthesis (31 P NMR) compared with judo athletes with lower VO2max. This can be important in intermittent tasks as judo, when the athlete must perform many high intensity efforts with brief time to recover. Similar results were found in studies on non-judo players (Tomlin and Wenger 2001).

CONCLUSION

Successful judo athletes have very low levels of body fat. Mesomorphy is the most predominant somatotype component in male athletes. Moreover, high level competitive judo athletes present with highly developed anaerobic power and capacity as well as maximal oxygen uptake (VO2max). These variables seem to be more prominent in the upper body than in the lower body, suggesting that physical preparation should focus on improvement in the upper body. therefore together with technical and tactics training, judo athletes should focus on improving their arm segment circumferences, general arm anaerobic power and capacity. However, this procedure must be investigated more to verify the possible benefits on subsequent performance. Therefore, this may be considered as an ideal profile when

preparing an athlete for engaging in high-level judo.

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