95 - DEHYDRATION AND HIDRO REPOSITION DURING JUDO TRAINING

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INTRODUCTION

To training in the best conditions of your physical capacity, the athlete should begin the exercise in state of normal hydration and with great levels of muscular and hepatic glycogen (MARINS, 2000). An appropriated nutritional strategy contributes positively to the athlete's performance. On the other hand, an incorrect strategy for replacement of liquids can affect it negatively (ACSM, 1996).

According to MARINS et al. (2000), the dehydration is intimately linked to the loss of the quality in the physical activity, as long as the athlete do exercises it occurs a decrease of the plasmatic volume, increasing of submaximal heart rate, reduction of cardiac output and blood flow, smaller cutaneous irrigation and perspiration production, smaller muscular irrigation and increase the lactate concentration, reduction in total time of exercise and larger incidence of cramps.

The real need of hydro replacement during the judo training is not very clear yet, as an example the studies of BRITO and MARINS (2002) and BRITO (2005) - works which measured the need of hydro replacement during a judo training. However three factors that contribute to increase or to reduce the need of hydro-energetic replacement of judokas: 1) daily heavy workload; 2) the equipment (*judogui*) that makes difficult the heat loss to enviroment; 3) the environments where the trainings are accomplished (BRITO and MARINS, 2005).

Differently of other sports, in judo, the practice of the training differs of the competition. The training during between 90 and 120 minutes, while a combat in competition can over in 10 minutes, or only 10 or 15 seconds; that factor diversifies the needs of fluid replacement of athletes' during competitions and trainings. Besides presenting a long duration, the training exposes the judoka to other own factors of the modality that increase the thermal stress, as the use of *kimonos* and the dynamics of training (BRITO and MARINS, 2005).

The monitorament of weight before and after the trainings is beneficial for two reasons: a) for the adjustment of body weight along a training period, avoiding the rapid weight loss; and b) an aid in establishment of strategies of fluid replacement during the training.

In this way, the aims of this study were: identify the dehydration provoked by judo training with duration of 60 minutes and if the consumption of liquids *ad libitum* is enough to avoid the dehydration.

METHODOLOGY

Sample: this study was appraised judokas of Academic Athletic Association of Federal University of Viçosa (AAA-UFV). They were random selected of a population of 60 judokas, 15 volunteers with a medium age of 22.07 ± 2.05 years old and percentage of fat 13.17 ± 3.05% for the equation of THORLAND et al. (1991) for wrestlers. To participate of this study all athletes should be training and competing regularly in the last year and in the current year. All were informed of objectives of study and in case of them didn't agree, they could leave the study.

Experimental Protocol: Six trainings were accomplished, along two weeks, with duration of 60 minutes each, accomplished in the same period of the day (beginning 11hs and 40 min and I finish to 12hs 40 min). The experiment was divided in two parts, being 3 trainings in the first and 3 in the second week. The trainings presented the following structure:

· 10 minutes of preparation;
· 20 minutes of technique;
· 15 minutes of stand combat (*Randori Tachi-waza*) e
· 15 minutes of ground combat (*Randori Ne-waza*)

The first part was accomplished on Monday, Wednesday and Friday of first week of experiment. During these trainings the athletes were not hydrated, they were weighty only before and after the trainings. In the second week, it was repeated the procedures of first week, however, it was available liquids for the athlete's hydration *ad libitum*.

Procedures: during the first week the athletes were weighty immediately before and after the training conclusion with the minimum clothes possible following the recommendations of MARINS and GIANNICHI (2003). In the second week the weighing procedures were the same of the first week, however, it was available glasses of 200 mL of water, 200 mL and 300 mL of Gatorade®, the amount of water and carbohydrate drink consumed was noted. Any intervention was not accomplished in relation to the hydration procedures, so that the volunteers adopted the procedures that habitually accomplish.

The athletes' results were contained to obtain the weekly average. This way it was used for analysis the average of initial and final weight in first week, the average of initial and final weight of second week, besides the average of consumption of liquids in the second week.

The absolute dehydration was established by the difference among the initial and final weight. The percentage of dehydration was established by the following equation:

$$\%dehydration = \frac{(inicialweight - finalweight)x100}{inicialweight}$$

For the second week of training the partial dehydration was established by difference between initial and final weight. The total dehydration was established by difference between initial and final weight added the consumption of liquids during the training. The percentage of total dehydration was established for the following equation:

$$\%dehydration = \frac{[(inicialweight - finalweight) + liquidconsumption]x100}{inicialweight}$$

It was also registered the temperature and the relative humidity of air to the begin final of each training, adopting for analysis the initial and final average of the temperature and relative humidity of the air in the first and in the second week.

Statistical analysis: Initially it realized the test of Kolmogorov-Smirnov to verify the normality of sample. Following the Student's test t to verify significant differences among the body mass before and after the trainings. The level of significance adopted was 5%. The tests were performed in software SPSS version 14.0.

RESULTS and DISCUSSION

The table 1 presents the average of the temperature and the initial and final relative humidity of air in the first and in the second week of the experiment.

Table 1 - Average of the temperature and relative humidity of the air.

Training	Variables	Initial	Final
Average of 1st week	Temperature º C	29.3 ± 1.1	32.2 ± 2.3
	Humidity %	75.2 ± 3.5	69.5 ± 3.2
Average of 2nd week	Temperature º C	30.2 ± 2.4	34.8 ± 4.3

According the results presented in Table 1, the temperature rose among the beginning and the end of all training sessions, and the relative humidity of air reduced among the sessions. In agreement with the ACSM (1996), the temperature and relative humidity of air recorded in the beginning and final of sessions exposed the volunteers from moderate to high risk of thermal exhaustion and intermation. This daytime was adopted for accomplishment of experiment, because this is the habitual daytime of training of subjects, this way they would be acclimatized and adapted to accomplish physical effort in these environmental conditions, like this the found results would be suitable with the reality of the appraised population.

The results for analysis of normality test are presented in the Table 2.

Table 2 - Normality Indicators for the variables in the appraised sample.

	1st week		2nd week	
	Initial weight	Final weight	Initial weight	Final weight
Normality	0.936	0.934	0.743	0.833

The Kolmogorov-Smirnov's test is recommended to verify normality in small samples (WITTE and WITTE, 2005). According Table 2 the whole sample presented an acceptable normality. This way, the difference among averages could be accomplished by a parametric test.

The Table 3 summarizes the results of first and second week of training.

Table 3 - Average of dehydration and liquids consumption of first and second week of training.

	1st week	2nd week
Initial weight (Kg)	78.38 ± 8.67	78.23 ± 8.63
Final weight(Kg)	76.91 ± 8.46[a]	77.19 ± 8.65
Absolute dehydration (Kg)	1.48 ± 0.35	1.04 ± 0.41
Consumption of liquids (L)	---	0.65 ± 0.28
Total dehydration (Kg)	---	1.68 ± 0.38
% partial dehydration	---	1.34 ± 0.59
% total dehydration	1.88 ± 0.36	2.16 ± 0.5

a = difference statistically significant among the initial and final weight ($p < 0.05$).

In agreement with Table 3 a judo training with 60 minutes of duration with the characteristics adopted in this study, reduces significantly the body weight of judokas. In opposition, the consumption of liquids *ad libitum* avoid dehydration reducing the stress imposed to athletes, however, not being enough to maintain the normal hydration state.

The medium percentage of dehydration in 1st week of training was close to 2%. On the other hand, in second week, the medium percentage of dehydration didn't surpass 1.5%. According MARINS et al. (2000), when the athlete surpasses 1% of dehydration he loses 6% of its physical work capacity, close to 2% of dehydration occurs a reduction in 10% of $VO_{2máx}$, between 10 and 20% of reduction in time of race and alterations in the mental function.

Alterations in the mental function can affect the judokas performance, once the capacity of concentration is decisive in sports where the combat can be defined by a perfect point (BRITO and MARINS, 2005). In boxers, HALL and LANE (2001) observed a direct correlation between weight loss and adverse psychological effects, as elevation in the aggressiveness levels and tension. LANDERS et al. (2001) observed worse results in cognitive tests when the fighters reduced the body weight. With base in the studies previously presented it is possible to relate that, at the end of a session of judo training of 60 minutes it happens a reduction in quality of training, and as one of influenced factors the hydric loss.

During the second week of training the hydration reduced the dehydration to inferior values to 1.5% (Table 3), what could reduce deleterious effects of dehydration in capacity of concentration of the judokas. CIAN et al. (2001) they observed that the fluid replacement improves the athletes' mental capacity. Considering that the judo is a modality extremely technique, the mental function is fundamental for a quality training and results in competition.

The rate of perspiration observed was near 1,5L/h. The values of study were superior to other sports, where the perspiration rate rotates around 1L/h (MARINS et al., 2000; KAY et al., 2004). Possibly the largest perspiration observed is succeed from the obligatory equipment to modality (*judogui*), a adult braided *kimono* (official for competitions) weighs 3kg and they are made in cotton; material that increases the perception of effort and the body temperature, what turns judoka submitted to a thermal stress superior to of other modalities (BRITO and MARINS, 2005). All the appraised athletes in this study used braided kimono.

The dehydration observed during the second week of experiment was inferior to observed in the first week, however, the total dehydration was superior, in absence of liquids the athletes during the second week of experiment; the percentage of medium dehydration would surpass 2%. Possibly the elevation of the temperature and relative humidity of the air registered during these trainings might have influenced to increase the perspiration rate and, it consequently result in dehydration.

The hydration *ad libitum* was not enough to maintain the hydro homeostasis of judokas. ACSM (1996) recommends that liquids are restored as they are lost, because the athlete avoids this form the apparition of adverse symptoms to performance as an example: the elevation of body temperature, reduction of $VO_{2máx}$ and anticipation of fatigue. MARINS et al. (2000) describes 21 physiologic acute effects deriving from the dehydration. An increase in the offer of liquids can avoid the emergence of dehydration during training sessions. This could be reached with the adoption of regular intervals for hydro replacement.

The indicators of physiologic compromising associates to dehydration seem well described. In this sense, BRITO et al. (2005) observed that the dehydration close to 2% affects the expression of the force in judokas. MONTAIN et al. (1998) observed that the dehydration affects the capacity of muscular metabolism, affecting the resistance of force. In a surprising way, the study of SMITH et al. (2001) with boxers was surprising. The authors provoked a situation of hydric restriction of up to 1 liter and caloric restriction in up to 1.000 kcal a day, during five days in eight athletes, provoking, at end of period, loss of 3% of body weight. The results showed that there was a not difference in the heart rate and potency of the punch, indicating that hydric and caloric restriction, when controlled, cannot bring damages to the athletes. In a triathlon competition the best results were

observed in athletes that complete the track dehydrated in relation to normohydrated and the hiperhydrated (SHARWOOD et al., 2002).

The strategy of hydro replacement adopted, 73.3% of athletes used a combination between carbohydrate drink and water. The others ingested only water. The consumption of carbohydrate drink presents advantages in comparison of water (FRITZCHE et al., 2000; MARINS, 2000; NIEUWENHOVEN et al., 2000; SAWKA and MONTAIN, 2000). However, in modalities with up to 60 minutes of duration it seems there not to be any differences between the consumption of water or carbohydrate drink (ACSM, 1996; MARINS et al., 2000).

The consumption of carbohydrate drinks besides supplying energy and increases the voluntary ingestion due to palatability of drink (MARINS et al., 2001). On the other hand, second reporters of the own judokas, in spite of supplying energy, the consumption of carbohydrate beverage leaves residual taste, needing like this, to consume water soon after to remove the excess of sodium drink that stays in the mouth.

CONCLUSIONS

A judo training with similar characteristics results in dehydration close to 1,5 liters per hour, rate of hydric loss superior to other sports. The hydro replacement *ad libitum* was not enough to maintain the athletes' hydro homeostasis.

REFERENCES

ACSM. American College Sports Medicine Position Stand - Heat and cold illnesses during distance running. Med. Sci. Sports Exerc. 28(10):139-148, 1996.

BRITO CJ. Hidratação com e sem carboidratos durante o treinamento de judô. Dissertação de Mestrado. Programa de Pós-graduação em Ciência da Nutrição. Universidade Federal de Viçosa, 2005.

BRITO CJ, MARINS JCB. Mensuração de reposição hídrica durante o treinamento de Judô. Anais do XVII Congresso Brasileiro de Nutrição, p. 81. Porto Alegre, 2002.

BRITO CJ, MARINS JCB. Caracterização das praticas de hidratação em atletas da modalidade de judô no estado de Minas Gerais. R. Bras, Ci. Mov. 13(2):59-74, 2005.

BRITO CJ, GATTI K, NATALI AJ, COSTA NMB, SILVA CHO, MARINS JCB. Estudo sobre a influência de diferentes tipos de hidratação na força e potência de judocas. Fitness & Performance. 4(5):274-9, 2005.

CIAN C, BARRAUND PA, MELIN B, RAPHEL C. Effects of fluid ingestion on cognitive function after heat stress or exercise-induced dehydration. Int. J. PsychoPhysiol. 42:343-51, 2001.

FRITZSCHE RG, SWITZER TW, HODGKINSON BJ, LEE S, MARTIN JC, COYLE EF. Water and carbohydrate ingestion during prolonged exercise increase maximal neuromuscular power. J. Appl. Physiol. 88:730-7, 2000.

HALL CJ, LANE AM. Effects of rapid weight loss on mood and performance among amateur boxers. Br. J. Sports Med. 35:390-5, 2001.

LANDERS DM, ARENT SM, LUTZ RS. Affect and cognitive performance in high school wrestlers undergoing rapid weight loss. J. Sports Exer. Psychol. 23:307-16, 2001.

KAY B, O'BRIEN BJ, GILL ND. Exercise-induced hypervolemia may not be consequential to dehydration during exercise. J. Sports Sci. Med. 3(YISI 1):50-5; 2004.

MARINS JCB. Estudio comparativo de diferentes procedimientos de hidratación durante un ejercicio de larga duración. Tesis Doctoral.: Departamento de Fisiología y Farmacología. Universidad de Murcia; 2000.

MARINS JCB, DANTAS EH, ZAMORA NAVARRO S. Deshidratación y ejercicio físico. Selección 9(3):33-47, 2000.

MARINS JCB, GIANNICHI RS. Avaliação e prescrição de atividade física: guia prático 3ª ed. Editora Shape; 2003.

MOUNTAIN SJ, SMITH AS, MATTOT RP, ZIENTARA GP, JOLESZ FA, SAWKA MN. Hypohydration effects on skeletal muscle performance and metabolism: a ^{31}P-MRS study. J. Appl. Physiol 84(6):1889-94, 1998.

NIEUWENHOVEN MA, BRUMMER RJM, BROUNS F. Gastrointestinal function during exercise: comparison of water, sports drink and sports drink with caffeine. J. Appl. Physiol. 89:1079-085, 2000.

SAWKA MN, MOUNTAIN SJ. Fluid electrolyte supplementation for exercise heat stress. Am. J. Clin. Nutr. 72:564-572, 2000.

SHARWOOD K, COLLINS M, GOEDECKE J., WILSON G, NOAKES T. Weight changes, sodium levels, and performance in the South African Ironman Triathlon. Clin. J. Sports Med. 12:391-9, 2002.

SMITH M, DYSON R, HALE T, HAMILTON M, KELLY J, WELLINGTON P. The effects of restricted energy and fluid intake on simulated amateur boxing performance. Int. J. Sport Nutr. Exerc. 11:238-47, 2001.

THORLAND WG, TIPTON CM, LOHMAN TG, BOWERS RW, HOUSH TJ, JOHNSON GO, KELLY JM, OPPLIGER RA, TCHENG T-K. Midwest wrestling study: prediction of minimal weight for high school wrestlers. Med. Sci. Sports Exerc. 23(9):1102-10, 1991.

WITTE RS, WITTE JS. Estatística. 7ª ed. Editora LTC, 2005.

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DEHYDRATION AND HIDRO REPOSITION DURING JUDO TRAINING

ABSTRACT

The fluid replacement during the sporting practice is fundamental for a good performance. The aims of this study were: identify the dehydration induced by the judo training with duration of 60 minutes and if the consumption of liquids *ad libitum* is enough to avoid this dehydration. Participated of this study 15 male judokas (medium age 22.07 ± 2.05 years and body weight 78.35 ± 8.89kg). The athletes were appraised in six trainings accomplished in alternate days. In the first 3 trainings the judokas were not hydrated. And, in the other trainings they were supplied with water and carbohydrate solution to hydrate *ad libitum*. According the results, a session of judo training with 60 minutes of duration imposes the athlete's loss of weight close to 2% (approximately 1.5kg for the sample). The athletes, even with reposition themselves finished the trainings with superior dehydration to 1%. It is concluded that a training of judo of 1 hour of duration, imposes a hydric loss of 2% of body weight and that the hydration model adopted (*ad libitum*) was not enough to maintain the homeostasis of the judokas, it is recommended to adopt regular intervals of hydration.

Key-words: hydration, judo, body weight

LA DÉSHYDRATATION ET L'APPORT HYDRIQUE AU COURS DE L´ENTRAÎNEMENT DE JUDO
RÉSUMÉ

L´apport hydrique pendant l´activité sportive est fondamentale à réussir une bonne performance. Les buts de cette étude sont : identifier la déshydratation pendant une séance d´entraînement de judo (durée de soixante minutes) et tester se l´apport hydrique *ad libitum* est suffisant pour éviter la déshydratation. L´échantillon a été composé de 15 judokas avec l´âge moyenne de 22,07 ans (écart-type ± 2,05 ans) et le poids corporel a présenté une moyenne de 78,35 kg (écart-type ± 8,89 ans). On a récolté de données au cours de six séances d´entraînement réalisées en jours alternés. Aux trois premières séances d´entraînement les judokas ne se sont pas hydratés. Aux trois séances suivantes a été fourni *ad libitum* aux judokas de l´eau et une soluté de réhydratation composée de carbohydrate. D´après ces résultats, la séance d´entraînement de judo de soixante minutes de durée a provoqué aux athlètes la perte de poids de 2% environ (1,5 kg en moyenne pour cet échantillon). Les judokas qui se sont hydratés ont perdu un peu plus de 1% du poids corporel. On peut conlure qu´une séance d´entraînement de judo (durée de soixante minutes) provoque une perte hydrique de 2% du poids corporel et l´apport hydrique (*ad libitum)* n´a pas été suffisant au maintien de l´homéostasie des judokas. On recomande d´adopter d´intervalles réguliers de réhydratation.

Mots clés: hydratation, judo, poids corporel

DESHIDRATACIÓN Y REPOSICIÓN HÍDRICA DURANTE EL ENTRENAMIENTO DE JUDO
RESUMEN

La reposición de líquidos durante la práctica deportiva es fundamental para el desempeño. Los objetivos de esto estudio fueron: identificar la deshidratación provocada por lo entrenamientos de judo con duración de 60 minutos y se el consumo de líquidos *ad libitum es* suficiente para evitar la deshidratación. Participaron de esto estudio 15 yudocas masculinos (edad media 22,07 ± 2,05 años y masa corporal 78,35 ± 8,89kg). Lo atletas fueron evaluados en seis entrenamientos realizados en días alternados. En los 3 primeros entrenamientos los yudocas no se hidrataron, en los demás entrenamientos los atletas fue ofertado a los atletas agua y solución carbohidratada para hidratación *ad libitum*. En acuerdo con los resultados, una sesión de entrenamientos de judo con 60 minutos de duración resulta en perdida de masa próxima a 2% (aproximadamente 1,5kg para la muestra). Los atletas, mismo hidratando terminaron los entrenamientos con deshidratación superior a 1%. En conclusión un entrenamientos de judo con 1 hora de duración, resulta en perdida hídrica de 2% del peso corporal y el modelo de hidratación adoptado (*ad libitum)* no fue suficiente para mantener la homeostasia dos yudocas, recomendase adoptar intervalos regulares de hidratación.

Palabras-clave: hidratación, judo, masa corporal

DESIDRATAÇÃO E REPOSIÇÃO HÍDRICA DURANTE O TREINAMENTO DE JUDÔ
RESUMO

A reposição de líquidos durante a prática esportiva é fundamental para o bom desempenho. Os objetivos deste estudo foram: identificar a desidratação provocada pelo treino de judô com duração de 60 minutos e se o consumo de líquidos *ad libitum* é suficiente para evitar esta desidratação. Participaram deste estudo 15 judocas masculinos (idade média 22,07 ± 2,05 anos e peso corporal 78,35 ± 8,89kg). Os atletas foram avaliados em seis treinos realizados em dias alternados. Nos 3 primeiros treinos os judocas não se hidrataram, nos demais treinos os atletas foi fornecido aos atletas água e solução carboidratada para se hidratarem *ad libitum*. De acordo com os resultados, uma sessão de treino de judô com 60 minutos de duração impõe aos atletas perda de peso próxima a 2% (aproximadamente 1,5kg para a amostra). Os atletas, mesmo se hidratando terminaram os treinamentos com desidratação superior a 1%. Conclui-se um treino de judô de 1 hora de duração, impõe uma perda hídrica de 2% do peso corporal e que o modelo de hidratação adotado (*ad libitum)* não foi suficiente para manter a homeostasia dos judocas, recomenda-se adotar intervalos regulares de hidratação.

Palavras-chave: hidratação, judô, peso corporal.