



Perceived ideal body weight exacerbates bulimia and dieting in Bodybuilding Athletes

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ABSTRACT

The passion of bodybuilding athletes for a symmetric, lean, heavily muscled body leads them to carry out exhausting exercise programs and restrictive eating regimens, sometimes resulting in disordered eating behaviors. This study investigates potential exacerbators on the development of disordered eating in bodybuilding (professional and recreational) and strength athletes. This cross-sectional single time point study involved 103 Cypriot bodybuilding athletes of both sexes, performing at three levels: professional, recreational and strength athletes. The Eating Attitude Test 26 (EAT-26) and The Three Factor Eating Questionnaire (TFEQ-R21) were used to evaluate disordered eating and eating behaviors respectively. Scores on the items of the questionnaires according to sex were compared using the Mann–Whitney *U* test and differences according to bodybuilding performance status or/and body weight deviation category using the Kruskal–Wallis test. The current study was performed under the auspices of the Hellenic Center of Education & Treatment of Eating Disorders (KEADD). The degree of deviation between the perceived ideal body weight and the actual body weight was associated with increased risk of eating disorder. Athletes who desired a lower body weight recorded higher scores on EAT-26 overall ($p=0.001$), and the subscales of dieting ($p=0.01$) and bulimia ($p=0.001$). Cognitive restraint and emotional eating scales of TFEQ-R21 were more pronounced in the non-professional athletes ($p=0.01$). The emotional eating score was higher in women. There is a need for appropriate sport-specific, gender-specific preventive intervention to deescalate the risk of eating disorder, in both professional and non-professional bodybuilding athletes.

1. Introduction

Bodybuilding is a demanding sport that requires prolonged periods of intensive resistance training to achieve a symmetric body with considerable muscle mass, and restrictive preparation diets [1]. In the case of professional bodybuilders, success is judged on the on-stage posing performance, and is determined by the muscular bulk and configuration, and minimal body fat, which is often marginal for survival [2]. Evidence-based guidelines are available for the balanced nutrition and training for achieving optimum body composition [3], but professional bodybuilders often choose restraint eating in the hope of obtaining the desired body configuration [4]. Their obsession with a muscular body image success during the contest takes priority over health protection.

Several studies have described professional bodybuilders of both

sexes as dissatisfied with their muscularity, and as having low self-esteem and a high rate of disordered eating behaviors [5,6]. Professional bodybuilders count as measures of their success their symmetric body appearance and level of performance, about which they become obsessed [7]. Common disordered eating patterns among bodybuilders anorexia and binge eating disorder, and body dysmorphia anxiety [5].

Concerning recreational bodybuilders, less data is available, and the evidence is inconclusive. In some studies, non-professional bodybuilders are described as having a similar psychological profile and as applying the same restrictive eating strategies as the professionals [8], but in others they are reported to have healthier eating patterns [8]. The motives of recreational bodybuilders certainly differ from those of the professionals, as they usually aim for a leaner, muscular body, to increase self-satisfaction and self-acceptance [9].

In a recent meta-analysis, the personality traits detected in both

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professional and recreational bodybuilders of both sexes included higher levels of neuroticism, perfectionism, obsession and need for control, but also of depression and anxiety, in comparison with strength athletes, who do not perform bodybuilding [10].

Comparative studies on disordered eating behaviors in professional and recreational bodybuilders and strength athletes have been sporadic and the findings were inconclusive [11]. Studies investigating eating behaviors and risk of disordered eating in non-homogenous populations, such as athletes performing different sports or training at different level, such as competitive with non-competitive [5,12,13], use different instruments to capture eating attitudes and behaviors comprehensively.

This study, conducted in Cyprus, aimed to identify the eating behaviors of bodybuilding and strength athletes of both sexes and at different performance levels and evaluated the impact of the deviation from the perceived as ideal body weight on the eating behaviors and eating disorder risk.

2. Materials and methods

2.1. Participants

In this cross-sectional single time point study, a purposive sample of 103 athletes (76 males) were recruited, from seven private fitness centers in Cyprus (4 based in Nicosia and three in Limassol). The participants were divided into three groups according to their performance level: a) professional bodybuilders ($n = 38$) who participated in competitions, but were in an off-season period, i.e. were not preparing for competition; b) recreational bodybuilders ($n = 32$) selected according to the following criteria: being major, trained constantly to develop muscularity at least for three years and for more than four hours per week, but without participating in competitions; c) strength athletes ($n = 33$), who trained regularly with weights, at least for four hours per week, aiming for strength, but not excessive muscularity.

Athletes during their contest preparation period or with a history of a chronic disease were excluded from the study. All the participants were informed on inclusion about the aims of the study and provided written informed consent. The study was approved by the Cypriot Bioethics Committee (Reference number EEBK 2017.01.32). The study was performed under the auspices of the Hellenic Center for Training & Treatment of Eating Disorders (KEADD).

2.2. Anthropometric measurements

Body weight was measured with the participants wearing light clothes with TANITA WB-260A body weight analyzer (0.1 kg accuracy). Body height was measured without shoes and socks, using a portable scale with a Leicester height measure (0.1 cm accuracy).

2.3. Questionnaires

Participants were approached at the fitness center, before performing their exercise activity. They provided personal information, including age (in years) and the current perceived ideal body weight, and completed two standardized self-reported questionnaires:

The Eating Attitudes Test (EAT-26), assesses the risk of disordered eating and measures three domains, oral control, bulimia and dieting. It has good reliability, validity and internal consistency [14–16] with Cronbach's α coefficient 0.87 for oral control, 0.88 for bulimia and 0.78 for dieting. An overall score of ≥ 20 was used as an indicator of increased risk of eating disorder.

The Three-Factor Eating Questionnaire-R21 (TFEQ-R21) (revised version) [17], which assesses three domains of eating behavior; cognitive restraint, uncontrolled eating and emotional eating. This questionnaire presented good internal consistency for the current population: Cronbach's α coefficient 0.91 for cognitive restraint, 0.885 for uncontrolled eating and 0.79 for emotional eating.

Body weight dissatisfaction was calculated as the difference between the actual body weight and the perceived ideal body weight, and the athletes were classified in three subgroups: those with actual body weight equal to or lower than the perceived ideal (non-deviating bodybuilders), those with actual body weight 1–5 kg greater (low-deviating), and those with actual body weight more than 6 kg greater than the perceived ideal body weight (high-deviating).

2.4. Statistical analysis

The scores on the items of the EAT-26 and TFEQ-R21 questionnaires were expressed as mean values and standard deviation (SD). Differences of scores according to sex were compared using the Mann–Whitney U test and differences according to bodybuilding performance status or/and body weight deviation category using the Kruskal–Wallis test. Scores were \log -transformed, to achieve normality and homogeneity of the variances, and compared by two-way ANOVA analysis for sex, exercise status and their interaction, and sex, bodyweight deviation category and their interaction. All tests were performed with a level of significance at $\alpha=0.05$. Statistical analysis was conducted using IBM SPSS Statistics 20. One-way ANOVA post-hoc power calculation was performed, with G. Power (3.1.9.4), based on the observed value of effect size per EAT-26 score and considering the mean values, sample and SD within each group according to the weight deviation.

3. Results

The anthropometric measurements of the participants and their scores on the questionnaires are presented in Table 1. No statistically significant difference between the sexes was observed in the overall scores of EAT-26 and TFEQR21 or their domains, apart from emotional eating on TFEQR21, for which females scored higher.

As shown in Table 2, neither performance level alone, nor the interaction between sex and performance level affected the scores.

As shown in Table 3, overall, only 20/103 athletes had a body weight equal to or lower than their perceived ideal body weight; these comprise the non-deviating sub-group, while the rest desired a lower body weight, and were sub-grouped as low-deviating, i.e., those desiring up to 5 kg weight loss (41/103) and high-deviating, i.e., those desiring a weight loss of from 6 to 19 kg (41/103), as shown in Table 3. The distribution is depicted in Fig. 1.

The overall score on EAT-26 increased according to the increasing deviation between actual and perceived ideal body weight. Thus, the high deviating athletes showed higher overall scores on EAT-26 and

Table 1

Characteristics of bodybuilding and strength athletes and scores on the Eating Attitudes Test (EAT-26) and Three-Factor Eating Questionnaire-R21 (TFEQ-R21), according to sex.

Sex	Males	Females	Total
Number of participants	76	27	103
Age (years) (SD)	25.6 (5.1) ^a	25 (6.4) ^a	25.4 (5.4)
Height (m) (SD)	1.8 (0.1)	1.7 (0.0)	1.7 (0.1)
actual BW (kg) (SD)	82 (7.8) ^a	62.6 (6.7) ^b	76.9 (11.4)
Perceived ideal BW (kg) (SD)	88.3 (92.2) ^a	53.3 (11.3) ^b	71.4 (13.1)
EAT-26 score (SD)	21.8 (11.5) ^a	23.1 (7.9) ^a	22.2 (10.6)
at high risk N (%)	45 (59.2) ^a	15 (55.5) ^a	60 (58.2)
Dieting score (SD)	13.2 (7.7) ^a	15.4 (5.7) ^a	13.8 (7.3)
Bulimia (SD)	2.1 (2.3) ^a	1.9 (1.9) ^a	2.0 (2.2)
Oral control (SD)	4.8 (2.9) ^a	4.1 (2.7) ^a	4.6 (2.9)
Cognitive restraint* (SD)	2.9 (0.8) ^a	2.9 (0.5) ^a	2.9 (0.7)
Uncontrolled eating* (SD)	2.6 (0.6)	2.6 (0.6) ^a	2.6 (0.6)
Emotional eating* (SD)	1.9 (0.7) ^a	2.3 (0.8) ^b	2.0 (0.7)

BW = body weight.

Different superscript letters (a, b) indicate statistically significant difference among the indicated groups at $\alpha=0.05$ significance level.

* Indicates subscales of TFEQ-R21.

Table 2
Scores on the Eating Attitudes Test (EAT-26) and the Three-Factor Eating Questionnaire-R21 (TFEQ-R21) scores, according to the sex and the level of performance of athletes (N = 103).

	Sex	Level of performance		
		Professional bodybuilders	Recreational bodybuilders	Strength athletes
Number of participants	M	28	24	24
	F	10	9	8
EAT-26 score (SD)	M	19.9 (8.5)	24.8 (12.2)	21.2 (13.5)
	F	24.5 (5.0)	24.7 (7.5)	19.5 (10.2)
Dieting score (SD)	M	12.2 (6.1)	14.9 (8.6)	12.7 (8.4)
	F	17.5 (3.9)	16.4 (4.6)	11.5 (7.2)
Bulimia score (SD)	M	1.6 (1.4)	2.3 (2.0)	2.3 (3.3)
	F	1.6 (1.0)	2.1 (2.4)	2.0 (2.3)
Oral control Score (SD)	M	4.2 (3.4)	5.5 (2.5)	4.8 (2.9)
	F	3.7 (2.1)	4.4 (2.8)	4.4 (3.3)
Cognitive restraint * score (SD)	M	2.9 (0.7)	3 (0.6)	2.7 (0.9)
	F	2.9 (0.5)	3 (0.5)	2.8 (0.6)
Uncontrolled eating * score (SD)	M	2.6 (0.5)	2.6 (0.7)	2.5 (0.5)
	F	2.5 (0.4)	2.5 (0.7)	2.8 (0.6)
Emotional eating * score (SD)	M	1.9 (0.6)	1.9 (0.7)	1.9 (0.7)
	F	2.5 (0.7)	2.0 (0.9)	2.4 (0.7)

M: males, F: females.

* Indicates subscales of TFEQ-R21.

Table 3
Effect of perceived ideal body weight on the scores on the Eating Attitudes Test (EAT-26) and the Three-Factor Eating Questionnaire-R21 (TFEQ-R21) in bodybuilding and strength athletes.

	Non deviating	Low deviating	High deviating	P value
Number of participants	20	41	41	
Age, years (SD)	26.8 (2.7)	29.4 (6.0)	28.5 (4.9)	
Actual body weight, kg (SD)	71.8 (10.3)	76.2 (10.6)	80.4 (11.7)	
Perceived ideal body weight, kg (SD)	75.5 (10.3)	72.9 (10.5)	69.8 (11.6)	
EAT-26 score (SD)	13.6 (9.7) ^a	21.2 (9.9) ^b	27.5 (8.8) ^c	***
Dieting score (SD)	6.8 (6.3) ^a	12.8 (6.3) ^b	18.2 (5.4) ^c	***
Bulimia score (SD)	1.4 (2.1) ^a	1.8 (2.7) ^a	2.5 (1.5) ^b	**
Oral control score (SD)	3.8 (2.8) ^a	4.9 (3.1) ^a	4.7 (2.6) ^a	
Cognitive restraint * Score (SD)	2.4 (0.6) ^a	2.4 (0.7) ^a	2.8 (0.4) ^b	**
Uncontrolled eating * score (SD)	2.4 (0.6) ^a	2.4 (0.7) ^a	2.8 (0.4) ^b	**
Emotional eating * score (SD)	1.5 (0.6) ^a	1.9 (0.6) ^b	2.3 (0.7) ^c	***

Superscript letters (a, b, c) indicate statistically significant difference between subgroups at $\alpha=0.01$ (**) and $b=0.001$ (***) significance level.

Non-deviating = current body weight equal to or lower than perceived ideal body weight.

Low-deviating = current body weight 1–5 kg greater than perceived ideal body weight.

High-deviating = current body weight 6–19 kg greater than perceived ideal body weight.

* Indicates subscales of TFEQ-R21.

dieting scores, increasing with the degree of deviation from the perceived ideal body weight, regardless of the level of performance (Table 3, Fig. 2).

Scores for bulimia, cognitive restraint and emotional eating were significantly higher in high-deviating than in non- and low-deviating recreational athletes. Low- and high-deviating professional bodybuilders scored higher on the emotional eating scale than their non-deviating peers (Fig. 2).

Post hoc power was 0.99 with an effect size equal to 0.64.

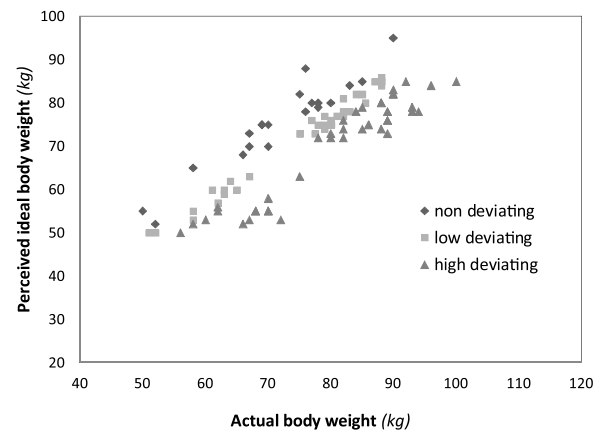


Fig. 1. Distribution of actual and perceived ideal body weight in bodybuilding and strength athletes (N = 103).

Non-deviating= current body weight equal to or lower than perceived ideal body weight.

Low-deviating = current body weight 1–5 kg greater than perceived ideal body weight.

High-deviating= current body weight 6–19 kg greater than perceived ideal body weight.

4. Discussion

Bodybuilding, as a body image-related sport, strongly affects the eating attitudes of the athletes. In this study, athletes of both sexes, who were performing strength exercises and bodybuilding at both professional and non-professional level, presented a similar high risk of disordered eating and food restriction measures. According to the study findings, an exacerbating factor for the risk of eating disorder and distorted eating behavior risk was the desire for a lower body weight, especially in the recreational athletes.

Emotional eating scores were higher in the female participants. Generally females express greater dissatisfaction with their body image, and may alleviate their negative feelings by altering their eating choices and behaviors [18]. Female bodybuilders, being highly preoccupied with their body image, have been observed to adopt disordered eating behavior, mainly bulimia [19]. A different causation for emotional eating was proposed in a cohort of wrestling athletes from both sexes [20]. Similar to bodybuilding, wrestling is an anaerobic sport, resulting to high heart rate, high energy demands, resulting to negative psychological effects and expressed with behaviors such as emotional eating.

Studies have linked the overwhelming passion, in both competitive and recreational bodybuilders, for a lean, heavily muscled body, with the risk of eating disorders and pathological symptoms [4]. Among our participants, this risk, as captured by EAT-26 questionnaire and especially the dieting subscale, was associated with the desire for a lower body weight, with no significant differentiation between professional and recreational athletes. This is the first time that bodybuilders are depicted to have their eating attitude and behavior affected by weight loss. So far, literature associates eating disorders in this group of athletes to body composition, i.e. excessively lean and muscular physique. Associations between weight loss and eating pathology are described during competition periods [21].

Desire for lower body weight in bodybuilders could be indicative of a trend in the new generation of bodybuilders of returning to the “original” for physique of this, described as a “lean, muscular and symmetrical, artistic body” [22]. The first athletes in this sport were aiming for good health, together with a balanced figure [8]. Unfortunately, the eating strategies of the athletes in our study do not comply with the healthy, balanced strategy prototype, but resemble more closely in their eating practices the weight-sensitive athletes in other sports [23].

In this study, the recreational athletes who perceived as ideal a body

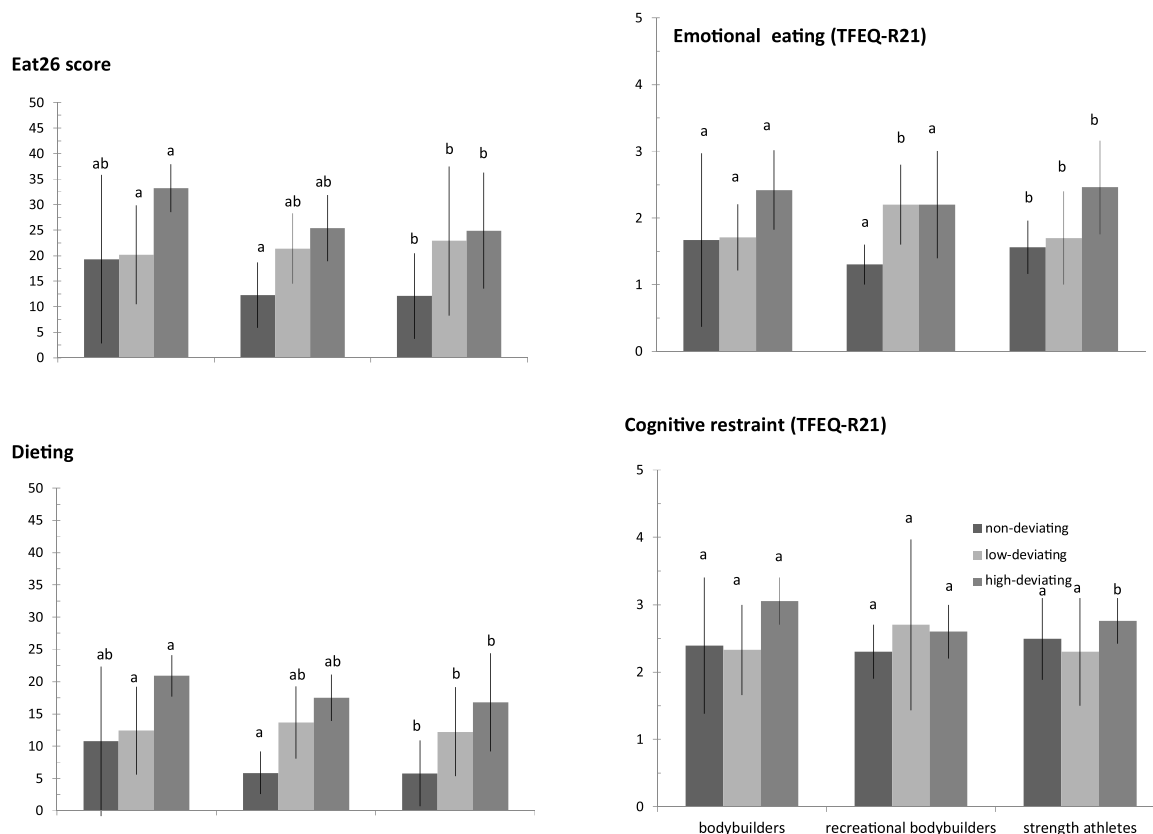


Fig. 2. Perceived ideal bodyweight and risk of disordered eating behaviors, according to scores on the Eating Attitudes Test (EAT-26) and Three-Factor Eating Questionnaire-R21 (TFEQ-R21) in bodybuilding and strength athletes (N = 103). Different superscript letters (a, b) indicate statistically significant difference among deviation categories of the same athletes' group, at significance level $\alpha=0.05$. Non-deviating = current body weight equal to or lower than perceived ideal body weight. Low-deviating = current body weight 1–5 kg greater than perceived ideal body weight. High-deviating = current body weight 6–19 kg greater than perceived ideal body weight.

weight much lower than their current weight presented an increased risk, recording higher scores for bulimia and cognitive restraint. Reduction in the risk of eating disorder in professional athletes can be achieved with the help of coaches who are well-informed and sensitized regarding the complications of disordered eating, and who can provide guidance and monitoring aimed at both balanced eating and good performance [24]. Conversely, the risk for non-professional athletes in a variety of sports may be greater than that of the professionals, as they may not be supervised by coaches and do not take measures for preventing disordered eating risk and behavior [25]. Similarly, we demonstrated paradoxical, restrictive eating behaviors in the recreational athletes, which could be eliminated with proper supervision. An emerging need is revealed for sport-specific, gender-specific preventive actions to deescalate the risk of eating disorder and behavior, in both professional and non-professional athletes [26]. In addition, personalized nutritional and psychological therapy [27,28] would help the athletes at risk to obtain a healthy self-acceptable body image.

One limitation of this study was the relatively small sample, particularly of females. Registered female bodybuilders in the Cyprus Bodybuilding and Fitness Federation account for less than 10 % of the members [29], which allows us to consider the proportion of females in our sample, and therefore our results, as acceptable. We used the 5 kg as a cut-off point, considering it as a small, manageable weight deviation in diet practice, representative of minimum weight change, i.e. not resulting in wide BMI changes. In some studies BMI is alternatively used as an indicator of weight change. In our cases of bodybuilders, BMI does not represent actual body synthesis, who have abundance of muscle [30]. More sensitive tools have been proposed for identifying the risk of

eating disorder risk in bodybuilding athletes [31]. EAT-26 though has been previously used in bodybuilders [21] and our participants constituted by athletes at different performance level. Data collecting information through a self-report has limitations. People are often biased when they report on their own experiences. Taking these limitations into consideration, the selected questionnaires answered the research questions satisfactorily; our findings lay the ground for future investigation in these group of athletes and broaden the issues explaining their eating behaviors.

5. Conclusions

Body image perception and satisfaction in bodybuilders and strength athletes can be impaired by their desire for a lower body weight, leading to disordered eating behaviors. Our results link the risks in bodybuilding with documentation of eating disorder risk in weight sensitive sports. As the recreational bodybuilding athletes appeared to be more vulnerable to disordered eating behaviors, appropriate educational intervention should be undertaken to provide holistic dietary, psychological and sport coaching, for both professional and non-professional athletes, to promote the original dual concept of healthy body and mind.

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Authors' contributions

Dimitris Efthymiou and Emilia Vassilopoulou designed and implemented the research and wrote the manuscript. Lampros Kokokuris contributed to data analysis. All authors reviewed and approved the document prior to submission.

Institutional review board statement

This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Cyprus Bioethics Committee (Reference number EEBK 2017.01.32).

Data availability statement

Data supported reporting results can be provided upon request.

Conflict of interest

The authors declare no conflict of interest.

Ethic statement

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Cyprus Bioethics Committee (Reference number EEBK 2017.01.32).

Declaration of Competing Interest

The authors report no declarations of interest.

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