ORIGINAL ARTICLE

Mood response after two weeks of rapid weight reduction in judokas

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Abstract

Background and Study Aim: It is common for judo athletes to use methods for rapid weight loss in the days preceding competitions in an attempt to create a supposed advantage by being able to compete in lower body weight categories. The aim of the study was the mood response in judo athletes after two weeks of rapid weight reduction.

Materials and Methods: This experimental study included 39 judokas randomly divided into 2 groups: experimental (EG) and control (CG). The rapid weight reduction strategies adopted in the EG were structured with a view to achieving a weekly loss of approximately 5%. The mood was assessed using the reduced version of the Profile of Mood States (POMS) instrument.

Results: A group vs time ($p<0.01$) interaction effect was identified for body weight, with a reduction only in the EG ($p<0.01$). For the negative mood subscales, except "confusion", the findings revealed significant group vs time ($p<0.01$) interactions, with increased scores recorded only in the EG ($p<0.01$). The results showed a significant group vs time ($p<0.01$) interaction for the vigour subscale, with the scores, increased in the CG ($p<0.01$) and reduced in the EG ($p<0.01$).

Conclusions: It was concluded that rapid weight reduction was not effective for improving the mood state of judokas, highlighting a reduction in vigour and increase in anger, fatigue and depression.

Keywords: Disordered Eating in Sports Scale • Profile of Mood States • sport psychology • training session

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Weight loss – ***noun*** the fact of losing weight or of becoming thinner [26].

Weight-loss plan – ***noun*** a scheme to reduce body weight, usually by reducing calorie intake, increasing physical activity or a combination of both [26].

Weight reduction – ***noun*** same as **weight loss** [26].

Ippon – one point. Achieved through the execution of a valid technique on the opponent [27].

Nutritionist – ***noun*** a person who specialises in the study of nutrition and advises on diets [26].

Sports psychology – ***noun*** the scientific study of the mental state of sportspeople, looking at issues such as motivation, concentration, stress and self-confidence [26].

Sport psychology – is an interdisciplinary science that draws on knowledge from many related fields including biomechanics, physiology, kinesiology and psychology. It involves the study of how psychological factors affect performance and how participation in sport and exercise affect psychological and physical factors [28].

Training session – ***noun*** a period of time during which an athlete trains, either alone, with a trainer or with their team [26].

Technique – ***noun*** a way of performing an action [26].

Technique – specific procedures to move one's body to perform the task that needs to be accomplished [29].

Tactics – decisions and actions of players in the contest to gain an advantage over the opposing players [29].

Aerobic training – ***noun*** training that increases the body's capacity for aerobic exercise [26].

Aerobic power – ***noun*** same as **VO2Max** [26].

Anaerobic power – ***noun*** same as **anaerobic capacity** [26].

INTRODUCTION

Judo is a combat sport, characterised by the fight between two opponents and fast muscle actions [1]. The combat has a maximum duration of 5 minutes and the judoka who obtains the highest score or makes the opponent fall with the back (*ippon*) on the mat wins. It is a sport of unpredictability (decision-making) and is divided into body weight categories [2]. It seems common for judo athletes to use rapid weight reduction methods in the days preceding the competition in order to compete in a lower category [2].

Rapid weight reduction methods include restriction of food intake for long periods, use of laxatives/diuretics/appetite suppressants, use of plastic clothing during physical training and use of sauna in order to reduce the body water content [3]. Studies show that approximately 50% of athletes of combat sports with division by weight class (judo, jiu-jitsu, Olympic weightlifting and wrestling) adopt rapid weight reduction methods prior to competitions [4-6]. Coaches and athletes tend to associate rapid weight reduction with positive psychological adaptations. [1]

It seems that the psychological adaptations (motivation, self-efficacy and mood state) arising from the rapid weight reduction are not yet clear. Although Filaire et al. [4] and Brito et al. [5] indicate that rapid weight loss can lead to increased motivation, attenuation of self-efficacy and worsening of mood, it should be highlighted that these adaptations need to be confirmed by scientific findings.

The mood state refers to the set of positive and negative feelings that vary in intensity and duration [7]. The mood state includes feelings of depression, tension, anger, fatigue, confusion and vigour. Studies have shown a positive relationship between the mood state and the "iceberg" profile (increased vigour and the other feelings reduced) and sports performance [6, 8, 9]. According to Rouveix et al. [10], the mood state may be modified because of a change in body composition. However, it is unclear whether rapid weight reduction can modify the mood state. From a practical point of view, this type of investigation will contribute to the knowledge of judo coaches regarding the psychological adaptations that rapid weight reduction can generate in their athletes.

Thus, the aim of the study was the mood response in judo athletes after two weeks of rapid weight reduction. From this, considering the statements of some authors [4, 5], a hypothesis was formulated: judo athletes that rapidly reduce weight would present worsened mood states.

MATERIALS AND METHODS

Participants

This was an experimental and randomised study, with duration of 2 weeks, developed with male judo athletes. The participants were selected in a non-probabilistic way, with 42 judokas, participants of the Brazilian judo championship, aged 18 to 25 years, included. The participants were randomly divided into two groups: experimental (EG, n = 21) and control (CG, n = 21)

The judokas trained on average for 2h per day, with a frequency of five times per week. To be included in the study the athletes needed to: a) have been a judo athlete for at least three years; b) systematically train in judo for at least 8 hours per week; c) be registered in the national championship, organized by the Brazilian Judo Confederation and; d) be available to answer the questionnaires and participate in the anthropometric measurements. Three athletes were excluded due to not presenting one of the questionnaires fully answered or missing more than 10% of the training sessions during the study period (2 weeks). Therefore, the investigation included a final sample of 39 judokas (EG = 20 and CG = 19). It should be noted that no statistical differences for age ($F(2, 37) = 2.95$, $p = 0.20$), fat percentage ($F(2, 37) = 1.76$, $p = 0.29$), frequency of rapid reduction of body weight eating behaviors ($F(2, 37) = 2.24$, $p = 0.23$) and mood state ($F(2, 37) = 1.87$, $p = 0.32$) were identified between the EG and CG prior to the initiation of the investigation.

After receiving information about the procedures to which they would be submitted, the participants signed a consent term, agreeing with the methodological procedures of the study. The procedures adopted in this study met the standards of Helsinki for research with human subjects. The project was approved by the Human Research Ethics Committee.

Experimental procedures

Both groups (EG and CG) followed the same physical, technical, tactical and psychological training during the two week study period. The description of the training can be seen in Table 1. Before the start of the study (48h), the athletes filled in the Disordered Eating in Sports Scale [11], the Profile of Mood States [7] and participated in anthropometric evaluations (body weight and body fat percentage). During the trial period, the athletes were accompanied by nutritionists, physicians and physiotherapists, in an attempt to ensure satisfactory health conditions. No health problem was identified in the athletes analysed during the investigation. The rapid weight reduction strategies adopted by the EG were structured with a view to achieving a weekly loss of approximately 5%. Finally, 48 hours after the end of the intervention, the judokas again filled in the Disordered Eating in Sports Scale, the Profile of Mood States and participated in anthropometric evaluations, as shown in Figure 1.

Measures

The mood state was assessed using the reduced version of the Profile of Mood States (POMS) [7], in its version validated for the Portuguese language [12]. Viana et al. [12] revealed a consistency of 0.77 for the POMS. For the present sample, Cronbach's alpha values of 0.82 and 0.83 were found in the pre and post-test, respectively. The reduced version of the POMS contains 42 simple mood indicators, divided into six subscales: tension (T), depression (D), anger (A), vigour (V), fatigue (F) and confusion (C). Each subscale contains 7 items in a Likert scale (not at all = 0; a little = 1; moderately = 2; quite a bit = 3; extremely = 4) and the score can range from 0 to 28. The T, D, A, F and C subscales are considered negative mood factors and the V subscale considered positive. The sum of the negative factors is calculated, and the score for the positive factor subtracted. The higher the score, the greater the negative mood state.

To evaluate disordered eating behaviours, the Disordered Eating in Sports Scale (DES) was used, developed and validated for Portuguese by Fortes et al. [11]. The questionnaire consists of 21 questions on a five-point Likert scale (0 = never; 1 = almost never; 2 = sometimes; 3 = often; 4 = always) that seek to evaluate the frequency of eating behaviours of risk for the onset of eating disorders. For the present study, only the "Food restriction and weight reduction" subscale was used, which consists of 6 items (e.g. "Practical exercise beyond what is considered necessary burn calories," "Use of warm clothing/plastic clothes during the training, in order to lose weight"). The higher the score, the higher the frequency of behaviours directed towards the rapid reduction of body weight. In the validation study, Fortes et al. [11] indicated an internal consistency of 0.66 for the

Resistance *noun* **1.** the ability of a person not to get a disease **2.** the ability of a bacterium or virus to remain unaffected by a drug **3.**opposition to a force [26].

Resistance training – *noun* training that increases muscle strength by working against resistance such as a weighted dumbbell or barbell [26].

Active recovery – *noun* rehabilitation from an injury in which gentle exercise is taken to maintain flexibility [26].

Muscle strength – essential and basic physical capacity in combat sports by which the body is moving status is modified [30].

Likert scale – is a **psychometric** scale commonly involved in research that employs **questionnaires**. It is the most widely used approach to scaling responses in survey research, such that the term (or more accurately the **Likert-type scale**) is often used interchangeably with a *rating scale*, even though the two are not synonymous [31].

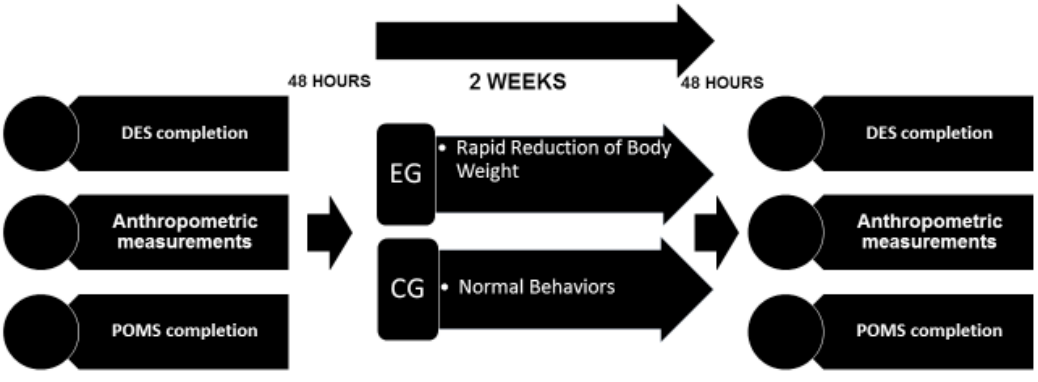

Figure 1. Experimental design of the investigation (**DES** = Disordered Eating in Sports Scale; **POMS** Profile of Mood States; **EG** experimental group; **CG** control group).

Table 1. Characterisation of the 10 judo training sessions.

Session	Warm up	Technique/Tactic	Main part	Regenerative	Mental
1	15 minutes: light running	20 minutes: ippon seoi nage, tai otoshi and kata guruma.	40 minutes: muscle strength (resistance training)	10 minutes: flexibility	20 minutes: cognitive-general method
2	10 minutes: jumps and lateral displacement	15 minutes: *uskui nage and uki otoshi*	80 minutes: aerobic resistance	10 minutes: active recovery	-
3	5 minutes: rolls and jumps	30 minutes: *sumi otoshi, seoi otoshi and yama arashi*	25 minutes: aerobic power	5 minutes: flexibility	30 minutes: cognitive-specific method
4	20 minutes: light running, lateral displacements and rolls	10 minutes: *kouchi gaeshi and uki goshi*	50 minutes: active recovery	20 minutes: decision-making videos	-
5	10 minutes: forward jumps and rolls	30 minutes: *o goshi, koshi guruma and harai goshi*	40 minutes: anaerobic resistance	15 minutes: active recovery	10 minutes: cognitive-specific method
6	25 minutes: Light running and various jumps	20 minutes: *ushiro goshi, de ashi harai and sasae tsurikomi ashi*	25 minutes: aerobic power	20 minutes: decision-making videos	-
7	15 minutes: rolls and jumps	15 minutes: *kosoto gari and kouchi gari*	30 minutes: muscle strength (resistance training)	15 minutes: flexibility	20 minutes: cognitive-specific method
8	5 minutes: light running	40 minutes: *kosoto gake, ashi guruma, harai tsurikomi ashi and o soto guruma*	50 minutes: aerobic resistance	10 minutes: active recovery	-
9	15 minutes: rolls and jumps	25 minutes: sumi gaeshi, ura nage and tawara gaeshi	40 minutes: recuperative	20 minutes: flexibility	20 minutes: cognitive-general method
10	10 minutes: light running	20 minutes: *hane makikomi, yoko wakare and kouchi makikomi*	15 minutes: anaerobic power	30 minutes: decision-making videos	-

ippon seoi nage etc., throw technique in judo.

"Food restriction and weight reduction" subscale. For the present sample, the internal consistency value of 0.71 was found, assessed by Cronbach's alpha.

For the determination of body weight and height, a portable scale (Tanita® BC-601, Sao Paulo, Brazil) and a portable stadiometer (Welmy®, Santa Barbara do Oeste, Brazil) were used, respectively. The body mass index (BMI) was calculated from the following formula: BMI = body weight (kg)/height (m)^2. The body density was determined by the skinfold thickness technique, using a scientific skinfold calliper (Lange©, Washington, USA) on the tricep, pectoral and subscapularis skinfolds, adopting the Jackson and Pollock protocol [13]. For the skinfold measurements, the standards of the *International Society for the Advancement of Kinanthropometry* [14] were used. The percentage of body fat (%BF) was determined using the Siri equation [15].

Statistical analysis

Levene's test was used to test the homoscedasticity, while the sphericity of the data was checked using Mauchly's test. When this last premise was not confirmed the Greenhouse-Geisser correction was adopted. Because of nonparametric violation, measures of central tendency (mean) and dispersion (standard deviation and standard error) were used to describe the variables of the investigation. Two-way analysis of variance (two-way ANOVA) with repeated measures was used for the pre- and post-experiment comparisons between the groups. The calculation of Cohen's effect size was adopted for the analysis of the magnitude of the differences. To analyze the effect size (ES), the classification proposed by Rhea [16] was adopted: d<0.2 = trivial effect size, d<0.4 = small, d≤0.4 and >0.8 = moderate, and d≥0.8 = large effect size. All data were analysed using the SPSS 21.0 software, adopting a 5% significance level.

Table 2. Descriptive values (mean/standard deviation) of the study variables.

Variables	EG (n = 20)	CG (n = 19)
POMS	66.27 ±9.41	63.83 ±8.39
FRWR Subscale	15.62 ±2.07	15.21 ±1.96
Body weight (kg)	72.33 ±6.93	73.79 ±6.46
Fat percentage	17.58 ±5.04	18.25 ±5.87
Age (years)	22.38 ±1.84	22.01 ±1.72
Training regimen (hours)	10.07 ±0.57	10.19 ±0.68

POMS Profile of Mood States**; FRWR** food restriction and weight reduction.

RESULTS

No statistically significant difference was found in the comparisons between the groups (EG and CG) at baseline, for the age (p = 0.20), relative body fat (p = 0.29), frequency of rapid weight reduction eating behaviors (p = 0.23) and mood state (p = 0.32) variables (Table 2).

A group vs. time (p<0.01) interaction effect was identified for body weight, with reduction only in the EG (p<0.01; ES = 0.9). For the T subscale, the findings only revealed effects for time (p<0.01), with increased scores for both the EG (p = 0.01; ES = 0.6) and CG (p = 0.01; ES = 0.6). A significant group vs time (p <0.01) interaction was revealed for the D subscale, with higher scores being only found in the EG (p = 0.01; ES = 0.5). A results indicated a significant group vs. time (p<0.01) interaction for the A subscale, with increased scores only in the EG (p = 0.01; ES = 0.5) (Table 3).

Concerning the C subscale, the results did not indicate a group vs time (p>0.05) interaction. The results showed a significant group vs time (p<0.01) interaction for the V subscale, with the scores, increased in the CG (p<0.01; ES = 0.8) and reduced in the EG (p<0.01; ES = 0.9). Considering the Food restriction and weight reduction subscale, the results showed a group vs time interaction (p<0.01), with an increased score, only verified for the EG (p = 0.01; ES = 0.7) (Table 3).

DISCUSSION

This study aimed to analyse the response of the mood after two weeks of rapid weight reduction in judokas. The results showed that the judokas that adopted methods for rapid weight reduction (EG) increased the magnitude of negative mood and reduced positive mood, whereas the CG reduced negative mood and increased positive mood, confirming the hypothesis of the present investigation.

While rapid weight reduction just prior to a competition appears to be common in judo [1, 4, 5], it is worth noting the scarcity of scientific investigations concerning the psychological adaptations. Researchers highlight that rapid weight reduction, characterised by unhealthy methods (use of laxative/diuretic/appetite suppressant, use of plastic clothes in physical training sessions, etc.), can lead to reduced self-efficacy/self-confidence and motivation, increased stress and worsening of the mood state in athletes [17]. However, it seems that the reduction of negative mood (anger, depression and tension) and increase in the perception of vigour are closely related to optimisation of the performance of athletes in competitions [8, 9].

The results of this study showed increased tension after the two weeks of investigation (post-intervention) in both groups, refuting the initially made hypothesis. However, this finding can be explained by the proximity of the target competitive event (Brazilian judo championship). According to Le Meur et al. [9], it is common for athletes to experience high levels of anxiety just prior to a competition. It should be noted that the T subscale of the POMS covers symptoms similar to those of anxiety. Therefore, the increased tension after the 2 weeks of intervention may indicate an increase in the pre-competition anxiety of the judokas.

Regarding the other negative mood subscales (D, A and F), except the C subscale, the findings were similar. Depression anger and fatigue increased in the EG and remained stable in the CG. This result can be explained due to of the

Table 3. The mean and standard error of body weight, the scores of the POMS subscales and score of "Food restriction and weight reduction" subscale according to the stage of the investigation (pre- and post-test).

Variable	EG (n = 20)		CG (n = 19)	
	Pre-test	Post-test	Pre-test	Post-test
Body weight (kg)	**72.5 ±3.6***	**64.8 ±4.0#**	73.1 ±3.9	72.6 ±4.2
Tension	**10.8 ±0.8***	**12.9 ±0.9#**	**10.5 ±1.0***	12.3 ±0.9
Depression	**10.2 ±0.9***	**12.6 ±1.1#**	10.3 ±1.0	10.6 ±1.2
Anger	**9.9 ±0.7***	**13.4 ±0.8#**	10.0 ±0.8	9.6 ±0.9
Fatigue	**8.6 ±0.8***	**15.6 ±0.7#**	8.3 ±0.9	8.7 ±1.0
Confusion	9.4 ±1.1	9.7 ±0.9	9.7 ±0.9	9.5 ±0.7
Vigor	**19.3 ±0.9***	**14.3 ±1.0#**	**19.8 ±0.7***	22.2 ±0.8
FRWR Subscale	**12.7 ±0.9***	**19.5 ±1.0#**	12.6 ±0.8	12.5 ±0.9

FRWR food restriction and weight reduction; *p<0.05 in relation to the post-test; #p<0.05 in relation to the CG in the post-test.

rapid weight reduction that occurred in the EG. According to Rouveuix et al. [10], the mood of the athlete can negatively change after situations that require high bodily stress, more specifically, after a period of rapid morphological change. Furthermore, according to Spriet [18], rapid body weight reduction can generate the feeling of drowsiness, tiredness and muscle fatigue, which, in turn, could explain the increase in a negative mood (D, A and F) in the EG. Above all, the large effect size for F when the groups were compared post-test stands out, indicating a high probability that this effect is true for the population of male judokas. Sports training scholars emphasise that increased weight reduction just prior to competitions can generate attenuation of the muscle glycogen stores [18] and plasma concentration of serotonin [19], which may explain, in a certain way, the increased sense of F, D and A in the EG after the two weeks of investigation.

The results for the C subscale indicated no change in its magnitude for either group. Hernandez et al. [20] found no alteration in confusion due to exercise or morphological change. Therefore, it seems that rapid weight loss does not affect feelings of insecurity, indecision and disorientation in athletes. Pinheiro et al. [21] pointed out that the levels of confusion are only affected when athletes also show clinical symptoms of overtraining.

In contrast, the V subscale showed changes after the two weeks of the study. In the EG vigour decreased, whereas in the CG vigour increased. It should be noted that a difference in V was found between the EG and CG (large effect size). Researchers have stated that rapid weight reduction can generate feelings of loss of energy and motivation in athletes [8, 10], which may explain this finding. Considering that studies indicate a close positive relationship between subjective perceptions of energy/motivation and sports performance [9, 10], it can be assumed that judokas who adopt rapid weight reduction may reduce their competitive performance. According to Fortes et al. [22], vigour is the most important mood aspect for athletes that succeed in their sports careers.

Therefore, it seems that the rapid weight reduction, as performed by the EG in this study, cannot be recommended for the improvement of vigour. Regarding the "Food restriction and weight reduction" subscale, the findings showed higher scores in the EG and maintenance in the CG after the two-weeks of intervention. This result indicates that the judokas of the EG increased the frequency of the use of behaviours related to rapid weight reduction, while those of the CG maintained this. Furthermore, it should be noted that the body weight of the EG was reduced compared to that of the CG after two weeks of the adoption of rapid weight reduction methods, revealing a large size of the effect. Studies have shown that the adoption of the rapid weight reduction methods can cause health problems, namely: cardiac arrhythmia, reduced bone mineral density and attenuation of muscle [5, 23], which can be considered worrying. Although this study presents novel and important findings, it also presents limitations that should be mentioned. Questionnaires were used as the

evaluation instruments. Therefore, the answers may not reflect the reality of the context evaluated. Despite this limitation, it is assumed that this study reveals interesting results that deserve to be discussed in the scientific literature of the sports sciences field. Few studies have been developed that investigate the effects of rapid weight reduction in sports regarding variables that are related directly or indirectly to the performance. More specifically, although rapid weight reduction is culturally adopted by judo athletes, very few studies have been conducted to evaluate its effects on psychological variables [17, 24, 25].

CONCLUSIONS

In summary, the results of this study showed that rapid weight reduction worsened the mood state of judokas, especially highlighting a reduction in vigour and increase in anger, fatigue and depression. However, these findings should be analysed with caution due to the responses being subjective. From a practical point of view, considering that the reduction in vigour and the increased feeling of fatigue are not found in athletes who have achieved success in competitions [8, 10], it can be assumed that rapid weight loss is not recommended for potentializing the mental capacity and, thus, maximising athletic performance. Finally, further investigations are suggested to confirm these results. In addition, it is recommended that studies be conducted with female athletes.

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REFERENCES

1. Franchini E, Vecchio FB, Julio UF et al. Specificity of performance adaptations to a periodized judo training program. Rev Andaluza Med Deporte 2015; 8(1): 67-72
2. Artioli GG, Franchini E, Nicastro H et al. The need of a weight management control program in judo: a proposal based on the successful case of wrestling. J Int Society Sport Nutr 2010; 15(1): 1-5
3. Bratland-Sanda S, Sundgot-Borgen J. Eating disorders in athletes: Overview of prevalence risk factors and recommendations for prevention and treatment. Eur J Sport Sci 2012; 1(1): 1-10
4. Filaire E, Rouveix M, Pannafieux C et al. Eating attitudes, perfectionism and body-esteem of elite male judoists and cyclists. J Sports Sci Med 2007; 6(1): 50-57
5. Brito CS, Roas AFM, Brito ISS et al. Methods of body-mass reduction by combat sport athletes. Int J Sport Nutr Exercise Metab 2012; 22(1): 89-97
6. Fortes LS, Oliveira SFM, Mendonça LCV et al. Can disordered eating behaviors attenuate agility and countermovement jump in combat sports athletes? Rev Bras Educ Fis Esporte 2016
7. Mcnair DM, Lorr M, Droppleman LF. Manual for the profile of mood states. San Diego, CA: Educational and Industrial Testing Services; 1971
8. Mujika I, Chaouachi A, Chamari K. Precompetition taper and nutritional strategies: special reference to training during Ramadan intermittent fast. Br J Sports Med 2010; 44(4): 495-501
9. Le Meur Y, Hausswirth C, Mujika I. Tapering for competition: a review. Sci Sports 2012; 27(2): 77-87
10. Rouveix M, Bouget M, Pannafieux C et al. Eating attitudes, body esteem, perfectionism and anxiety of judo athletes and nonathletes. Int J Sports Med. 2007; 28(2): 340-345
11. Fortes LS, Almeida SS, Ferreira MEC. Psychometric analysis of Disordered Eating in Sports Scale (DES). Paidéia 2016; 26(2): 171-180
12. Viana MF, Almeida PL, Santos RC. Adaptação portuguesa da versão reduzida do Perfil de Estados de Humor – POMS. Análise Psicol 2001; 1(1): 77-92 [in Portuguese]
13. Jackson AS, Pollock ML. Generalized equations for predicting body density of men. Br J Nutr. 1978;40:497-504
14. The International Society for Advancement for Kineanthropometry. Australia: National Library of Australia [cited 2016 Jul 13]. Available from: http://www.isakonline.com
15. Siri WE. The gross composition of the body. In: Tobias CA, Lawrence JH, editors. Advances in biological and medical physics. New York: Academic Press, 1956: 239-280
16. Rhea MR. Determining the magnitude of treatment effects in strength training research through the use of the effect size. J Strength Cond Res 2004; 18(6): 918-920
17. Durguerian A, Bougard C, Drogou C et al. Weight loss, performance and psychological related states in high-level weightlifters. Int J Sports Med 2015; 37(2): 230-238
18. Spriet LL New insights into the interaction of carbohydrate and fat metabolism during exercise. Sports Med 2014; 44(1): 87-96
19. Pyne DB, Mujika I, Reilly T. Peaking for optimal performance: Research limitations and future directions. J Sports Sci. 2009; 27(3): 195-202
20. Hernández R, Torres-Luque G, Olmedilla A. Relations among training volume, body weight, and profile of mood states for elite judoka during a competitive period. Percept Motor Skill 2009; 3(6): 870-880
21. Pinheiro FA, Santos TM, Ugrinovitsch C et al. Effects of light deprivation in physical performance and psychophysiological responses to a time-to-exhaustion exercise test. Physiol Behav 2015; 151: 535-540
22. Fortes LS, Ferreira, MEC, Oliveira SFM et al. Effect of a period of tapering on mood in swimmers. Rev Bras Educ Fis Esporte 2016
23. El Ghoch M, Soave F, Cafugi S et al. Eating disorders, physical fitness and sport performance: A systematic review. Nutrients 2013; 5: 5140-5160
24. Garthe I, Raastad T, Refsnes PE et al. Effect of two different weight-loss rates on body composition and strength and power-related performance in elite athletes. Int J Sport Nutr Exercise Metabol 2011; 1(1): 97-104
25. Janiszewska K, Przybyłowicz KE. Precompetition weight loss among Polish taekwondo competitors – occurrence, methods and health consequences. Arch Budo 2015; 11(1): 41-45

26. Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black, 2006

27. Budō: The Martial Ways of Japan. Tokyo: Nippon Budokan Foundation; 2009

28. Weinberg RS, Gould D. Foundations of Sport and Exercise Psychology. Champaign, IL: Human Kinetics; 2010

29. Martens R. Successful Coaching. 3rd ed. London: Human Kinetics; 2004

30. Calvo Rico B, García García JM, Monteiro LF et al. Kinematic indicators in combat sports athletes in a pre-competitive dehydrated status. Arch Budo Sci Martial Art Extreme Sport 2015; 11: 181-188

31. Likert R. A technique for the measurement of attitudes. Arch Psychol 1932; 22(140): 55

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