Body image and body composition: comparisons of young male elite soccer players and controls

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Abstract

The purpose of this study was to evaluate the body composition and body image (perception and satisfaction) in a group of young elite soccer players and to compare the data with a control group (age and BMI-matched). Participants were 56 volunteer males whose mean age and BMI were 19.6 (SD 1.3) years and 23.3 (SD 1.1) kg/m^2, respectively. Results showed that soccer players have a higher lean mass and lower fat mass compared with controls. Moreover, the body perception (difference between current and actual image) was more accurate in controls than in soccer players and the results suggest a tendency for soccer players to aspire to have more muscle mass and body fat percentage. Soccer players perceived the ideal image with significantly higher body fat percentage than their current and actual image. However there were not body dissatisfaction differences between groups. Although the results are necessarily limited by the small size, the findings should be of interest to coaches in charge of young elite soccer teams.

Key words: anthropometry; body image perception; body image satisfaction; university students; males

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Introduction

Body composition, anthropometric dimensions, and morphological characteristics play a vital role in determining the success of a soccer player (Keogh, 1999; Silvestre *et al.* 2006). These parameters are sensitive indicators of the growth progress and nutritional status of a population that is ultimately relevant to a specific event in which the subjects excel. Proper evaluation of these parameters reflects the quantification of the body's major structural components, which are required in different proportions for various sports to achieve excellence and which have influence on the selection of soccer players (Gil *et al.* 2007).

Such a detailed assessment of the body is fundamental, yet a frequently overlooked standpoint from which subsequent assessment of body image may proceed. As "an evaluation of body size, weight, or any other aspect of the body that determines physical appearance" (Thompson, 1990), body image may be viewed as the fulcrum of the mutual influences of physique, exercise and dietary behavior on one another. It is a determinant of self-esteem and includes perceptual, cognitive and affective elements, which are based partly on the construction of an objective anthropometric representation (Kay, 1996).

Several recent studies have found that athletes were better able to perceive body dimensions than non-athletes (Stewart *et al.* 2003) and that athletes reported a more positive body image than the control groups (Hausenblas & Downs, 2001). This result may be due to the possibility that athletes, because of their high physical activity levels, may more closely resemble the current aesthetic ideal of thin/lean and fit physique for females and a lean and muscular physique for males than the non-athletes (Brownell, 1991). This finding may also be due to the fact that

physical activity participation is associated with an increase in positive psychological characteristics (e.g., increased self-esteem, decreased mood disturbance) that are related to positive body image (Fox, 2000; Landers & Arent, 2001). However, most of the research findings have been shown in women and little is known about the effect of physical activity on body image in males. Moreover, few studies assessed body composition to examine the moderating effects of body image in athletes.

The present study was therefore focused to evaluate the body composition and body image (perception and satisfaction) of a group of young soccer players and a control group and to compare it. It was hypothesized that the soccer players would have better perception and lower dissatisfaction with their body image than the control group.

The study took into account the problems with using body mass index (BMI) and percentage of body fat (%BF) in research with athlete (Huddy *et al.* 1993). As a result, it used the fat-free mass index (FFMI) because groups of athletic men, although potentially similar in body fat percentage, can differ considerably in levels of muscularity. The FFMI is a measure of muscularity derived from height, weight and body fat percentage (Kouri *et al.* 1995).

Methods

Subjects

Participants were 56 volunteer males from the academy of a professional soccer team (n=28) and from the University of the Basque Country (control group, n=28) whose mean age and body mass index (BMI) were respectively, 19.6±1.3 yr and 23.3±1.1 kg/m^2.

The group of cases consisted of elite young soccer players (4 external-defenders, 5 central defenders, 6 central midfielders, 4 external midfielders, 6 forwards and 3 goalkeepers), according to playing position. Soccer players carried out a 12-14 hour per week training

divided into 6 days, including technical, tactical and physical training program. All players were free of any illness and were not taking any medication. All athletes denied the use of anabolic agents.

Soccer players´ data were compared with age and BMI-matched control subjects. Controls were university students participating in a study designed to assess their nutritional status. From a total population of 62 men, 28 were drawn to match the players in age and BMI. The control group was also free of any illness and was not taking any medication. They were engaged in recreational sport activities such as swimming or soccer (in all cases < 3 h/wk) away from any competitive sport training.

Subjects provided written informed consent and the study was approved by the University Ethical Committee on Human Research. Subjects completed a questionnaire that included basic information, along with items querying self-reported weight and height and ideal weight. The physical characteristics and self-reported and ideal variables of the participants are summarized in Table 1.

Body composition assessment

A total of nine anthropometric measurements were taken: weight and height, and skinfolds (subscapular, abdominal, suprailiac, midaxillary, chest, thigh, and triceps). Measurements were taken in duplicate by a well-trained anthropometrist, after marking the corresponding anthropometric points on the right side of the subject in accordance with Ross & Marfell-Jones (1991).

The measuring instruments employed were a scale-stadiometer with a precision of 100 g and 1 mm; a skinfold caliper with a precision of 0.2 mm (Holtain Ltd. Crymych U.K); and a Harpenden anthropometric tape. The measurements in the soccer players´ group were made at the end-of football season.

BMI was calculated using the formula weight (kg) / height^2 (m^2). Current BMI refers to BMI calculated using measured weight and height. Self-reported weight and height were obtained via questionnaire ("How much do you weigh without clothes and shoes?" and "How tall are you without shoes?") and to achieve the ideal weight subjects were asked "Ideally, how much would you like to weigh?".

Body density was calculated using the equations of Jackson & Pollock (1978) (seven skinfolds) and the body density was converted to percentage body fat (%BF) by using Siri´s equation (Siri, 1961). The software used to assess the body image includes the formula of Jackson & Pollock as well. The results of %BF of controls were interpreted using the classification of Bray *et al.* (1988). The %BF of soccer players was classified according to the male body fat percentage chart of Jackson & Pollock (1977).

Body image assessment

After the anthropometric measurements, each subject took the somatomorphic matrix test (Pope *et al.* 2000). The male version of the test contains a computerized library of 100 images of men, arranged in a 10 x 10 matrix, representing 10 degrees of fatness and 10 degrees of muscularity. A graphic artist constructed the images, using reference photographs of actual men. On the fatness axis, the images begin at a BF of 4% (approximately the minimum figure attainable in men) and increase in steps of 4% to a maximum of 40% (a very obese man). On the axis of muscularity, the images are calibrated on the basis of a FFMI. The images begin at an FFMI of 16.5 kg/m^2 and increase in steps of 1.5 kg/m^2 to a maximum FFMI of 30.0 kg/m^2.

The computer poses four standard questions: 1) choose the image that best represents your own body (actual image), 2) choose the image that represents the body that you ideally would like to have (ideal image), 3) choose the image that represents the body of an average man of your age (average image), and 4) choose the image that represents the body most

desired by the opposite sex (attractive image). It should be noted that this last question was asked regardless of the subject's sexual orientation; thus, in the present study all of the subjects were heterosexual.

In each case, the subject scrolls through the images until he has chosen the image that he feels best answers the question. At that point, he clicks a button entitled "select this image". The computer then stores his answer to the question, restores the image to the screen, and poses the next question in the series.

Thus, for each subject, we obtained five measurements: 1) his actual body fat and muscularity (as expressed by FFMI), 2) his perception of what he thought his fat and muscularity looked like, 3) the level of fat and muscularity that he ideally desired to have, 4) his judgment of the level of fat and muscularity of an average man of his age in his society, and 5) his judgment of the level of fat and muscularity of the male body that women would prefer.

Studies in the literature on body image frequently assume that the difference between actual and ideal image provides a valid measurement of body image dissatisfaction (Thompson *et al.* 1998). The differences between actual and ideal FFMI, and between actual and ideal %BF were estimated. The positive differences were interpreted as dissatisfaction for exceeding and the negative differences as dissatisfaction by default.

The degree of dissatisfaction was measured with four categories based on the classification of Casillas-Estrella *et al.* (2006) and the increases for FFMI (1.5 kg/m^2) and for BF (4%) between images in the somatomorphic matrix test (Pope *et al.* 2000). It was considered that the subject was satisfied when the difference between actual and ideal image was 0. The other categories were: 1 (slight dissatisfaction, difference between actual and ideal FFMI = 1.5 kg/m^2, difference between actual and ideal BF = 4%); 2 (medium dissatisfaction, difference between

actual and ideal FFMI = 3.0 kg/m^2, difference between actual and ideal BF = 8%); 3 (severe dissatisfaction, difference between actual and ideal FFMI ≥ 4.5 kg/m^2, difference between actual and ideal BF ≥ 12%).

Statistical analysis

All results were expressed as mean±SD. The distribution of quantitative variables was tested for normality using the Kolmogorov-Smirnov test with the Lilliefors correction in order to apply a parametric or non-parametric test for groups' comparison. The differences between independent samples were analyzed using Student's test and the Mann-Whitney U test. And the differences between related samples (individual data) were analyzed using Student's test and the Wilcoxon test. Chi-square analysis was used to calculate the significance of differences between the subjects´ ratings of body image dissatisfaction. Alpha level for all of these analyses was set at $p<0.05$ (two-tail test). Data was analyzed using SPSS 13.0 (SPSS Inc., Chicago, IL, USA).

Results

An examination of the self-reported and ideal data indicated that 21.4% of players and 17.9% of control group desired a higher ideal weight. The discrepancy between ideal and current weight indicated that there were not significant differences between groups in the desire for weight gain or weight loss ($p>0.05$). Significant differences were observed between self-reported and current weight in the control group (difference: 1.4±1.9 kg; $p<0.01$). However this difference in the players´ group was not significant (difference: -0.1±0.4 kg; $p>0.05$).

Significant group differences were observed for current %BF and FFMI ($p<0.001$). Young elite soccer players had a higher FFMI than the control group. And the control group had a higher %BF than the soccer players ($p<0.001$) (Table 2). There were, however, no differences between groups in the perceived image in the %BF ($p>0.05$) and in all the measurements of the perceived image in the FFMI, apart from the

average image, with the soccer players perceiving smaller body size than the controls.

According to the classification for the %BF, in the control group 39.3% obtained data lower than normal value and the rest (60.7%) were inside the normality. In the players´ group, 3.6% were classified as lean, 67.9% as ideal and 28.6% as average. As far as the position in the team, three groups of players (defenders, midfielders and forwards) had similar body composition (Table 3).

Differences in FFMI perceived were observed between ideal and average image in the soccer players´ group ($p<0.001$) and between ideal and attractive image in the control group ($p<0.001$) (Table 4). Soccer players perceived the average image with significantly lower FFMI than their current, actual, ideal and attractive image ($p<0.001$). Moreover, both soccer players and controls perceived the ideal, average and attractive image with significantly higher BF than their actual image (Table 5), but these differences were higher in players than in controls ($p<0.001$).

Regarding to the body image dissatisfaction, 78.5% of players and 82.2% of controls were dissatisfied respect to the index of muscularity (Table 6). Although these results were not statistically significant, more soccer players than control subjects showed severe negative dissatisfaction, while in the control group more individuals showed a slight negative dissatisfaction with FFMI (Table 7). There were no differences in dissatisfaction observed for %BF between groups. 64.3% of players and the same percentage of controls were dissatisfied with %BF.

Discussion

The present study compared different body composition indicators between a group of soccer players and a control group. The age and the weight and height values of the soccer players were within the range of values reported by other authors (Casajús & Aragonés, 1991; González &

Andrés, 1996). However, body fat percentage obtained had lower values than those published in different studies of teams from the same category (Reilly, 1996; Silvestre *et al.* 2006) and similar to the results of other authors (Alburquerque *et al.* 2005; Pellenc & Costa, 2006). Rico-Sanz *et al.* (1998) stated in his review work that soccer players should have a body fat percentage of around 10% and this is higher than our results. Would have to ask if the comparison of body fat percentage was valid, since the above mentioned studies used different equations.

The body composition study revealed, as expected, that the soccer players had significantly lower fat mass and a significantly higher lean mass compared with age and BMI-matched control subjects. This is similar to findings reported by other authors (Wittich *et al.* 2001; Bandyopadhyay, 2007).

There were no differences in body composition according the playing position in soccer players. Authors investigating body fat in different playing positions in soccer (Reilly, 1996) found small differences in body fat percentage among the outfield positions, although midfielders tended to have lower body fat levels. Midfield is a position in which players spend most of their time running and sprinting and cover more ground than their defensive and offensive team mates (Di Salvo *et al.* 2007).

Regarding the bias in self-reports of weight, the control group obtained larger differences than the soccer players. Control individuals said that they weigh more than their current weight ($p<0.01$). However, this difference in the soccer players´ group was not significant, probably because they were weighed periodically.

In addition, in the present study difference between FFMI of the current and actual image was found in the soccer players´ group ($p<0.05$), while in the control group it was not different. In contrast, other studies

suggested that perception was better in athletes than controls (Stewart *et al.* 2003).

The difference between ideal and average image suggest difference in soccer players ($p<0.001$). They considered that their ideal image had greater muscle mass than the image that represents the body of an average man of their age. This difference could be due to the relation between muscularity and sports performance (Hoshikawa *et al.* 2006).

On the other hand, in the control subjects differences were observed between ideal and attractive image ($p<0.001$), with the FFMI values being higher for the attractive image than for the ideal image. This result could be related to the men's concept about masculinity (Pope *et al.* 2000). A variety of research has indicated a relationship between men's endorsement of traditionally masculine ideas and characteristics, and his desire for additional muscle (McCreary *et al.* 2005). Some research has suggested this relationship between muscle mass and masculinity may begin early in life, as boys' action figures are often depicted as super-muscular, often beyond the actual limits of human physiology (Pope *et al.* 1999).

Regarding the body fat, the number of controls classified as lower than normal value (39.3%) was higher than the number of players (3.6%). However soccer players perceived the ideal, average and attractive image with significantly higher body fat percentage than their actual image. There were no corresponding differences in the control group. However, significant differences were found between groups in the difference between actual and attractive image for the body fat ($p<0.05$). Soccer players perceived an image with higher body fat than their actual image as attractive, while controls considered an image with lower body fat than their actual image as attractive. This discrepancy between groups could be due to the body image perception, since in soccer players the actual %BF was much higher than their current %BF. Very little research has examined the body fat dissatisfaction in athletes, but most of them

emphasized the desire for not to gain fat (Yang *et al.* 2005; Choi *et al.* 2002). Our findings may also be due to the fact that soccer players took the ideal image and average image together, instead of associating the ideal image with the value of %BF recommended in the sportive practice.

The results of body image dissatisfaction revealed, that there were not differences neither FFMI nor BF between groups. Therefore the initial hypothesis was not proved (the soccer players would have lower dissatisfaction with their body image than the control group). Although the results about dissatisfaction with FFMI were not statistically significant, the soccer players´ data pooled, suggesting that more soccer players than control group showed severe negative dissatisfaction, desiring greater muscle mass. This would support the contention that men's drive for muscle mass is unrelated to their actual level of muscle mass (McCreary *et al.* 2006).

In summary, the young elite soccer players of the present study have an higher lean mass and lower fat mass compared with age and BMI-matched control group. Moreover, the body perception was better in controls than in soccer players and the results suggest a tendency for players to aspire to have more muscle mass. But there were not body dissatisfaction differences between groups.

Although the results are necessarily limited by the small size, the findings should be of interest to coaches in charge of young elite soccer teams.

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Table 1. Physical characteristics and self-reported and ideal variables of the subjects (mean±SD)

Variable	Soccer players	Control group	p
Age (yr)	19.5±1.3	19.7±1.4	NS
Height (cm)	179.1±6.5	177.4±4.9	NS
Weight (kg)	74.6±5.8	73.3±6.1	NS
Body mass index (kg/m^2)	23.3±1.0	23.3±1.1	NS
Self-reported weight (kg)	74.5±5.7	74.7±6.0	NS
Self-reported height (cm)	179.0±6.5	178.5±4.9	NS
Ideal weight (kg)	74.2±5.7	74.1±5.5	NS

BMI, body mass index; NS, not significant differences

Table 2. Current measurements and perceived

	Soccer players	Control group	p
BF (%)			
Current	7.6±1.7	12.3±3.1	<0.01
Image			
actual	14.7±6.5	18.0±5.1	NS
ideal	17.3±4.6	17.4±3.5	NS
average	19.6±5.6	19.0±3.7	NS
attractive	17.3±3.6	16.0±4.8	NS
FFMI (kg/m^2)			
Current	21.3±0.9	20.2±0.7	<0.001
Image			
actual	20.6±1.9	20.4±1.4	NS
ideal	23.0±2.2	22.1±1.7	NS
average	19.6±1.6	21.4±1.5	<0.001
attractive	23.5±1.7	24.0±1.4	NS

BF, body fat; FFMI, fat-free mass index

Table 3. Body composition of the football (soccer) players according to the playing position

Playing position	BF (%)	FFMI (kg/m^2)
Defenders (9)	7.3±1.6	21.2±0.7
Midfielders (10)	7.7±1.9	20.9±0.9
Forwards (6)	7.8±2.0	22.0±0.7
Goalkeepers (3)	7.6±0.8	21.7±0.7

BF, body fat; FFMI, fat-free mass index

Table 4. Differences between current measurements of FFMI (kg/m^2) and perceived

	Soccer players	Control group	p
Current image – Actual image	0.7±1.8*	-0.2±1.5	<0.05
Current image – Ideal image	-1.7±2.4**	-1.9±1.9***	NS
Current image – Average image	1.8±2.0***	-1.2±1.6**	<0.001
Current image – Attractive image	-2.2±2.1***	-3.8±1.8***	<0.01
Actual image – Ideal image	-2.4±1.7***	-1.8±1.2***	NS
Actual image – Average image	1.0±1.8**	-1.0±1.9**	<0.001
Actual image – Attractive image	-2.9±1.9***	-3.6±1.7***	NS
Ideal image – Average image	3.4±2.2***	0.8±2.1*	<0.001
Ideal image – Attractive image	-0.5±1.9	-1.8±1.8***	<0.05
Average image – Attractive image	-3.9±2.0***	-2.6±2.0***	<0.001

Level of signification in the group, *p<0.05; **P<0.01; ***p<0.001

Table 5. Differences between current measurements of BF(%) and perceived

	Soccer players	Control group	p
Current image – Actual image	-7.2±6.4***	-5.7±4.8***	NS
Current image – Ideal image	-9.7±4.5***	-5.1±3.7***	<0.001
Current image – Average image	-12.0±6.1***	-6.7±4.4***	<0.001
Current image – Attractive image	-9.7±3.7***	-3.7±6.2**	<0.001
Actual image – Ideal image	-2.6±6.4*	0.6±5.2	NS
Actual image – Average image	-4.9±7.3**	-1.0±7.4	NS
Actual image – Attractive image	-2.6±6.5*	2.0±7.3	<0.05
Ideal image – Average image	-2.3±8.1	-1.6±4.3	NS
Ideal image – Attractive image	0.0±3.9	1.4±4.3	NS
Average image – Attractive image	2.3±7.2	3.0±5.7	NS

Level of signification in the group, *p<0.05; **p<0.01; ***p<0.001

Table 6. Differences between actual and ideal image in the soccer players´ group

FFMI categories	Total	Difference[a]	
		Positive	Negative
0 (difference = 0)	6(21.4%)		
1 (difference = 1.5 kg/m^2)	6(21.4%)		6(21.4%)
2 (difference = 3.0 kg/m^2)	10(35.7%)		10(35.7%)
3 (difference ≥ 4.5kg/m^2)	6(21.4)		6(21.4)
BF% categories			
0 (difference = 0)	10(35.7%)		
1 (difference = 4%)	10(35.7%)	6(21.4%)	4(14.3%)
2 (difference = 8%)	5(17.9%)	1(3.6%)	4(14.3%)
3 (difference ≥ 12%)	3(10.7%)		3(10.7%)

[a]The positive differences were interpreted as dissatisfaction for exceeding and the negative differences as dissatisfaction by default; BF, body fat; FFMI, fat-free mass index

Table 7. Differences between actual and ideal image in the control group

FFMI categories	Total	Difference[a]	
		Positive	Negative
0 (difference = 0)	5(17.9%)		
1 (difference = 1.5 kg/m^2)	14(50.0%)		14(50.0%)
2 (difference = 3.0 kg/m^2)	8(28.6%)		8(28.6%)
3 (difference $\geq$ 4.5kg/m^2)	1(3.6%)		1(3.6%)
BF% categories			
0 (difference = 0)	10(35.7%)		
1 (difference = 4%)	12(42.9%)	7(25.0%)	5(17.9%)
2 (difference = 8%)	4(14.3%)	4(14.3%)	
3 (difference $\geq$ 12%)	2(7.1%)		2(7.1%)

[a]The positive differences were interpreted as dissatisfaction for exceeding and the negative differences as dissatisfaction by default; BF, body fat; FFMI, fat-free mass index