

Predominance and effect of graduation belt on rapid weight loss in Brazilian Jiu-jitsu athletes

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Abstract:

Combat sports such as judo, kickboxing, boxing, wrestling, Brazilian jiu-jitsu (BJJ), taekwondo, and karate are sports in which two individuals compete. Weight divisions were created to avoid possible injuries that can happen by differences in strength due to a significant disparity in body mass, as well as to implement a more balanced and fair competition environment between opponents. BJJ differs from the way of weighing in other combat sports modalities concerning the interval between weigh-in and first fight, approximately 10 minutes. The present study aimed to verify if the belt rank of jiu-jitsu competitors impacts weight loss and how weight is lost. Methodology: This is an observational study with 162 national athletes (67.7% men and 38.38% black belts), with 34.5 (6.8) years of practice in Brazilian jiu-jitsu, who participated in national competitions in Brazil between June and August 2021. They answered a questionnaire about their weight history and impacts on mass body gain. The frequency and percentage of responses were analyzed, in addition to the performance of the Kruskal-Wallis graduation tests, to compare RWL and methods and perception factors during PPR. Our results demonstrated that 135 athletes, 80% men and 38% black belts, with an average age of 29.5 years and an average practice time of 7.5 years. 62% of athletes reported doing PPR with a 3.9% decrease in body mass up to 10 days before the competition. Black belt athletes reported doing PPR more frequently (69%) and lost more body mass than the other graduations (4.6%). In addition, brown and black belts reported feeling more fatigued during PPR. The graduation and time of BJJ practice seem to influence the performance of RWL (4.6%) for weight loss to compete, with black belt athletes performing it more commonly; however, there are possible discomforts such as dizziness, fatigue, and cramps.

Key Words: Nutrition, Martial Arts, Sport Physiology, Musculoskeletal, Neural Physiological Phenomena, Judo.

Introduction

In combat sports, such as judo, kickboxing, boxing, taekwondo, karate, Mixed Martial Arts, wrestling, and Brazilian jiu-jitsu (BJJ) (Brabec et al., 2019; Del Vecchio et al., 2018; Fernandes et al., 2018; Fernández et al., 2019), competitors compete by weight category, so they must undergo weigh-ins to determine their weight category before tournaments (Bueno et al., 2022; Carvalho et al., 2022; Ceylan et al., 2022; Gamero-del Castillo et al., 2020; Mauricio et al., 2022; Reale et al., 2020, Santos et al., 2022). This regulation is because, theoretically, athletes with similar body weights usually have similar anthropometric characteristics and, therefore, comparable physical skills (Andreato & Branco, 2016; Slimani et al., 2017; Torres-Luque et al., 2016). Weight divisions also exist to avoid possible injuries that could happen by differences in strength due to a significant disparity in body mass (Čierna et al., 2018), as well as to implement a more balanced and fair tournament environment between athletes (Artioli et al., 2010; Reale, Slater, Cox, et al., 2018; Roklicer et al., 2020). BJJ differs from other combat sports in the way of weighing because athletes have just 10 minutes after weigh-in to the first fight. This fact makes rapid weight loss (RWL) more challenging, as there is less time for the body to recover before combat begins (Villar et al., 2018; White & Kirk, 2021).

In sports such as boxing and wrestling, weigh-in takes place 3 hours before the fight on boxing and a day before on wrestling, according to preceding authors (Artioli et al., 2010; Junior et al., 2006). Past studies indicated that weight loss does not have deleterious effects on performance (Mauricio et al., 2022); however,

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researchers replicated the procedures of judo, sambo, and wrestling, where there are 4 to 12 hours between weighing and competition (Castor-Praga et al., 2021; Drid et al., 2021; Reale, Slater, & Burke, 2018; Torres-Luque et al., 2016). There are disagreements regarding RWL in combat sports; initial results demonstrated that a 6% RWL decreases the strength of wrestlers (Barbas et al., 2011) and also reported that dehydration of 3 to 4% of initial weight can impair muscular endurance capacity (Lambert & Jones, 2010), but does not directly affect absolute strength and power, while an original study concluded that 3% to 6% of RWL could impair performance in wrestlers (Horswill et al., 1994). Authors found that RWL affects athletes' mood and cognition, and the return to eating minimizes the harmful effects of weight loss (Brandt et al., 2018, 2021). Recently, other authors indicated that RWL could not negatively affect performance related to strength and power (Mauricio et al., 2022). Despite these critical contributions, most were performed only with experienced athletes. Little is known about weight loss in beginner or intermediate BJJ athletes.

Specifically, multicenter research with different combat modalities verified that when comparing Wrestling, Boxing, Judo, Taekwondo, Kickboxing, and MMA, BJJ is the one with less RWL (Barley et al., 2018). Among those athletes who lost weight, only 10% of the fighters were losing weight, and 81% of those who competed at a regional level, did the RWL method (Barley et al., 2018). This recent study indicated the RWL in BJJ with a procedure with a more significant predominance of gradual diet associated with physical activities and restriction of liquids (Barley et al., 2018). In agreement, other authors analyzed athletes exclusively, indicating that the most common form of RWL was the gradual diet, followed by increased physical activity, discovering that 59% of the participants of official tournaments use RWL (White & Kirk, 2021). Authors (Brito et al., 2012) indicated that more than 60% of 500 combat sports athletes had RWL (<7 days). Of BJJ practitioners, only 27% lost more than 5% of their initial weight, increasing physical activity as the primary form of RWL (Brito et al., 2012). This finding differs from other authors (Figlioli et al., 2021), who evaluated sambo athletes and found that 87% of athletes had RWL. The most used methods were skipping meals, going to the sauna, and eating a gradual diet (Figlioli et al., 2021).

Nutrition assessment, RWL procedures, and effects are necessary for advising combat athletes on dietary strategies and evaluating the effectiveness of supplementation and dietary regimens (Hasan et al., 2021; Nobre et al., 2018). Lately, a study verified the effect of a 3% RWL on neuromuscular performance in Olympic-style boxers (Zubac et al., 2020). The RWL condition declined neuromuscular performance, where 5-s maximum isometric voluntary contractions force output (MVC) of the dominant leg knee extensors prior was 12% lower, and voluntary activation deficits of 7% were observed after the fatigue protocol in the RWL group (Zubac et al., 2020). Following RWL, time to exhaustion for the sustained 70% MVC was 69 ± 20 s versus 86 ± 34 s for control (Zubac et al., 2020). Given the significance of the impacts that RWL can generate on the physical performance and health condition of BJJ fighters (Brandt et al., 2021; Coswig et al., 2019; Kim et al., 2015; Mauricio et al., 2022), and the fact that there are no RWL studies with beginners and intermediates in BJJ, this research aimed to verify whether the graduation of jiu-jitsu competitors impacts weight loss and how weight is lost.

Material & methods

Study design

This research is a cross-sectional study carried out through a questionnaire applied remotely through google forms and personally at the first national-level BJJ competition held by the International Brazilian Jiu-jitsu Federation (IBJJF) in 2021, 'Rio winter 2021'. A single researcher performed all measurements, applying the RWL Questionnaire (Artioli et al., 2010). The objectives and risks were informed to the participants, and the Free Informed Consent Term was signed. All athletes signed the Free Informed Consent Term. Following the WMA Declaration of Helsinki, the local Research Ethics Committee approved this research (nº 57395822.0.0000.5286).

Subjects

For this study, 162 volunteers were selected, already training in BJJ before the pandemic and participating in national-level competitions in 2021. Also, 25 respondents were excluded from the survey for not completing the questionnaire or not meeting the inclusion criteria. The inclusion criteria were Brazilian jiu-jitsu practitioners who had at least 18 months of practice and competed nationally in 2021. Furthermore, our exclusion criteria were BJJ practitioners who had not been training regularly in the last six months and participants who were not competing in a national competition in 2021.

Procedures

We used the valued Rapid Weight Loss Questionnaire (RWLQ), a self-reporting instrument designed to evaluate RWL patterns among judo/BJJ competitors. The RWLQ is specific to the competitive environment and uses grappling athletes' language, including most athletes' usual terms, words, and phrases. We followed the instructions of RWLQ authors (Artioli et al., 2010), using an effortless and precise language style. Google forms questionnaire was used to collect data with BJJ athletes in competitive activity between July-August 2021 at the national level participating in (IBJJF) competitions. Participants were initially approached during the 2021 Rio

Winter Competition. The study was explained, and the way of filling in the questionnaire highlighted the importance of the fidelity of the report (Artioli et al., 2010).

Measures

RWLQ (Artioli et al., 2010) – RWLQ questionnaire had the first part about general information (i.e., date, age, gender, at what age you begin to practice the modality, at what age you begin to compete, how much you weigh, how tall are you). Afterward, athletes answer about achievement and participation in the competition to date (i.e., level, competitions, graduation, time of practice, weekly training volume, competitive experience, and medals last year). After, RWLQ has specific questions: have you ever lost weight to compete?; what is the most weight you have cut to compete in your career?; how many times did you cut weight to compete last season?; how much weight do you usually cut before competitions?; at what age did you begin to cut weight for competitions? How much weight do you usually regain in the week following a competition?; who encouraged and taught you to lose weight?; how often did you use specific methods to lose weight before competitions?

Statistical Analysis

The frequency and percentage of responses were analyzed, in addition to performing Kruskal-Wallis grading tests to compare RWL and methods and perception factors during RWL. The effect size was calculated using hedges (g) and interpreted according to small ($r=0.10$), medium ($r=0.30$), or large ($r=0.50$). The significance level of $p \leq 0.05$ was applied. All analyzes were analyzed by SPSS 20.0 software for windows.

Results

Regarding the sample, we observed that 135 athletes participated, 115 of them men (80%), 38% were black belts, with an average age of 29.5 years, average practice time of 7.5 and 8.5 years (62%), reported doing RWL (kg) with an average of 3.9% weight loss within ten days before the competition. Table 1 shows a descriptive analysis of results according to BJJ graduation.

Table 1. Percentage of participants in each graduation, age, weight, height, practice time, BJJ training time/week, other exercises, RWL practice.

Belt	Participant s	Age	Weight	Height	Pratice time	Hours of BJJ train	Other activities	RWL practice	RWL*	%weigh t lost
Blue	30 [22%]	(7) (7)@	26.2 81 (16.8)	1.73 (0.09)	4.85 (3.6)	9h (30%)	< 9 (30%)@	14 (47%)	3.3 (2.5)*	4*
Purpl e	32 [23%]	(7) (8)@	27.8 77.5 (15)	1.72 (0.08)	5.9 (2.4)	3 a 4.5h (34.5%)	6 (19%)	19 (59%)	3 (1.2)	3.7
Brow n	23 [17%]	(6) (7.7)	29.6 76 (10.8)	1.74 (0.09)	5.7 (2.8)	9h (35%)	< 4 (17.5%)	16 (69%)	2.6 (1.7)	3.2
Black	52 [38%]	(8) (6.6)	34.5 81.8 (12.5)	1.75 (0.07)	13.5 (6.8)*##\$	9h (40.5%)	< 4 (7.5%)	36 (69%)	3.75 (2)*	4.6*

* = distinctive for the blue belt; # = distinctive for the purple belt; \$ = distinctive for the brown belt; @ = distinctive for the black belt, RWL= Rapid weight loss; $p \leq 0.05$.

In BJJ graduations comparisons, there was a statistical difference between the age of participants from blue and purple belts versus black belts ($K=26.968$, $p \geq .001$); there was also a difference in practice time between blue and purple belts versus black belts ($K=69.414$, $p \geq .001$); between the black versus blue belts about the amount of weight lost ($K=8.889$, $p=.031$), however, the brown belts had a higher number of RWL that the others graduations ($K=13.403$, $p=.004$). There was a significant difference between blue and black belts ($K=13.199$, $p=.004$) compared to the practice of other modalities besides BJJ. Table 2 shows the methods used by BJJ athletes during RWL.

Table 2. RWL methods are divided by different graduations.

Methods	Gradual Diet	Restrict- ed Diet	Fasting	Slipping meals	Liquid restrictions	Training with plastic cloths	Active dehydration	Water oscillation	Steam room	Hot tub	Laxatives	Diuretics	Thermogenics
Belts													
Blue	Never (40%)#@	Never (43.5%)	Never (53.5%)	Never (50%)	Never (60%)	Never (57%)	Never (50%)	Never (50%)	Never (60%)	Never (87%)@	Never (83.5%)@	Never (63.5%)	Never (70%)@
Purple	Always (59.5%)	Never (47%)	Never (40.5%)	Rarely (44%)	Never (50%)	Never (50%)	Never (34.5%)	Never (28%)	Never (53%)	Never (59.5%)	Never (59.5%)	Never (50%)	Never (44%)
Brown	Sometimes and always (26%)	Sometime s (35%)#	Always (26%)	Never (39%)	Never (26%)	Sometimes (30.5%)	Sometimes (43.5%)	Always (30.5%)	Sometimes (30.5%)*#	Never (56.5%)	Never (48%)	Never (39%)	Never (35%)
Black	Always (54%)	Rarely and sometimes (31%)	Never (34.5%)	Never (36.5%)	Rarely (33%)	Rarely (33%)	Rarely and sometimes (29%)	Never (29%)	Never (33%)	Never (50%)	Never (52%)	Never and rarely (33%)	Rarely and sometimes (27%)

* = distinctive for blue belt; # = distinctive for purple belt; \$ = distinctive for brown belt; @ = distinctive for black belt, $p \leq 0.05$.

Results related to RWL methods demonstrated that the blue belts reported having less frequency in performing gradual weight loss than the purple and black belts ($K=15.644$, $p=.002$, $p=0.025$); concerning the restrictive diet, the purple belts reported having a lower frequency in performing this method than the brown belts ($K=8.797$, $p=.026$); however, brown belts reported doing steam house more often than blue and purple belts ($K=13.224$, $p=0.03$, $p=0.041$); about the hot tub, the blue belts differed from the black belts with less frequency ($K=10.157$, $p=.01$), in the same way with the use of laxatives ($K=8.705$, $p=0.54$); and the use of thermogenic ($K=15.701$, $p\geq.001$).

Also, most blue belts do not usually perform the methods and report not having performed any of the commonly performed methods. Unlike black belts, who mostly perform RWL practices and report performing a gradual diet (54% consistently), followed by restrictive diet, dehydration, and use of thermogenic (31%, 29%, and 27%, respectively), although the purple belts report mostly on a gradual diet (59%), and the brown belts perform, gradual diet, oscillation at water consumption and fasting (26%, 30.5%, and 30.5% respectively), yet sometimes they perform a restrictive diet, training in plastic clothes, dehydration and steam house (35%, 30.5%, 43%, and 30.5%, respectively), nonetheless most athletes reported having the gradual diet as the most common weight loss method and most of them reported never having done any of the other methods.

Table 3. Symptoms experienced during RWL are divided according to graduation, presented in percentage.

	Dizziness	Fainting	Fatigue	Cramps	Palpitations	Chest pain	Headache	Stomach ache	Motion sickness	
Blue	70.0	7.0	60.0	47.0	13.0	13.0	53.0	33.0	37.0	Yes
	30.0	93.0	40.0	53.0	87.0	87.0	47.0	67.0	63.0	No
Purple	53.0	0.0	78.0	47.0	25.0	3.0	53.0	34.5	31.0	Yes
	47.0	100.0	22.0	53.0	75.0	97.0	47.0	65.5	69.0	No
Brown	75.0	0.0	85.0	50.0	15.0	5.0	40.0	35.0	30.0	Yes
	25.0	100.0	15.0	50.0	85.0	95.0	60.0	65.0	70.0	No
Black	48	7.7	84.5	63.5	27	9.5	50	44	33	Yes
	52	92.3	15.5	36.5	73	90.5	50	56	67	No
Mean	61.5	3.7	*76.9	51.9	20.0	7.6	49.0	36.6	32.8	Yes
	38.5	96.3	*23.1	48.1	80.0	92.4	51.0	63.4	67.3	No

In the RWL period, 61.5% reported feeling dizzy (classified as dizziness in table 3.), 76.9% fatigued, and 51.9% cramps. However, the chi-square test of independence showed no significant differences concerning symptom senses in the PPR period and the belt of the athletes.

For Orientation of RWL, 54% of respondents reported having already been advised by nutritionists, followed by the BJJ coaches 42% and physical trainers 27%. In comparison, the doctor had 12%, others with the internet, friends, and parents corresponded to 13%.

Discussion

The rapid weight loss methods performed by BJJ athletes also occur in other combat sports such as Judo, Wrestling, and MMA. These methods have been documented since 1943 in wrestlers, with a prevalence of rapid weight loss close to 90% (Tuttle, 1943). Also, in Olympic sports (including Wrestling) such as boxing and judo, it reached 60%. However, in the present study, the prevalence of rapid weight loss oscillates between belt graduation and time of practice, with 69% of the black belts performing RWL, while only 47% of blue belts perform RWL (Kazemi et al., 2005; Khodaei et al., 2015; Viveiros et al., 2015). Preceding authors conducted a study with more than 500 athletes from different combat modalities. Nevertheless, BJJ athletes 155 athletes, and it found that 57% were losing weight, with an average loss in the week of 2.9kg, 4.1% of the initial body mass, and only 27% of them lost more than 5% of the initial body mass (Brito et al., 2012). This data is similar to the one found in the present study, in addition to the percentage of athletes who make rapid weight loss, but also the average weight loss, which was 3.1 kg and 3.9% of body mass (Brito et al., 2012).

Sports such as judo demonstrated higher results in weight frequency, in competitors of regional levels, national, and international showed a frequency of weight loss of 89%, with approximately 3 - 5% of weight lost in 7 - 10 days. This result corroborates with the one found in our study, where there was 3.7 to 4.6% weight loss (Artioli et al., 2010). This result also happened with Wrestling with differences between university and high school students, where college athletes seem to lose more than 5% of their weight. In comparison, high school athletes lose up to 5% of their weight (Steen & Brownell, 1990), yet a previous study about BJJ pointed out that 50% of the participants made an RWL. Weight, however, 34% lost up to 7 days before the competition and 31% up to 14 days, and their losses did not exceed 3.5% of the initial body mass (White & Kirk, 2021).

Our findings demonstrated that the most performed weight loss method, gradual weight loss, was most applied by purple and black belts (59% and 54% always use this method, which differs from the other graduations in the present study). Wrestling practitioners also performed this method, making a gradual weight

loss of 4% of initial body mass. Another method also used by BJJ practitioners was dehydration, which was used by brown belts (43%). These wrestlers also used this method to lose up to 5% of body mass (Finn et al., 2004; Motevalli et al., 2015).

The present results differ between graduations since the blue belts have a lower recurrence in the performance of any of the evaluated methods. Their higher rates indicate that they do not perform any RWL methods (Maurício et al., 2022). Authors found that a period of inactivity of 4.3 months showed an average gain of 4.8 kg, which underscores the importance of a nutritionist in monitoring athletes to maintain body weight throughout the competitive period (Maurício et al., 2022).

Several studies discussed many RWL methods to understand the most commonly used methods in different modalities (Brito et al., 2012; Reale et al., 2017). Wrestlers, for example, seem to use dehydration and food restriction more typically and gradually, with less recurrence of steam house, hot tub, or laxatives (Barley et al., 2018), which corroborates what was found in this study when considering brown and black belts. Nonetheless, it is different from what is performed by MMA athletes, who already have the methods of using the steam house as a recurring strategy, where the data demonstrate about 76% of the participants using it (Connor & Egan, 2019). Also worth mentioning is that MMA has an aggressive weight loss, where athletes usually weigh themselves about 30 hours before the fight, so the athlete usually does an RWL with more than 5% of the initial body mass, different from the recommended and recurrently used in other combat sports (Artioli et al., 2010; Barley et al., 2018).

In addition to what has already been mentioned about the methods used for rapid weight loss in BJJ athletes, our study contributes to past studies (Brito et al., 2012; White & Kirk, 2021) by stratifying the issue of graduations with an analysis of which belt usually makes weight loss more or less recurrently, in addition to analyzing which practices are most used and least used, both for athletes and each graduation.

It can also be observed that most athletes report having already received instructions for RWL, mainly from nutritionists (54%), followed by the BJJ teacher (42%) and physical educators (27%). This data differs from the preceding report (Ranisavljev et al., 2022), which found that most participants were influenced to lose weight by their sports coaches, followed by teammates. Another result was seen by (Barley et al., 2018), who found that BJJ athletes were advised to lose weight, mainly by coaches and not by nutritionists.

Another analysis carried out in this study was the possible harmful effects of weight loss, as shown in table 3, where most athletes do not have harmful effects such as nausea, headache, stomach pain, chest pain, palpitations, and fainting. However, most athletes who lost weight reported having felt fatigued, dizzy, and having cramps (77%, 61.5%, and 52%, respectively), although fatigue was more common when correlated with graduation belt, being seen in 78% of the purple belts, 85% of the brown belts and 84.5% of the black belts, and only 60% of the blue belts, and these had dizziness as the most significant harmful symptom related to rapid weight loss, however, without significant differences between the graduations and symptoms.

Besides that, the study had some limitations; for example, it did not analyze the impact of weight loss on the chance of success in competition. In addition, we did not question the impact of the harmful effects of RWL on the performance or well-being of the participants, as it has been reported that dizziness, fatigue, and cramps. Because of this, the current work emphasizes the importance of knowledge of health professionals, mainly nutritionists and technicians, to the most used techniques to lose weight quickly, in addition to the knowledge of the symptoms that can occur with the practices carried out for RWL in different levels of graduation and experience in the sport. Future research has to verify the effects of RWL on female BJJ athletes (Carvalho, Rego, et al., 2022). Different RWL methods were demonstrated, and different symptoms were felt, so new research is needed to identify possible symptoms for each method, the impact of methods on performance, and the relationship of this method with the level of experience and knowledge of the practitioner.

Conclusions

The present study verified the possible accomplishment of RWL, the most used methods, and the difference between the accomplishment and the form to accomplish it, according to different graduations. We can thus conclude that the graduation and the time of practice of BJJ can influence the accomplishment of RWL and the chosen methods, with gradual weight loss being the most used form of weight loss; concerning the time of sports practice and graduation, the black belt has the highest percentage of weight loss (4.6%), and more often performs RWL to fight. In addition, it seems that rapid weight loss can provide athletes with some discomforts, such as dizziness, fatigue, and cramps, with fatigue being more recurrent in athletes with higher ranks of brown and black belts. The concern with weight control and using different weight loss methods increases with the increase in adherence. That is, more senior athletes have more restrictive diets and use methods that can impact physical fitness performance during competitive fights. It is worth mentioning that the bands provided are the ones that most performed RWL practices that include caloric restriction, dehydration, and use of thermogenic, among other means that could be better controlled by institutions, nutritionists, doctors, and coaches so that there are no long-term health problems.

Conflicts of interest - None.

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