

Title: Exacerbating factors eating disorder risk in bodybuilding athletes

Short title: Exacerbators for eating disorders in bodybuilders

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Title: Desire for weight loss and risk of eating disorder 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 and strength athletes.

The 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. 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, and the subscales of dieting and bulimia. Cognitive restraint and emotional eating scales of TFEQ-R21 were more pronounced in the non-professional athletes. 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.

Keywords

Athletes; eating disorders; weight loss; body dissatisfaction; body image disorders

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. 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 [1]. Evidence-based guidelines are available for the balanced nutrition and training for achieving optimum body composition [2], but professional bodybuilders often choose restraint eating in the hope of obtaining the desired body configuration [3]. 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 [4,5]. They count as measures of their success their symmetric body appearance and level of performance, about which they become obsessed. Thus, professional bodybuilders present high rates of disordered eating patterns, including anorexia and binge eating disorder, and body dysmorphia anxiety [4].

Concerning recreational bodybuilders, less data is available, and the evidence is inconclusive. In some studies, they are described as having a similar psychological profile and as applying the same restrictive eating strategies as the professionals [6], but in others they are reported to have healthier eating patterns. 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 [7].

In a recent meta-analysis, the personality traits detected in both 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 non-bodybuilder strength athletes [8]. It is not clear whether these personality traits were pre-existing or if they resulted from the practice of the specific sport.

Comparative studies on disordered eating behaviors in professional and recreational bodybuilders and strength athletes have been sporadic and the findings were inconclusive. This study, conducted in Cyprus, aimed to identify the eating behaviors of bodybuilding and strength athletes of both sexes and at different performance levels.

Materials and Methods

Participants

Athletes were recruited from several fitness centers in Cyprus (n=103, 76 males). The participants were divided into three groups according to their performance level: professional bodybuilders (n=38) who participated in competitions, recreational bodybuilders (n=32) who trained constantly to develop muscularity, but without participating in competitions, and strength athletes (n=33) who trained regularly with weights, aiming for strength, but not excessive muscularity.

Athletes 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).

Anthropometric measurements

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

Questionnaires

Each participant 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), which assesses the risk of disordered eating, measures three domains, oral control, bulimia and dieting. It has good reliability, validity and internal consistency, as described elsewhere [9,10] 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) [11], 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).

Statistical Analysis

The scores on the items of the EAT-26 and TFEQ-R21 questionnaires were expressed as mean values and standard deviation (SD). One-way ANOVA post-hoc power calculation was performed, based on the observed value of effect size per variable, and other auxiliary quantities, such as the error SD, with the significance level of the test held at a specified value. 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 $\alpha=005$. Statistical analysis was conducted using IBM SPSS Statistics 20.

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.

TABLE 1 ABOUT HERE

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

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 5kg 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 Figure 1.

-TABLE 3, FIGURE 1 ABOUT HERE-

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

-FIGURE 2 ABOUT HERE-

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 (Figure 2).

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. This confirms the concept that for exercise to benefit physical and psychological health, it should be carried out under professional guidance and supervision [12]. 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. Females express greater dissatisfaction with their body image, and may alleviate their negative feelings by altering their eating choices and behaviors [13]. Female bodybuilders, being highly preoccupied with their body image, have been observed to adopt disordered eating behavior, mainly bulimia [14].

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 [3]. 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.

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” [15]. The first athletes in this sport were aiming for good health, together with a balanced figure [6]. 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 [16].

In this study the recreational athletes who perceived as ideal a body 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 [17]. 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 [18]. 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 [19]. In addition, personalized nutritional and psychological therapy [20,21] 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 [22], which allows us to consider the proportion of females in our sample, and therefore our results, as acceptable. More sensitive tools have been proposed for identifying the risk of eating disorder risk in bodybuilding athletes[23]. Taking these limitations into consideration, the selected questionnaires, EAT-26 and TFEQR21, answered the research questions satisfactorily, and our findings lay the ground for future investigation.

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).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data supported reporting results can be provided upon request.

Conflict of Interest

All authors declare no conflicts 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).

Proofreading declaration

The manuscript was proof-read by a native speaker before submission.

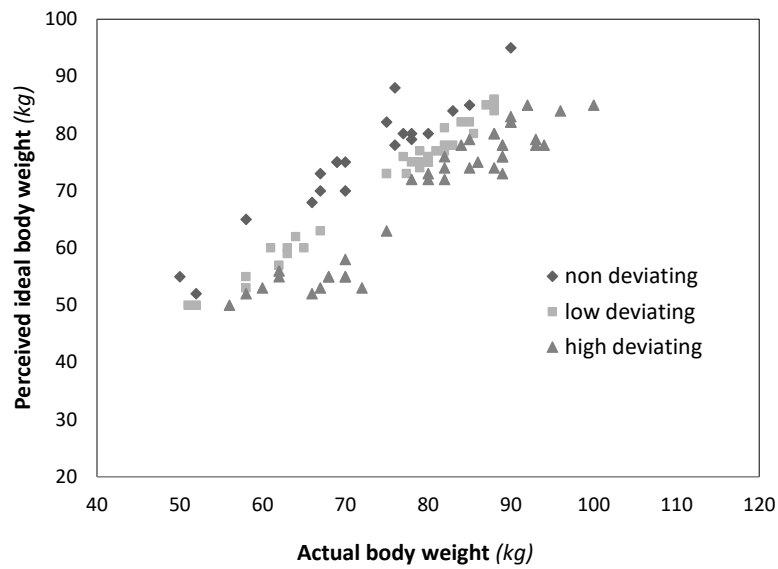
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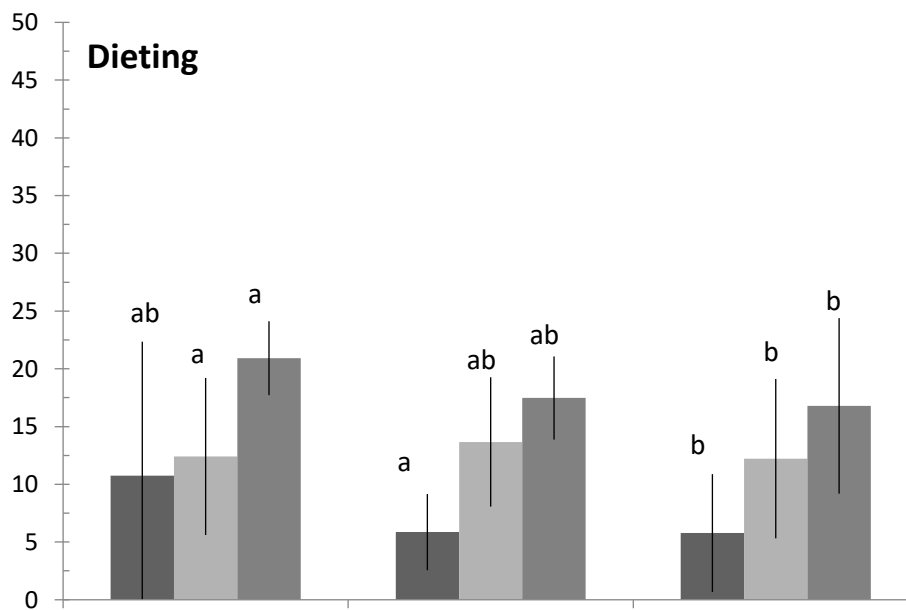
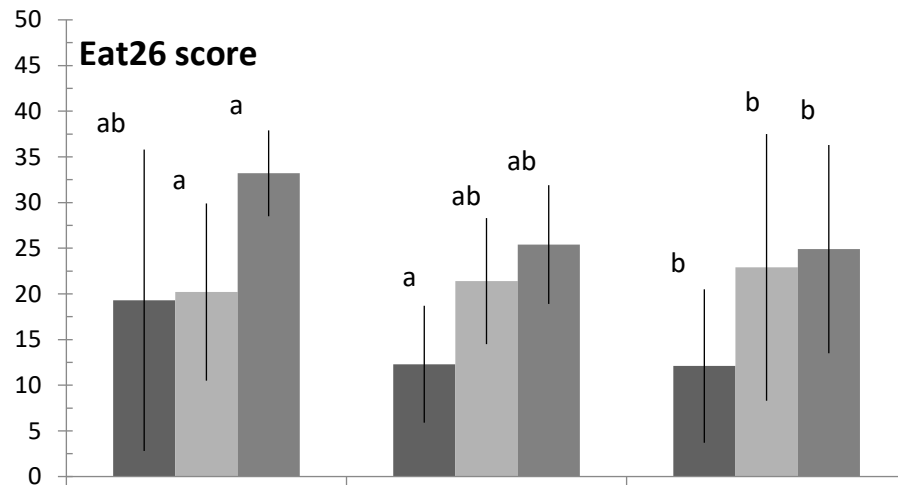
Figure 1

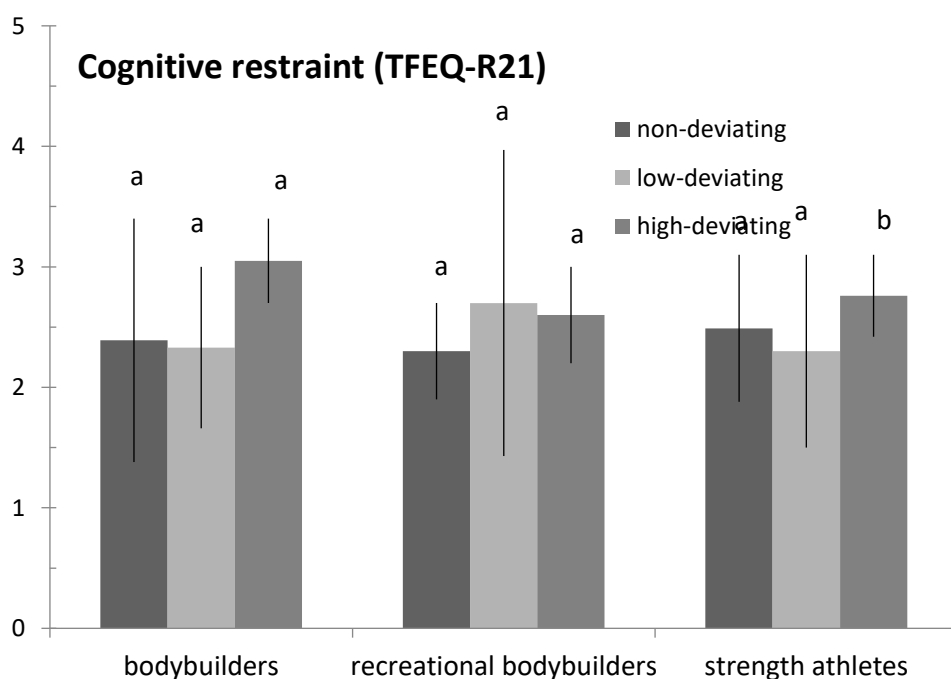
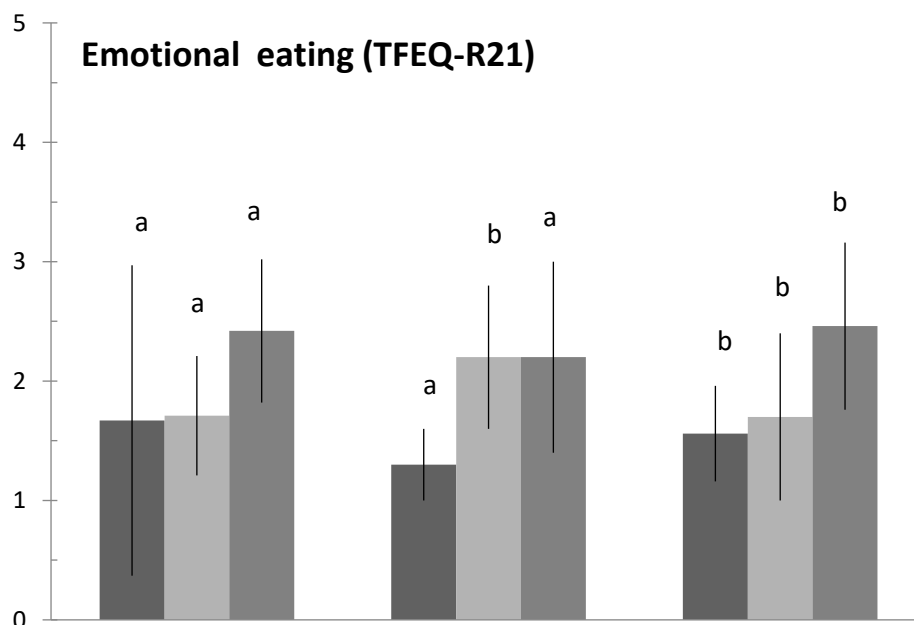
Distribution of actual and perceived ideal body weight in bodybuilding and strength athletes (N=103)



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

Figure 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 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
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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	28.6 (5.1)
Height (m) (SD)	1.8 (0.1)	1.7 (0.0)	1.7 (0.1)
<i>actual</i> 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

- Indicates subscales of TFEQ-R21

Superscript letters indicate statistically significant difference among the indicated groups at $\alpha=0.05$ significance level.

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)

*Indicates subscales of TFEQ-R21

M: males, F: females

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 valu
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*	1.5 (0.6) ^a	1.9 (0.6) ^b	2.3 (0.7) ^c	***

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

*Indicates subscales of TFEQ-R21

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