THE Mac-Nutrition COLLECTIVE

An Evidence-based Approach to Recovery After Rapid Weight Cutting for Combat Sports

Dr Lewis James

AIMS

- Describe the common methods used to 'cut weight' in combat sports, their physiological consequences and how they may differ between sports
- Explore the evidence that underpins recovery between weigh-in and competition
- Consider some of the ethical and health implications of rapid weight loss

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Why do Combat Sports Athletes 'Cut' Weight?

Weight Loss Terminology

- **Gradual weight loss:**
  - Weight loss due to change in body fat/protein stores
  - In the weeks and months leading up to weigh-in

- **Rapid weight loss ('weight cutting'):**
  - Generally unrelated to change in body fat/protein stores
  - Weight loss in the days and hours before weigh in

The 'Cut' Will Depend on the Rules/Sport

Sport	Weigh-in	Considerations
Professional MMA	>24 h pre	Hydration test?
Professional Boxing	>24 h pre	Rehydration clause?
Amateur MMA	>3 h pre	Could be >24 h
Amateur boxing	>3 h pre	Each day they compete
Amateur wrestling	Morning of	Tournament and finals
Taekwondo	Evening before	5% regain limit
Judo	Evening before	5% regain limit
Brazilian Jui-jitsu	Immediately pre	

Why Do Athletes 'Cut' Weight?

› Med Sci Sports Exerc. 1998 Jun;30(6):949-51. doi: 10.1097/00005768-199806000-00026.

Acute weight gain and its relationship to success in high school wrestlers

R R Wroble, D P Moxley

2.4% vs 1.9%

Weight re-gain in 260 high school wrestlers significantly greater in winners

Why Do Athletes 'Cut' Weight?

> Int J Sport Nutr Exerc Metab. 2019 Jan 1;29(1):1-8. doi: 10.1123/ijsnem.2018-0034.

Weight Regain, but not Weight Loss, Is Related to Competitive Success in Real-Life Mixed Martial Arts Competition

Victor Silveira Coswig [1], Bianca Miarka [2], Daniel Alvarez Pires [1], Levy Mendes da Silva [1], Charles Bartel [3], Fabrício Boscolo Del Vecchio [3]

> Int J Sports Physiol Perform. 2022 Dec 6;18(1):85-94. doi: 10.1123/ijspp.2022-0204. Print 2023 Jan 1.

Rapid Weight Gain and Weight Differential Predict Competitive Success in 2100 Professional Combat-Sport Athletes

Vincent Baribeau [1], Christopher Kirk [2], Danny Q Le [1], Arjun Bose [1], Ariel Mueller [3], Duncan French [4], Todd Sarge [1], Carl Langan-Evans [5], Reid Reale [6], Kadhiresan R Murugappan [1]

> Int J Sport Nutr Exerc Metab. 2016 Dec;26(6):525-530. doi: 10.1123/ijsnem.2015-0359. Epub 2016 Aug 24.

Regain in Body Mass After Weigh-In is Linked to Success in Real Life Judo Competition

Reid Reale, Gregory R Cox, Gary Slater, Louise M Burke

> Int J Sports Physiol Perform. 2017 Aug;12(7):856-863. doi: 10.1123/ijspp.2016-0311. Epub 2016 Nov 11.

Weight Regain: No Link to Success in a Real-Life Multiday Boxing Tournament

Reid Reale, Gregory R Cox, Gary Slater, Louise M Burke

> Int J Sport Nutr Exerc Metab. 2020 Sep 1;30(5):357-361. doi: 10.1123/ijsnem.2019-0347. Epub 2020 Jul 8.

Worth the Weight? Post Weigh-In Rapid Weight Gain is Not Related to Winning or Losing in Professional Mixed Martial Arts

Christopher Kirk [1 2], Carl Langan-Evans [2], James P Morton [2]

Why Do Athletes 'Cut' Weight?

Weight loss pressure on a 5 year old wrestler

R A Sansone, R Sawyer

Br J Sports Med 2005;39:e2 (http://www.bjsportmed.com/cgi/content/full/39/1/e2). doi: 10.1136/bjsm.2004.013136

I'll bet that I was the only one in the sauna last night. I haven't had anything to eat today, or yesterday

'Why are you all eating before weigh ins?'

Pressured by **father** to lose ~2.3 kg or approximately **10%** of his body weight for his wrestling tournament.

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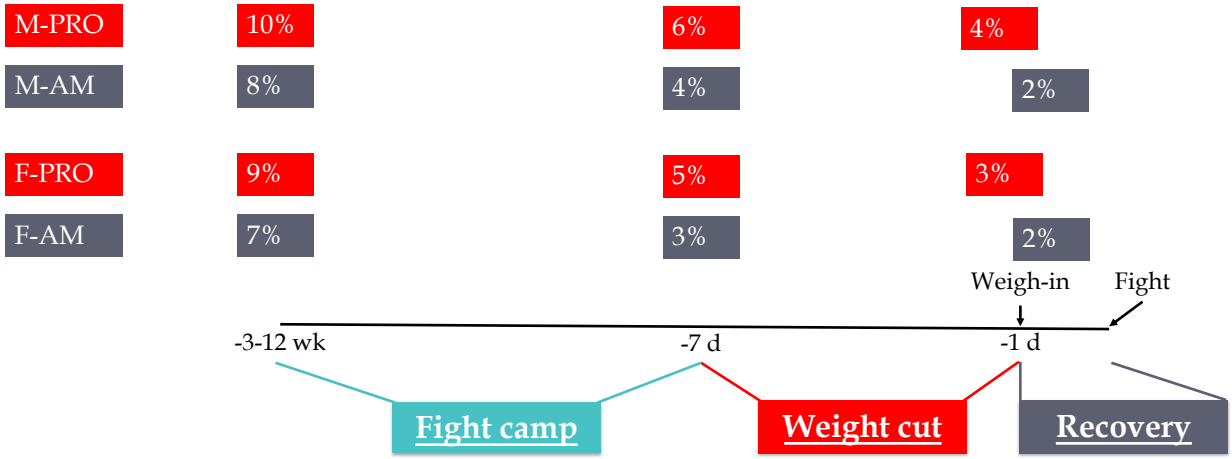
Rapid Weight Loss Methods and Effects

Typical Weight Loss (MMA)

Average weight loss

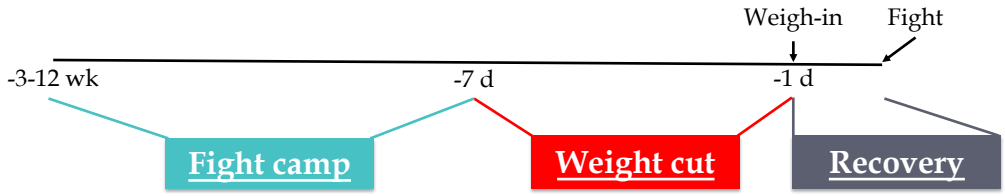


Hillier et al. (2019)

Typical Weight Loss (MMA)

Maximum weight loss

M-PRO	26%	14%	13%
M-AM	27%	15%	11%
F-PRO	16%	13%	8%
F-AM	15%	7%	6%



Hillier et al. (2019)

What Goes Down Must Come Up

J Funct Morphol Kinesiol. 2022 Dec 15;7(4):115. doi: 10.3390/jfmk7040115.

Weight Loss and Competition Weight in Ultimate Fighting Championship (UFC) Athletes

Corey A Peacock [1], Duncan French [2 3], Jose Antonio [1]

Percent (%) Weight Change			
72 h Before	−6.7	±	2.3
48 h Before	−5.7	±	2.1
24 h Before	−4.4	±	2.9
Post-Weigh-In	9.7	±	4.0

Rapid Weight Loss Methods

- Energy restriction
- Low carbohydrate intake
- Low-residue diets
- Water loading
- Sodium manipulation
- Dietary fibre manipulation
- Fluid restriction

- Exercise
- Heat exposure (passive/active)

- Laxatives
- Diuretics
- Spitting
- Vomiting

- Blood letting/donation
- Colonic irrigation

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- **Exercise**
- **Heat exposure (passive/active)**

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- Spitting
- Vomiting

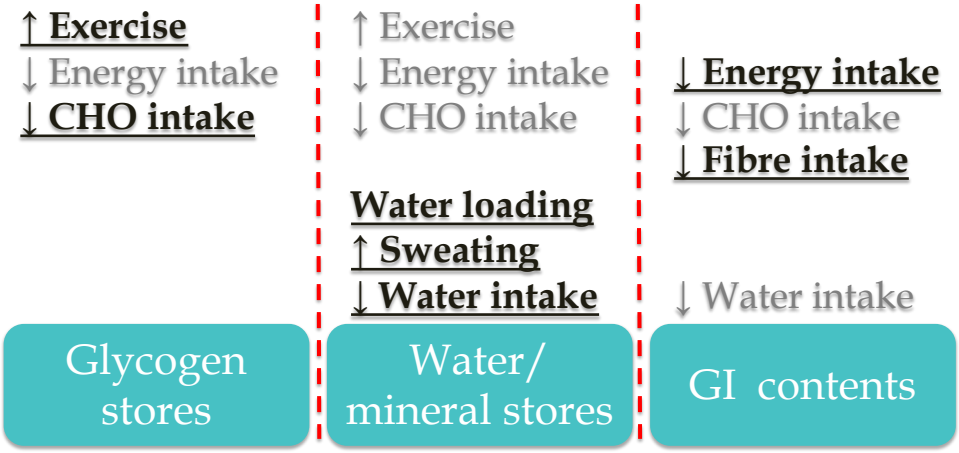
- Blood letting/donation
- Colonic irrigation

Mechanisms of Rapid Weight Loss

Curr Sports Med Rep. 2021 Apr 1;20(4):199-217. doi: 10.1249/JSR.0000000000000831.

ACSM Expert Consensus Statement on Weight Loss in Weight-Category Sports

Louise M Burke [1], Gary J Slater [2], Joseph J Matthews, Carl Langan-Evans [3], Craig A Horswill [4]

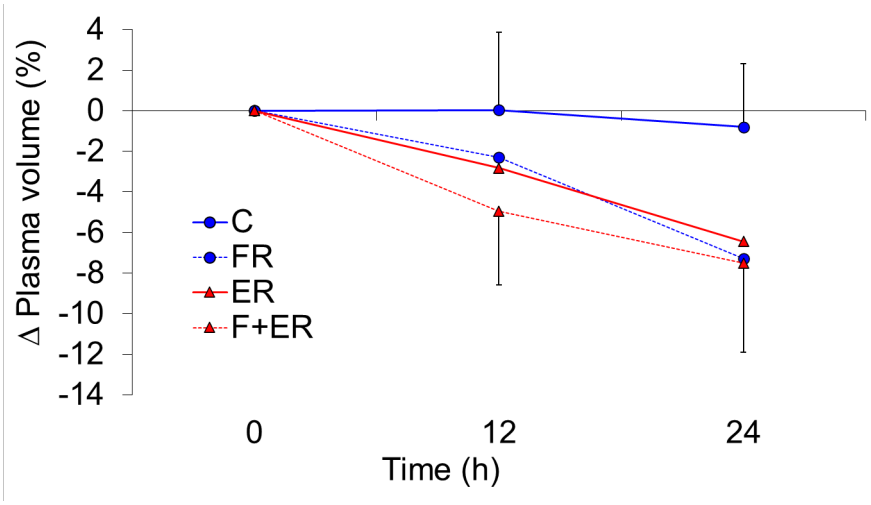


Key Influencers

	Competition level	
Influencer	Professional	Amateur
Training partner	17.6	13.9
Fellow MMA athlete	18.9	10.8
Doctor	0.7	0.6
Physical trainer	3.4	3.6
MMA coach	22.3	38.6
Parents	0.7	0.6
Dietician	14.2	9.6
Internet	12.2	15.7

Hillier et al. (2019)

Inadvertent Dehydration



Body mass loss	
C	-0.3%
FR	-1.9%
ER	-2.0%
F+ER	-2.4%

James & Shirreffs (2013)

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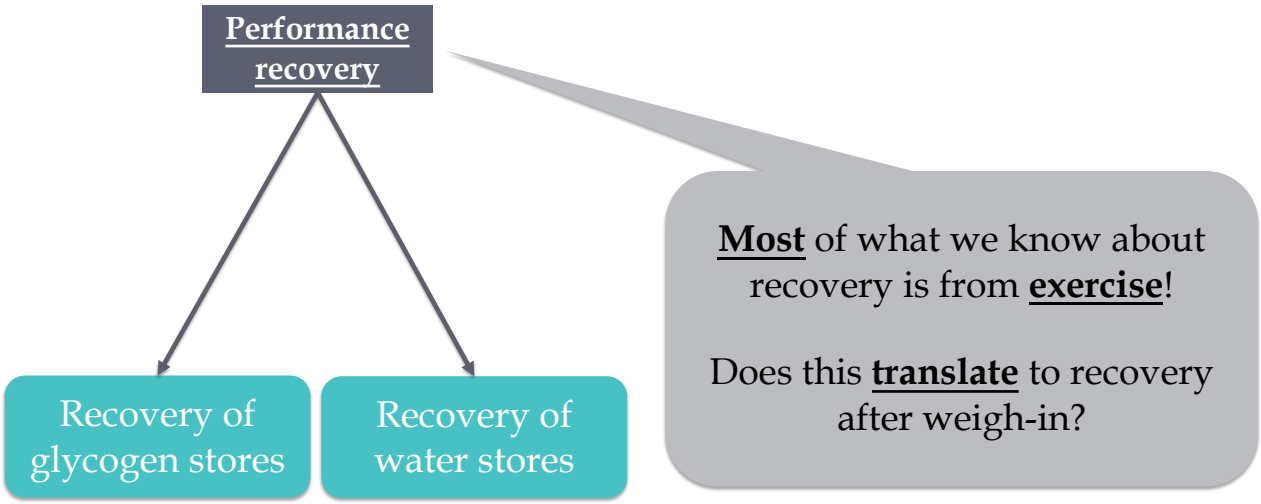
Rapid Weight Loss and Performance Effects

Weight Cutting and Performance

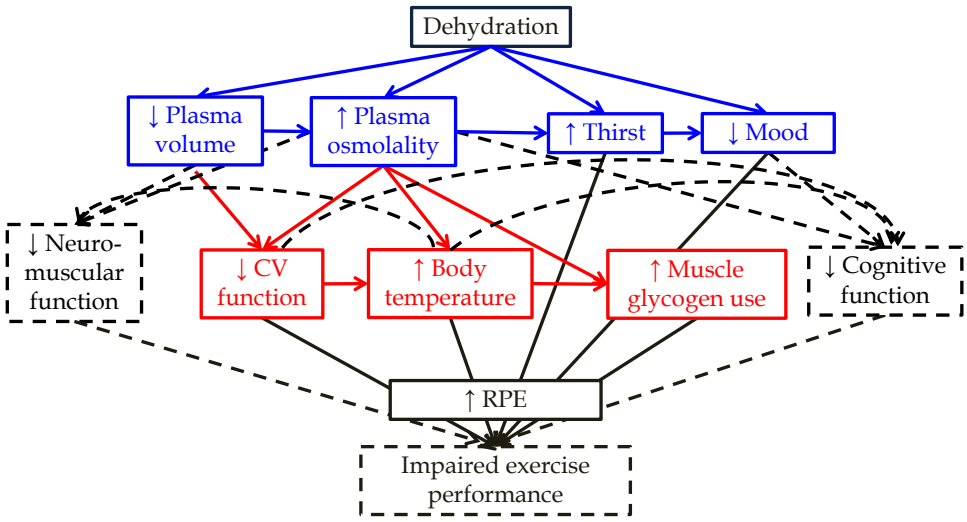
- Performance effects will depend on:

- Methods used
- Proximity of weigh-in to competition
- Ability to recover any deficits

Recovery Priorities

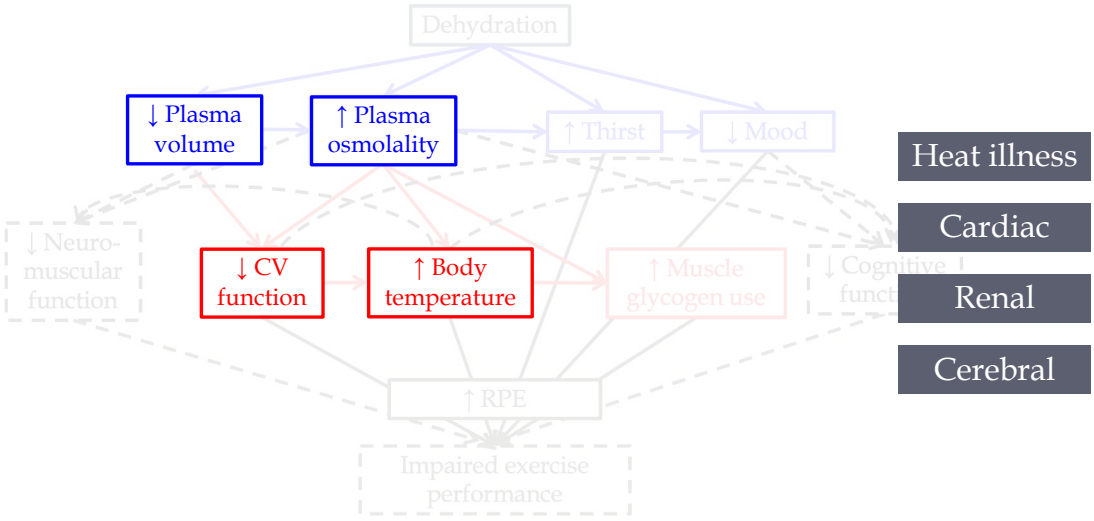


Dehydration: **Performance** and Health



Adapted from James et al. (2019)

Dehydration: Performance and **Health**



Adapted from James et al. (2019)

Dehydration: Performance

Dehydration: Performance

Review > Sports Med. 2019 Dec;49(Suppl 2):103-114. doi: 10.1007/s40279-019-01188-5.

Does Hypohydration Really Impair Endurance Performance? Methodological Considerations for Interpreting Hydration Research

Lewis J James [1], Mark P Funnell [2], Ruth M James [3], Stephen A Mears [2]

Dehydration: Performance (blinding)

J Appl Physiol 126: 870–879, 2019.
First published January 10, 2019; doi:10.1152/japplphysiol.01026.2018.

RESEARCH ARTICLE

Blinded and unblinded hypohydration similarly impair cycling time trial performance in the heat in trained cyclists

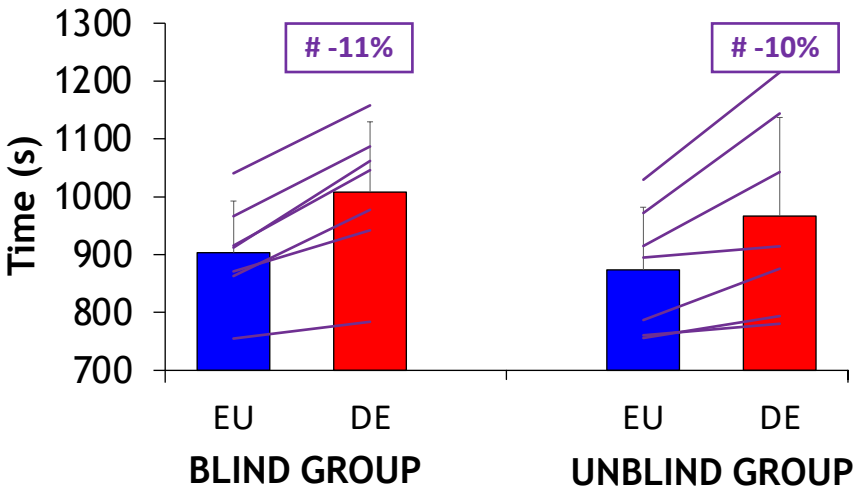
Mark P. Funnell, Stephen A. Mears, Kurt Bergin-Taylor, and Lewis J. James
National Centre for Sport and Exercise Medicine, School of Sport, Exercise and Health Sciences, Loughborough University, Leicestershire, United Kingdom

	BLIND GROUP	UNBLIND GROUP
Age (y)	26 (5)	26 (6)
Body mass (kg)	73.6 (6.6)	75.2 (8.4)
Body fat (%)	10 (2)	9 (2)
VO_{2peak}	63 (5)	64 (4)
Cycling history (y)	6 (2)	6 (3)
Training (h/week)	8 (4)	9 (4)

Dehydration: Performance (blinding)

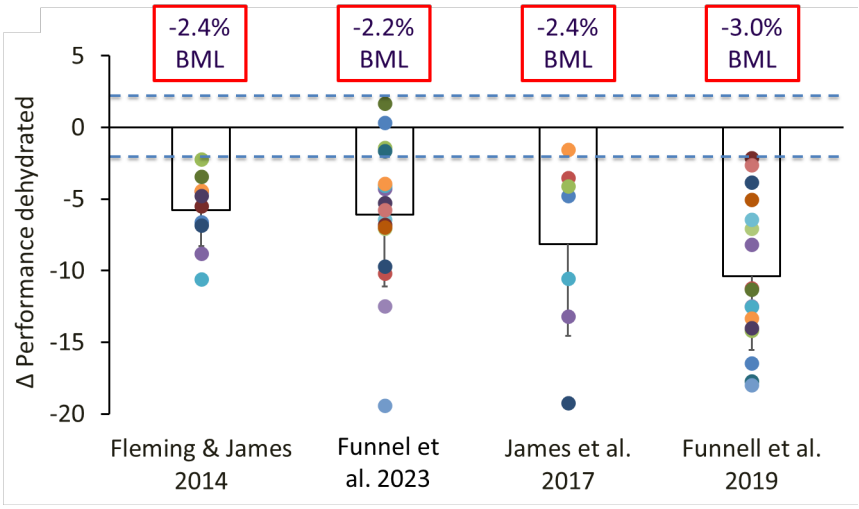
	BLIND GROUP		UNBLIND GROUP	
	EU	DE	EU	DE
Δ Plasma volume (%)	-4.8 (3.9)	-8.1 (4.2) #	-3.9 (4.2)	-9.9 (1.9) #
Serum osmolality (mosmol/kg)	289 (5)	298 (6) #	286 (8)	296 (5) #
Heart rate (beat/min)	147 (8)	160 (11) #	139 (9)	153 (10) #
Thirst (0-10)	4 (2)	7 (2) #	3 (1)	8 (1) #
GI temp (°C)	38.0 (0.4)	38.5 (0.4) #	38.0 (0.8)	38.6 (0.5) #
RPE	12 (1)	14 (1) #	13 (2)	15 (2) #
Fullness	5 (2)	5 (2)	3 (2)	3 (1)

Dehydration: Performance (blinding)



Funnell et al. (2019)

Dehydration: Performance (tolerability)



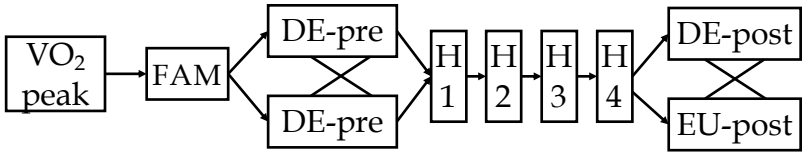
Dehydration: Performance (tolerability)

Appl Physiol Nutr Metab. 2014 Feb;39(2):124-9. doi: 10.1139/apnm-2013-0044. Epub 2013 Jul 26.

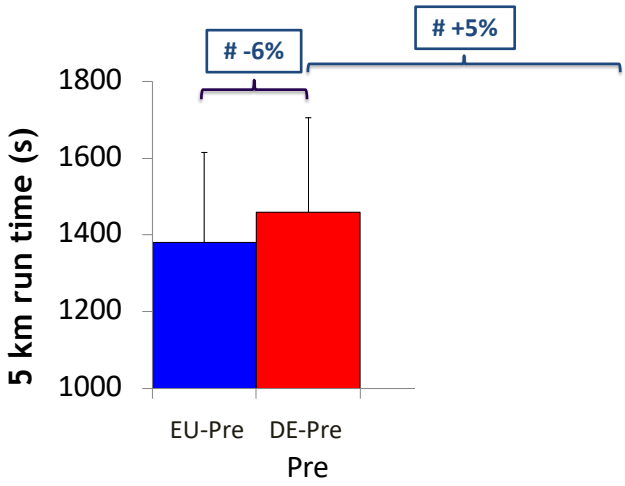
Repeated familiarisation with hypohydration attenuates the performance decrement caused by hypohydration during treadmill running

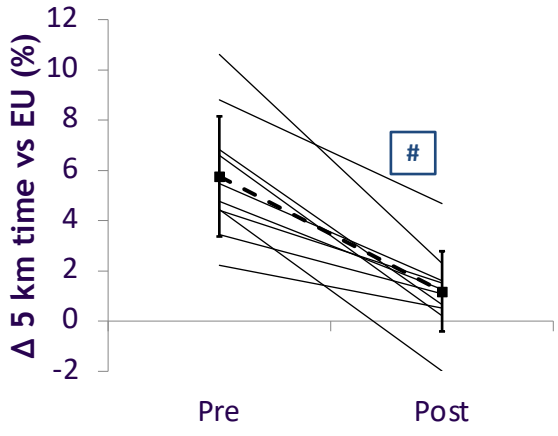
Joseph Fleming [1], Lewis J James

Study overview



Dehydration: Performance (tolerability)





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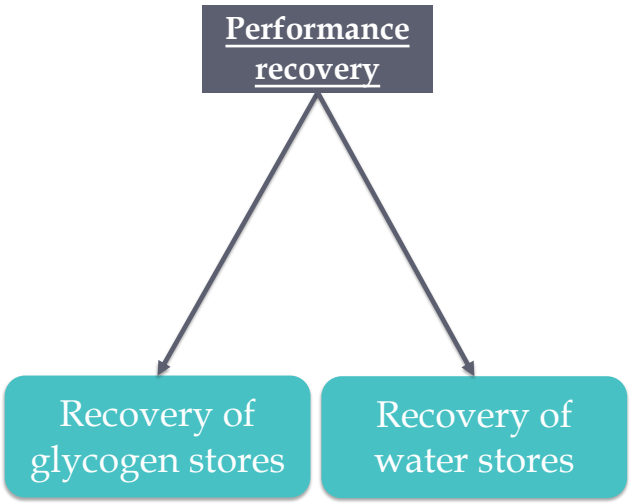
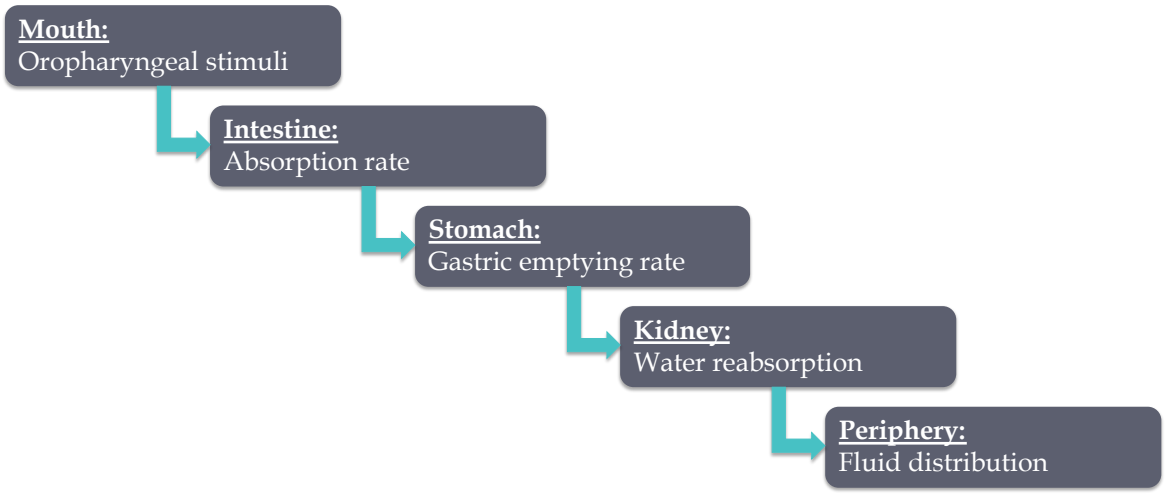
Recovery after Rapid Weight Loss

Recovery



Recovery of Water Stores: Rehydration



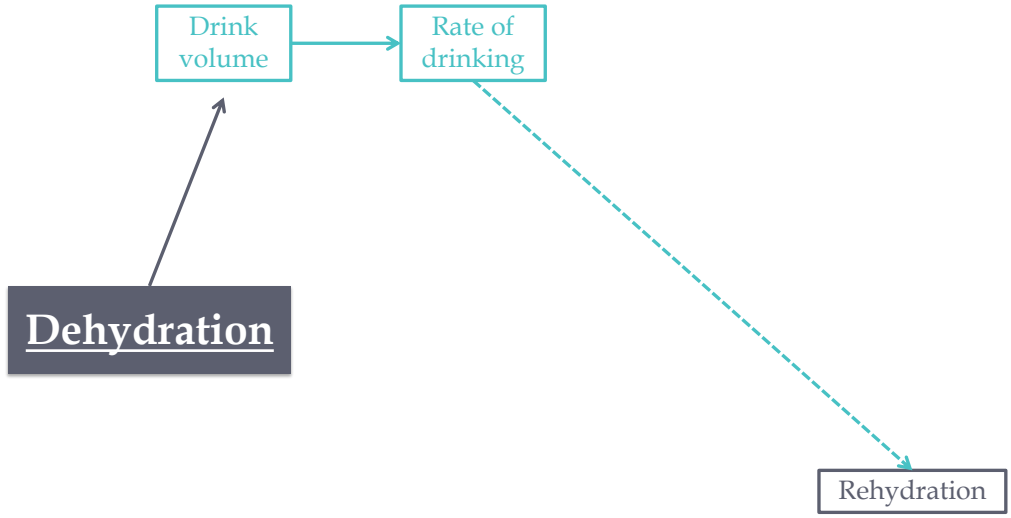
Optimising Rehydration

Review > J Appl Physiol (1985). 2017 Apr 1;122(4):945-951. doi: 10.1152/japplphysiol.00745.2016. Epub 2017 Jan 26.

Optimizing the restoration and maintenance of fluid balance after exercise-induced dehydration

Gethin H Evans [1], Lewis J James [2], Susan M Shirreffs [3], Ronald J Maughan [2]

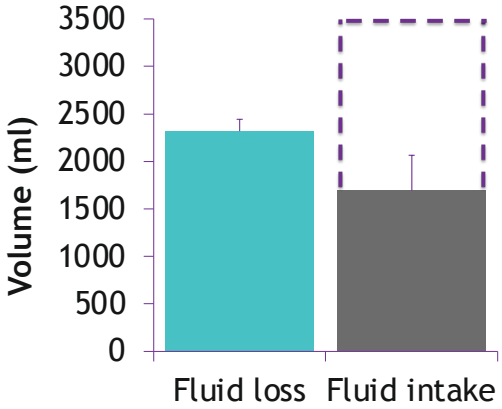
Optimising Rehydration



Adapted from Evans et al. (2017)

Recovery of water stores: Rehydration

Mouth:
Oropharyngeal stimuli

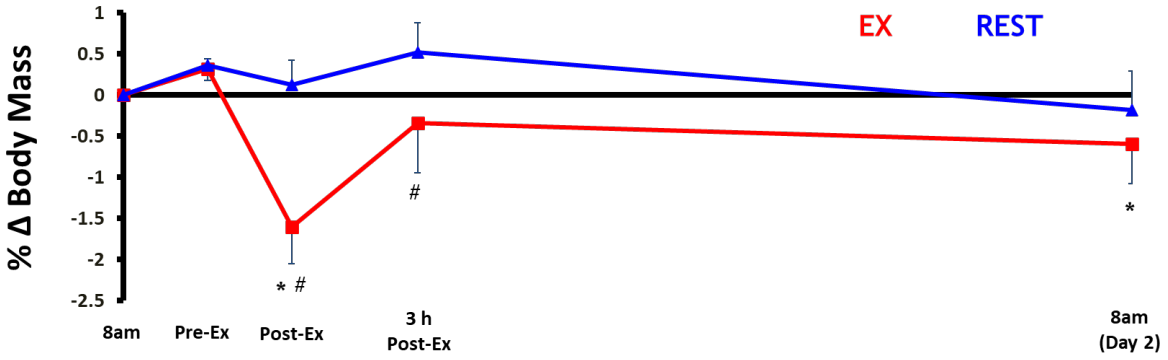


James et al. (Unpublished)

Recovery of water stores: Rehydration

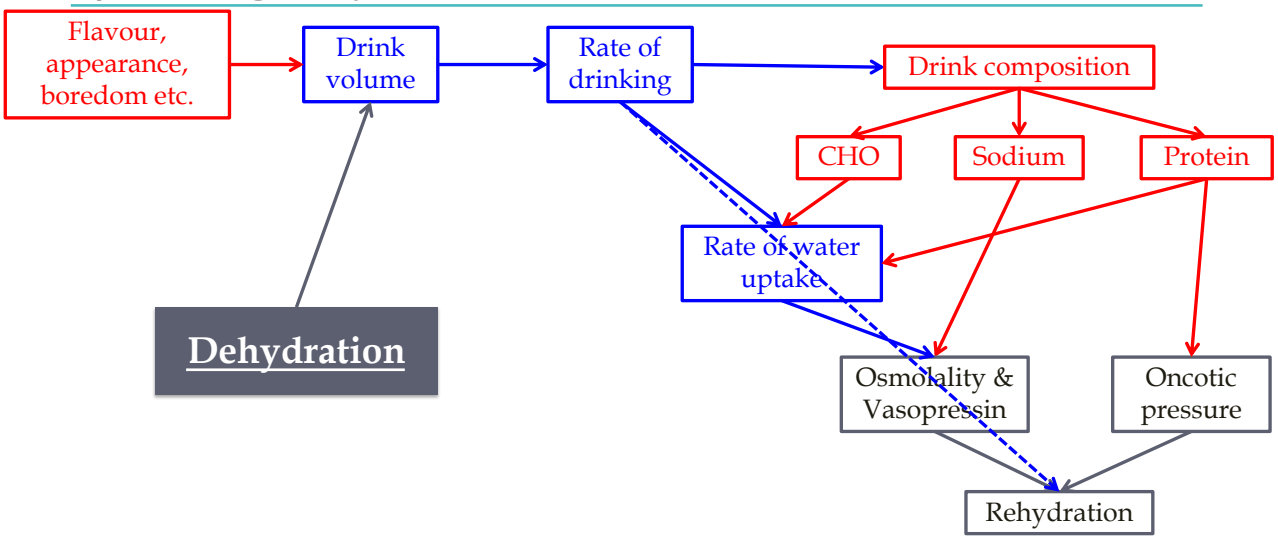
Mouth:
Oropharyngeal stimuli

Body mass loss not recovered over 20 h



Funnell et al. (2023)

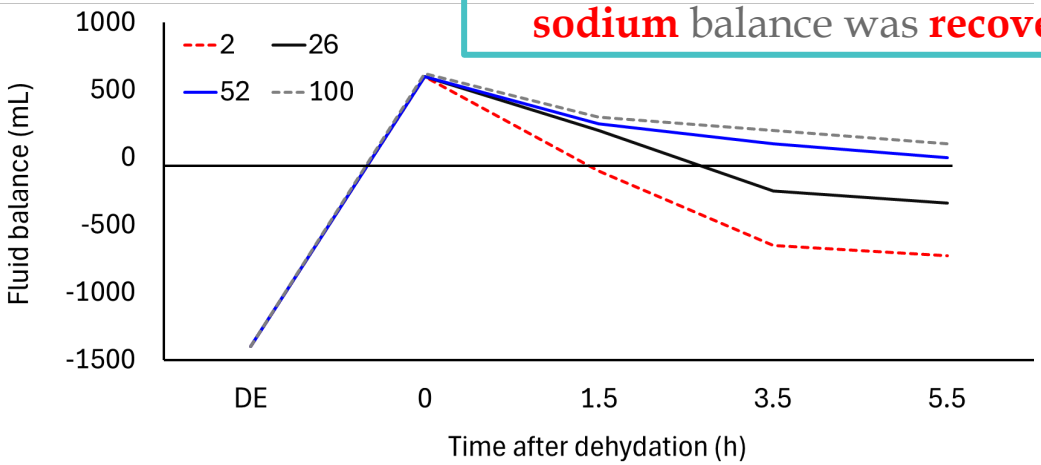
Optimising Rehydration



Adapted from Evans et al. (2017)

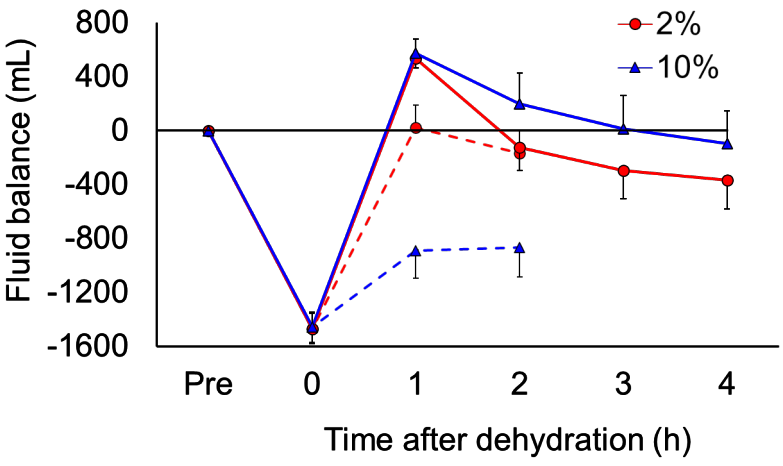
Rehydration: Sodium

Full **rehydration** only occurred when **sodium** balance was **recovered**



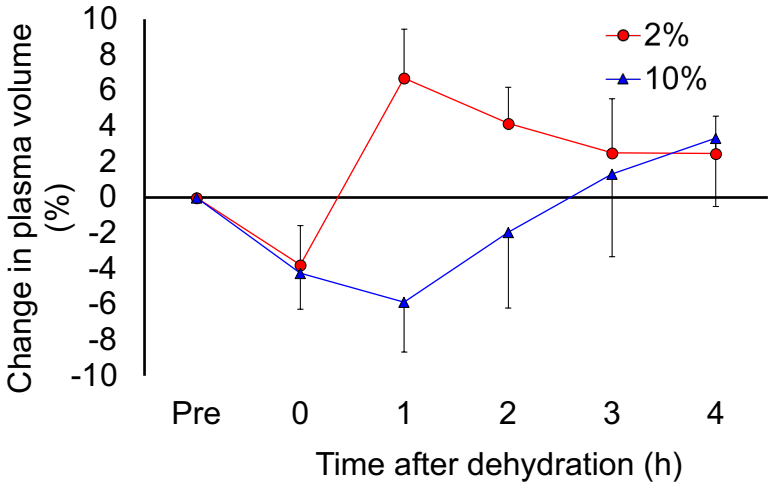
Adapted from Maughan & Leiper (1995)

Rehydration: Carbohydrate



Adapted from Clayton et al. (2014)

Rehydration: Carbohydrate



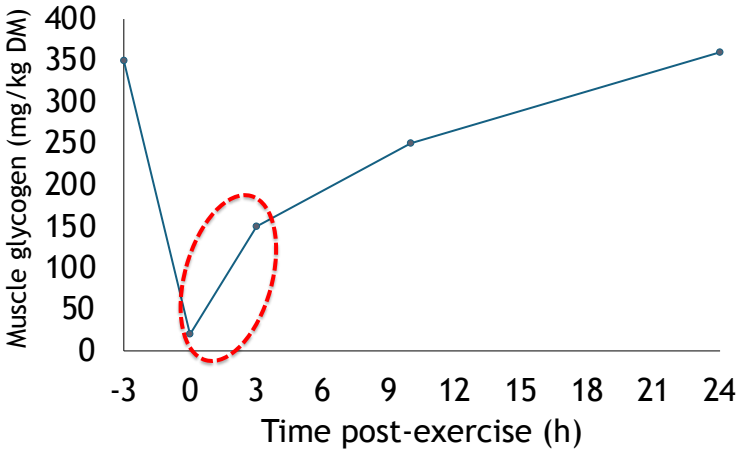
Adapted from Clayton et al. (2014)

Rehydration: Recommendations

Recommendations:

- Adequate fluid intake is key (plan intake accordingly)
- Use high sodium, dilute carbohydrate rehydration drinks
- Consider assessing the athletes sweat sodium concentration
- Carbohydrate and protein might be beneficial, but foods may be better options
- Some supplements may assist with rehydration (sodium bicarbonate/citrate), but be careful with gastrointestinal issues

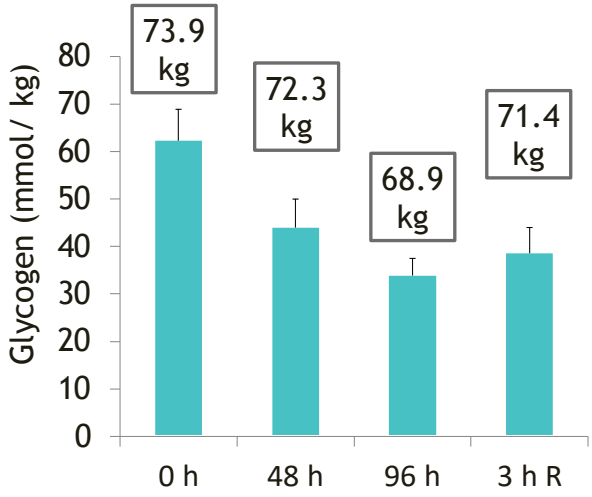
Recovery of Glycogen Stores: Kinetics



Initial resynthesis **unlikely** as **fast** as post-exercise

Casey et al. 1995. J Phys

Recovery of Glycogen Stores



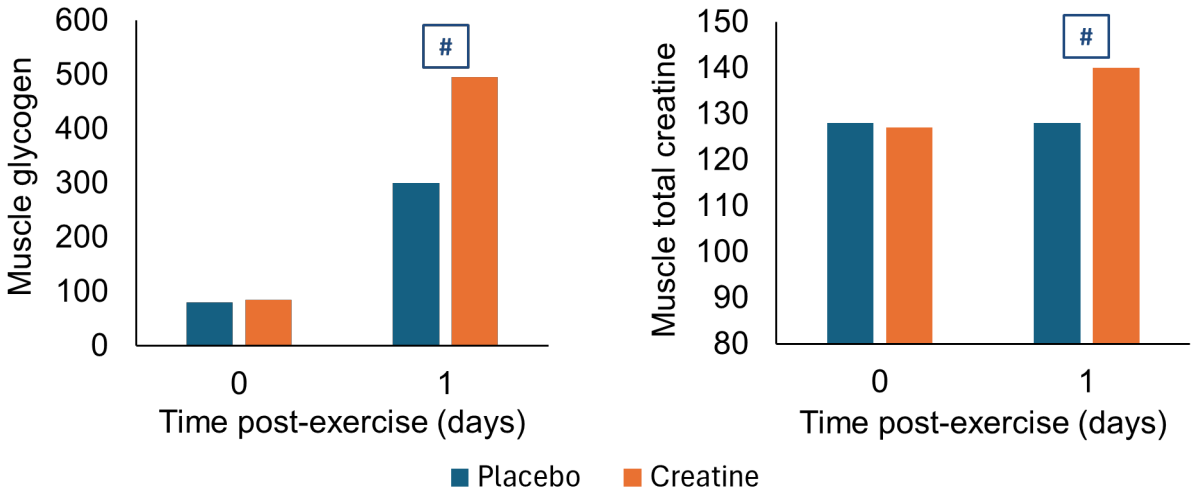
Recommendations:

Follow general exercise recovery guidelines

- ~1 g/kg/h for 2-4 h post-weigh in
- 10-12 g/kg/day
- High GI
- Feed small & often

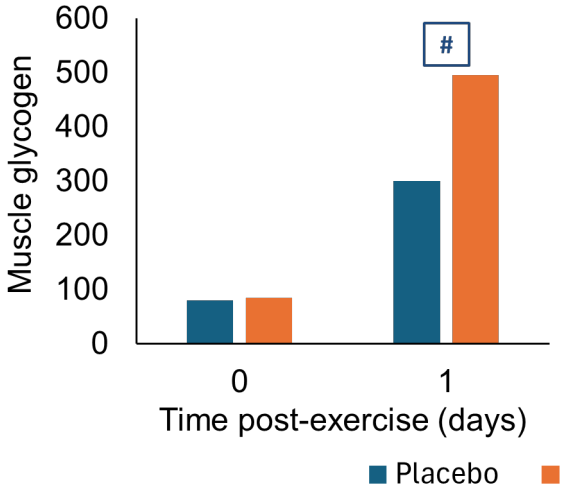
Houston et al. (1981)

Glycogen Resynthesis: Creatine



Roberts et al. (2016)

Glycogen Resynthesis: Creatine



Can use creatine post-weigh-in to augment glycogen resynthesis

Also **increased performance** in 5 min high-intensity test - Oopik et al. (2002)

Roberts et al. (2016)

Planning Recovery

- Plan must be specific to the athlete's scenario
- Plan **water**, **electrolyte** and **carbohydrate** to maximise recovery
  - What is needed will depend on the 'cut' and recovery time available
- **0-2 h:** Where dehydration is significant, **recovery of fluid balance** should be the focus for health and performance reasons
  - Rapid recovery of plasma volume
  - High sodium, dilute carbohydrate (hypotonic) fluids, plus carbohydrate snacks
- **2 h onwards**: Focus should be on **maximising carbohydrate** whilst continuing to replace fluid and electrolyte losses
  - Use exercise-based guidelines for carbohydrate intake, and consider other strategies

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Rapid Weight Loss and Athlete Health

Case Reports > MMWR Morb Mortal Wkly Rep. 1998 Feb 20;47(6):105-8.

Hyperthermia and dehydration-related deaths associated with intentional rapid weight loss in three collegiate wrestlers--North Carolina, Wisconsin, and Michigan, November-December 1997

Centers for Disease Control and Prevention (CDC)

Heat illness

Cardiac

Renal

Cerebral

Rapid Weight Loss and Athlete **Health**

> Eur J Appl Physiol. 2024 Apr;124(4):1085-1096. doi: 10.1007/s00421-023-05328-8.
Epub 2023 Oct 17.

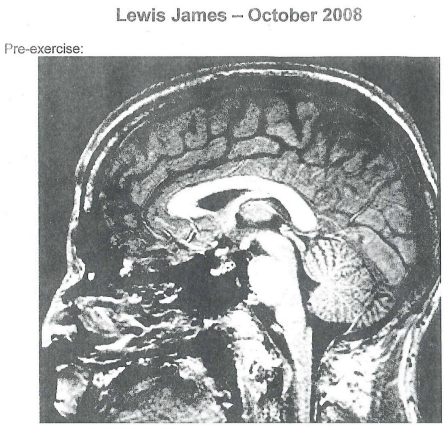
Hypohydration induced by prolonged cycling in the heat increases biomarkers of renal injury in males

Loris A Juett [1] [2], Jack E Drury [1], Thomas B Greensmith [1], Alfie P Thompson [1], Mark P Funnell [1], Lewis J James [1], Stephen A Mears [3]

Renal

THE Mac-Nutrition COLLECTIVE

Rapid weight loss and athlete **health**



Cerebral

Rapid Weight Loss and Athlete **Health**

Original Article | Published: 28 March 2006

Weight cycling of athletes and subsequent weight gain in middleage

S E Saarni ✉, A Rissanen, S Sarna, M Koskenvuo & J Kaprio

International Journal of Obesity **30**, 1639–1644 (2006) | Cite this article

Metabolic

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Can We Prevent Weight Cutting?

- In an **ideal** world, **yes**, but in the **real** world, it will be very **difficult**!

- **Proposed methods:**
- Hydration testing
- Moving weigh-in closer to competition
- Increasing weight categories available
- Minimum weight assessments
- Re-weigh

All have issues, some of which may put us in a worse position that we currently are

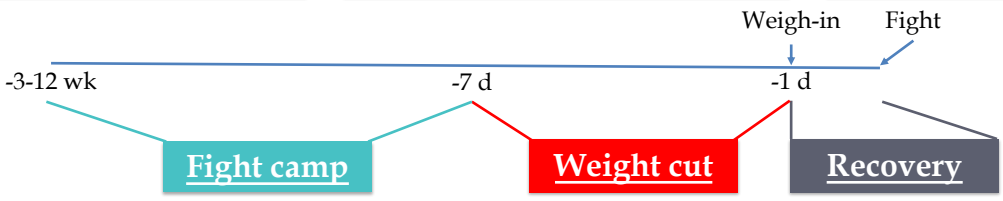
- Coach and athlete education!?

What Else Can We Do For Athlete Health?

Fight camp (and before):
- Reduce weight cycling
- Start camp closer to weight
- Aim to maintain glycogen
- Heat acclimation?

Weight cut:
- Avoid large weight cuts
- Avoid short-notice fights
- Heat illness education
- Use cooling methods

Recovery:
- Optimise rehydration and recovery



SUMMARY

- Many, but not all, combat sports athletes lose large amounts of weight before weigh-in, much as dehydration, with potentially very serious consequences
- The main recovery considerations are glycogen re-synthesis and rehydration
- The specifics of the recovery plan will need to consider the individual athletes situation
- Scientists, practitioners, athletes and coaches need to work together to find ways to minimise weight cutting practices

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Further Reading

- Burke LM, Slater GJ, Matthews JJ, Langan-Evans C, Horswill CA. Curr Sports Med Rep. 2021 Apr 1;20(4):199-217.
- Reale R, Slater G, Burke LM. Eur J Sport Sci. 2017 Jul;17(6):727-740.
- James LJ, Funnell MP, James RM, Mears SA. Sports Med. 2019 Dec;49(Suppl 2):103-114.
- Evans GH, James LJ, Shirreffs SM, Maughan RJ.
- J Appl Physiol (1985). 2017 Apr 1;122(4):945-951.