# CHAPTER 19

## Making the weight: case-studies from professional boxing

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### *Introduction: background to issue*

Professional boxing is categorised into weight classes intended to promote fair competition by matching opponents of equal stature and body mass (commonly referred to as 'weight' within the sport). Boxing is a sport that has its own tradition and culture in relation to weight making practices. Many boxers achieve their target weight via the combination of acute and chronic means that involve severe energy restriction and dehydration (1). The latter weight-making method is common in the days preceding the weigh-in and is known as 'drying out'. Depending on the stage of the boxer's career, the number of contests per annum usually ranges from one to six. Typical durations of training camps for each contest ranges from 6-12 weeks and it is not uncommon for boxers to commence training with considerable weight to lose (see Table 1).

Table 1. Body composition analysis as assessed via dual-energy x-ray absorptiometry (DXA; QDR Series Discovery A, Holognic Inc, Beford, MA) for three professional boxers at the onset of their training camps. In these cases, the athletes were only competing on average three times per year and thus the inactivity in-between training camps resulted in the boxers commencing training with considerable weight loss requirements. Note that for Boxer 1 and 3, the required weight loss could only be achieved via a combination of both fat and lean mass loss.

| Boxer | Weight Division | Body Mass (kg) | Body Fat (%) | Fat Mass (kg) | Lean Mass (kg) | Required Weight Loss (kg) | Duration to Make Weight (weeks) |
|---|---|---|---|---|---|---|---|
| 1 | Super-featherweight (59 kg) | 68.3 | 12.1 | 8.5 | 56.6 | 9.3 | 12 |
| 2 | Light-heavyweight (81 kg) | 92.0 | 18.1 | 17.2 | 73.1 | 11.0 | 9 |
| 3 | Flyweight (51 kg) | 60.1 | 17.7 | 10.9 | 47.9 | 9.1 | 8 |

Although data concerning weight-making practices of professional boxers is scarce (2), research examining amateur boxers reported weight losses of 3-4 kg in the week preceding competition (1). The acute dehydration that is common to such weight losses impair performance as evidenced by reduced punching force (3), whilst dehydration and energy restriction carry obvious health risks. Indeed, reductions in energy and fluid intake during training (and in the weeks and days prior to competition) may increase infection risk (4), induce fluctuations in mood state (5) and compromise training intensity (6). Furthermore, increased cardiovascular and thermoregulatory strain could induce injury and, in extreme cases cause fatality (7).

This chapter provides an overview of ongoing support work (over a 5 year period) adopting a more structured and scientific approach to making weight for a 25 year old professional male boxer competing in the 57 kg featherweight division (Boxer 1 from Table 1). We begin by presenting an overview of the athlete's sporting background followed by supporting scientific rationale and outcomes of our chosen nutritional interventions. Data from the initial support period has been published previously (2) and we refer to these data (where appropriate) so as to provide a full case history of our ongoing support work.

***Presentation of athlete and overview of sporting history***

Boxer 1's achievements include junior and senior national amateur champion titles as well as a junior Olympic gold medal. He turned professional at age 18 and soon achieved success acquiring a national featherweight title and later held a version of the world featherweight title. The athlete's usual approach to making weight relied on a 6-8 week training camp comprising a daily diet consisting of one meal (usually consumed at lunch time and consisting of one large sandwich and a diet cola), daily use of sweat suits during training, no consumption of food or drink for one to two days preceding the weigh-in (he also used sweat suits and low-intensity exercise in the hour preceding the weigh-in) and re-fuelling strategies between weigh-in and competition consisting of high fat based foods such as confectionary products and fried foods e.g. bacon, eggs, sausages etc. The athlete revealed he was now struggling to make the featherweight limit and had decided to move up in weight to the 59 kg super-featherweight division.

***Overview of initial nutritional and conditioning intervention***

Based on assessment of body composition (see Table 1) and despite moving up in weight, we initially realised the 59 kg weight limit could only be achieved via a combination of fat and lean mass loss (see (2)) for a more detailed overview of initial athlete assessment). To achieve this target weight loss of 0.5 -1 kg over a 12 week period, we opted to attain an energy deficit via a combination of restricted energy intake (restricted to approximate values of resting metabolic rate, RMR) and increased energy expenditure. Relative to the athlete's habitual energy intake, our initial nutritional intervention consisted of reduced fat and carbohydrate (CHO) intake concomitant with increased protein intake (see (2) for example meal plans where the athlete adhered to a daily diet approximately equivalent to his resting metabolic rate: 6-7 MJ. 40% CHO, 38% Protein, 22% Fat). The rationale for reduced CHO intake (2-3 g/kg body mass) was to enhance lipid oxidation and stimulate gluconeogenesis to achieve lean mass loss (Howarth et al. 2010)(8). In order to not induce the latter process at too great a rate and to maintain daily calorie intake at our intended level, we also increased protein intake to 2-2.5 g/kg body mass which included the provision of protein ($\approx$ 20 g) in close proximity to the onset and completion of exercise so as reduce protein degradation and promote protein synthesis (9,10,11). Fat intake was restricted to < 1 g/kg and was largely achieved via consumption of unsaturated fats from fish sources and oils. CHO foods were consumed from low to moderate glycemic index (GI) based foods to minimise the suppression of lipolysis in the post-prandial period and during subsequent training sessions (12). The athlete also consumed a multivitamin supplement providing 100% of the RDA to potentially maintain immune function in conditions when energy intake is compromised . Fluid intake was restricted to water or low calorie flavoured water and was consumed *ad libitum* throughout each day though the athlete was instructed to consume the necessary fluid to re-hydrate immediately after each training session (13). The athletes training programme comprised fasted runs at moderate-intensity (6 am) so as to maximise lipid oxidation (14,15) and promote oxidative training adaptations (16), boxing-specific sessions (11 am) and finally, strength and conditioning sessions (5 pm) three times per week. The scheduling of resistance training at this time was to promote circadian influences on strength as well as to avoid any molecular interference effect associated with concurrent training in close proximity (17).

***Outcome of the initial intervention***

In our initial support period (2), average body mass loss was 0.9 $\pm$ 0.4 kg per week equating to a total loss of 9.4 kg (a weight loss representing a decrease in percent of body fat from 12.1 to 7.0%). Following the weigh-in, the athlete consumed a high CHO diet (12 g/kg body mass) supported by appropriate hydration strategies and entered the ring 30 hours later at a weight of 63.2 kg. Our initial intervention represented a major change to the athlete's habitual weight making practices and did not rely upon any form of intended dehydration during the training period or preceding weighing-in. Consistent with other authors (18), we also observed that the provision of a high protein diet and structured resistance training was relatively successful at maintaining lean mass (despite being in a daily energy deficit) and it was only until considerably low body fat levels were reached did lean mass show the necessary decline to make the 59 kg weight limit (see Figure 1). He also reported that this was the easiest he had ever made the weight despite energy and fluid intake four to six times per day.

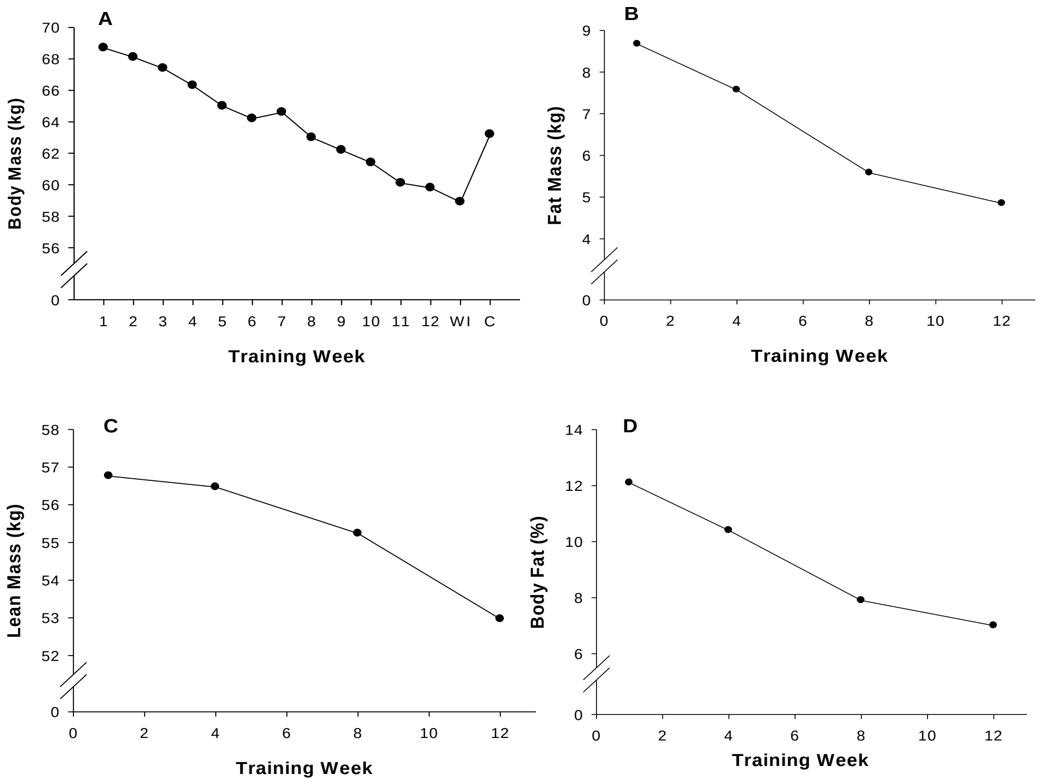


Figure 1. Changes in Boxer 1's (A) body mass, (B) fat mass, (C) lean mass and (D) per cent of body fat throughout the 12 week intervention period to make weight for the 59 kg super-featherweight division. WI = weigh-in, C = competition (data adapted from Morton et al. 2010)(2).

***Ongoing support work***

Despite the new approach to making weight and also one further contest at the 59 kg limit (both of which were defeats), the athlete retired from the sport citing boredom with training, competition and the repeated requirement to make weight as contributing factors (in effect, the athlete reported he had fallen out of love with the sport). However, after a 9 month retirement period in which he was involved in coaching young novice boxers, he re-developed a passion for the sport and decided to box competitively again. At this time, he also changed coaches and his new coaching team agreed he should compete at the lightweight limit of 61.4 kg, almost 4.5 kg heavier than the featherweight division that he had competed in most of his career. At this new weight division, the athlete was thus able to increase daily carbohydrate intake to 3-5 g/kg (depending on the duration and phase of the training camp) and maintain protein and fat intake at 2-2.5 g/kg and < 1g/kg, respectively. With this increased energy intake (and continued integration of weight training into his training plans) and an intentional acute dehydration of 1-1.5 kg prior to weigh-in, lean muscle mass is now typically 2-2.5 kg greater at the time of competition than when he boxed at super-featherweight. The athlete now reports that mentally, his training is focused more on improving boxing specific technique and fitness as opposed to becoming pre-occupied with making weight. He also feels that he is at the strongest and fittest point of his career. With the continual development of trust between the boxer and support staff, we now also regularly incorporate various supplement strategies (e.g. β-alanine, HMB, CLA, omega 3 fatty acids, BCAAs, vitamin D) in an attempt to promote training adaptation, recovery and performance. After appropriate re-fuelling and hydration following weigh-in, he now usually enters the ring at a fighting weight of 65-66 kg, a weight that he and his coach feels he performs best in training and sparring. Since his comeback, he has won numerous national and international titles and the athlete remains convinced that boxing at this heavier weight (which he now believes is his natural boxing weight), is one of the main contributing factors.

***Conclusions***

It is difficult to provide definitive recommendations for making weight in this chapter, owing to the fact that every boxer presents a different scenario in terms of RMR, target weight loss, daily training energy expenditure, time to achieve target weight etc. However, we have recently published guidelines for combat athletes (19) encouraging a strategy focusing on increased protein intake in combination with resistance training (so as to maintain lean mass in the face of daily energy deficits), reduced CHO availability (and the reliance upon LGI CHO sources to promote lipid oxidation), as well as reduced intake of those foods that are simultaneously high in sugar and saturated fat intake. Additionally, emphasis should be placed upon coach and athlete education so as to develop a training culture, which promotes adequate hydration before, during and after training (see Langan-Evans et al. 2011 for a detailed discussion of these guidelines).

In addition to changes in *composition* and *quantity* of energy intake, it is also important that *timing* of energy intake is aligned to the structure of the daily training schedule in order to promote lipid oxidation, training adaptation and recovery (see Table 2). We have used similar principles with professional boxers ranging from flyweight to heavyweight (in the latter case, to change body composition and not necessarily mass) and observed positive results (see Figure 2). The success of these interventions are underpinned through continual education of coach and athlete and the willingness of both parties to adopt novel practices despite being unfamiliar to boxing culture. Given the lack of research in this area, we consider it vital that similar case-study type accounts from other weight-making sports are published in the scientific literature (e.g. see reference 20). Only through sharing such information can the safety and performance of such athletes be enhanced.

Table 2. Overview of guidelines for timing and composition of nutritional and fluid intake in relation to the structure of the daily training schedule. In this case, strategies are included for a boxer performing 3 training sessions per day (this usually represents a boxer's most intense training day and such days typically only occur 2-3 times per week). Note that quantities of foods are not disclosed owing to the need for formulating individualised interventions.

| Time | Training Session and/or Nutritional & Fluid Intake | Training and /or Nutritional Aims |
|---|---|---|
| 630-715 am | Moderate-intensity steady state run undertaken in fasted state accompanied with appropriate fluid intake | Maximise lipid oxidation and promote hydration |
| 730 am | Moderate CHO / moderate protein / low fat breakfast with appropriate fluid intake | Promote *some* restoration of liver and muscle glycogen and protein synthesis as well as re-hydration |
| 10 am | Low CHO / moderate protein and low fat snack | Promote CHO availability and protein synthesis |
| 11 am – 1230 pm | Sport-specific training session accompanied with appropriate fluid intake | Development of sport-specific fitness / technique and promote hydration |
| 1 pm | Moderate CHO / moderate protein and low fat lunch accompanied with appropriate fluid intake | Promote *some* restoration of liver and muscle glycogen and protein synthesis as well as re-hydration |
| 4 pm | Moderate protein intake | Stimulate protein synthesis prior to strength and conditioning |

| | | |
|---|---|---|
| | | session |
| 430-530 pm | Strength and conditioning training session accompanied with appropriate fluid intake | Development of sport-specific aspects of strength and conditioning and promote hydration |
| 530 pm | Moderate CHO / moderate protein and low fat snack (or recovery drink) accompanied with appropriate fluid intake | Promote *some* restoration of liver and muscle glycogen and protein synthesis as well as re-hydration |
| 7 pm | Low CHO / moderate protein and low fat dinner | Promote protein synthesis and hydration as well minimising evening fat storage |
| 10 pm | Moderate protein intake | Promote protein synthesis prior to sleeping |

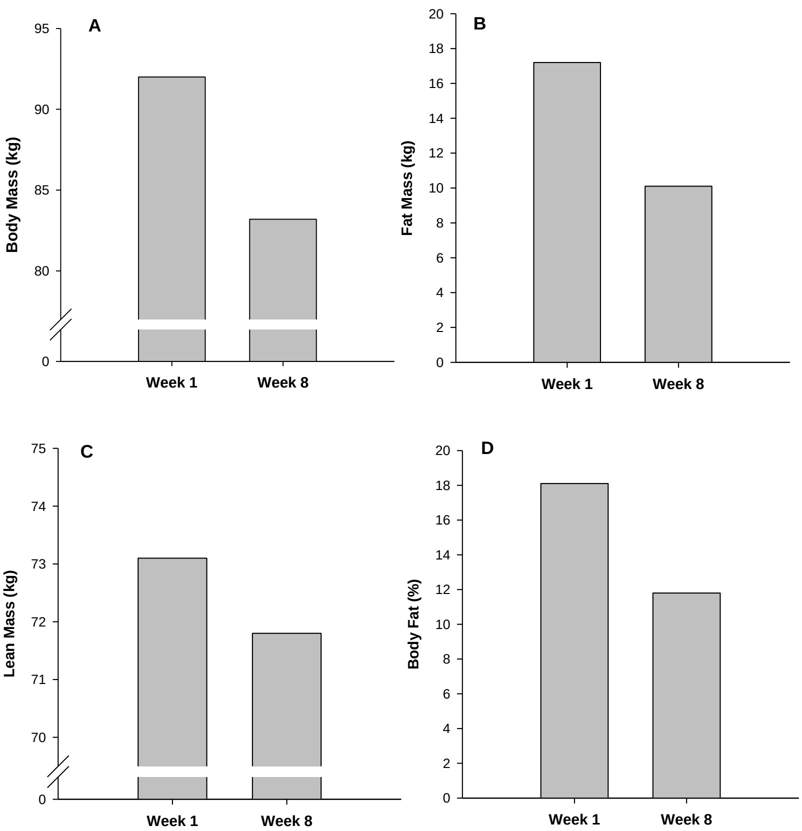


Figure 2. Changes in Boxer 2's (A) body mass, (B) fat mass, (C) lean mass and (D) per cent of body fat throughout a 9 week intervention period to make weight for the 81 kg light-heavyweight division. Data are presented for week 1 and 8 of the intervention period.

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**Commentary:** Andy Lane, University of Wolverhampton, UK.
The case study outlines a successful weight-making intervention with a professional boxer. In reviewing the case study, the first issue that stands out is the athlete's approach to weight making before the intervention. He ate one meal per day of dubious nutritional quality whilst engaging in heavy training. He would fast for two days before the weigh-in. The degree of self-control to manage this diet is impressive. He would experience intense hunger and most likely feel tired and lacking energy at a time when the opposite state was required. Following the weigh-in, all barriers to self-control are let down with the hope that he could feel strong and energetic before the contest.

The intriguing part of work such as this is the negotiation process. The boxer and his coach will hold mixed views on their existing strategy. They will hold a positive belief that it worked previously and appears successful for others whilst acknowledging, by the fact that external help has been requested, that change is needed. The boxer and his support team would hold beliefs on how severe this change might need to be, and the approach of identifying lean body mass, whilst likely to be seen as credible is compromised by mass produced bathroom scales which claim to produce the same value. In our work with a professional boxer, we reported a case where he began to believe he could compete at a lower weight following a discussion with highly successful boxing coach (1). In that case study, we describe how the boxer began to believe that he could make the lower weight and the advantage in terms of strength over his opponents. Sports scientists have evidence to support their ideas but do not necessarily have credibility. When a boxing coach asks the question: "which boxer has followed this type of diet before"? What does the sport scientist say other than explain why it should work, and why following a diet developed for one person is also not always advisable. In the case study presented above, it is evident that care is taken to build relationships between key personal. The quality of the intervention is likely to be reflected in the quality of the relationship between coach, boxer and sports scientist (see (2, 3) for a discussion).

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