Effectiveness of Diet Refeeds and Diet Breaks as a Precontest Strategy

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ABSTRACT

Physique competitors focus on optimizing body composition through maximizing muscle mass and loss of body fat. Competitors frequently experiment with various methodologies purported to improve body composition, but often, there is a lack of evidence on their efficacy. Emerging evidence suggests that intermittent energy restriction (IER) methodologies such as refeeds and diet breaks may offer various benefits to competitors by improving fat loss efficiency, lean body mass retention, and attenuating metabolic adaptation to weight loss. This review examines these methodologies and the evidence for their efficacy and proposes practical ways to implement IER that may benefit physique competitors.

INTRODUCTION

A physique competitor's success is highly related to their body composition. To achieve low levels of body fat, competitors typically follow 8–20 + week diets in which energy expenditure is increased and caloric expenditure is decreased (3,7,10,13,14,21,24,30,31,33). Kleiner et al. (13), reported that male bodybuilders followed high protein, low-fat hypocaloric diet patterns. Similarly, Chappell et al. (7), reported that male and female physique athletes followed a high-protein, high-carbohydrate, low-fat (~30–35/50/15–20% of energy from protein/carbohydrates/fats) diet where the total intake of all macronutrients decreased over time as the competitors got closer to the competition.

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Although energy restriction is necessary for fat loss to occur, it can be achieved in a continuous or intermittent fashion. Continuous energy restriction requires reducing the energy intake every day relative to weight maintenance requirements; alternatively, intermittent energy restriction (IER) uses alternating periods of energy restriction with periods of greater energy intake that are sometimes referred to as "refeed" periods or "diet breaks" within the fat-loss plan (25,35). Among physique athletes, both methods of caloric restriction have been reported (7,21,34). Chappell et al. (7) reported that 10 out of 32 male competitors and 8 out of 16 female competitors consumed periodic "cheat meals" during their contest preparation; furthermore, one of the 32 males and 4 of the 16 females used refeed strategies during their contest preparation, Refeed days were also reported by Mitchell et al. (21) among 4 of 9 bodybuilders as part of their contest preparation.

One of the potential benefits of incorporating an IER dietary strategy is to offset some of the adverse physiological effects that continuous dieting can exert. A discussion of the impaired physiological functioning that manifests itself in athletes was put forth by the International Olympic Committee (IOC) in the form of a consensus statement and is referred to as a syndrome titled "Relative Energy Deficiency in Sport (RED-S)." The syndrome of RED-S refers to relative energy deficiency and includes impairments of resting metabolic rate, menstrual function, bone health, immunity, protein synthesis, and cardiovascular health (22). According to the IOC statement on RED-S, it is a mismatch between an athlete's energy intake (diet) and the energy expended in exercise, leaving inadequate energy to support the functions required by the body to maintain optimal health and performance (22). In other words, low-energy availability is the likely factor responsible for the impairments observed in this syndrome. Considering the preparation a physique athlete undertakes to peak for competition (a combination of caloric restriction and a concomitant increase in exercise volume)–the likelihood of this type of athlete experiencing symptoms of RED-S is elevated. Although research investigating IER in physique athletes is in its infancy, there are some data and optimism to suggest that such strategies may prevent symptoms of RED-S.

KEY WORDS:
diet breaks; diet refeeds; physique competitors; precontest preparation; intermittent energy restriction

Although not all competitors and coaches implement diet breaks or diet refeeds as part of their contest preparation plans, there seems to be a theoretical construct as to why these practices may be effective during a contest preparation phase for the physique athlete. Since the evidence on the efficacy of such practices is scarce in the literature, the purpose of this article is to review the existing evidence to help determine whether these practices may be effective as part of a contest preparation strategy for physique athletes.

DEFINITION OF TERMS

The terms cheat day, cheat meal, diet refeeds, and diet breaks are sometimes used interchangeably by coaches and athletes. To improve clarity on the topic, the definitions below will be used for the purposes of this article. If applicable, definitions of these terms from the existing literature are used. These are the acting definitions:

- Cheat meal–Eating one meal without regard to quantity or macro/micronutrient composition. The intake may be measured at the end of the meal, but there are no predetermined goals to achieve in terms of total calorie or macro/micronutrient intake for the specific meal. Depending on the quantity of food consumed, a measured cheat meal may still fit into the daily dietary goals for the day while on a caloric deficit or as part of a diet refeed or diet break strategy. Murray et al. (23) defined a cheat meal as a meal in which one's restrictive and meticulously calculated dietary regimen may be abandoned for a brief influx of "prohibited" foods.
- Cheat day–An entire day of eating without regard to quantity or macro/micronutrient composition. While the intake may be measured at the end of each day, there are no predetermined goals to achieve in terms of total calorie or macro/micronutrient intake. Cheat days include a string of back to back cheat meals and most likely result in a significantly higher than normal consumption of calories that usually come from carbohydrates and fats.
- Diet refeeds–A diet strategy used to reach a specific target of calories and macro/micronutrients that is usually set at the individual's estimated weight maintenance energy requirements or slightly above (i.e., 5–10% above) their maintenance energy intake for 1–3 days. Trexler et al. (34) defined a refeed as a brief period of overfeeding in which caloric intake is raised slightly above maintenance levels, and the increase in caloric intake is predominantly achieved by increasing carbohydrate consumption. The bodybuilders who implemented diet refeeds as part of their precontest strategy in a study by Mitchell et al. (21), reported a 46 ± 21% increase in energy from their normal hypocaloric diet with a 114 ± 41% increase in carbohydrates, a 63 ± 66% increase in fats, and a 4 ± 11% reduction in protein. If a cheat meal is measured and there is room in the daily calorie/macronutrient allowance for the day, it may be integrated as part of the diet refeed. Diet refeeds can be arranged in many ways; for example, 5 days of energy restriction followed by 2 days of diet breaks or 12 days of energy restriction followed by 3 days of diet refeeds.
- Diet breaks–A diet strategy where a continuous string of 4+days to several weeks of weight maintenance calories (or slightly above) are consumed as part of the fat loss plan with a specific target of calories and macro/micronutrients for each day. Diet breaks can be arranged in many ways, for example, one week of energy restriction may be followed by one week of a diet break or 2 weeks of energy restriction may be followed by 2 weeks of a diet break. In order for fat loss to occur, the periods of the diet breaks must not result in energy intake significantly above weight maintenance calories.

HORMONAL RESPONSES TO FAT LOSS AND ENERGY RESTRICTION

The energy restriction required for fat loss to occur is accompanied by a myriad of hormonal responses. Specifically, thyroid hormones (triiodothyronine [T3], thyroxine [T4]), leptin, insulin, insulin-like growth factor, ghrelin, testosterone, and cortisol are all altered during periods of energy restriction, (1,11,17,25,30,34). Research indicates that very low adiposity and energy restriction result in decreased levels of thyroid hormones, (11,30,36); leptin, (11,18,33); insulin, (17,30); and testosterone, (11,17). Conversely, the hormones ghrelin, (18,30), and cortisol, (19,30), have been reported to increase during energy restriction. Collectively and individually, alterations of these hormones may lead to fat loss plateaus by reducing energy expenditure and potentially making adherence to a fat loss plan more challenging.

The thyroid hormones, particularly T3, play an important role in regulating energy expenditure where decreases in these hormones lower the metabolic rate and decrease thermogenesis, (12). Moreover, the low levels of leptin and high levels of ghrelin that occur with low levels of body fat and energy restriction work synergistically to stimulate appetite (2,19). Similar to leptin, insulin is another adiposity signaling hormone where higher levels of the hormone have an anorexigenic effect on the body (32). Furthermore, insulin levels play an important role in suppressing muscle protein breakdown (28); hence, low levels of insulin may contribute to losses in fat-free mass. Testosterone, which plays a role in increasing muscle protein synthesis and muscle mass (28), has an inverse correlation with fat mass and may regulate adiposity by inhibiting adipogenesis (16). Conversely, the glucocorticoid cortisol induces muscle protein breakdown (28), and may hinder the action of leptin (39).

In a case report of a natural male bodybuilder over a 6-month contest diet period, the fasting levels of leptin, T3, testosterone, insulin, and T4 dropped by 47, 50, 75, 83, and 39%, respectively (30). Furthermore, fasting cortisol and ghrelin levels rose by 100 and 39%, respectively (30). Similar results have been reported in larger cohorts. In a study investigating the effects of anabolic and catabolic hormones during the contest preparation phase of 14 male bodybuilders, it was reported that insulin and insulin-like growth factor decreased significantly over the course of an 11-week contest preparation diet while testosterone decreased significantly during the first 5 weeks of the diet (17). More recently, a study of 50 female fitness competitors looked at the effects of intensive weight reduction on body composition and serum hormones (11). Over the 4-month fat loss diet to prepare for a fitness competition, significant decreases in leptin, T3, testosterone, and estradiol were reported along with an increased incidence of menstrual irregularities (11). Collectively, it has been suggested that low energy intake combined with low levels of adiposity result in hormonal responses aimed at conserving energy and increasing energy intake (34). Table 1 summarizes the hormonal responses associated with energy restriction and fat loss during contest preparation.

There have been a few reports of a reversal of the hormonal adaptations in the postcompetition period when energy intake and body fat stores are increased. In a case study of a drug-free male bodybuilder (30), it was reported that 5 of 7 hormones returned to baseline/predieting levels (defined as within 15% of baseline hormonal value). Specifically, testosterone, T4, T3, ghrelin, and insulin returned to precontest preparation levels while leptin and cortisol still had not returned to precompetition levels within 6 months after competition. In another case study of a drug-free male bodybuilder (24), testosterone and T3 still had not returned to precontest preparation/baseline levels while T4 concentrations were recovered along with a return to elevated energy intake and fat mass. At this time, we are not aware of any existing data that have investigated the effects of diet breaks (increased energy intakes) within the contest preparation phase and the potential effects such a diet break/increased energy intake would have on the aforementioned metabolic hormones.

METABOLIC RESPONSES TO FAT LOSS AND ENERGY RESTRICTION

In addition to hormonal adaptations, the metabolic responses to fat loss and energy restriction also involves a downregulation of total daily energy expenditure. An individual's total daily energy expenditure (and the relative proportion of the total amount) includes the following:

- Resting metabolic rate (~60–70%)
- Nonexercise activity thermogenesis (~5–15%)
- Thermic effect of food/diet-induced thermogenesis (~10–15%)
- Exercise activity thermogenesis (~5–15%)

Each one of these components of total daily energy expenditure has been shown to decrease in response to weight loss and/or energy restriction. In obese populations, it has been reported that exercise activity thermogenesis is suppressed in response to weight loss (8,37). Similarly, nonexercise activity thermogenesis also decreases with energy restriction in studies of obese subjects (15,29). Although the relative magnitude of the thermic effect of food does not seem to change with energy restriction, the overall reduced energy intake does decrease the absolute magnitude of the thermic effect of food (20,34).

Of the variables comprising total daily energy expenditure, resting metabolic rate has been the most studied in the physique athlete population. In the published case study literature where resting metabolic rates of physique athletes have been tracked during contest preparation (congruent with fat loss and energy restriction), there has been a suppression of the resting metabolic rate (24,26,27,30,33). On average, the reduction in resting metabolic rate was approximately 18% (ranging from 9 to 47%).

Campbell et al. recently published 2 studies in abstract form (5,6) that investigated the effects of a 2-day refeed in dieting resistance-trained males (n = 14) and females (n = 13) seeking to optimize their physiques. There was a 7-week diet phase in which one group was randomly assigned to reduce their caloric intake by 25% per week for 7 consecutive weeks (consecutive dieting group). By contrast, the other group (refeed group) reduced their caloric intake by 35% for 5 of 7 days per week while including a 2 day increase in caloric intake (in the form of carbohydrates only) for 2 consecutive days per week. At the end of the week, the 25% calorie restriction for the refeed group matched the energy restriction of the consecutive dieting group. At the end of the 7-week dieting intervention, both groups had significant reductions in fat mass and body mass, but the refeed group retained more fat-free mass compared with the continuous dieting group (0.9 kg more for the refeed group) (5). Furthermore, the consecutive dieting group experienced a significant decrease in resting metabolic rate as compared to baseline values (~4%), whereas the refeed group maintained their resting metabolic rate during the diet intervention (6). The weight loss and energy restriction practices that physique athletes subject themselves to for competitive success elicit physiological homeostatic responses. These responses include metabolic adaptations that are manifested through hormonal alterations and a suppression of metabolic rate. Although these unfavorable responses to fat loss and energy restriction are reversible with postcompetition weight gain and increased energy intakes, a future goal of physique scientists is to investigate dietary strategies that may be able to mute the responses that may hinder maintenance of fat-free mass and lower resting metabolic rate during the contest preparation period. The inclusion of diet breaks and diet refeeds should be further investigated for their potential in this area since there is some initial evidence indicating that IER may help to attenuate a decrease in fat-free mass and resting metabolic rate that would be beneficial for a physique competitor.

THE EFFECTS OF REFEEDS AND DIET BREAKS

The effects of IER on weight loss for the overweight, obese, and/or diabetic populations started to gain interest after

Table 1
Hormonal adaptations during contest preparation/energy restriction

Hormone	Response (reference)
Testosterone	↓ (19,32)
Cortisol	↑ (19,32,33)
TSH	↓ (33)
T4	↓ (19,32)
T3	↓ (19,32)
Insulin	↓ (19)
Leptin	↓ (19,32,33)
Ghrelin	↑ (19,32)

Wing and Jeffrey investigated the effects of diet breaks in 142 participants by separating them into groups of a continuous 14-week diet group, a long-break diet group, and a short-break diet group (38). All participants received the same standardized behavioral weight loss program with 14 weekly sessions; however, the long-break group took a 6 week diet break after the seventh week of dieting, and the short-break group took a 2 week break after the third, sixth, and ninth week of dieting (38). During the diet breaks, the participants were instructed to stop all weight loss efforts (38). Although the diet breaks naturally slowed down the process of weight loss, the overall weight lost between 0 and 5 months or 0–11 months did not differ between the groups that incorporated the diet breaks and the group that dieted continuously throughout the duration of the study (38).

More recently, Byrne et al. examined whether IER improved weight loss efficiency compared with a continuous energy restriction (4). Fifty one obese men were randomly placed into either a continuous 16-week energy restriction group or an intermittent diet group that alternated 2 weeks of energy restriction with 2 weeks of weight maintenance calories (4). Clearly, both groups underwent the same 16-week diet intervention; however, it took the intermittent diet group 30 weeks to complete the 16 weeks diet intervention due to the 7 × 2-week breaks that occurred between 8 × 2-week diet periods. The researchers reported that 19 participants in the continuous diet group completed the study and lost an average of 9.1 ± 2.9 kg; furthermore, 17 participants in the intermittent diet group completed the study and lost an average of 14.1 ± 5.6 kg (4). Hence, the authors concluded that greater weight and fat loss was achieved in the intermittent diet group (4).

Although many other studies have compared the effects of intermittent and continuous energy restriction on the obese or overweight population, it has been suggested that active lean individuals may benefit more from IER strategies due to their different metabolic status as compared to the overweight or obese sedentary populations (25). Although the practice of diet refeeds and diet breaks has been around for many years in the physique world, it is not until recently that research on these practices has been performed with this population as previously discussed (5,6).

Aguilar et al. (1) also reported on the effects of intermittent carbohydrate refeeds versus continuous dieting on leptin concentrations in a subsample of the participants, from the larger cohort studied by Campbell et al. (5,6). In this pilot study, 9 resistance-trained participants were randomly placed into either a refeed group or a continuous diet group in conjunction with a 4 days per week resistance training program for 7 weeks (1). All participants adhered to a 25% kcal reduction from their baseline calorie intake over the course of the week; however, the refeed group implemented 2 consecutive days of elevated carbohydrate/calorie intake (to maintenance calories) followed by a 35% caloric restriction for 5 days each week while the continuous diet group adhered to a continuous 25% caloric restriction every day for 7 weeks (1). Leptin concentrations and body weight were measured at baseline and after the diet intervention (1). Although both groups significantly lost body weight and had significant decreases in leptin concentrations, the differences between the groups was not significant (1). However, the small sample size may make it difficult to detect anything less than a very large effect size in this pilot study. Hence, the authors concluded that future studies should investigate larger sample sizes to determine whether carbohydrate refeeds during a hypocaloric diet can attenuate decreases in plasma leptin concentrations (1).

PRACTICAL APPLICATIONS AND CONCLUSION

Intermittent dieting encompasses a myriad of different strategies such as diet breaks and refeeds. There are limitless ways in which the physique athlete might apply them to improve fat loss efficiency and retain or improve lean body mass while tailoring them to personal preference. Although this review has focused on the physiological benefits of intermittent dieting, the possible psychological preferences should not be ignored. Although there are little data on this topic in particular, anecdotally some athletes report improved adherence when they implement these strategies. Although there are many ways to apply intermittent dieting strategies, there are a few principles that must be adhered to (a) while some diet breaks and/or refeeds may make use of periods of eating over maintenance, an overall energy deficit must be maintained if continuous fat loss is to occur. For example, if an athlete had an average energy expenditure of 2,500 calories per day (17,500 calories per week) but consumed 20,000 calories per week by using 2 days of eating at 5,000 calories for "refeeds" while eating 2,000 calories on their 5 "normal" days, they would likely gain fat or at minimum not lose fat due to overeating on a weekly basis. (b) These techniques are only appropriate if the athlete maintains their adherence. If these strategies cause the individual athlete to be less adherent to their overall nutritional strategy, then they may be inappropriate for that particular athlete.

It is important for athletes and coaches to understand that more aggressive increases in calories on refeed days will mean that the athlete will need to be even more energy restricted on nonrefeed days. Likewise, incorporating long-diet breaks, such as the 2-week diet breaks used in the study by Byrne et al. (4), will significantly extend the duration of the total competition preparation phase. Therefore, it is important for coaches and athletes to consider how much time they are prepared to spend in a deficit as well as how much total preparation time (number of weeks in a deficit as well as maintenance) they are willing to commit. It is also important to note that diet breaks and refeeds do not have to be mutually exclusive. Although single-day refeeds likely do not confer any additional fat loss benefits compared with continuous dieting, multiple day refeeds may provide a protective effect on fat-free mass (~0.9 kg) and metabolic rate (less than 100 kcal per day difference) (5,6). Although these differences may appear small, a physique competitor would likely find an additional 0.9 kg of fat-free mass to be advantageous during a competition where muscularity is valued. In addition, maintaining a slightly higher resting metabolic rate (~100 calories) over the course of their contest preparation could assist in their ability to burn more calories without doing any extra activity. Furthermore, if a few higher calorie or maintenance days per week improve adherence for the individual athlete, then it is a worthy addition. Diet breaks seem to have a more robust effect on protecting lean body mass and attenuating decreases in resting metabolic rate; however, an optimal diet break length for physique athletes is not known. The Byrne et al. (4) study, conducted in obese males, used the approach of a 2-week diet followed by a 2-week diet break at maintenance. However, if an athlete needed to lose a significant amount of body fat, this could lead to a very long total preparation phase if as much time is spent at maintenance calories as during caloric restriction. It is possible that 1-week diet breaks may still be effective, and many coaches report using them with success. Current popular protocols include diet: diet-break ratios of 2:2, 2:1, 3:2, 3:1, and 4:1. Ideally, an athlete would probably like to use the minimal amount of time spent in a diet break that provides the maximum benefit, so that the overall preparation phase is not extended longer than necessary. The longer the total preparation phase, the less time spent in the offseason muscle building phase by default. As such, the goals of leanness and retaining lean body mass and resting metabolic rate must also be balanced with spending enough time in the offseason gaining phase to build the requisite amount of muscle mass to be competitive. As of now, it is not known if a 1-week diet break may provide the same benefits as 2 weeks of diet breaks, so any further discussion is speculative.

If we were to speculate on an optimal usage of diet breaks, we might recommend a graded diet break frequency during the contest preparation phase. That is, less frequent diet breaks when the preparation begins and resting metabolic rate, leptin, testosterone, and T3 are still high from the offseason overfeeding phase. As the competitor progresses through prep and body fat drops, gradually incorporating more frequent refeeds to maintain resting metabolic rate and lean body mass during the most difficult phases of prep may be more optimal than maintaining the same diet break frequency the entire preparation phase. As fat is lost and adipocytes become depleted, it becomes more likely that energy will be liberated from lean tissue versus fat tissue (9). Perhaps providing more frequent diet breaks for athletes as they become leaner could improve fat loss efficiency, lean body mass retention, and mitigate fat loss plateaus. For example, beginning the initial phases of contest prep using a 4:1 ratio of diet: diet break, then moving to 3:1, then 2:1, and finally 1:1 may be more optimal than simply using a set ratio for the entire duration of the preparation; however, we can only speculate. Of course, it only makes sense for an athlete to increase diet break frequency if they have given themselves enough overall preparation time, so that they will not run out of time to be stage lean.

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