

Prevalence, Magnitude, and Methods of Weight Cutting Used by World Class Powerlifters

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Abstract

Kwan, K and Helms, E. Prevalence, magnitude, and methods of weight cutting used by world class powerlifters. *J Strength Cond Res* 36(4): 998–1002, 2022—Powerlifters compete in the squat, bench press, and deadlift, with winners determined by the highest 3-lift total in each weight class. As a weight class-based sport, athletes often compete in classes lower than their habitual weight, using various strategies to make weight. This study's purpose was to examine weight cutting prevalence, magnitude, and methods among 42 male and 22 female powerlifters (25 ± 8 years old; 4 ± 2.2 years of competitive experience) competing at the 2018 International Powerlifting Federation classic world championship. The lifters, 83% of whom cut weight losing an average $2.9 \pm 4.3\%$ of body mass, completed a previously validated weight cutting questionnaire. The most frequently used weight cutting methods were gradual dieting (42.18%, 31.25%), fluid restriction after fluid loading (32.8%, 34.4%), restricting fluid ingestion without fluid loading (23.4%, 9.4%), fasting (15.6%, 18.7%), increased activity (9.4%, 24.4%), laxatives (9.4%, 18.7%), sauna (7.8%, 6.3%), diuretics (7.8%, 6.3%), skipping meals (4.7%, 21.9%), and wearing rubber suits (1.6%, 2.6%). Most lifters experienced negative changes in psychological state, with only 9% reporting never experiencing any negative effect on psychological state across the 5 states measured. Lifters reported experiencing fatigue (15.6%, 45.3%), anger (3.2%, 26.6%), feelings of isolation (4.7%, 12.5%), and anxiety (14.1%, 35.95%), and 11 of the 12 lifters who reported a perceived decrement in training performance performed weight cutting. Both weight cutting methods and negative psychological changes experienced were reported as always, sometimes. Therefore, it is vital to provide specific recommendations based on scientific research to improve the efficacy and safety of making weight while minimizing performance decrements.

Key Words: powerlifting, rapid weight loss, strength training

Introduction

Powerlifting is a strength sport consisting of 3 competitive movements: the squat, the bench press, and the deadlift. The overall winner is determined by the highest total load lifted in all 3 lifts in the lifters' respective weight classes. In the International Powerlifting Federation (IPF), there are a total of 8 weight classes for both male and female lifters, respectively. Because of the segregation of weight classes and the relationship between body mass and the ability to carry a larger amount of muscle mass and strength (18), many powerlifters choose to compete in a weight class lower than their habitual weight to gain a competitive advantage (16). This results in the use of various rapid weight loss (RWL) strategies to make weight before a powerlifting competition.

There are numerous studies that show that undergoing RWL can result in impaired exercise performance (30), increased injury risk (11), negative psychological effects (9), and, in extreme cases, the risk of death (3). By losing a large amount of body mass in a short period, athletes expose themselves to physiological side effects such as reduced plasma volume (31) and impaired thermoregulatory processes, which can affect exercise performance (26), electrolyte imbalance, which can affect muscle contractility (19), and higher markers of muscle damage (28).

Athletes' psychological state can also be affected during RWL (16). Symptoms of depression, a reduction in concentration, and an increase in confusion are commonly present in athletes

undergoing RWL (10). Dehydration specifically can reduce blood flow to the telencephalon (15), a major part of the brain, which could cause a reduction in metacognitive abilities. Moreover, dehydration can lead to an increase in rating of perceived exertion (RPE) (17). Given that RPE can be used to prescribe load to (12) inform resistance training for powerlifting (13), an increased RPE could potentially have a negative influence on attempt selection during competition, which is a predictor of competitive success in powerlifting (4).

In addition, methods of dehydration used during RWL can pose significant negative impacts on both performance and health. One study demonstrated that dehydration causing a 1.5% decrease in body mass led to a 5% reduction in bench press 1 repetition maximum (27), whereas another study showed that dehydration led to a consistent decrease in total work completed (measured by volume load) during resistance training (14). In addition, injury risk increases in combat athletes who lose more than 5% of their body mass before competition (11). Finally, in extreme cases, death can occur from RWL, as seen when 3 Olympic wrestlers died due to severe dehydration, resulting in reduced potassium levels, which altered the activity of the sodium-potassium pump, causing cardiac arrest (3). Although there is a robust amount of research demonstrating that RWL has negative impacts on health and performance, most of this research is performed in wrestling, jujitsu, karate, and other combat sports. To our knowledge, there is only 1 study on RWL among powerlifters by Nolan et al. (22), but this study was conducted across the powerlifting population at multiple competitive levels. Thus, our study aimed to complement the existing research by

specifically surveying world class powerlifters to examine the prevalence of weight cutting practices at the elite level and to assess whether there were any associations between weight cutting practices, competitive success, and mood state and perceived stress.

Methods

Experimental Approach to the Problem

Powerlifters who competed at the 2018 IPF classic world championships were invited to complete a survey after they had finished competing. The survey was based on a previous validated questionnaire (2) but modified to ensure relevance for powerlifting. From the data collected, a cross-sectional approach was used to assess the relationship between competitive success (winning a medal), prevalence of weight cutting, methods of weight cutting, subject characteristics (e.g., age, experience, sex, and Wilks score), and perceived psychological stressors during weight cutting and competition among world class powerlifters.

Subjects

Powerlifters (aged >18 years) competing at the IPF world classic championship 2018 in Calgary, Canada, participated in this survey of weight cutting strategies. Subjects were voluntary and approached in person by the researcher postcompetition. The only exclusion criteria were women in the 84 kg+ and men in the 120 kg + weight class, as these weight classes do not require the athletes to perform any form of weight cutting to make weight. A sample of 64 (42 males and 22 females) athletes were surveyed during the length of the competition. For analysis, the subjects were separated into 2 groups based on competitiveness: those who won a medal versus those who did not. All athletes competed under the raw category standard stipulated by the IPF. This category permits the athlete to wear knee sleeves, wrist wraps, lifting belt, and a nonassistive powerlifting singlet. All athletes also needed to comply to the IPF standard of competing drug and banned substance free. Ethical approval for this research was obtained from the Auckland University of Technology university ethics committee (approval number 18/161), and all study volunteers provided written informed consent after having the study procedures explained in detail before participation.

Procedures

The RWL questionnaire was designed and validated by Artioli et al. and was meant for the assessment of RWL practices in Judo athletes (2). Therefore, after consulting with powerlifting coaches and pilot testing with powerlifters, modifications of certain terms such as competition to powerlifting meets and other minor changes were made to make it suitable for use with powerlifters. Briefly, the RWL questionnaire asked the subject to report the prevalence of various weight cutting strategies as never, almost never, sometimes, always, or stopped using, as well as the prevalence of 5 perceived psychological states using the same qualitative descriptors.

Lifters were approached for recruitment after they had competed, and volunteers were provided a hard copy of the questionnaire. Furthermore, the principal investigator verbally discussed the questions with each subject to remove any ambiguity the lifter might potentially have about the questions. The athletes' competitive performances were separated and analyzed for variables such as age, weight class, final RWL score, meets

competed, number of cuts performed, weight lost for this competition (% of body mass), most weight lost (% of body mass), how long before competition cuts began, weight regain post-competition, perceived performance decrement during training, and Wilks score (a measure for strength relative to body weight, and a higher Wilks score indicates a stronger and higher caliber lifter). The data collected were then entered into a Google form after the end of the competition. The survey was performed from the 11th to the 17th of June, 2018.

Statistical Analyses

The RWL questionnaire was scored as per Artioli et al. (2) to produce a final RWL score for each athlete. Frequency analyses were performed for methods of RWL and psychological effects experienced during RWL. Statistical analyses were completed using JASP (version 0.13.1, University of Amsterdam, Amsterdam). Descriptive statistics (i.e., mean, standard deviation, and frequency analysis) were used to report athlete characteristics based on their responses to the questionnaire, which provided ordinal data. An independent T-test was used to compare parameters across the independent variable of athlete caliber (medal vs. no medal). A chi-square test was performed to compare associations between categorical variables (i.e., medal count, perceived decrement in training performance, and "did you cut for this meet?"). Statistical significance was set at $p \leq 0.05$. All data was reported as mean $\pm$ SD

Results

Of a total of 64 respondents (42 males and 22 females), 53 engaged in weight cutting in preparation for this competition. Athletes were categorized based on competitive performance (won a medal versus no medal). Characteristics of the combined sample, medalists, and nonmedalists are shown in Table 1. Ninety percent of medal winners engaged in weight cutting for this competition, whereas only 10% of medal winners did not. Among nonmedal winners, 70% engaged in weight cutting, whereas 30% did not. The medalists lost an average of $4.1 \pm 4.6\%$ of body mass, whereas nonmedalists lost $2.7 \pm 3.1\%$ of body mass, respectively. The most weight medalists lost throughout their competitive career was $5.7 \pm 3.4\%$ of total body mass, whereas nonmedalists lost $4.7 \pm 2.3\%$ of body mass. Medalists reported a higher RWL score (32.8 ± 11.3) than nonmedalists (28.5 ± 11.1), but this difference was not significant ($p < 0.08$). Twelve respondents reported that they perceived a decrement in their training performance, 11 of whom engaged in weight cutting. However, a reported perceived decrement in training performance did not exhibit a significant relationship with winning or medal or not χ^2 (1, $N = 64$) = 0.767, $p = 0.381$.

Winning a medal was only significantly associated with the number of meets participated in that year ($p = 0.025$) and Wilks score ($p < 0.001$), which is a score that represents relative strength for comparisons across weight classes (29). Finally, significantly more athletes who won medals, also cut weight χ^2 (1, $N = 64$) = 5.063, $p = 0.024$.

As shown in Table 2, the most commonly used method to make weight for competition was fluid restriction after fluid ingestion and gradual dieting. Of note, 32.8 and 42.1% reported that they always used these respective methods. The least common method to make weight was using fat burners/diet pills and vomiting with 89.1 and 85.9% reporting never. Surprisingly, stopped using

Table 1**Self-reported characteristics of world class powerlifters competing at IPF Classic Worlds 2018.*†**

	Total subjects	Medal	No medal
Age	26.2 ± 6.5	25.8 ± 6.7.0	25.4 ± 4.6
Body mass	72.2 ± 16.1	76.6 ± 20.1	77 ± 14.9
RWL score	31.5 ± 10.7	32.8 ± 11.3	28.5 ± 11.1
What age did you start powerlifting?	21.3 ± 5.2	20.7 ± 5.4	21.4 ± 4.2
How many meets did you compete this year?	2.1 ± 0.9	2.7 ± 1.3**	2 ± 0.9
How many meets in the past year did you cut for?	2.3 ± 1.4	2.4 ± 1.1	2 ± 1.6
How much weight did you lose for this meet (% of bodyweight)?	2.9 ± 4.3	4.1 ± 4.6	2.7 ± 3.1
What was the biggest weight cut you done in your competitive career? (% of bodyweight)	5.4 ± 3.2	5.7 ± 3.4	4.7 ± 2.3
Athlete caliber (measured by Wilks)	456 ± 39.2	481 ± 42.5**	435.4 ± 30.9
How long before the meet did you start cutting weight (days)?	32 ± 33.2	27.4 ± 29.4	29 ± 31.3
How much weight do you regain in the week after competition?	2.6 ± 2.2	2.7 ± 2.3	2.2 ± 2.03

*IPF = International Powerlifting Federation.

†Significant differences marked as ** $p < 0.05$.

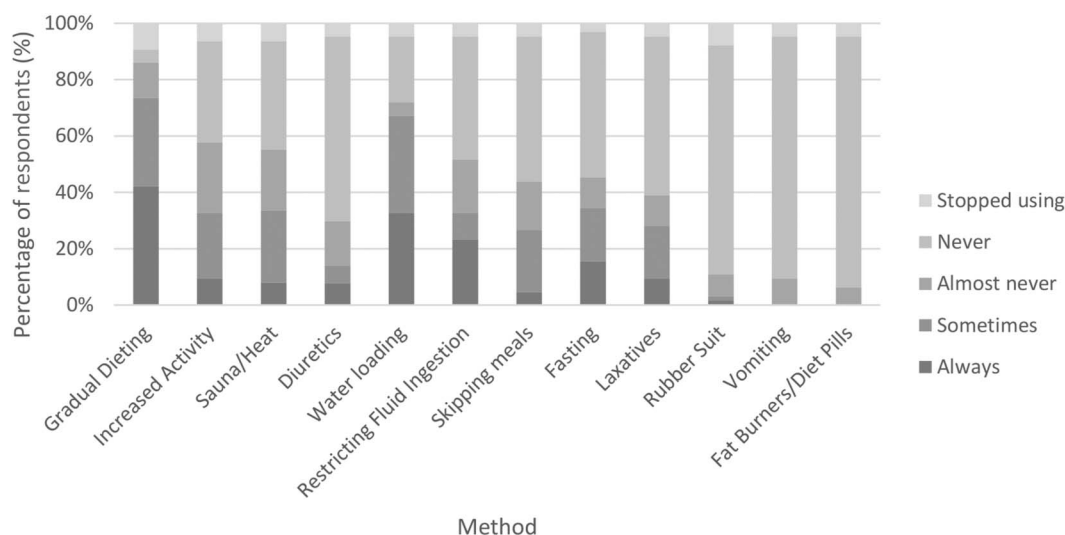
results were quite similar across all methods ranging from 3.1 to 7.8%.

Regarding the effects of weight cutting (Table 3), 15.6% of athletes reported that they always experienced fatigue and anxiety, making them the most common negative psychological states experienced. However, more athletes reported “sometimes” across fatigue, anger, and anxiety with 45.3, 26.6, and 35.9%, respectively, reporting these outcomes. The least experienced negative emotional state was depression and isolation, in which the athletes reported only 4.7 and 3.1% for always.

Discussion

To the knowledge of the authors, this is the first study conducted in world class powerlifters that assessed the prevalence, magnitude, and methods of weight cutting in preparation for competition. We conducted this study in elite athletes in person during the duration of the 2018 IPF world classic championships. This is an

important factor for 2 reasons, the first being our survey was collected shortly after competition, which minimizes recall bias (21), and the second being that this was performed in world class athletes, allowing us to observe the practices of elite athletes and to identify any potential differences with those who are not as competitive (23). We found that among world class powerlifters, the prevalence of weight cutting is high, as 83% of the athletes made weight using a combination of RWL and gradual dieting. The average weight loss using these methods was ~2.9% of body mass. Although gradual dieting would not fall under RWL, usage of gradual dieting had a high prevalence as well, which is why we included the data in our final analysis. However, despite obtaining both total amount of weight loss and the methods used to achieve this weight loss, details such as macronutrient distribution and calorie consumption were not recorded. This is because the survey was based on a previous survey calorie and macronutrient intake wasn't a part of the survey. Second, recalling specific calorie intake can be highly inaccurate if no previous tracking was performed; hence, the researchers decided not to

Table 2**Self-reported weight loss methods of world class powerlifters competing at IPF Classic Worlds 2018.***

*IPF = International Powerlifting Federation.

Table 3
Self-reported psychological state of world class powerlifters competing at IPF Classic Worlds 2018.*

Psychological state	Always (%)	Sometimes (%)	Almost never (%)	Never (%)
Fatigue	15.6	45.3	21.9	17.2
Anger	3.2	26.6	25.0	45.3
Anxiety	14.1	35.9	14.1	35.9
Isolation	4.7	12.5	25.0	57.8
Depression	3.1	7.8	26.6	62.5

*IPF = International Powerlifting Federation.

include it as part of the survey. A study conducted by Nolan et al (22) that surveyed powerlifters with the same questionnaire shows that of a lower competitive level on average showed that both the prevalence of weight cutting and magnitude of weight loss were similar with the findings of our study, at 85.8% of respondents and 3.0% of body mass, respectively (22). Although both the survey used both us and Nolan have not been validated for specifically powerlifting, similar findings between both surveys indicate potential utility and could warrant a validation study in the future.

We further segregated the athletes according to competitive success (medalists versus nonmedalists) to identify any potential differences in weight loss practices. We found that athletes who performed some form of weight cut leading into this competition tend to win medals more often compared with those who did not. There was also a difference in magnitude of body mass loss between the athletes who won a medal and those who did not win a medal (4.1 vs. 2.7%), but this difference did not reach statistical significance ($p = 0.13$). Future research with a larger sample size is needed to determine whether this lack of significance could be due to our relatively small sample size. Unsurprisingly, medalists had a higher overall Wilks score than nonmedalists, but the medalists also competed in more meets throughout the year, indicating that athlete experience with weight cutting might play a potential role in weight cutting success. This could be attributed to elite athletes being predisposed to use RWL strategies that are more severe in nature in order to gain a competitive edge over their opponents; hence, previous experience may allow more successful execution of a severe weight cut (23). Another interesting finding was that in the study by Nolan et al. (22), the average Wilks score for athletes categorized under High Wilks was 429, whereas in our study, those who did not win a medal averaged 435 Wilks, indicating a difference in the athlete caliber surveyed between our and the study by Nolan et al. Furthermore, the usual amount of body mass lost before competition by the high Wilks group in Nolan's study and the nonmedalists in our study were both 2.7%. These comparisons may support the notion that the more elite the athlete is, the greater the tendency for the athlete to cut more weight to potentially gain a competitive edge over opponents, which is similar to findings seen in the literature on combat sport athletes (8).

Although the athletes who won medals lost more weight compared with those who did not, the weight loss compared with other weight class sports was lower. In combat sports such as Judo and mixed martial arts (MMA), the range of average weight loss is between 6 and 11% of body mass (25), whereas in our study, it was only an average of 2.9%. However, severity of the cut cannot be measured solely by the amount of weight lost, and thus, analyzing the total RWL score might provide a more complete picture. The medalists in our study reported a higher average

RWL score compared with nonmedalists (32.8 vs. 28.5), and the average score across all lifters was higher compared with the scores reported by Nolan et al. (31.5 vs. 25.1). Indeed, the average RWL score from our study is more similar to some cohorts of elite and experienced taekwondo athletes (25) that reported scores of 31.7. These similarities might imply that higher-level athletes not only cut more weight but also use more severe methods to do so.

The discrepancy in the magnitude of weight loss between powerlifters and combat sport athletes despite a similar severity in RWL score could simply be due to the shorter time available to refuel and rehydrate after weigh-ins. In combat sports and MMA competitions, rules typically allow 24–36 hours between weigh-ins and competition compared with just 2 hours in powerlifting. Previous research in combat sport athletes also indicates that the more time available between weigh-ins and competition, the greater the tendency for an athlete to perform a cut of larger magnitude (1).

Rapid weight gain (RWG), which is the total amount of weight gained by an athlete post-weigh-ins, is a commonly used surrogate marker of total weight lost. Drawing on data from Australian Olympic combat sport athletes, 1 cohort reported RWG of roughly 4.3% (25) compared with 2.6% reported in our current survey. This suggests that combat athletes more aggressively use RWL before competition compared with powerlifters. Furthermore, in combat sports, the magnitude of RWG immediately after weigh-ins before competing can be a predictor of competitive success (24), but this finding is sport specific as it was not observed in boxing (5). This might indicate that combat sports involving grappling, when additional body mass might provide an advantage, could benefit more from RWG than striking sports. However, the effect of acutely higher body mass (due to rehydration) on powerlifting performance is unknown, and thus, the influence of RWG on powerlifting performance is not well elucidated and warrants more research.

From our study, elite athletes commonly used water loading and cutting (32.8%) and gradual dieting (42.2%) to make weight, whereas the usage of sweating-based RWL methods such as sauna/heat (7.8%) and rubber suits (1.6%) was not as common in terms of the percentage reported as always used. This confirms findings from Nolan et al. showing that prevalence between powerlifters and combat sport athletes was similar when it came to the usage of water manipulation and gradual dieting, but there was a stark difference in sweating-based RWL methods. Fasting was only somewhat common, as 15.6% reported always, and 18.7% reported sometimes; this method might be less popular among powerlifters as its utility could be influenced by the shorter time available to recover post-weigh-in. Because the powerlifters we surveyed had only <2 hours permitted between weigh-ins and competition, there might be insufficient time to rehydrate and refuel, especially when the amount of weight loss is large. Although there are currently no studies investigating rehydration in powerlifters, a study that measured an 18-hour rehydration period in wrestlers losing 3.5% of body mass showed that it was insufficient for full recovery (20). Although a study conducted in competitive weightlifters showed that a 2-hour period of rehydration was sufficient to prevent a decrement in performance after 4.3% of body mass loss (6). The differences between these studies could be due to different performance demands, or it could potentially be caused by the study's use of an ad libitum fashion post-weigh-in rehydration and refueling period, without accounting for the exact amount of food and fluids consumed. In an uncontrolled environment, there is a potential for athletes to under eat or rehydrate due to suppression of thirst and appetite post-RWL (7), which might influence the degree of recovery across different athletes. Hence, more research into the areas of rehydration and refueling post-weigh-in for strength athletes is needed to establish

evidence-based recommendation to minimize performance decrements.

Finally, the psychological effects of RWL are well documented in the combat sports literature with similar findings observed in the present study. Our subjects reported increased levels of anger, fatigue, and anxiety, which were similar to increased levels of confusion, rage, fatigue, depression, and isolation found in combat athletes (16). Investigators reporting powerlifters' RPE-based load selection accuracy noted that more research is needed to determine whether fatigue influences load selection accuracy (12). Thus, the finding that RWL increases perceived fatigue makes the decision to perform RWL for powerlifting an important consideration. Athletes should assess whether an increase in negative emotions and perceived fatigue, which could plausibly cloud one's judgment when selecting appropriate attempts, is worth engaging in RWL.

Practical Applications

Elite powerlifters competing at IPF worlds report losing on average ~3% of body mass before competition. However, lifters that won a medal reduced body mass by an average of 4.1%. There was an association between the number of competitions per year and increased success in winning a medal. These findings might indicate that the more practice cutting weight an athlete has, the less likely it will hinder their performance. Water loading and cutting seems to be the most commonly used method in conjunction with some form of gradual dieting; considering their frequent use at the elite level, this might indicate these methods have a lower chance of harming performance. When selecting an RWL method, one should consider the potential benefit of experience. Specifically, the method most familiar to the athlete could be an important factor in deciding which method to use, as there is not enough information on the advantages or disadvantages of any specific method. Finally, an athlete might experience negative psychological effects from RWL, which may need to be managed during the RWL process and during competition to prevent athlete burn out or errors in attempt selection.

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