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Effects and symptoms of dehydration in Brazilian jiu-jitsu athletes

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Abstract

Objective. To measure rapid weight loss and urinary indicators of hydration status, as well as to assess the effects and symptoms of dehydration in Brazilian jiu-jitsu (BJJ) athletes at different moments. *Methods*. 17 male BJJ athletes (aged: 24.4 ± 3.5 years; body mass (BM): 76.8 ± 14.6 kg; body fat: 16.6 ± 6.4%), were evaluated between 8 and 9 am at three different moments: Baseline (10 days pre- competition), measurement of BM and stature, collection of urine samples, and food record of the previous 24 hours; pre-competition, measurement of BM, urine samples, and questionnaire to assess rapid weight loss (RWL), and post-competition (24h after), day after competition, with measurement of BM, and urine samples for analysis of specific gravity. *Results.* There was a tendency to decrease BM to compete (baseline: 76.8 ± 14.6 kg, pre-competition: 75.4 ± 13.4 kg, post-competition: 77.3 ± 13.7 kg; $p < 0.07$), with 88.2% of athletes using methods that increase dehydration. The majority of athletes were dehydrated at the three time points of the study (94.1%; USG = 1.021 ± 0.005 Usg at baseline, 88.2%; 1.020 ± 0.007 Usg at pre-competition, 88.2%; 1.022 ± 0.008 Usg on the post-competition day), accompanied by symptoms associated with RWL (82.4% increased heart rate, 52.9% headache, 47.1% hot flashes, 41.2% nausea, 41.2% disorientation, and 29.4% dizziness). *Conclusions.* Rapid pre-competitive weight loss and symptoms associated with dehydration were observed in the BJJ athletes. It is recommended that educational measures are promoted to inhibit RWL among BJJ athletes, requiring the engagement of health professionals and organizations that govern the sport (federations and confederations).

Keywords: Martial arts; combat sports; BJJ; dehydration; weight loss; sport competition.

Efectos y síntomas de deshidratación en atletas de jiu-jitsu brasileño

Resumen

Objetivo. Medir la pérdida rápida de peso y los indicadores urinarios relativos al estado de hidratación, así como evaluar los efectos y síntomas de deshidratación en atletas de jiu-jitsu brasileño (BJJ) en diferentes momentos. *Métodos.* 17 atletas masculinos de BJJ (edad: 24,4 ± 3,5 años; masa corporal (BM): 76,8 ± 14,6 kg; grasa corporal: 16,6 ± 6,4 %), fueron evaluados entre las 8 y las 9 am en tres momentos diferentes: estado basal (10 días precompetición), medición de la BM y estatura, recolección de muestras de orina y registro de alimentación de las últimas 24 horas; precompetición, medición de BM, muestras de orina y cuestionario de evaluación de pérdida rápida de peso (RWL), y postcompetición (24 h después), día posterior a la competición, con medición de la BM y muestras de orina para análisis de gravedad específica.

Efeitos e sintomas de desidratação em atletas de jiu-jitsu brasileiro

Resumo

Objetivo. Medir a rápida perda de peso e indicadores urinários do estado de hidratação, bem como avaliar os efeitos e sintomas de desidratação em atletas de Brazilian jiu-jitsu (BJJ) em diferentes momentos. *Métodos*. 17 atletas de Jiu-Jitsu do sexo masculino (idade: 24,4 ± 3,5 anos; massa corporal (MC): 76,8 ± 14,6 kg; gordura corporal: 16,6 ± 6,4%), foram avaliados entre 8 e 9 horas da manhã em três momentos diferentes: Linha de base (10 dias antes da competição), aferição de massa corporal e estatura, coleta de urina e registro alimentar das últimas 24 horas; pré-competição, mensuração de MC, amostras de urina e questionário para avaliação da perda rápida de peso (RWL), e pós-competição (24h após), dia seguinte à competição, com mensuração de MC, e amostras de urina para análise de gravidade específica.

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Contributions: (A) Study design. (B) Literature review. (C) Data collection. (D) Statistical / Data analysis. (E) Data interpretation. (F) Manuscript preparation.

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Resultados. Hubo una tendencia a disminuir la BM para competir (estado basal: 76,8 ± 14,6 kg, precompetición: 75,4 ± 13,4 kg, postcompetición: 77,3 ± 13,7 kg; p < 0,07), y un 88,2% de atletas utilizaron métodos que aumentan la deshidratación. La mayoría de los atletas estaban deshidratados en los tres momentos del estudio (94,1 %; USG = 1,021 ± 0,005 Usg al inicio, 88,2 %; 1,020 ± 0,007 Usg antes de la competición, 88,2 %; 1,022 ± 0,008 Usg en la postcompetición), mostrando síntomas asociados al RWL (82,4% aumento de la frecuencia cardíaca, 52,9% dolor de cabeza, 47,1% sofocos, 41,2% náuseas, 41,2% desorientación y 29,4% mareos). *Conclusiones.* Se observó que los atletas de BJJ tuvieron una rápida pérdida de peso precompetitiva y síntomas asociados a la deshidratación. Se recomienda que se promuevan medidas educativas para inhibir el RWL entre los atletas de BJJ, para lo cual es necesaria la participación de profesionales de la salud y de las organizaciones que regulan el deporte (federaciones y confederaciones).

Palabras clave: Artes marciales; deportes de combate; BJJ; deshidratación; pérdida de peso; competición deportiva.

R*esultados*. Houve tendência de diminuição da MC para competir (basal: 76,8 ± 14,6 kg, pré-competição: 75,4 ± 13,4 kg, pós-competição: 77,3 ± 13,7 kg; p < 0,07), com 88,2% dos atletas usando métodos que aumentam a desidratação. A maioria dos atletas estava desidratada nos três momentos do estudo (94,1%; USG = 1,021 ± 0,005 Usg no início, 88,2%; 1,020 ± 0,007 Usg no pré-competição, 88,2%; 1,022 ± 0,008 Usg no pós- dia da competição), acompanhada de sintomas associados a RWL (82,4% aumento da frequência cardíaca, 52,9% dor de cabeça, 47,1% ondas de calor, 41,2% náusea, 41,2% desorientação e 29,4% tontura). *conclusões*. Perda de peso pré-competitiva rápida e sintomas associados à desidratação foram observados nos atletas de Jiu-Jitsu. Recomenda-se que medidas educativas sejam promovidas para inibir o RWL entre os atletas de Jiu-Jitsu, exigindo o engajamento dos profissionais de saúde e dos órgãos que regem o esporte (federações e confederações).

Palavras-chave: Artes marciais; desportos de combate; BJJ; desidratação; perda de peso; competição esportiva.

1. Introduction

Brazilian jiu-jitsu (BJJ) is a combat sport that develops through intermittent actions (Andreato et al., 2013, 2016, 2017; Coswig et al., 2018), with the main objective of taking the opponent to submission (Del Vecchio et al., 2016; Detanico et al., 2017; Gasparotto et al., 2015). BJJ competitions are divided into classes and categories, which are organized by level of graduation, sex, age, and body mass (Gasparotto et al., 2015; IBJJF, 2021), in order to provide an equal competitive atmosphere and reduce physical and technical differences between fighters. Data on Brazilian athletes indicated that approximately 57% of male competitors performed rapid weight loss (RWL), aiming at competitive advantage (Brito et al., 2012). When observing the use of RWL in other grappling combat sports, such as judo, values of 86% of athletes report reducing body mass to compete (Artioli, Gualano, et al., 2010). In wrestling, RWL prevalence values between 60-90% are observed among high school, collegiate, and international style wrestlers (Alderman et al., 2004; Oppliger et al., 2003; Steen & Brownell, 1990). It has been reported that nearly 90% of judo athletes engage in RWL on multiple occasions per year (Artioli, Gualano, et al., 2010). Similar values of RWL prevalence are reported among BJJ (56.8%), karate (70.8%), and taekwondo (63.3%) athletes (Brito et al., 2012). In sambo, it was observed that 88.7% of the athletes intentionally reduced their body mass pre-competition (Todorović et al., 2021).

RWL allows the athlete to compete in a category with a lower body mass limit, giving them an advantage when competing against lighter, smaller, and weaker athletes (Artioli et al., 2016). Mostly, RWL is influenced by the sports coach and training colleagues (Mazzoccante et al., 2016), and is undertaken without professional assistance, which facilitates the choice of methods that are more harmful and dangerous to health (Artioli et al., 2006; Ceylan, Kons, et al., 2022; Kons et al., 2017; Mazzoccante et al., 2016; Reale et al., 2017; Reljic et al., 2013). In this sense, a great diversity of methods have been used for RWL, highlighting severe fasting, strenuous training, the use of plastic or rubber clothing, induction of vomiting, laxatives, diuretics, saunas, and dehydration induced by fluid restriction (Ceylan, Kons, et al., 2022; Kons et al., 2017; Oppliger et al., 2003; Steen & Brownell, 1990; Tipton & Tcheng, 1970).

In general, RWL induces dehydration, which presents as a decrease in the volume of plasma fluids, negatively affecting cell osmolarity (Cheuvront & Sawka, 2005; Pallarés et al., 2016) and leading to deleterious effects, such as hormonal imbalance, immunosuppression, changes in the cardiovascular system, hydroelectrolytic imbalance, decreased renal function, impaired mental status and an impaired mood status (Andrade, Silva, et al., 2019; Armstrong et al., 1998; Choma et al., 1998). These dysfunctions are not only evident in more severe reductions (> 6-7% of body mass), but also in moderate reductions of 3 to 5% of body mass (Ceylan, Kons, et al., 2022; Choma et al., 1998).

Thus, negative aspects related to dehydration during competitive practice are associated with symptoms that produce damage, depending on the type of RWL method used (Sawka et al., 2007), highlighting dizziness, hot flashes, increased heart rate, fever, nausea, nosebleeds, disorientation, and headache (Alderman et al., 2004). Although the symptoms are of a singular nature, the evidence proposes multiple integrations that culminate in the reduction in physical and, sometimes, sporting performance (American College of Sports Medicine, 2007; Cheuvront et al., 2004; Sawka & Coyle, 1999). However, to date, little is known about the consequences and symptoms related to the use of RWL in BJJ athletes (Brito et al., 2012), which would assist in the diagnosis and creation of strategies to inhibit RWL. Therefore, the aim of this study was to measure rapid weight loss and collect urinary samples of hydration status, as well as to evaluate the effects and symptoms of dehydration in BJJ athletes during a competitive period. Our hypothesis was that athletes reduce body mass to compete, and this process is accompanied by dehydration and negative symptoms.

2. Methods

2.1. Participants

This study included 17 male Jiu-Jitsu athletes (age: 24.4 ± 3.5 years; body mass: 76.8 ± 14.6 kg; height: 175 ± 7 cm; body fat: 16.6 ± 6.4%), graduated of brown or black belt, with an international competitive level 94.1%, and experience of 6 ± 2 years of jiu-jitsu practice, recruited for convenience in an academy of a city in the south of Brazil. As inclusion criteria, the athletes were required to: i) be male with more than 5 years of practice in BJJ, based on proof of registration with the state federation; ii) have at least brown belt graduation; iii) be in a competitive period; iv) have participated in the first two stages of the state championship of the current year; and v) regularity of at least 5 h per week of training in BJJ. As exclusion criteria, a positive self-report to reduce training or competitions, and/or respond positively to the consumption of nutritional supplements during the completion of a 24-hour food record were considered.

Following the invitation, the participants were integrated into the research only after hearing a brief explanation of the study's objectives and signing the Informed Consent Form, declaring their voluntary participation. The study was approved by the Local Human Research Ethics Committee (CAEE: 03682912.6.0000.0117).

G*Power software (version 3.1.9.4, Universität Düsseldorf, Germany) was used to calculate the sample size needed to obtain a power of approximately 80% ($\alpha = 0.05$) and a large partial effect size eta square 0.14 in the analysis of variance (ANOVA) with repeated measures (RM) within the factors. The analysis indicated that a sample size of 17 would be adequate to detect a difference between the three measurements.

2.2. Experimental design

This was a descriptive study, which followed a design of repeated measures in which each participant was his own control. Urinary measurements of hydration status and body mass were determined according to phases: 1) *baseline*, 10 days before the competition; 2) *pre-competition*, at the time of weighing, where athletes competed in the morning; and 3) *post-competition day*, on the day after the official competition (state championship). During the baseline phase, body mass, stature and urine sample data were collected and a food record of the previous 24 hours was applied. During the pre-competition phase, body mass and urine samples were repeated, and a questionnaire was applied to assess the RWL. In the post-competition phase, only body mass and urine samples were collected. All collections took place between 8:00 am and 9:00 am, after an 8-hour fast.

2.3. Questionnaires

To assess the history of rapid weight loss methods, the *Rapid Weight Loss Questionnaire* (RWLQ) was applied (Artioli, Scagliusi, et al., 2010), adapted to BJJ (White & Kirk, 2021). In addition, a food record of the previous 24 hours was applied to limit the participation of athletes who used medications or supplements that could interfere with hydration status. In order to standardize the interviews, the Multiple Pass Method methodology (Moshfegh et al., 2008) was used, and all athletes were assessed individually by the same nutritionist. Finally, to quantify the main symptoms resulting

from the use of RWL methods and the main phenomena that occurred due to the reduction in body mass through dehydration methods, the questionnaire by Alderman et al. (2004) was used, with adaptations to BJJ.

2.4. Anthropometry

Body mass was measured with the participants wearing as little clothing as possible using a scale (Filizola®), with an accuracy of 0.1 kg, and stature was determined using a portable stadiometer (Sanny®), with an accuracy of 0.1 cm, according to the protocol of Lohman et al. (1992).

2.5. Hydration status assessment

The measurement of urine density was performed with a hand-held Uridens Inlab® refractometer, previously calibrated, with a scale from 1.000 to 1.040 (Casa et al., 2000). For collections, the athletes were instructed to discard the first stream of urine and, without interrupting urination, collect the medium stream, avoiding filling the 5 mL flask up to the cap, and closing it immediately after completion. The refractometer was recalibrated with distilled water between the readings obtained (Ferreira et al., 2010). To reduce the risk of inter-rater error, the same researcher performed all analyses by applying a drop of urine, from the sample cup, onto the refractometric measuring surface, with a mineral-free pipette and recording the specific gravity of urine (USG). The hydration status followed the parameters established by the *National Athletic Trainer's Association* (Casa et al., 2000), considering the following values of USG: hydrated "< 1.010", minimal dehydration "1.010 to 1.020", significant dehydration "1.021 to 1.030" and severe dehydration above "1.030" (Broglio et al., 2014).

2.6. Statistical analyses

Data are presented as means ± standard deviation, and percentile frequency was used to classify the hydration status in the different phases and also the main influencers of the RWL method from the RWL-Q. To better explore the data, it was decided to dichotomize the data in the RWL questionnaire, which contains five categories. The Shapiro–Wilk test was used to confirm the normality of the data. The Mauchly test was used to test the sphericity of the data, and one-way ANOVA for repeated measures was applied to compare the differences between body mass and specific gravity of urine, followed by the Bonferroni post-hoc analysis to analyze the interactions between baseline, pre-competition, and 24h post-fight measures. The statistical significance was set as $p < 0.05$. Finally, to determine the magnitude of differences, Cohen's d (1988) effect sizes (ES) were calculated and interpreted using the thresholds proposed by Rhea (2004) for highly trained individuals, as follows: <0.25, 0.25–0.50, 0.50–1.00, and >1.00 for trivial, small, moderate, and large, respectively. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 24.

3. Results

The data in Table 1 demonstrate the changes in body mass between different moments (p= 0.016), with a tendency to a difference between baseline and pre-competition (p = 0.064), with lower values for the pre-competition moment (-1.4 kg; -1.8%); and a difference between pre-competition and post-competition (p= 0.031), with lower values for the pre-competition moment (-1.9 kg; -2.5%).

Regarding hydration status, no significant differences were observed (> 0.05) in the average value of the urine density between moments (Table 1). However, at the three moments of data collection, the athletes presented dehydration, with 94.1% of the fighters being rated as dehydrated at baseline, 88.2% at pre-competition, and 88.2% on the post-competition day. Among the study participants, 88.2% reported the use of methods to induce dehydration. Table 2 presents the intra-subject hydration status over time at the evaluated moments (baseline, pre- and post-competition).

Table 3 shows the main influencers for RWL and the frequency with which this occurred during the pre-competitive period (low influence or high influence), for each method. Regardless of the RWL method chosen by the athlete, it is possible to observe that the BJJ coach had a lot of influence, followed by training colleagues and more experienced athletes.

Table 1. Values of body mass and specific gravity of urine between the baseline, pre-competition, and post-competition day (n = 17).

	Baseline	Pre-competition	Post-competition day	Cohen's d^a	Cohen's d^b
Body mass (kg)	76.8 ± 14.6	75.4 ± 13.4 #	77.3 ± 13.7*	0.09	0.14
Specific gravity of urine (USG)	1.021 ± 0.005	1.020 ± 0.007	1.022 ± 0.008	0.16	0.26

Data expressed as M ± SD. *Different from the pre-competition moment (p< 0.05). #Difference trend from the baseline (p< 0.07); Cohens'd[a] = baseline VS pre-competition; Cohens'd[b] = baseline VS pre-competition.

Table 2. Intra-subjects' hydration status over time at the analyzed moments (baseline, pre-competition, and post-competition).

Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Baseline	2	2	3	2	2	3	2	2	3	3	2	2	2	2	3	3	3
Pre-competition	3	2	1	4	2	3	2	2	3	2	2	3	2	2	3	2	3
Pos-competition	1	3	2	2	4	1	4	3	3	2	2	2	2	2	3	2	2

1 Well hydrated:< 1.010 USG; 2 Minimal dehydration: 1.010 to 1.020 USG; 3 Significant: 1.021 to 1.030 USG; 4 Serious dehydration: >1.030 USG.

Table 3. Main influencers on the use of rapid body mass loss methods in Brazilian jiu-jitsu athletes (n = 17).

Influencers	Little influence	A lot of influence	Total (%)
Training Colleagues	12 (70.6%)	5 (29.4%)	100%
Another athlete	13 (76.5%)	4 (23.5%)	100%
BJJ coach	10 (58.8%)	7 (41.2%)	100%
Physical trainer	15 (88.2%)	2 (11.1%)	100%
Medical doctor	17 (100%)	0 (0%)	100%
Nutritionist	17 (100%)	0 (0%)	100%
Parents or relatives	16 (94.1%)	1 (5.9%)	100%
Internet	16 (94.1%)	1 (5.9%)	100%
Others	16 (94.1%)	1 (5.9%)	100%

Data expressed as frequency and percentage in the row.

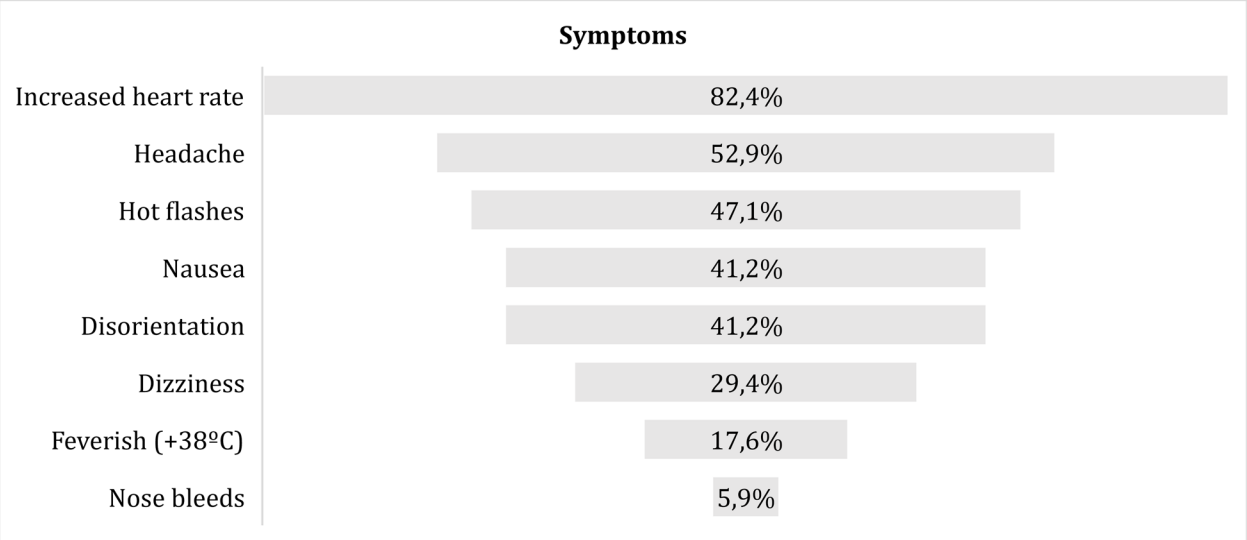
Table 4 shows the prevalence of individual use among the different methods for RWL and the frequency with which this occurs during the pre-competitive period (Always; Sometimes; Almost never; Never used; I used it, but I don't use it anymore), for each method. It was observed that among the methods, the one with the highest prevalence among the BJJ fighters in this sample was the method "Increased exercises (more than usual), 23.5% (Always) and 35.3% (Sometimes)".

Table 4. Prevalence of individual use of methods of use of rapid loss of body mass in Brazilian jiu-jitsu athletes (n = 17).

	Always (%)	Sometimes (%)	Almost never (%)	Never used (%)	I used it, but I don't use it anymore (%)
Gradual dieting	11.8	35.3	11.8	41.2	0
Skipping 1 or 2 meals	0	23.5	23.5	52.9	0
Fasting	11.8	17.6	11.8	58.8	0
Restricting fluids ingestion	17.6	5.9	5.9	70.6	0
Increased exercises (more than usual)	23.5	35.3	0	41.2	0
Training intentionally in heated rooms	0	11.8	11.8	76.5	0
Saunas	0	0	11.8	88.2	0
Training with rubber / plastic suits	5.9	11.8	11.8	70.6	0
Use winter or plastic suits during the whole day and/or night (without exercise).	0	0	0	100	0
Spitting	0	17.6	5.9	76.5	0
Laxatives	0	0	0	100	0
Diuretics	0	11.8	5.9	82.4	0
Diet pills	0	11.8	0	88.2	0
Vomiting	0	0	5.9	94.1	0

In relation to RWL methods, there was a high prevalence of the most reported was increased exercise practices, followed by restriction in fluid intake, plastic clothes, spitting, sauna, skipping meals, and fasting throughout the day. The frequency distribution of symptoms resulting from rapid weight loss between the baseline, pre-competition, and post-competition day demonstrated no differences between moments for the total reporting of symptoms ($p > 0.05$). At the pre-competition collection moment, the prevalence of signs and symptoms related to RWL are shown in Figure 1.

Figure 1. Percentage of Brazilian jiu-jitsu ($n = 17$) who presented symptoms during the pre-competitive period.



4. Discussion

The main findings of this research demonstrated that there was a tendency to reduced body mass between baseline and pre-competition moments, as well as differences for body mass between the pre-competition and post-competition day. The vast majority of athletes demonstrated dehydration in all phases of the study (baseline, pre-competition, and post-competition), as well as symptoms resulting from RWL

In the present study, initially, there was a hypothesis that athletes would undergo RWL methods, to seek possible competitive advantages, however, our hypothesis was not confirmed and all athletes were hypohydrated from baseline to pre-competitive moments. Generally, combat sports athletes compete in a category below their normal body mass, believing that they gain an advantage when fighting in a lower body mass category (Artioli et al., 2016). This strategy is common among combat sports, and in BJJ some reports follow the same line, with prevalence rates between 57% and 63% among athletes of different competitive levels (Brito et al., 2012; Mazzoccante et al., 2016), and a lower prevalence among athletes of international level (50%) compared to athletes of regional level (62.5%) (Brito et al., 2012). In other modalities, these prevalences rates may be even higher, such as 68-70% in high-school wrestlers (Kiningham & Gorenflo, 2001; Steen & Brownell, 1990), 89% in Judokas (Artioli, Gualano, et al., 2010), and 89% in college wrestlers (Steen & Brownll, 1990).

This lower prevalence of body mass reduction in BJJ may be due to the fact that, in most competitions, the athletes are weighed immediately before the combat (Ceylan et al., 2021). In this sense, the short time between the weigh-in and the match could be a factor that inhibits very sharp reductions in body mass (Ceylan et al., 2021). Previously, smaller magnitudes of reduction were observed in BJJ athletes when compared to judo athletes (Brito et al., 2012), and in the current study, there was a reduction trend between baseline and weigh-in, with a magnitude that can be considered low (-1.8%). In addition, for body mass, there was a difference between the weigh-in and the post-competition day.

USG values did not demonstrate significant differences between the moments of collection in this study. However, based on the USG it can be considered that the athletes in this study presented hypohydration at all moments (Broglio et al., 2014; Ceylan, Barley, et al., 2022; Ceylan & Balci, 2021), and these results are reliable for assessing hydration status, since there is a high association between

USG measurements and urine osmolarity, including in analyses performed during the body mass loss period in wrestlers (Fernández-Elías et al., 2014; Sommerfield et al., 2016). These results are similar to previous findings with mixed martial arts athletes and Judokas, with the USG assessment demonstrating hypohydration of the fighters (Alves et al., 2018; Ceylan, Barley, et al., 2022; Ceylan & Balci, 2021). Corroborating these findings, Pettersson and Berg (2014) reported a similar fact in their sample of elite athletes of international level in taekwondo, judo, and boxing of the Swedish national team (n = 63; 20 females; 43 males). These authors found a mean USG of 1.029 and 47.6% were severely hypohydrated on the morning of the competition. In addition, the authors pointed out that no adequate hydration level was observed for any of the athletes and that 11% had USG values < 1.020, the limit for absence of hypohydration mentioned for measurements in the morning. In addition, in other combat sports, such as wrestling, that have similar rules to BJJ during the qualification of the weight categories (short interval between weigh-in and competition), the data are similar to the present study in the aspect of not having changes in the body mass, however diverging in USG measurements when measured 2h pre-combat (Güder, 2020). In the present study, the USG measurements of BJJ athletes took place between 8 a.m. and 9 a.m. on the day of the competition. It is suggested that some athletes may not have yet reached their weight category and still be presenting a restrictive process, either of liquids, or being in a malnourished state until the official weigh-in. Thus, based on body mass and specific gravity of the urine, it is plausible to consider that the athletes entered this study while already in the process of reducing body mass, a fact that could explain the state of dehydration at the baseline period.

Dehydration in fighting athletes can damage physical and psychological performance (Andrade, Flores, et al., 2019; Ceylan, Kons, et al., 2022; Coswig et al., 2015; Franchini et al., 2012), and performance and health may be even more accentuated in BJJ, since most official competitions do not adopt an interval between the weigh-in and the first match, thus there is no recovery period, during which athletes tend to regain their body mass and hydrate. In this sense, the athletes' dehydration diagnosis included the pre-competition moment (weigh-in), which could be serious, because it may take up to 48 hours for athletes to return to normal hydration, fully restoring body fluid (Costill & Sparks, 1973). These outcomes should be viewed with care, because dehydration due to RWL can induce harmful physiological alterations to health (Artioli et al., 2016; Franchini et al., 2012), which in extreme cases can lead to death (CDC, 1998). It is also relevant that BJJ athletes be made aware of the importance of correct hydration, as well as learning to control their hydration status (e.g.: control by urine color).

In the current study, symptoms were observed at all times, which may be due to body mass loss/dehydration, with a high prevalence of increased heart rate, headache, hot flashes, nausea, disorientation, and dizziness. This is an important aspect, because although in the literature different studies have evaluated the effects of body mass loss on performance (Alves et al., 2018; Andrade, Flores, et al., 2019; Coswig et al., 2015), the symptoms resulting from RWL in BJJ athletes have not yet been analyzed, and this factor that can indirectly affect the performance of athletes in training and competitions. Corroborating with the present research, a study of 363 cadet wrestling athletes reported negative symptoms (22.2% hot flashes, 17.8% fever, 20.0% nose bleeds, 42.2% nausea, 44.4% dizziness, 46.7% headache) resulting from RWL even after regaining body mass of 3.3 ± 1.7kg (Alderman et al., 2004). Additionally, it is possible to observe negative symptoms resulting from RWL among adolescents of both sexes, as reported by Viveiros et al. (2015) (84.6% weakness, 30.8% cramps, 23.1% anxiety, 23.1% irritability), even after recovery of body mass between weigh-in and post-competition (after 24 h) (female recovered 2.7 ± 1.4 kg and male 1.5 ± 0.9 kg), indicating that symptoms remain after body mass regain.

As limitations of the present study, we can suggest the small sample size, in addition to the absence of females, which could provide more information about the dynamics of rapid body mass loss and its effects and symptoms. Given the inability of the researchers to control the sample for a longer period prior to the beginning of the study, it can be said that the present sample was already in a dehydrated state. Even so, this does not invalidate the results, since the objective of the study was to observe the effects promoted by dehydration on symptoms during the pre-competitive period among BJJ fighters. The sample size calculation was impossible because there are no previous studies with a similar design and population. Consequently, the results reported here should not be extrapolated to other populations. In addition, it is suggested that future research be performed to

analyze different moments of the competitive period, such as the beginning, middle, and end of the competitive year, verifying possible interference of the weather.

Finally, a fact that deserves attention regards the people who influence athletes to achieve body mass loss. In the reports, the BJJ coach, training colleagues, and other athletes exerted the greatest influence on this practice. In this sense, highly experienced athletes with RWL seem to be less affected by this process of abrupt reduction in body mass (Artioli et al., 2006), a fact that may influence the incentive for novice athletes to include RWL as a pre-competitive routine. This is an aspect that needs to be worked on, so that health professionals have a greater influence on the conduct of athletes, thus minimizing the risk and damage to their health (Brito et al., 2012).

4. Conclusion

There was a tendency to reduce body mass to compete, with dehydration being observed in the majority of athletes in all phases of the study (baseline, pre- and post-competition). In addition, the RWL was accompanied by adverse symptoms such as increased heart rate, headache, hot flashes, nausea, disorientation, and dizziness. Therefore, it is recommended that educational measures be promoted in order to inhibit body mass loss among BJJ athletes, requiring the engagement of health professionals and organizations that govern the sport (federations and confederations).

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