

## Review Article

# Weight Management for Athletes: Important Things to be Considered

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### Abstract

Weight management is difficult for most individuals, as indicated by the high numbers of obesity around the world. Obesity has increased dramatically over the past decades. Unfortunately, this epidemic is not limited to adults but also to children in both globally and Cyprus. Developing a weight management plan is essential for everyone. Regarding to an athlete, weight management is an increasingly integral part, as consuming the right kind of food can lead them in success or failure. The special nutritional needs of athletes are depending on the sport. The most important priority for them is to establish a well-chosen nutrition program based on the type of the sport; the training load and the competitions needs. Health professionals and sport nutritionists need to understand dynamic energy balance and be prepared with effective and evidence-based dietary approaches to help athletes and active individuals achieve their body-weight goals. Therefore, the following review aiming to examine the most recent published data for weight-management both elite and recreational athletes of all ages, and to set out the most appropriate weight-management guidelines and dietary strategies to help them apply this knowledge to the practicalities of their own sport and individual situation.

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## 1. Introduction

Weight management is difficult for most individuals, as indicated by the high numbers of obesity around the world [48]. Obesity is a global health epidemic characterized by excessive body fat accumulation [20]. Individuals with body mass index (BMI) falling within 25-29.9kg/m<sup>2</sup> are indicated as overweight, whereas individuals with BMI at or above 30kg/m<sup>2</sup> are indicated as obese [41]. Based on a study conducted in 2014, revealed that within four decades the global obesity in men has tripled, from 3.2% in 1975 to 10.8% in 2014 [43]. During the same period, obesity in women has more than doubled from 6.4% in 1975 to 14.9% in 2014.



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Unfortunately, the obesity epidemic is not limited to adults. Currently, 32 % of children between the ages of 2 and 19 years are above the 85 % percentile for BMI for age [29]. Published data have documented that there is severe obesity problem in children in Cyprus over the past decade, making childhood obesity one of the most crucial public health problems in our country [41]. In a recent study conducted in 2010, 20.1% of Cypriot children between the ages of 6-12 were found obese, up from 16.5% in 2000. Similarly, obesity rates within the same group raised from 5.9% in 2000, to 8.1% in 2010 which means that more young athletes will come to their sport fatter than considered desirable for optimal performance [41].

Developing a weight management plan is essential for everyone. Proper nutrition plays an important role at peak performance, specifically when someone does exercise to keep fit, participate regularly in organized sports activities or training to reach the top level of the sport. With regard to an athlete, weight management is an increasingly integral part, as consuming the right kind of food can lead individually in the success or failure [52]. If athletes combine serious restriction energy with a strong resistance and strength training program, then it can actually lead to metabolic changes. These two factors are extremely stressful for the athletes due to lose rapid body weight, also minimized their sports performance, and dangerous about their health [23].

The special nutritional needs of athletes are depending on the sport; whether they want to lose body fat or gaining and/or maintaining lean tissue [23]. While some athletes appear to be naturally lean, with weight and body size well matched for their sport, others need to change their weight and/or body composition to be competitive. For instance, aesthetic sports e.g. rhythmic and artistic gymnastics, ice-skating or dancing, weight division sports e.g. judo, or rowing gym sports e.g. aerobics, endurance sports e.g. long distance running are sports requiring low body-weight and/or body composition in order to considered an athlete as elite [56].

The most important priority for athletes is to establish a well-chosen nutrition program based on the type of the sport, body composition goals about the sport, also the training load and the competition needs [5]. A proper athletic diet will provide adequate nutrients and energy to enhance adaptations from training, support optimal recovery with no food-related stress. It is known that heavy training, requires more nutrients and energy mainly in carbohydrate, protein and micronutrients (vitamins and minerals) [5].

Health professionals and sport nutritionists need to understand dynamic energy balance and be prepared with effective and evidence-based dietary approaches to help athletes and active individuals achieve their body-weight goals [23]. Therefore,

the aim of this review is to examine the most recent published articles for weight-management both elite and recreational athletes of all ages, and also to set out the most appropriate weight-management guidelines to help them apply this knowledge to the practicalities of their own sport and individual situation.

## 2. Weight – Control Behavior in Athletes

In general, most athletes who want to lose weight fall into two categories; those who are overweight or obese based on body-fat levels, and those who are already lean, but desire additional body fat loss. Some of these athletes fall into weight-sensitive (e.g., endurance athletes, ski jumping), weight-class (e.g., wrestling, judo), or aesthetically judged (e.g., gymnastics, figure skating) sports [46].

It is known that excess body fat decreasing athletic performance as well as could increase the risk of chronic diseases for athletes. One study found that 21% of first Division college football players were obese and had insulin resistance, while 9% had metabolic syndrome. Thus, for these athletes, weight loss could improve performance and prevent the development of serious chronic diseases [3].

Conversely, many elite and recreational athletes who have normal weight or low body weights, yet they still want to lose weight in order to improve their performance and/or to achieve a body shape for aesthetic reasons [46]. Some of these individuals are young and still growing, which is the least desirable time to severely restrict energy intake while participating in high levels of exercise [24].

Restrict weight control and diet low in calories are particularly widespread in sports where focus in leanness (leanness-sports) or low body weight like aesthetic or endurance sports. One study showed that NCAA Division I athletes who competing in leanness sports, had significantly higher on the sub-score for Body Dissatisfaction and had lower mean desired body weight than those competing in non-leanness sports [35]. This study was in line with Rosendahl et al. [39] who compare leanness sports and non-leanness sports concluded that athletes competing in leanness sports scored higher for weight-control behaviour than those competing in non-leanness sports.

On the other hand, a study with 204 NCAA Division I, athletes of many sports types using the Questionnaire for Eating Disorder Diagnosis showed that over half of the athletes were not satisfied with their body weight. More of them wanted to lose weight (~5.9 kg), and also there was a weight fluctuation of more than 10% within a year of the athletes. They stated that the methods they used to reduce their body weight were exercise around 2 hours a day and the fasting or on a low calories diet [16].

Martinsen et al. [24] had 606 elite athletes from 50 different sports types who showed similar frequencies of pathogenic weight-control methods like vomiting, laxatives, diuretics and diet pills. It seemed that between female and male athletes, the female athletes used more these pathogenic weight-control methods. When looking at weight concerns, the 24% of the female athletes and 7.5% of the male athletes were presently on a diet and have been on a diet at least three times before due to this reason.

In addition, for athletes in aesthetic sports like figure skaters, synchronized swimmers, gymnasts, maintaining a low body weight over a competitive season without injury or illness or the use of extreme weight-control methods is also a challenge [45]. In a study of psychosocial correlates of bulimic symptoms were participated 280 NCAA Division I female gymnasts and 134 NCAA Division I female swimmers/divers showed that the level of body dissatisfaction, as well as restrictive eating, was related to the amount of experienced pressure from teammates and coaches [1].

Other study showed that there was no difference about the weight-concerns between the synchronized swimmers and other "non-weight dependent sports types" such as basketball, volleyball, soccer [13].

However, it seemed that it can be difficult to manage safe weight loss in athletes who need to meet a designated weight on competition day, like lightweight rowers, jockeys, or wrestlers. These individuals typically weight cycle, with their weight fluctuating dramatically between the competitive and off seasons [58], (Berkovich et al. 2016).

Looking at weight-dependent sports, three studies described methods of rapid weight-control amongst judo athletes and one study for Taekwondo. The first one where was among elite male and female judo athletes showed that 86% have reduced body weight rapidly before the competition (around 2-5%), with some athletes losing up to 10% ten times or more in their careers [2]. The fluctuation of weight was confirmed with a study of Rouveix et al. [40] which showed that quick weight reduction is an inherent part of the judo athletes. Also, 70% of the athletes seemed that lost more than 2.8 kg during a season, with the methods of excessive exercises or limit the food and fluids consumption.

Moreover, in a cross-sectional study of Berkovich et al. (2016) were used 108 male athletes from local judo teams. Rapid Weight Loss (RWL) was practiced by 80% of the athletes before competition, beginning at an average age of  $12.5 \pm 2.2$  years with the highest prevalence (~94%) in the oldest group of judoka (16-17.9 years). Pre-competition weight loss duration was  $8 \pm 5.4$  days, with an average weight reduction of  $1.5 \pm 1.1$  kg. The number of weight loss efforts per athlete in the past season was

$2.8 \pm 2.2$ . RWL was achieved by increased physical activity (82.6%), skipped meals (56.3%), or fasting at least once (47%). Two-thirds of the athletes indicated that they experienced pressure from their coaches and were the most influential figure in their decision to lose weight before competition. These athletes used the methods which compromised nutritional status, diminished physical performance and impaired growth and development. These methods can potentially lead to significant health risks. A key priority for the persons who guide young adults in weight loss for competitive sports is to have the knowledge and understanding to make safe recommendations and appropriate decisions about achieving specific and healthy weight goals.

Moreover, Sandos et al. (2016) investigated the prevalence, magnitude, and methods of quick weight loss among 72 male and 44 female Taekwondo athletes from all competitive levels. The results from the given questionnaires have shown that among the male athletes, 77.4% of the regional/state level and 75.6% of the national/international athletes declared to have reduced weight to compete in lighter weight categories. Among women, 88.9% of regional/state level and 88.6% of national/international level were using rapid weight loss strategies. Athletes reported to usually lose around 3% of their body weight, with some athletes reaching around 7% of their body weight. The methods used to achieve weight loss are potentially dangerous for health and had no difference between sexes. Four methods were more frequently used by men athletes in higher competitive levels as compared to lower levels, as follows: skipping meals, fasting, restricting fluids and spitting. Taekwondo athletes lost around 3% of their body mass, using the health-dangerous methods. Although no difference was found between sexes, while lower level athletes typically skip meals, fast, restrict fluids and spitting. Considering that these health-threatening methods are more commonly used by lower level athletes, specific education programs should be directed to them [49].

Another study investigated the methods adopted to reduce body mass (BM) in competitive athletes from the grappling (judo, jujitsu) and striking (karate and taekwondo) combat sports in Brazil. A standardized questionnaire was used with objective questions self-administered to 580 athletes. Regardless of the sport, 60% of the athletes reported using a method of RWL via increased energy expenditure. Strikers tend to begin reducing BM during adolescence. Furthermore, 50% of the sample used saunas and plastic clothing, and only 26.1% received advice from a nutritionist. In addition, a high percentage of athletes use unapproved or prohibited methods such as diuretics, saunas, and plastic clothing [4]. Few athletes are naturally light weight enough for these types of competitive sports, thus weight loss will be required the weeks or days prior to competition [44].

### 3. Achieving a Healthy and Competitive Body Weight

According to a research conducted in 2015, depending on the sport, the weight of an athlete during the competitive season is usually lower than the weight in off season. As a result of this, most of the athletes restricting their energy intake in order to achieve their competitive weight and they often gain the lost-weight back during the off season [23]. The ultimate goal for everyone and for athletes as well, is to develop healthy eating habits so as to achieve a healthy body weight that they can maintain for most of the year. In that way, athletes reducing the amount of weight that need to be lost for competition. The same research supported that for some sports, losing high amount of weight - for the needs of the competitive season - is not healthy for most athletes. Moreover, Manore [23] continued by saying that the key priority for each athlete is to make sure that their goal-weight is realistic and will not cause any health issues and/or increase the risk of injuries. Taking into consideration their ages as well as the level of their physical development are some ways that can help the athlete identify whether the weight they are trying to achieve is realistic. Sport dietitians are the health professionals should monitor athletes to help them reach their body-weight goals and to assure they are maintaining healthy eating habits [23].

While thinking of dietary strategies, expect to be analyzed evidence-based diet and lifestyle guidelines for athletes who are having a weight-specific goal; whether they are interested in losing weight, maintaining lean tissue and/or preventing weight regain [23]. To be more specific, dietary strategies section will provide to athletes an in-depth to diet and exercise specific behavior changes so as to produce the desired body-weight and composition modifications

### 4. Energy Restriction Approaches

The approach for restricting energy intake combined with an intense endurance and strength-training program can actually increase metabolic adaptations that slow weight loss and diminish the additive effects of these two factors on weight loss. But, this approach should be avoided because athletes are leading in a number of other negative performance and health consequences [28]. For example, decreased athletic performance effects due to decreased muscle strength, glycogen stores, concentration, coordination and training responses, and increased irritability. Also, increased negative health consequences (injury due to fatigue, loss of lean tissue, poor nutrient intakes, etc), increased risk of disordered eating behaviors, dehydration, and emotional distress due to hunger, fatigue, and stress [15].

It is important to remember that with negative energy balance, lean, fit individuals can quickly lose lean tissue if energy is restricted too dramatically [50]. For instance, one study placed active military personnel (BMI  $25 \pm 1$  kg/m<sup>2</sup>) on a 40 % energy-restricted diet for 30 days, while being fed the recommended dietary allowance (RDA) for protein (0.8 g/kg/body weight) [30]. Of the 3.3 kg lost during this time (4.2 % body weight), 58 % was lean tissue (1.9 kg). In contrast, when they placed sedentary overweight individuals (BMI 27.8 kg/m<sup>2</sup>) on a 25 % energy-restriction diet for 3 months, they lost 6 kg, with only 33 % coming from lean tissue (2 kg) [30]. Furthermore, Garthe et al. [15] showed that the athletes who had slower, and more logical weight loss around 0.7 % loss of body weight per week helped maintain lean tissue while improving strength gains compared with more severe weight loss (1.4 % weight loss/week).

Therefore, for the athletes who already have a training, it is preferable to moderately restrict energy intake (e.g., 500–700 kcal/day) and take longer to reach the weight loss goal (0.50–1 kg /week). This approach also allows the time required to adapt to new dietary habits while making sure adequate energy is available for exercise training [15].

## 5. Timing of food Consumption during Training and throughout the Day

Timing of food intake around exercise training and spreading food intake throughout the day is a key priority for the athlete. This approach ensures that the body has the nutrients and energy needed for the specific exercise and the building and repairing of lean tissue [46]. Furthermore, may delay hunger and as an extension of this may prevent the athlete from consuming foods or beverages not included in their diet plan. It is evidence-based that when athletes are concerned about their weight -particularly female athletes- they usually skipping meals, mainly breakfast [12]. Recent study of Erdman [12] reported that 98% of elite Canadian male athletes consumed breakfast, while Shriver et al. [42] at the same year found that only 23% of elite college female athletes consumed breakfast. The majority of the athletes in the second study reported their diets to be poor, most of the calories were consuming at dinner and they found it difficult to maintain their weight. Those eating habits may be a result of the idea that skipping breakfast will help in reducing caloric intake, therefore the overall weight [42].

Focusing on the athlete, breakfast constitutes the most important meal of the day, mainly due to the fact that it can provide carbohydrates needed to help replenish lost glycogen after an overnight fast and provide the appropriate fuel for exercise [8]. For

those who participate in an early-morning workout, eating a light pre-workout snack and a nutritious post-workout breakfast will assure the adequate nutrients have been lost during exercise particularly carbohydrate and protein. In a research examined the importance of breakfast for athletes, it was found that during moderate training weeks, breakfast provided 21% of the daily carbohydrate intake for junior elite triathletes, while during high intensity training weeks, breakfast provided 28% of their daily carbohydrate intake. Therefore, skipping breakfast would lower total daily carbohydrate intake, thus affecting exercise performance [8].

As mentioned above, post-workout meal is crucial as well, since it provides to the athlete all the necessary nutrients for the replenishment of lost glycogen, and also building and repairing their lean tissue. An appropriate post-workout meal should compose of foods high in fluids for rehydration and carbohydrates in the form of low energy dense foods, such as whole fruits and vegetables and whole grains. Sport dietitians should monitor athletes so as to ensure they develop healthy eating habits and prepare the most appropriate diet plan according to the individual needs. Overall, the use of low energy dense diet plan is the most effective way for refueling during training periods, while during competitive periods there is a need for higher energy dense foods if glycogen replacement needs to occur in less than 24 hours [23].

## 6. Diet Plan for Weight Loss

The possibilities of whether a low in energy dense diet plan is more effective on weight loss for athletes compared with a high energy dense diet plan were examined below.

Generally, this type of diet is lower in fat and reduces or eliminates energy dense beverages particularly sweetened beverages and alcohol [28]. More specifically, a low-energy dense diet is composed with a high consumption of vegetables, whole fruits and grains as well as incorporates low-fat dairy products. This low-fat, high-fiber, high-water diet means an individual still feel satiated even when the overall energy intake is lower, mostly due to the greater volume of food [28]. As reported by many references, when examined the effectiveness of a low-energy diet plan on the overall weight-changes, is expected to observe an overall weight and energy intake reduction, weight regain prevention as well as satiety maintenance [10, 38].

In a follow-up study, Rolls and his colleagues observed the effect of changing portion size, energy density or a combination of the two, on total energy intake over two days [37]. They altered energy density by substituting full fat foods with low fat foods (e.g. whole milk with skim milk) and by changing portions of vegetables. The study concluded that energy density and portion size independently altered energy



intake. Reducing portion size by 25%, decreased energy intake by 231kcal / day (10% decreases). Similarly, when energy density was reduced by 25%, energy intake decreased by 575 kcal / day (24% decreases). Therefore, minimizing both energy density and portion size will have the most positive impact on energy intake reduction by 32% [37]. Another similar study has shown this weight loss approach also works in longer dietary interventions. Ledikwe et al. [21] examined 35 obese women consuming a low energy dense diet for one year and 36 obese women consuming low fat diet only for the same period. They found that the first group has lost 20% more weight than the second group. Dietary fat intake was similarly decreased in both groups, but those in the low energy dense group, reported significantly lower ratings of hunger. Physical activity was the same between the groups. Currently, there is no published research reporting the effectiveness of the low energy dense diet for weight loss in athletes. However, only two resent researchers suggest that for highly active females, this diet plan does not provide enough energy to cover the exercise cost and reproductive function [18, 34]. The satiating effect of these diets combined with the hunger effects of intense exercise may contribute to the energy deficiency of this group of athletes.

Overall, lowering the energy dense of the diet is preferable at reducing energy intake rather than lowering portion size. For athletes following a lower energy dense diet could help them maintain their weight loss. A key component of a low energy dense eating plan is to promote satiation by increasing the intake of foods high in water and fiber, while reducing the intake of high fat foods [18].

## 7. Consumption of Energy Dense Beverages

Consumption of energy dense beverages and alcohol increase the overall daily energy in a diet plan, but it has been shown that there is a reduction in satiety and incomplete energy compensation [18]. Removing those beverages from the diet may help athletes achieve their weight-goals without making any other dietary changes. For these athletes, sweetened beverages (e.g., sport drinks) should be limited to meet the recommended consumption for hydration and fueling when participating in sport [18].

## 8. Protein Intake, Quality, and Timing

When the energy intake is restricted, it is easy for protein intake to decrease while protein needs to increase with energy restriction in order to help the preservation of skeletal muscle integrity, especially as regards physically active individuals [7].

Generally, athletes have increased protein needs compared with non-active individuals (1.4–1.7 g/protein/kg and 0.8 g/protein/kg respectively) [19, 36]. The volume and type of exercise as well as the level of energy restriction will determine the amount of additional protein needed [7]. For example, Mettler et al. [26] demonstrated that increasing dietary protein during periods of severe energy restriction can help in the maintenance of lean tissue in active individuals participating in strength training during dieting. For 1 week, they placed 20 healthy resistance-trained male athletes on an energy-restricted diet (60 % of habitual energy intake). During this time, they were randomly assigned to two groups, either in the control group (1 g/protein/kg;  $n = 10$ ) or in the treatment group (2.3 g/protein/kg;  $n = 10$ ). The results derived from the above study showed that the loss of lean mass was greater in the control group (-1.6 kg in 1 week) than in the treatment group (-0.3 kg). Thus, the higher protein intake (~35 % of energy intake) helped preserve lean tissue when energy intake was severely restricted for a short time.

In addition, athletes need to consume adequate high-quality protein throughout the day, but especially after exercise and at breakfast [57]. Spreading protein intake throughout the day is beneficial for weight loss for athlete by ensuring that adequate protein amount is constantly available for building, repair, and maintenance of lean tissue. In addition, higher protein diets have been associated with increased satiety and reductions in energy intake. Weigle et al. [55] reported a decrease in energy intake ( $-441 \pm 64$  kcal/day) over a 12-week period in healthy sedentary individuals fed an ad libitum high-protein diet (30 % energy from protein, 20 % fat, and 50 % carbohydrate) compared with an isocaloric lower protein diet (15 % of energy from protein). Although, most athletes consume high amounts of protein, they may not get this protein after exercise and spread it out throughout the day. It may be more usual for the majority of the energy and protein to be consumed in a large meal at the end of the day [22].

## 9. Conclusions

Taking all into consideration, weight management for athletes can be difficult, and in sometimes risky for the health. Despite the fact that they spend high amounts of energy in the training, they may still need to monitor diet and lifestyle to maintain a competitive body weight. If an athlete needs to lose weight, working with a supportive health care team such as coach, sports medicine team, and sport dietitian will help ensure success. Furthermore, a registered dietitian trained in sports nutrition should be collaborate with the coaches in order to help the athlete identify and reach a realistic goal weight with making an individualized daily meal plans, address nutrition and sport supplements and health issues, and make sure the athletes is fueled appropriately for

their sport. To provide a consistent message to the athlete, all health professionals need to understand the many physiological and environmental factors influencing body weight and energy balance. This will improve their ability to design personalized and realistic weight-management programs.

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