SCIENTIFIC JOURNAL OF SPORT AND PERFORMANCE

REVIEW ARTICLE

Optimizing weight cutting practices in MMA: A systematic review of safer methods

Lucas de Paula Barbosa . *Metropolitan University of Santos. Brazil.*
Ana Carolina Staub. *Metropolitan University of Santos. Brazil.*
Maria Luiza Caetano Dias. *Metropolitan University of Santos. Brazil.*

ABSTRACT

As in other combat sports, mixed martial arts (MMA) is contested within standardized weight classes; athletes routinely manipulate body mass in the pre competition period ("*weight making*") to satisfy divisional limits at the official weigh-in. This systematic review evaluated the safest weight making strategies in MMA athletes from psychological, physiological, and nutritional perspectives. The protocol was submitted to PROSPERO (CRD420251083111) and the review adhered to PRISMA guidelines. PubMed, Embase, and Web of Science were searched from inception to June 8, 2025. Eligible studies were English language, peer reviewed original research involving MMA athletes preparing for competition. Fifteen studies met inclusion criteria. Across studies, a progressive multi week gradual weight loss (GWL) phase, typically achieved through dietary energy restriction and increased training load, was favored over aggressive rapid weight loss (RWL). Although both GWL and short term RWL can achieve target weigh in mass, RWL was associated with acute hypohydration at competition time, elevations in muscle damage/catabolic biomarkers, increased renal strain (with isolated reports of acute kidney injury), and adverse psychological effects (e.g., mood disturbance, cognitive impairment risk) in limited evidence. These findings support prioritizing structured GWL across the preparation period and minimizing the magnitude and duration of RWL when required.

Keywords: Performance analysis, Sport medicine, Martial arts, Martial arts performance, Boxing, Anthropometry, Weight loss, Nutrition, Nutritional supplements, Combat sports.

Cite this article as:
Barbosa, L. dP., Staub, A. C., & Dias, M. L. C. (2026). Optimizing weight cutting practices in MMA: A systematic review of safer methods. *Scientific Journal of Sport and Performance*, *5*(2), 195-204. https://doi.org/10.55860/TQYF8776

Corresponding author. *Metropolitan University of Santos. Brazil.*
E-mail: lupaulabarbosa@hotmail.com
Submitted for publication September 02, 2025.
Accepted for publication October 13, 2025.
Published October 24, 2025.
Scientific Journal of Sport and Performance. ISSN 2794-0586.

doi: https://doi.org/10.55860/TQYF8776

INTRODUCTION

Mixed Martial Arts (MMA) is a dynamic combat sport that integrates various fighting disciplines, including both striking and grappling techniques. MMA incorporates elements from martial arts such as boxing, Brazilian jiu-jitsu, and Muay Thai (James et al., 2016; Buse et al., 2006; Lenetsky & Harris et al., 2012; Park et al., 2019).

It is important for fighters to undergo a process known as "*making weight*," which involves cutting weight in order to meet the required weight class. This process is also essential in other combat sports (Coswig et al., 2015; Coswig et al., 2019; Connor &et al., 2019; Hiller et al., 2019).

During fight preparation, athletes often subject themselves to unhealthy methods for making weight. These practices include rapid weight loss (RWL), cutting carbohydrates, consuming very low-calorie diets, immersion in hot or cold water, sauna use, diet pills, skipping meals, the use of laxatives, and other extreme strategies (Anyżewska et al., 2018).

It is important to note that rapid weight loss (RWL) is one of the methods commonly used by athletes, but it is not the only approach. Gradual dieting is also frequently employed, and in some cases, both strategies are combined (Januszko et al., 2021; Anyżewska et al., 2018).

The objective of this study is to explore whether there are healthier methods for making weight, with the aim of promoting strategies that enhance both athlete safety and performance. Therefore, the purpose of this systematic review is to identify the safest and most effective methods for weight reduction in mixed martial arts (MMA).

MATERIALS AND METHODS

Study identification and selection were performed by two authors, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Figure 1). The study protocol was preregistered in the PROSPERO International Prospective Register of Systematic Reviews (CRD420251083111).

Eligibility criteria

Inclusion criteria were restricted to studies that met the following conditions: (1) involved Mixed Martial Arts (MMA) athletes preparing for competition; (2) were written in English; (3) were published as original research in peer-reviewed journals as full-text articles; and (4) specifically evaluated the effects of weight loss strategies on athletic performance parameters. Publications such as reviews, meta-analyses, abstracts, citations, conference proceedings, opinion pieces, books, book reviews, statements, letters, editorials, non-peer-reviewed journal articles, and commentaries were excluded from the analysis.

Search strategy

A systematic search was conducted in the electronic databases PubMed, Embase, and Web of Science up to July 2025. After retrieving the records, duplicate entries were removed. The remaining articles were then independently screened by two reviewers based on the predefined inclusion and exclusion criteria. Any disagreements (n = 2) were resolved through consultation with the first author. Studies that did not explicitly refer to pre-contest Mixed Martial Arts athletes or did not align with any of the following terms were excluded:

(1) Mixed Martial Arts, (2) Combat Sports, (3) MMA, (4) UFC Fighter, (5) Weight Cutting, (6) Weight Loss, (7) Weight Making, (8) Rapid Weight Loss, or (9) Gradual Weight Loss.

Risk of bias assessment

The methodological quality of the included studies was assessed using a modified version of the Downs and Black checklist (1998), tailored for non-randomized studies involving weight-cutting strategies in combat sports. The adapted tool consisted of 7 binary items (Yes = 1; No or Partially = 0), totalling a maximum possible score of 7 per study. The items evaluated were: Clarity of study objectives, description of interventions and outcomes, presentation of outcome variation (e.g., standard deviation or confidence intervals), representativeness of the target population, avoidance of measurement bias (e.g., blinding or objective tools), consideration of confounding factors (e.g., age, sex), adequate sample size or power.

The studies were independently evaluated by authors. Any discrepancies in their assessments were resolved through discussion, and if consensus could not be reached, a third author was consulted to make the final decision.

RESULTS

Study selection

The search strategy and study selection process resulted in the inclusion of 15 full-text studies in the review (Figure 1). Thirty-seven studies not explicitly referring to Mixed Martial Arts athletes and gradual weight loss (GWL) or rapid weight loss (RWL) were ultimately excluded.

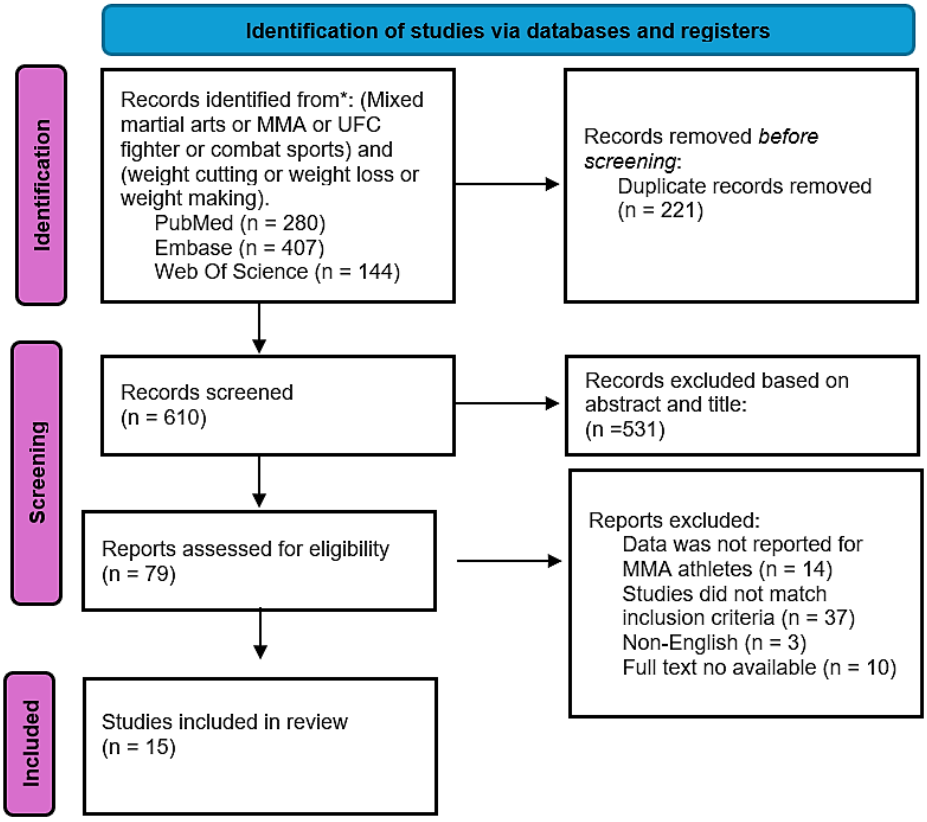

Figure 1. PRISMA flow diagram of included studies.

Participants and characteristics

The studies included were published up to July 2025. Reporting of participant characteristics was inconsistent: five studies did not state the sample size; 13 enrolled male athletes only; eight did not report the sex of participants; and four included female athletes. In addition, 13 studies failed to provide participants with ages. (Table 1)

Table 1. Characteristics of included studies.

First-author (year)	Title (abridged)	Participants number	Men and Women (n)	Mean age ± SD
Barley et al. (2018)	Weight-loss strategies across combat sports	637	Mixed (~25 % female)	N/A
Barley & Harms (2025)	RWL across combat sports survey	256	220 males / 36 females	28.4 ± 9.5
Brechney et al. (2021)	Weight-cut magnitude & MMA outcomes	75	Not specified	Not specified
Camarço et al. (2016)	Salivary NO & cognition after RWL	2	2 males	22
Connor & Egan (2021)	Hot-bath weight loss (self-adjusted temperature)	8	8 males	29.4 ± 5.3
Connor & Egan (2019)	RWL methods reported by Irish MMA athletes	30	30 males	Not specified
Coswig et al. (2015)	Biochemical responses to RWL in MMA	17	17 males	27.4 ± 5.3
Crighton et al. (2015)	Alarming weight-cutting behaviours in MMA	30	Not specified	Not specified
Evans et al. (2023)	Weight cutting in female UFC fighters	133	133 females	29.5–32.0
Jetton et al. (2013)	Dehydration & acute weight gain before competition	40	38 males 2 female	25.2 ± 0.65
Kasper et al. (2018)	Extreme weight-making: case study	1	1 male	Not specified
Matthews et al. (2016)	Extreme RWL & RWG in UK MMA	7	7 males	24.6 ± 3.5
Peacock et al. (2022)	Weight loss & regain in UFC	616	Not specified	31.1 ± 4.0
Reale et al. (2024)	Acute & chronic weight-making in professional MMA	33	Not specified	Not specified
Siqueido (2010)	Physiology of competitive MMA fighters	11	11 males	26.6 ± 4.7

Study risk of BIAS assessment

All included studies were appraised using the Downs and Black (1998) risk of bias tool. (Table 2).

Table 2. Risk of Bias (downs & black).

Article	Clear Objective	Clear Description	Results w/ Variation	Representative Sample	Measurement Bias Control	Confounding Controlled	Adequate Sample Size	Total Score	Quality
Barley & Harms 2025 – Rapid Weight Loss Across Combat Sports	1	1	1	0	1	0	1	5	Moderate
Barley et al. 2018 – Weight Loss Strategies Combat Sports	1	1	1	0	1	0	1	5	Moderate
Brechney et al. 2021 - Weight cut magnitude & MMA outcomes	1	1	1	0	1	0	0	4	Moderate
Camarco et al. 2016 – Salivary Nitrite Cognition Power	1	1	1	0	1	0	0	4	Moderate
Connor & Egan 2019 – Prevalence and Magnitude of RWL	1	1	1	1	1	0	0	5	Moderate
Connor & Egan 2021 – Hot Water Immersion Trial	1	1	1	1	1	1	0	6	High
Coswig et al. 2015 – Harmful	1	1	1	0	1	0	0	4	Moderate

Biochemical Responses									
Crighton et al. 2015 – Alarming Weight Cutting Behaviours	1	1	1	0	1	0	0	4	Moderate
Evans et al. 2023 – Weight Cutting in Female UFC	1	1	1	1	1	1	0	6	High
Jetton et al. 2013 – Dehydration and Acute Weight Gain	1	1	1	1	1	0	1	6	High
Kasper et al. 2018 – Extreme Weight Making Case Study	1	1	0	0	1	0	1	4	Moderate
Matthews & Nicholas 2016 – Extreme RWL and RWG UK Fighters	1	1	1	0	1	0	0	4	Moderate
Peacock et al. 2022 – Weight Loss and Competition Weight UFC	1	1	1	1	1	1	0	6	High
Reale et al. 2024 – Acute and Chronic Weight Making	1	1	1	1	1	1	0	6	High
Siqueido et al. 2010 – Physiological Characteristics MMA	1	1	1	0	1	0	0	4	Moderate

Results of individual series

Rapid weight loss

The prevalence of RWL in MMA is alarmingly high. Over 90% of athletes report engaging in weight-cutting practices The magnitude of weight loss varies, but reductions of 5–10% of body weight are commonly reported (Barley et al., 2018). Among UFC athletes, studies found that male and female fighters typically lost between 4.5% to 6.6% of body mass in the final days before competition (Peacock et al., 2022).

Dehydration related adverse outcomes were frequently highlighted; for example, the Brazilian fighter Leandro Caetano de Souza reportedly died while using a sauna during a weight-cut attempt (Matthews & Nicholas et al., 2017). Potential complications from electrolyte disturbances arising from aggressive manipulation of fluid and sodium balance were also noted, along with possible decrements in cognitive performance under such conditions (Brechney et al., 2021; Connor & Egan et al., 2021; Connor & Egan et al., 2021; Coswig et al., 2019; Buse et al., 2006).

Elevations in serum lactate dehydrogenase (LDH) and aspartate aminotransferase (AST) were reported both before and after competition in athletes undergoing RWL. Lower testosterone concentrations and a reduced testosterone: cortisol (T/C) ratio were also described. Renal involvement was mentioned, with changes in serum creatinine interpreted in relation to the athlete's hydration and rehydration status (Evans et al., 2023).

Psychological impacts including confusion, perceived stress, and mood disturbances were described as commonly affecting athletes who engage in RWL practices (Jetton et al., 2013).

Gradual weight loss

Across published combat-sport cohorts, the most frequently reported weight-management practice among mixed martial arts (MMA) athletes is a gradual reduction in body mass implemented in parallel with increased training volume or physical exercise (Connor et al., 2019; Buse et al., 2006). Compared with rapid

weight-cutting methods, gradual weight loss is consistently described as safer from physiological and medical standpoints (Peacock et al., 2022).

When an appropriately managed gradual weight loss (GWL) phase is followed by a brief, well-controlled period of rapid weight loss (RWL) specifically limited to the final ~72 hours before the official weight-in, the combined approach appears effective for achieving target weight while minimizing the magnitude of extreme acute cutting required (Peacock et al., 2022).

Gradual weight loss, the so-called chronic phase of weight making, is strongly advocated, particularly when conducted under qualified nutritional supervision (Hiller et al., 2019; Centers for Disease Control and Prevention [CDC], 1998). Current best practice recommends a reduction of approximately 0.5 % of body mass per week, allowing physiological adaptation while preserving performance capacity (Reale et al., 2024).

Evidence suggests that athletes who reduced body mass by 10.6% performed worse than those who limited loss to 8.6%, underscoring the value of a moderated, progressive approach (Jetton et al., 2013).

DISCUSSION

Rapid weight loss

The findings across the studies clearly indicate that rapid weight loss (RWL) is associated with a range of negative effects, varying from mild to severe. In the context of competition, RWL appears to be linked to a potential decline in athletic performance during the fight itself (Jetton et al., 2013). More severe health concerns associated with RWL include renal stress resulting from dehydration. Although creatinine levels may appear low, this could be due to fluid overcompensation masking underlying kidney strain. Additionally, evidence of muscle damage has been observed in athletes undergoing RWL. Biomarkers such as lactate dehydrogenase (LDH) were significantly elevated both before and after competition. Post-match levels of aspartate aminotransferase (AST) also increased notably, while creatine kinase (CK) levels were found to be approximately 45% higher, indicating substantial muscular stress (Coswig et al., 2015).

Some methods commonly used in rapid weight loss (RWL) should be avoided to reduce the risk of health complications. Strategies such as skipping meals, excessive fluid restriction or overhydration, training in heated environments, wearing plastic or rubber suits, sauna use, and the use of laxatives or diuretics are not recommended due to their potential negative effects on athlete health (James et al., 2016; Kasper et al., 2019; Connor & Egan et al., 2021). Case reports and commission/medical records describe fighters withdrawing from scheduled bouts because of acute illness attributed to weight cutting, including nausea, vomiting, headache, severe muscle cramping, seizures, syncope (fainting), and flu-like symptoms (Crighton et al., 2016). Rapid weight loss (RWL) was associated with reductions in salivary nitrite, decrements in muscle performance, and impaired cognitive function in MMA athletes. A 36-h recovery interval appeared adequate when the RWL magnitude was ~5.3% of body mass but inadequate to fully restore these outcomes when the loss approached ~9.1% (Camarço et al., 2016).

Having medical supervision during the dehydration process is essential for protecting the athlete's health. One commonly used method, hot water immersion, can lead to a body mass reduction of around 2.7%. Whether using hot water with 5% Epsom salt or just fresh water, both approaches show similar results, with no major differences in how much weight is lost (Matthews & Nicholas et al., 2017). In pre-competition testing (~2 h prior), 39% of athletes presented with USG > 1.021, indicating significant hypohydration, while just 23% met the criterion for adequate hydration (USG < 1.010) (Jetton et al., 2013). Methods such as water loading

and fasting are specifically listed among modalities by which weight can be lost rapidly in the fight-week period (Peacock et al., 2022).

Subsequent comparisons have noted that rapid body-mass reductions of ~10.8% approximate the extreme magnitudes implicated in the 1997 cluster of hyperthermia-related deaths among three U.S. collegiate wrestlers an event that precipitated major NCAA policy reforms restricting dehydration-based rapid weight loss and certain forms of artificial rehydration (Lenetsky & Harris et al., 2012; Connor & Egan et al., 2021). Strategies involving the use of hormones are not feasible, as they are strictly prohibited by nearly all MMA federations and competitive organizations. This limitation restricts the scope of research in this area. Athletes who are found to have used banned substances through doping controls are often fined or, in some cases, permanently banned from competition.

Gradual weight loss

A safer periodization for weight making involves gradual weight loss (GWL), which focuses on long-term strategies and avoids harmful methods. The authors emphasize that initiating weight reduction earlier combined with consistent physical training, offers a safer alternative for athletes as competition approaches (Barley & Harms et al., 2025). Drastic weight-making approaches, particularly rapid weight loss (RWL), are not recommended, as they compromise physiological function and physical performance and are associated with a higher likelihood of competitive defeat (Jetton et al., 2013).

Approximately 46.6% of combat-sport athletes initiate weight-cutting 4–6 weeks before the competition. (Siqueido et al., 2010). Reported strategies include dietary (energy) restriction, sauna exposure (passive sweating), increased training load, and water loading. (Hiller et al., 2019; Matthews & Nicholas et al., 2017).

Hot-water immersion at approximately 39 °C, even without the addition of Epsom (magnesium sulphate) salts, can produce acute reductions of up to ~4.5% of body mass when the full protocol is completed and is associated with severe hypohydration, as reflected by urine osmolality values >700 mOsm/kg (Connor et al 2019). Nonetheless, partial implementation of the protocol still elicits meaningful short-term weight loss while attenuating the degree of dehydration.

From a nutritional standpoint, prescribed daily energy deficits typically range from ~750 to ~1,900 kcal while maintaining macronutrient targets of ~1.5–2.0 g protein/kg/day, ~0.5–1.5 g fat/kg/day, and ~3.0–5.0 g carbohydrate/kg/day (Matthews & Nicholas et al., 2017; Hiller et al., 2019; Crighton et al., 2016). Several protocols also include a post-exercise protein feeding of ~25–30 g (often delivered via a protein supplement). (Matthews & Nicholas et al., 2017; Hiller et al., 2019).

Despite its benefits, gradual weight loss, if marked by excessive caloric restriction, can lead to disordered eating behaviours, especially when unsupervised. Additionally, if GWL is initiated too late, athletes may face challenges making weight in the final days before the fight, resorting to more extreme weight loss methods (Barley & Harms et al., 2025).

Maintaining an average weight-loss rate of ~0.5% of body mass per week is advised to minimize adverse outcomes and may help attenuate losses of fat-free mass, as faster rates have been associated with greater lean tissue reductions (Reale et al 2024). Weekly nutritional adjustments should be made to keep the rate of loss on target (Barley et al., 2018).

CONCLUSION

The findings showed that rapid weight loss (RWL) strategies are effective in terms of reducing body weight quickly. However, they are often accompanied by numerous adverse effects, which can impact both health and athletic performance, some of which may be severe. Considering it, RWL might not be recommended due to its aggressive nature and the physiological strain it imposes.

On the other hand, gradual weight loss (GWL), when properly planned and monitored by professionals, proved to be safer. Even though certain techniques typically associated with RWL, such as sauna use and dehydration, might be employed during GWL, their implementation under professional supervision allows for safer and more controlled outcomes. Therefore, GWL appears to be a superior method for weight making, offering greater safety.

AUTHOR CONTRIBUTIONS

Barbosa, Lucas de Paula (1st authors and corresponding author): search strategy, screening, study selection, risk of bias, data extraction, wrote results, wrote discussion, wrote conclusion, final review. Staub, Ana Carolina (2nd Author): screening, risk of bias, data extraction, wrote results, wrote conclusion, final review. Dias, Maria Luiza Caetano (3rd Author): screening, wrote methods, fixed grammar, wrote tables, final review.

SUPPORTING AGENCIES

No funding agencies were reported by the authors.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

REFERENCES

Anyżewska, A., Dzierżanowski, I., Woźniak, A., Leonkiewicz, M., & Wawrzyniak, A. (2018). Rapid weight loss and dietary inadequacies among martial arts practitioners from Poland. International Journal of Environmental Research and Public Health, 15(11), 2476. https://doi.org/10.3390/ijerph15112476

Barley, O. R., & Harms, C. A. (2025). Rapid weight loss across combat sports and the relationships between methods and magnitude. Translational Sports Medicine, Article 2946317. https://doi.org/10.1155/tsm2/2946317

Barley, O. R., Chapman, D. W., & Abbiss, C. R. (2018). Weight loss strategies in combat sports and concerning habits in mixed martial arts. International Journal of Sports Physiology and Performance, 13(7), 933-939. https://doi.org/10.1123/ijspp.2017-0715

Brechney, G. C., Chia, E., & Moreland, A. T. (2021). Weight cutting implications for competition outcomes in mixed martial arts cage fighting. Journal of Strength and Conditioning Research, 35(12), 3420-3424. https://doi.org/10.1519/JSC.0000000000003368

Buse, G. J. (2006). No holds barred sport fighting: A 10-year review of mixed martial arts competition. British Journal of Sports Medicine, 40(2), 169-172. https://doi.org/10.1136/bjsm.2005.021295

Camarço, N. F., Sousa Neto, I. V., Nascimento, D. C., Almeida, J. A., Vieira, D. C. L., Rosa, T. S., Pereira, G. B., & Prestes, J. (2016). Salivary nitrite content, cognition and power in mixed martial arts fighters

after rapid weight loss: A case study. Journal of Clinical and Translational Research, 2(2), 63-69. https://doi.org/10.18053/jctres.02.201602.004

Centers for Disease Control and Prevention. (1998, February 20). Hyperthermia- and dehydration-related deaths associated with intentional rapid weight loss in three collegiate wrestlers-North Carolina, Wisconsin, and Michigan, November-December 1997. Morbidity and Mortality Weekly Report, 47(6), 105-108. Retrieved from [Accessed 2025, 16 October]: https://www.cdc.gov/mmwr/PDF/wk/mm4706.pdf

Connor, J., & Egan, B. (2019). Prevalence, magnitude and methods of rapid weight loss reported by male mixed martial arts athletes in Ireland. Sports (Basel), 7(9), 206. https://doi.org/10.3390/sports7090206

Connor, J., & Egan, B. (2021). Comparison of hot water immersion at self-adjusted maximum tolerable temperature, with or without the addition of salt, for rapid weight loss in mixed martial arts athletes. Biology of Sport, 38(1), 89-96. https://doi.org/10.5114/biolsport.2020.96947

Connor, J., & Egan, B. (2021). Self-reported methods of weight cutting in professional mixed-martial artists. Journal of Human Kinetics, 77(1), 229-238. https://doi.org/10.2478/hukin-2021-0052

Coswig, V. S., Fukuda, D. H., & Del Vecchio, F. B. (2015). Rapid weight loss elicits harmful biochemical and hormonal responses in mixed martial arts athletes. International Journal of Sport Nutrition and Exercise Metabolism, 25(5), 480-486. https://doi.org/10.1123/ijsnem.2014-0267

Coswig, V. S., Miarka, B., Pires, D. A., da Silva, L. M., Bartel, C., & Del Vecchio, F. B. (2019). Weight regain, but not weight loss, is related to competitive success in real-life mixed martial arts competition. International Journal of Sport Nutrition and Exercise Metabolism, 29(1), 1-8. https://doi.org/10.1123/ijsnem.2018-0034

Crighton, B., Close, G. L., & Morton, J. P. (2016). Alarming weight cutting behaviours in mixed martial arts: A cause for concern and a call for action. British Journal of Sports Medicine, 50(8), 446-447. https://doi.org/10.1136/bjsports-2015-094732

Downs, S. H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality of both randomised and non-randomised studies of health care interventions. Journal of Epidemiology and Community Health, 52(6), 377-384. https://doi.org/10.1136/jech.52.6.377

Evans, C., Stull, C., Sanders, G., Ricci, A., French, D., Antonio, J., & Peacock, C. A. (2023). Weight cutting in female UFC fighters. Journal of the International Society of Sports Nutrition, 20(1), Article 2247384. https://doi.org/10.1080/15502783.2023.2247384

Hillier, M., Sutton, L., James, L., Mojtahedi, D., Keay, N., & Hind, K. (2019). High prevalence and magnitude of rapid weight loss in mixed martial arts athletes. International Journal of Sport Nutrition and Exercise Metabolism, 29(5), 512-517. https://doi.org/10.1123/ijsnem.2018-0393

James, L. P., Haff, G. G., Kelly, V. G., & Beckman, E. M. (2016). Towards a determination of the physiological characteristics distinguishing successful mixed martial arts athletes: A systematic review of combat sport literature. Sports Medicine, 46(10), 1525-1551. https://doi.org/10.1007/s40279-016-0493-1

Januszko, P., & Lange, E. (2021). Nutrition, supplementation and weight reduction in combat sports: A review. AIMS Public Health, 8(3), 485-498. https://doi.org/10.3934/publichealth.2021038

Jetton, A. M., Lawrence, M. M., Meucci, M., Haines, T. L., Collier, S. R., Morris, D. M., & Utter, A. C. (2013). Dehydration and acute weight gain in mixed martial arts fighters before competition. Journal of Strength and Conditioning Research, 27(5), 1322-1326. https://doi.org/10.1519/JSC.0b013e31828a1e91

Kasper, A. M., Crighton, B., Langan-Evans, C., Riley, P., Sharma, A., Close, G. L., & Morton, J. P. (2019). Case study: Extreme weight making causes relative energy deficiency, dehydration, and acute

kidney injury in a male mixed martial arts athlete. International Journal of Sport Nutrition and Exercise Metabolism, 29(3), 331-338. https://doi.org/10.1123/ijsnem.2018-0029

Lenetsky, S., & Harris, N. (2012). The mixed martial arts athlete: A physiological profile. Strength and Conditioning Journal, 34(1), 32-47. https://doi.org/10.1519/SSC.0b013e3182389f00

Matthews, J. J., & Nicholas, C. (2017). Extreme rapid weight loss and rapid weight gain observed in UK mixed martial arts athletes preparing for competition. International Journal of Sport Nutrition and Exercise Metabolism, 27(2), 122-129. https://doi.org/10.1123/ijsnem.2016-0174

Park, S., Alencar, M., Sassone, J., Madrigal, L., & Ede, A. (2019). Self-reported methods of weight cutting in professional mixed martial artists: How much are they losing and who is advising them? Journal of the International Society of Sports Nutrition, 16(1), 52. https://doi.org/10.1186/s12970-019-0320-9

Peacock, C. A., French, D., Sanders, G. J., Ricci, A., Stull, C., & Antonio, J. (2022). Weight loss and competition weight in Ultimate Fighting Championship (UFC) athletes. Journal of Functional Morphology and Kinesiology, 7(4), 115. https://doi.org/10.3390/jfmk7040115

Reale, R., Wang, J., Stull, C. H., French, D., Amasinger, D., & Wang, R. (2024). Acute and chronic weight-making practice in professional mixed martial arts athletes: An analysis of 33 athletes across 80 fights. International Journal of Sport Nutrition and Exercise Metabolism, 34(5), 275-285. https://doi.org/10.1123/ijsnem.2023-0229

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L. A., & PRISMA-P Group. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: Elaboration and explanation. BMJ, 349, g7647. https://doi.org/10.1136/bmj.g7647

Siqueido, A. R. (2010). Physiological characteristics of competitive mixed martial art fighters [Doctoral dissertation, California State University, Long Beach]. ProQuest Dissertations & Theses.

