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Cross-Sectional Analysis of Actual Versus Perceived Body Composition in Female Footballer's Body Image

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Abstract

Introduction: Research surrounding body image has shown that when researchers use body mass index (BMI) as an estimate of their perceived BMI, participants typically overestimate. Therefore, the main objective of this investigation was to determine the correlation between actual and perceived BC in the overall, upper, trunk and lower body within female footballers.

Method: *n*=10 female footballers aged between the ages of 18-25 years competing in the National League Division One South West were recruited via selective and purposeful sampling. Six anthropometric skinfolds (triceps, subscapular, suprailiac, abdominal, anterior thigh and medial calf) were taken and then used in a pre-selected calibration model to calculate actual BC. A questionnaire containing 2D images of different components of BC were used to assess participants perceived BC. *P* value was set at < 0.05 and a paired Student *t*-Test was used to test for the difference and a Pearson's Correlation Coefficient test was then used to test the strength of the correlation between the actual and perceived BC.

Results: Actual whole BC ranged from 55–111 ($\bar{x}$79.2±20.5 mm) whereas participants whole body perceived BC ranged from 60–100 ($\bar{x}$82±0.5 mm). Sectional analysis revealed that the biggest difference in data was in the trunk (*P*=0.001).

Conclusion: Results indicated that perceived BC was higher than participants actual BC within overall and in sectional analysis, suggesting that female footballers competing at an elite level typically have negative body image perceptions.

Recommendations: It is suggested that future research continues to understand in greater depth which parts of the body athletes are dissatisfied with, in order prevent health consequences such as eating disorders.

Keywords: body mass index; body image; body composition; perception; female football

Introduction

Body image has been defined by Grabe *et al.* [1] as individual's perception of one's body, thoughts, and feelings about the way they look or feel in their body. Whereas Szymanski and Cash [2] and Grogan and Mechan [3]. Suggested that it is the picture of your own body that you form within your head, the evaluation of your body's size, weight, shape and muscularity and the thoughts and feelings that are associated with it. Consequently, body image is still regarded as an incredibly complex issue that can be influenced by parents, peers, society and the media as it has such an impact on the way we see ourselves and others [4,5]. Literature surrounding body image, body composition and body mass index has identified that two thirds of adults in the UK suffer from negative body image [6]. Moreover, it is an issue that the UK government continue to have concern towards, due to the damage that social media can cause to mental wellbeing [7,8,9]. Cash *et al.* [10]. and Pritchard *et al.* [9] findings suggested that participants perceived the pressures of body image as demoralising, especially within the female sporting environment. This is particularly prevalent when athletes are at a greater risk of developing body image distortion and eating disorders due to both sociocultural and sport-specific pressure to change their weight and aesthetic appearance and comparing themselves to other athletes [8,11,12,13].

Whilst there is acknowledgement, that body image perception is challenging to assess given its subjective nature and variety of manifestation, the most common body perception assessments have placed heavy reliance on assessing body image, with little attention to what parts of the body athletes are dissatisfied with [14,15]. Therefore, it is vital to not

just identify those female athletes who suffer with body dissatisfaction, but also identify which body parts are of greatest dissatisfaction [8,16].

The most employed methods used for measuring body image are photographs or 2D drawings of a silhouetted figure. Ralph- Nearman *et al.* [15] stated that these whole-body images fail to include body image assessments that include the perceptual details about individual body concerns, emotions, distress, or specific body areas (e.g., stomach, thighs and bust). Furthermore, research conducted by Hargreaves and Tiggemann [17] and Ralph-Nearman *et al.* [15] stated that they are lacking considerable body details, rendering, at best, a gestalt proxy for whole body perception. Conversely, previous studies have shown that through BMI, female athletes perceived their BMI as higher than their actual BMI [9,18]. However, BMI is believed to be unreliable especially when referring to the athletic population, as BMI cannot distinguish fat and lean masses [19]. Another method of establishing a participant's body perspective is to calculate body composition via the assessment of anthropometric skinfolds. This method is widely adopted as it allows the researcher to determine, using a population specific calibration model, a measure for subcutaneous fat at the specific site(s) of the participants [20]. Thus, through sectional analysis of the body, one can discover which sectioned areas of the body the athlete is dissatisfied with. Previous students by Mills and Cooling [21] Prichard *et al.* [9] Mills and Watson [18] and Virtanen *et al.* [22] discovered that when sectional analysis was used, females were mostly dissatisfied with their middle and lower bodies, specifically their hips and stomach. Therefore, this aim of this study was to establish the correlation between actual and perceived cross-sectional body composition in the overall, upper, trunk and lower body, with female footballers by combining a combining a questionnaire of whole-body images and sectional analysis.

Methods

Participants & recruitment

n=10 female volunteer participants aged 18–23 years old, that are currently playing competitive football in National League Division One South West were recruited for this study. A selective and purposeful sampling took place via email and social media recruitment processes through individually messaging the athletes, to get the appropriate data for the research. Prior to the study, all participants gave written consent and ethical approval was granted via the University of Gloucestershire Research Committee.

Procedure

Due to the lack of pre-validated questionnaires that fit the nature of this study, a new questionnaire was designed and consisted of 10 closed questions and was presented in two parts A: Personal Details and B: Perceived Body Image. Part B consisted of a series of 2D images (taken from Google and Shutterstock images) of the anterior, lateral, and posterior of the upper body, trunk and lower body segments. Participant were required to select which series of images (A to J) that were closely perceived to their image (Figure 1). A pilot study using *n* = 5 non-study participants was conducted to reduce the risk of misunderstanding and question bias.

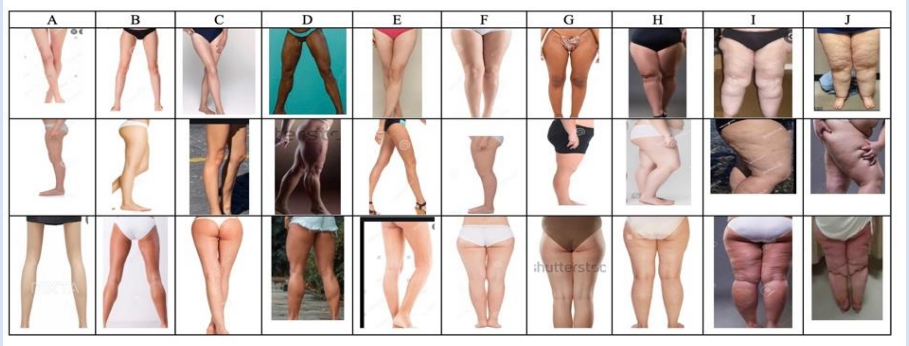

Figure 1: Illustrative example of 2D images of the lower limb.

Given the accessibility of subcutaneous fat around the body, may be a reason why there is a plethora of pre-published calibration models which exist in the literature which estimate body composition (via anthropometric skinfold thicknesses) within female athletes [23]. Although, questions have been raised relating to the restrictive range of anthropometric measures used within a calibration model, and in

particular the location and number of the anthropometric skinfold sites used23. Therefore, a decision was made to consider all potential pre-published models, by using a selection criterion for accepting or rejecting them. The selection criterion was determined by (i) participants that closely aligned to the present study sample in terms of age, body mass and stretched stature, (ii) anthropometric skinfold site specificity and (iii) the number of anthropometric skinfold sites used in the design of the calibration model. Table 1 illustrates the pre-published calibration models found in the literature that were considered for the present study.

Of the 11 models identified, two models were accepted and the remaining nine were rejected on the basis of failing the selection criterion. Closer inspection found that these nine models employed four commonly used anthropometric skinfold sites from the upper body area (biceps, triceps, suprailiac and subscapular) an area where female athletes do not seem to accumulate fat [24]. Furthermore, most of the models used the chest skinfold measurement, which is considered outdated in relation to the ISAK accreditations [25]. Evidence suggests that to improve the precision of the total fat value, additional skinfolds from other parts of the body is a requirement [24,26].

Table 1: Anthropometric calibration models for consideration.

Author	Publication year	Sample number	Sample characteristics	Skinfold calliper	Age	Body mass	Stretched stature	Accepted/ rejected
Pascale *et al.*,	1956	88	Soldiers	Medical nutrition	17.0-25.0	49.7-109.8	94.0-193.0	Reject
Dunin & Rahaman	1967	60	Volunteers	Harpenden	18.1-33.8	43.6-95.6	154.8-192.0	Reject
Behnke & Wilmore	1970	54	University sports students	Undisclosed	Undisclosed	Undisclosed	Undisclosed	Reject
Forsyth & Sinning	1973b	50	University students	Lange	19.0-22.0	68.5-85.9	178.4-179.6	Reject
Katch & McArdle	1973	53	University sport students	Lange	18.0-21.0	62.8-80.0	169.4-183.4	Reject
Lohman	1981	61	University students	Undisclosed	Undisclosed	Undisclosed	Undisclosed	Reject
Thorland *et al.*,	1984	141	National calibre Athletes	Lange	16.5-18.4	56.2-78.8	167.9-185.1	Reject
Withers *et al.*,	1987	207	State representatives	Harpenden	15.4-39.1	53.3-117.7	154.1-215.1	Reject
Evans *et al.*,	2005	132	College athletes	Undisclosed	20.0-22.0	58.6-68.9	159.3-196.4	Accept
Moon *et al.*,	2009	29	Athletes	Undisclosed	20.0-21.0	Undisclosed	Undisclosed	Reject
Garrido-Chamorro *et al.*,	2012	2500	Athletes	Undisclosed	18.5-22.5	55.6-77.9	163.6-172.8	Accept

Table 2 illustrates the accepted models with their range of anthropometric skinfold sites adopted. The first calibration model by Evans *et al* [27]. employed three skinfold sites of the abdominal, anterior thigh and triceps. The acquisition of more than six anthropometric sites can typically be cumbersome for practitioners, however, these sites more importantly considered the fat deposits of female athletes. The second calibration model by Garrido-Chammorro *et al.* [26] was designed with a sample size of *n*=2500 female athletes that were closely correlated to the current study population. The calibration model contained a range of anthropometric skinfolds from the upper and lower body, and the trunk regions, thereby considered as more appropriate for athletes due to the inclusion of the sum of six skinfolds to calculate body fat content [24].

Table 2: Accepted calibration models.

Author	Upper	Trunk	Lower	Overall
Evans *et al.*, (2005)	T	A	AT	T+A+AT
Garrido-Chamorro *et al.*, (2012)	T+Sb	Sp+A	AT+MC	T+Sb+Sp+A+AT+MC

Anthropometric measurements were performed according to International Society for the Advancement of Kin anthropometry (ISAK) robust standards using a Harpenden skinfold caliper [25,28]. Two measurement attempts were taken and recorded at 6 skinfold sites of the triceps (T), subscapular (Sb), suprailiac (Sp), abdominal (A), anterior thigh (AT) and medial calf (MC). The following sums of skinfolds were considered for fat content calculations; six skinfolds (SSS= T+Sb+Sp+A+TC+MC), upper body skinfolds (SUBS=T+Sb), trunk skinfolds (STS=Sp+A) and lower body skinfolds (SLBS= TC+MC). Data was transferred into Microsoft Excel spreadsheet where descriptive statistics were calculated and then converted into the selected 2 models of Evans *et al.*,[27] and Garrido-Chamorro et al. [26]. from Table 2.

Data analysis

All data was collated via aa Kin anthropometric data proforma and transferred onto a Microsoft Excel spreadsheet. Descriptive statistical analysis was undertaken and then a paired student *t*-Test set at $P < 0.05$ was used to establish the association between the actual and perceived body composition. Finally, Pearson's Correlation Coefficient (r) was conducted to measure the linear correlation between actual and perceived body composition.

Results

Results indicated that participants overall actual body composition values ranged from 55-111 mm with an average of 79.2 (±20.5) mm and participants overall perceived body composition ranged from 60-100 mm with an average of 82 (±20.5) mm as illustrated in Table 3.

Table 3: General summary (x + s) characteristics for (n=10) female athletes.

Variables	$\bar{x}$ + SD	Range	diff
Upper actual (SUBS)	22.2 ± 4.7	16.0-27.5	4.7
Upper perceived (SUBS)	24.0 ± 2.7	20.0-28.0	2.7
Trunk actual (STS)	26.2 ± 8.9	14.5-35.0	8.9
Trunk perceived (STS)	30.6 ± 7.2	18.0-36.0	7.2
Lower actual (SLBS)	34.9 ± 8.9	24.0-46.2	8.9
Lower perceived (SLBS)	39.2 ± 11.0	24.0-56.0	11.0
Overall actual (SSS)	79.3 ± 20.5	55.0-111.0	20.5
Overall perceived (SSS)	82.0 ± 15.5	60.0-100.0	20.5

Raw data was transferred into a Microsoft Excel spreadsheet and a scatter plot generated (See Figure 2), to establish whether there was visual correlation between overall perceived body composition and actual body composition with P value=0.365, R^2=0.838 and r=0.915.

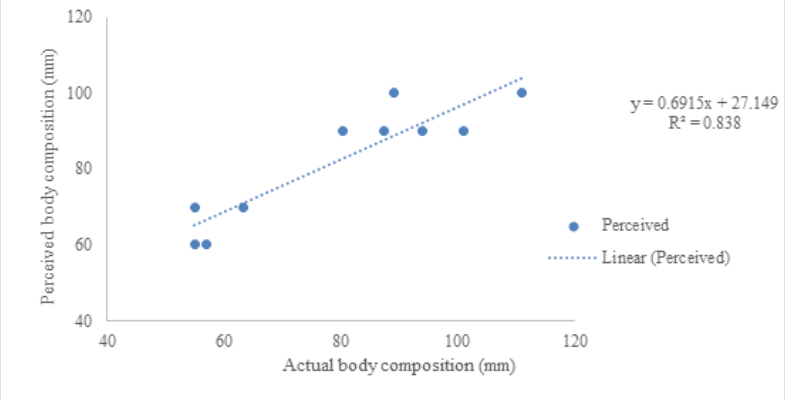

Figure 2: Correlation of overall actual and perceived body composition for female footballers.

Results indicated that actual upper body composition ranged from 16.0-27.5 mm with an average of 22.5 (± 4.7) mm (P = 0.103, R^2 = 0.5802 and r = 0.762), whereas perceived upper body composition ranged from 20.0-28.0 mm with an average of 24.0 (± 2.7) mm. The trunk actual body composition ranged from 14.5-35.0 mm with an average of 26.2 (± 8.9) mm (P = 0.001, R^2 = 0.9855 and r = 0.957), whereas perceived trunk ranged from 18.0-36.0 mm, with an average of 30.6 (± 7.2) mm.

The lower body actual body composition ranged from 24.0-46.2 mm with an average of 34.9 (± 8.9) mm (P = 0.30, R^2 = 0.7760 and r = 0.881), and the lower body perceived body composition ranged from 24.0-56.0 mm with an average of 39.2 (± 11.0) mm. Raw data was transferred into a Microsoft Excel spreadsheet and a scatter plot generated (See figure 3), to establish whether there was visual correlation between perceived BC and actual BC.

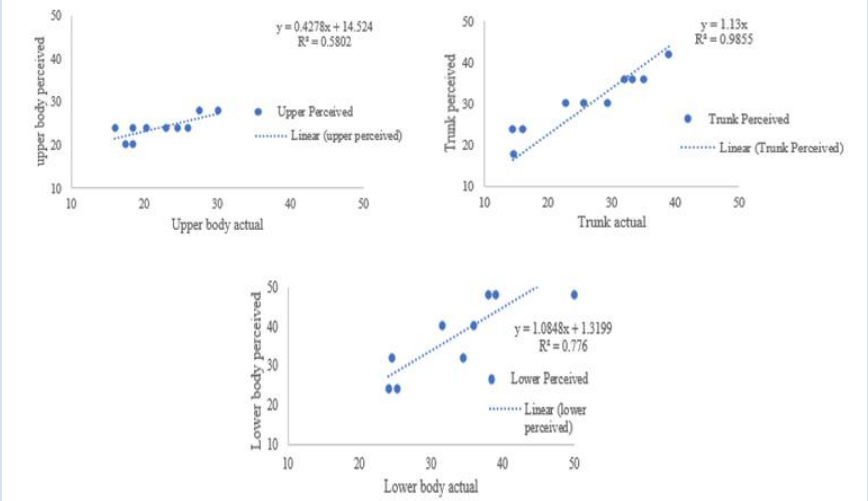

Figure 3: Correlation of overall actual and perceived body composition for female footballers

Discussion

Participant's age ranged from 20-25 years, with an average age of 22.2. A vast array of past studies has focused on female athletes below the age of 16 or over the age of 25 years. With limited studies being focused on young females of 18 to 25, it was therefore important to recruit young female participants for this study as Šerifović-Šivert and Sinanovi young women showed significantly more body dissatisfaction (0.65±0.7) than mature women (0.21±0.10). As evidenced within through current literature, athletes are particularly prone to eating disorders and heightened dissatisfaction with the body increases the risk of various adverse outcomes, including body image distortion and eating disorders [8,30]. According to Stice and Shaw [30] body dissatisfaction within certain sports such as football may be viewed as a primary precursor of eating disorders, for instance, abnormal eating, which can include restrictive eating, overeating, skipping meals and binge-eating and the use of diet pills and diuretics are undertaken by athletes to achieve desired weight or body shape. This suggests that athletes are experiencing the largest amount of body dissatisfaction and are therefore at the greatest risk of developing eating disorders. Kantanista et al.,[8] conducted an alike study within sport but this was within aesthetic sports (dance and synchronised swimming), their findings declared a more positive body image (P<0.05) than athletes from perceived masculine sports such as football. Thus, suggesting that using football in this current study would provide a different outcome to Kantanista *et al. [*8].

Level of competition is also a variable affecting body image as elite athletes declared higher levels of body dissatisfaction than recreational and non-competitive individuals. Kananista *et al.* [8]. stated that competition level and sport type may have been confounded or may have had an interactive effect. Findings from Varnes *et al. [*31] indicated that Division I athletes were the only athletes to report being more dissatisfied with their body shape.

The current study presents a mean overall BC of 79.3mm. Although the purpose of this study was not to understand whether athletes have a healthy amount of fat percentage, when comparing this set of data to other research it can be assumed that the athletes in the present study have a healthy body fat percentage. A study from Garrido-Chamorro *et al.*, [26] used n=106 female football players who had a mean overall body composition 00.0 ±8.5mm, with a body fat percentage of 14.9±2.9%. Therefore, as the athletes had 21mm less body fat compared to Garrido-Chamorro *et al..*, [26], it can be assumed their body fat percentage would be less than 14.5%. This difference in data can be due to the present study using elite athletes in comparison to the study from Garrido-Chamorro *et al.*, [26] as literature states that athletes are often leaner. It can also be assumed that all participants have a healthy BMI as a study using

female participants' BMI and percentage FM, and BMI and percentage FFM were positively and significantly associated (both r=0.82, P<0.001) [32].

The highest amount of body composition in the present study existed within the lower body that ranged from 24-46.2 (±8.9) mm and the trunk that ranged from 14.5-35 (±8.9) mm. In comparison to the upper body that ranged from 16-27.5 (±4.7) mm. Results are not uncommon as in fact, 40- 60% of body fat is in the subcutaneous region[33]. The present results are in similarity with Garrido-Chamorro *et al.*, [26], who also found the trunk and lower body presented the highest values, indicating a preferential distribution of fat in these body segments. Whereas, comparing lower body and trunk segments, results indicated that fat content tended to be slightly higher in the lower body. Whereas in men, the trunk values are seen to be higher than in the lower body. Nauli *et al.*, [34] stated that this is because men have a tendency of accumulating abdominal visceral fat, and therefore men are more likely to develop an apple shaped body [35]. Whereas in contrast women are referred to being pear-shaped, because as the present results show, women have a tendency of accumulating subcutaneous fat in the thigh (femoral) and buttock (gluteal regions) [36]. The R^2 value in the present study found that the trunk and lower body had a strong relationship between the two variables (R^2=0.9855, R^2=0.776), demonstrating that as one variable (actual BC) increases the other also increases (perceived BC) (P<0.05). The trunk was the only section with a significant difference between actual and perceived BC (P=0.001). When further analysis was conducted to determine the correlation between the two variables within each section, all (upper, trunk and lower) had a very high correlation (r =0.762, 0.957, 0.881).

It is evident from these findings that in the present study female athletes are most dissatisfied with their trunk. Thus, suggesting that although athletes may now be experiencing education regarding their overall body image, as no significant difference was found between overall actual and perceived BC (P = 0.365) compared to a study prior to the present study by Mills and Watson [18] where a significant difference was found between actual and perceived (P = 0.023), that education in body image must now take a focus towards understanding the areas athletes are most dissatisfied with, for instance the trunk within this present study.

The above findings support Hoyt and Kogan [37] results on several areas/muscle groups (Table 3) as it found that females were mostly dissatisfied with their abdomen (47%). However, the present study found that 100% of athletes faced body dissatisfaction within the trunk compared to the study by Hoyt and Koganm [37] where only 47% suffered body dissatisfaction. These findings would be expected as Reel *et al.*,[38] research indicated that female athletes are experiencing the greatest amount of body dissatisfaction, as this study shows they are the population that are overestimating their perceived BMI the greatest in comparison to other subpopulation groups. It is vital this is considered when working with female athletes as Stice and Shaw [39] indicated within their study that, in turn, heightened dissatisfaction with the body increases the risk of various adverse outcomes, for example eating disorders.

Conclusion

Results from this study found that there was a positive correlation between actual and perceived body composition within the overall body and all sections of the body (upper, trunk and lower) (r = 0.762, 0.957, 0.881 respectively), which are in line with previous literature from Mills and Cooling [21] and Mills and Watson [18] (P = 0.001). It is clear from the findings that the average perceived body composition was higher than the participants actual body composition. Significant differences (r = 0.957) were found in the trunk, suggesting that this area of the body in which female athletes are most dissatisfied with indicating a preferential distribution of fat in these body segments [26]. Further analysis found that there was an extremely high correlation r=0.915 between overall actual and perceived body composition. The very high positive correlation in the current study supports the statement by Kantanista *et al.*,[8], who declared that athletes are a subpopulation that often overestimate their perceived body composition compared to their actual body composition.

The present study suggests that females are making progress to more positive body image regarding overall body image, as no significant difference was found between overall actual and perceived body composition (P = 0.365) compared to a study prior to the present study by Mills and Watson[18] where a significant difference was found between actual and perceived (P = 0.023), however there was a significant

difference between actual and perceived BC in the trunk ($P = 0.001$). As body dissatisfaction is defined as a discrepancy between the actual and ideal body weight and shape, it therefore implies that this current study indicates that female athletes competing in football have a large amount of body dissatisfaction within the trunk. Future research must now move away from focusing on overall body image, due to numerous studies showing that females are dissatisfied with their body and must now focus on understanding which specific areas they are experiencing the most dissatisfaction.

Conflict of Interest

Not applicable.

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