

# Body weight reduction in combat sports

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

Klára Coufalová<sup>ABCDE</sup>, Eva Prokešová<sup>D</sup>, Tomáš Malý<sup>C</sup>, Jan Heller<sup>AD</sup>

Charles University in Prague, Faculty of Physical Education and Sport, Czech Republic

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## Abstract

**Background & Study Aim:** Competitions in combat sports are based on direct fight of competing parties. Weight limits in individual weight categories, are formal conditions for admitting to compete. Therefore, competitors are obliged to adapt their body weight to a particular weight category in a given time. The aim of this study was to knowledge about methods, including the length and other details of weight loss in combat sports with weight categories.

**Material & Methods:** The study included 53 experienced athletes (37 men and 16 women) competing in judo, wrestling Greco-Roman and freestyle, kickboxing, karate, box, thai box and taekwondo. The athletes practiced combat sports in average  $14.9 \pm 4.4$  years. Participants responded to a battery of questions (created by an experts), which was focused on personal information (e.g. age, sex, combat sport, length of sport practice, weight category and successes), reduction process (number of reductions per year, weight monitoring, using supplements, problems during weight reduction, etc.), methods of weight reduction and sources of information.

**Results:** The results showed that 77.4 % of the participants regularly reduce their weight before competition and this reduction comprises in average 5.4 % of body weight (average body loss was  $3.9 \pm 2.3$  kg, range from 1 kg to 10 kg). The most commonly applied body weight reduction methods included reduced food and liquids intake, diet changes, increased sweating and increased physical activity for higher energy output.

**Conclusions:** The body weight reduction prior to competitions turned out to be a common practise. The rapid body weight reducing methods can negatively influence sport performance and also athlete's health. Finding the most common ways of weight reduction is the first step to remedy inadequate procedures for body weight reduction.

**Keywords:** body weight loss • martial arts • weight category • energy intake

**Author's address:** Klára Coufalová, Faculty of Physical Education and Sport, Charles University in Prague, José Martího 31, 16252 Prague, Czech Republic; e-mail: coufalova@ftvs.cuni.cz

## INTRODUCTION

It became common practice to reduce the body weight just before the tournament in sports with weight categories. This is done by significant restriction of fluid and energy intake and exercises for increasing sweating and thus dehydration. These methods will not only decrease the amount of total body water, but also the body fat, together with lean body mass [1, 2]. Decrease of fat free mass (FFM) can be reflected in reduction of muscle strength and decreases in time the athlete is able to practice an

intensive exercise. This body weight reduction has serious consequences on athlete's health and performance. In case that the body weight is decreased rapidly, it significantly increases the risk not only of injury but also certain diseases. Yet most athletes in sports with weight categories normally reduce their body weight to a lower category to gain an advantage over the opponent and thus increase their chances of success. Horswill [3] found that 70-80 % of judoists reduce their weight for inclusion in the lower weight category.

The negative effects of rapid weight loss on physical aspects of an organism can be increased heart rate, worsened circulatory and respiratory functions, impaired thermoregulatory processes and risk of overheating, decreased renal blood flow and thus possible problems with kidneys and finally decreased amount of salt in the body. Reduced amount of circulating blood is manifested by decreased heart output at maximum and medium output. It also leads to reduction of muscle strength and to decrease of the length of intense performances [4].

To achieve fast weight loss, athletes use a number of “aggressive” nutritional strategies so many of them place themselves at a high health-injury risk [5]. That’s why we wanted to find various used methods of weight loss used by athletes in combat sports with weight categories.

The aim of this study was to knowledge about methods, including the length and other details of weight loss in combat sports with weight categories.

## MATERIAL AND METHODS

The study included 53 athletes (37 men and 16 women), mean age  $23.8 \pm 3.2$  years, from combat sports with weight categories (judo, wrestling Greco-Roman and freestyle, kickboxing, karate, box, thai box and taekwondo). Respondents were top Czech athletes, 4 of them took part in Olympic Games, 17 in World Championships, 25 participants took part in European Championships and all respondents except three athletes have a medal from Championship of the Czech Republic (36 gold medals).

The respondents answered to battery of questions (created by an experts panel), which has three parts. The first part was focused on personal information (e.g. age, sex, combat sport, length of sport practice, weight category and successes). The next part contains questions about reduction process (number of reductions per year, weight monitoring, using supplements, problems during weight reduction, etc.). In the last section we wanted to find methods of weight reduction and sources of information. At the end there was a space for own tips and methods of reduction.

Results were expressed as mean  $\pm$  standard deviation (Table 1). The correlation between weight loss in percentage of body weight and length of reduction was evaluated with Spearman’s correlation coefficient. The differences between variables from gender perspective we assessed with the test for comparison of two proportions – two independent samples. The probability of type I error (alpha) was set at 0.05.

## RESULTS

The results showed that 77.4 % of our respondents regularly reduce their body weight before competition (Table 2). This reduction is in average 5.4 % of body weight (average body loss was  $3.9 \pm 2.3$  kg, range from 1 kg to 10 kg). We observed maximum weight loss equal to 12% of initial body weight. Among the respondents maximum reduction in body weight was 13 kg. Before important events athletes reduced average  $6.3 \pm 2.6$  kg (range from 2 to 13 kg). Average length of reduction was  $6.1 \pm 3.6$  days. The correlation between weight loss in percentage of body weight and length of reduction is low ( $r = 0.44$ ).

Total 63.4 % of respondents who regularly reduce their body weight answered that the importance of competition does not affect the tactics of weight reduction (e.g. length of the reduction, eating habits, training, using of nutritional supplements in the reduction, etc.). Respondents who answered this question positively stated that their regulation of body weight is longer for more important tournament than for less important tournament. Total 61.0 % of respondents said that they do not maintain weight, if they have several tournaments in a row and 94.3 % of all respondents said that they continuously monitored their weight.

Total 43.4 % of all respondents use supplements during the whole training cycle and 51.2 % of respondents, who reduce their body weight use supplements during reducing period. The most represented supplements that are used in non-reduction period were the branched amino acids (BCAA) in 13 cases, protein products (12 cases), carbohydrate drinks (10 cases), vitamins (7 cases) and joint nutrition (4 cases). The most common supplements that are used during the reduction period were L-carnitine (10 cases), BCAA

**Table 1.** Basic characteristics of the subjects (mean  $\pm$  s)

Subject	n	Age (years)	Sport practice (years)	Weight (kg)	Trainings per week	Competitions per year
Men	37	$23.8 \pm 3.1$	$14.8 \pm 4.1$	$79.3 \pm 11.2$	$6.2 \pm 2.7$	$11.7 \pm 6.1$
Women	16	$23.6 \pm 3.3$	$15.3 \pm 4.6$	$62.6 \pm 7.3$	$6.0 \pm 3.5$	$8.3 \pm 4.9$

**Table 2.** Basic information about reduction of the research athletes (mean  $\pm$  s)

Variable	Men (n = 37)	Women (n = 16)	Total (n = 53)
Regular reduction [% of respondents]	75.7	81.3	77.4
Rate of reduction [in % of body weight]	6.0 $\pm$ 3.2	4.1 $\pm$ 1.5	5.4 $\pm$ 2.9
Number of reduction per year	7.6 $\pm$ 4.2	7.4 $\pm$ 4.3	7.6 $\pm$ 4.2
Maximum reduction [kg]	6.4 $\pm$ 3.2	5.4 $\pm$ 1.6	6.1 $\pm$ 2.9
Subjectively allowed maximum reduction [kg]	7.0 $\pm$ 2.8	4.8 $\pm$ 1.3	6.3 $\pm$ 2.6
Length of reduction [days]	5.7 $\pm$ 3.8	6.9 $\pm$ 2.9	6.1 $\pm$ 3.6

(7 cases), vitamins (7 cases), protein (5 cases) and carbohydrate (4 cases) drinks, caffeine supplements (3 cases) etc.

Most frequently declared by athletes, the problem during the procedure to reduce body weight is bad mood, irritability, however the least significant factor is the insomnia. Gender is a factor differentiating in all separated variables in varying degrees (Table 3).

Athletes gain information how to reduce the body weight primarily from their colleagues (more than three quarters of respondents) and 57.1 % of men and 53.8 % of women gain information about reduction from their coaches. We found significant differences ( $p < 0.05$ ) between men and women in using literature as a source of information about reduction. Only a small proportion of the respondents stated that they follow advice from the doctors or from the media (Figure 1).

The most popular methods of reducing body weight included: limitation of consumption of food or liquids, changes in diet, exercise in more layers of clothing, increased physical activity, sauna and nutritional supplements. Almost all examined contestants reduce their body weight by combination of food restriction (82.1 % of men, 100 % of women), fluid restriction (85.7 % of men, 84.6 % of women), changes in diet (85.7 % of men, 76.9 % of women) and more clothes on training (92.9 % of men, 61.5 % of women). Significant differences ( $p < 0.05$ ) between men and women concern the use of more clothes on training (Figure 2).

There were often mentioned methods as dehydration, distribution of meals in smaller portions and wearing more layers of clothing not only for physical activity. The respondents also stated bathing in hot water, eating only yogurt or taking pills that might increase sweating (e.g. paracetamol, ibuprofen). Another

**Table 3.** Perceived problems during reduction period (ordinal variable – total)

Variable	Men (n = 28)	Women (n = 13)	Total (n = 41)	Z	95% Confidence interval
Bad mood, irritability [%]	67.9	84.6	73.2	1.127	-13.6; 38.3
Fatigue [%]	35.7	46.2	39.0	0.638	-19.0; 39.3
Dehydration [%]	42.9	23.1	36.6	0.198	-11.9; 43.2
Hunger [%]	32.1	23.1	29.3	0.594	-32.1; 23.1
Nervousness [%]	21.4	23.1	22.0	0.119	-21.8; 31.1
Loss of strength [%]	14.3	30.0	19.5	1.239	-8.5; 44.7
Aversion to physical activity [%]	17.9	15.4	17.1	0.196	-26.2; 23.4
Insomnia [%]	14.3	15.4	14.6	0.093	-19.4; 29.3

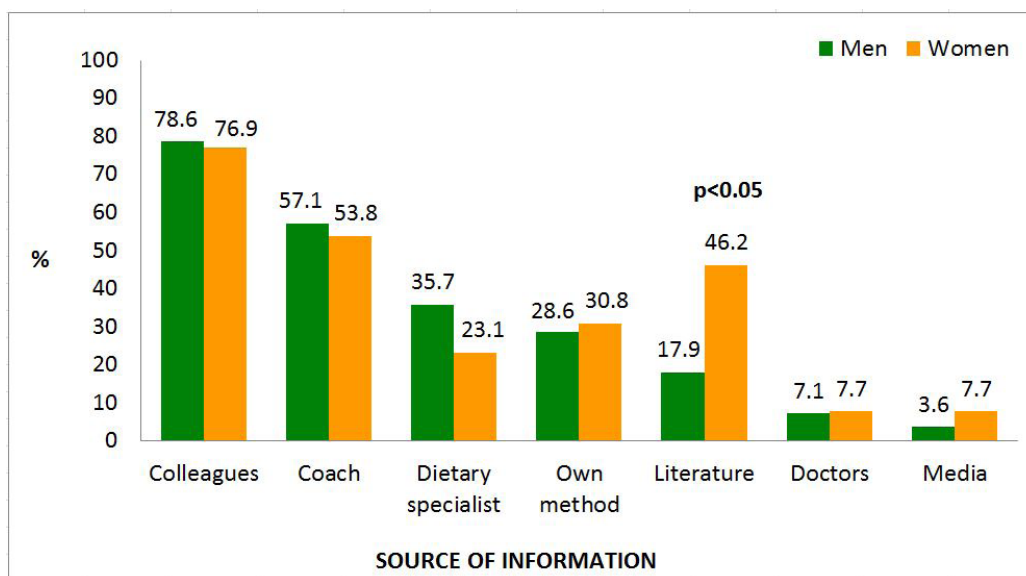


Figure 1. source of information on weight loss declared by the surveyed athletes

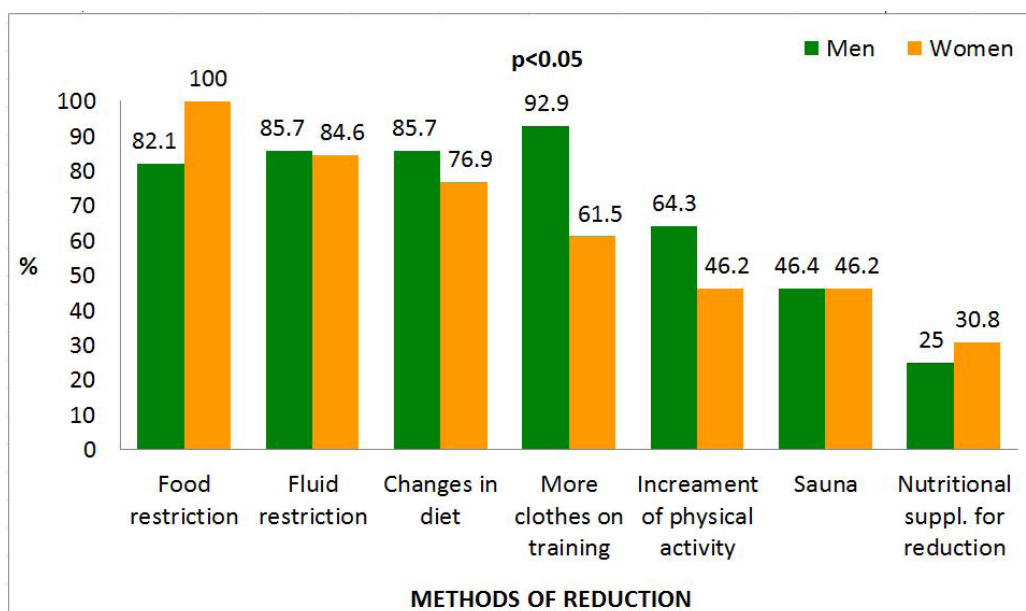


Figure 2. Methods to reduce body weight by the surveyed athletes

method was to increase the drinking up to 8 litres per day a week before the competition and then elimination of all fluid last two days before the competition.

## DISCUSSION

Our results show that losing body weight before tournament is very common in sports with weight categories. In our group more than 75 % of athletes admitted, that they regularly reduce their body weight before championships. Kinigham and Gorenflo [6]

found that 77 % of young American wrestlers reduced their body weight by over 2.27 kg. British wrestlers and boxers reduce body weight in average about 5-10 % [7]. The rate of weight change varies, e.g. at judo contestants, according to Japanese research [8], it is 2.8 kg per day. There are also cases, where a contestant reduced their body weight by over 18% in one week [9]. The pre-competitive body weight reductions, especially in the light weight category, where has been well documented extremely low fatty tissue [26], usually decrease total body water and lean body

mass [1, 2]. A decrease of lean body mass can reflect a reduction of muscle strength, which can affect the athlete's ability to train at the required intensity.

It is clear that methods and procedures of pre-competitive weight reduction are transmitted from experienced to less experienced competitors and coaches can also affect the way of body weight reduction. A lack of proper knowledge on how to lose weight harmlessly may often decrease an athlete's performance. According to this study almost all judoists use the combination of energy and fluid restriction, changes in the diet, more clothes on training and intense exercise training. These procedures can affect besides sport performance also health of competitors. Gilewski [27] found that physical activity combined with dietetic restrictions increases plasma activity of keratin kinesis, which points to muscle damage, and this, in turn, increases the risk of injury.

We also can compare our results with number of other studies. In a research with 16 kick boxers, who reduced in average 3.19 kg, which made for 4.07 % of their initial weight, Boguszewski [10] noticed that 100 % of his probands reduce body weight by restriction of food consumption, 75 % by restriction of fluid intake, 44 % by exercise in special clothes, 40 % by increased physical activity and 12 % by sauna. We also noticed that 100 % of women and 82.1 % of men reduce their body weight by food restriction. Very often are also changes in diet. Kurakake et al. [11] in their study observe daily caloric intake of Japanese judoists ( $n = 22$ ). It was 2024 kcal seven weeks before the competition, while one week before the competition caloric intake was 1355 kcal. The same author also showed a moderate increase of carbohydrate intake and decrease of fats and proteins in the reduction diet. Another studies [12-15] showed maintenance of high performance when athletes reduce their body weight through low-calorie, but carbohydrate diet. It is assumed that diet with higher amount of carbohydrates helps to maintain glycogen in muscles and improves performance compared with the same caloric diet, but low in carbohydrates [16].

A very interesting finding was the relationship between the length of reduction and weight loss, where the correlation was lower than we expected ( $r = 0.44$ ). We believe that this is one of the major mistakes of reduction body weight because the length of weight reduction greatly influences the method of reduction. In our group the length of weight losing was average  $5.7 \pm 3.8$  days for men and  $6.9 \pm 2.9$  days for women. In the research Boguszewski [10] noticed

that men initiated reduction 9.84 days before official weighing. Important is also time between official weighing and competition. Fogelholm [17] proved, that, if the time between the weighing and starting in championships in shorter than 5 hours, it is not recommended to reduce body weight by more than 4 %, if this time is longer, it is allowed to reduce body weight by 8 %. On the other hand, this could be an aspect influencing the reduction. Sport performance is more affected by reduction, if the time between the weighing and the tournament is shorter. We therefore believe, as well as Artioli [5] that shortening the time between the weighing and the tournament should be as short as possible to reduce the number of radical weight loss.

High percentages (73.2 %) of our respondents stated that they often had a bad mood and feel irritated and nervy during reduction of body weight. This is also proved by studies of mood swings due to reduction of body weight [18-21], where the authors found a negative effect of reduction on cognitive performance and mood. Study of Yoshioka [22] examined psychological changes during the weight loss. The changes were detected by the Profile of Mood State (POMS) that is used to evaluate the impact of training and overtraining on athletes' mental state. The results of this study showed significant increase of fatigue and stress and decrease of vigour in the group of reducing competitors versus non-reducing. Boguszewski [10] in his research with kick boxers ( $n = 25$ ; 16 men, 9 women), noticed that great part of contestants experienced negative effects of body weight reduction in the form of bad mood (69 % of men and 63 % of women), smaller strength (31 % of men and 25 % of women), and endurance (23 % of men and 25 % of women), and headaches (15 % of men and 25 % of women). Other studies have also reported increased fatigue, stress and anger after the body weight loss [19, 20].

Discussed problem is the influence of weight reduction on sports performance. Ziemiański [23] proves that sudden reduction of 5 % of body weight decreases physical efficiency even to 30 %, irrespective of the body weight reduction method applied. In the other side, a study of Artioli [24] revealed, that judo-related performance is not affected by an average 5 % body weight loss in experienced weight-cyclers if they are able to recover for 4 hours. Weight-cyclers can be metabolically adapted as a consequence of chronic weight-cycling. These adaptations might include in particular a faster muscle glycogen restoration, which would allow athletes a rapid recovery after weight loss. In contrast, Filare et al. [19] reported that left



hand grip values and 30-seconds jump test output decreased after seven days of food restriction in judo athletes. And Koral & Dosseville [25] found that rapid weight loss procedures did not have an effect on short intense efforts (squat jump, countermovement jump, repetitions of judo movements), but adversely affected prolonged physical performance. The same authors suggest that alterations in performance may depend on the type of body mass lost, type of sport and on the type of dietary restriction [25].

## CONCLUSIONS

Reducing of body weight before competition is unfortunately very common as our results also confirm. Decrease of body weight is most often achieved

by significant reduction of nutrient and fluid intake combined with procedures that increase sweating, both passive (sauna) and active (exercise in special rubber suits). This process may not be accompanied by medical complications in the short term, but they may occur over a longer period of time, especially if the athlete reduces his body weight often, inappropriately and extensively. Finding the most common ways of weight reduction is the first step to remedy inadequate procedures in body weight reduction. As rapid weight loss is not free of risk to health, rule changes should be implemented to prevent serious adverse occurrences. In parallel, educational programs should aim at increasing athletes', coaches' and parents' awareness about the risks of "aggressive" nutritional strategies as well as healthier ways to properly manage body weight.

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