

PostScript

LETTER

"Read with caution": a reply to Pickett *et al*

In recent years, psychological issues in bodybuilding have received much research attention.¹⁻⁴ Given both the popularity of training with weights and the many interesting psychological issues surrounding this phenomenon, research on such issues is clearly warranted. We were pleased therefore to see a recent study by Pickett *et al*⁵ in this journal purporting to examine muscle dysmorphia and social physique anxiety in bodybuilders and weight trainers. Muscle dysmorphia is a multidimensional condition where individuals exhibit a distorted body image, believing themselves to be thin and puny when in fact they are large and muscular.⁶ The study of Pickett *et al* compared three groups of men: competitive bodybuilders (n = 40), men who train regularly with weights (n = 40), and men who do not train with weights (n = 40). Several physiological measures (including weight, height, and body fat percentage) were taken, and participants completed several questionnaires, including the social physique anxiety scale (SPAS⁷) and the eating attitudes test (EAT-26⁸). The authors concluded from their results that competitive bodybuilders are not more "muscle dysmorphic" than either non-competitive weight trainers or physically active men who do not train with weights. Although we applaud the attempt of Pickett *et al* to examine this important topic, we suggest caution with regard to some of their findings and conclusions because of concerns about the sample and measures used. These concerns are explained in the following paragraphs.

Methodological concerns

Participants

One of our main concerns about the study of Pickett *et al* is the choice of participants and the vague description of their characteristics. The study examined competitive bodybuilders, men who regularly trained with weights, and physically active men who exercised but did not train with weights. However, it is unclear whether the "weight trainers" in this study would have classified themselves as bodybuilders. This issue is important as most people who class themselves as bodybuilders do not compete,⁹ and previous research has shown that they differ on a range of psychological characteristics from those who weight train for general fitness rather than bodybuilding purposes.^{2, 4, 10} In particular, are the weight trainers in the second group non-competitive bodybuilders, power lifters, or just motivated fitness lifters? Previous research^{1, 2} suggests that bodybuilders, powerlifters, and fitness lifters may have very different motives for lifting and may exhibit substantially different psychological behaviours. From their present design, it would be impossible to tell whether differences found were due to participants competing, or whether they were down to

comparing bodybuilders with non-bodybuilders.

In addition, the results of the study show that the weight gain desires of bodybuilders were only marginally higher than those of weight trainers (p<0.08). This is a very surprising finding, given that gaining muscle is the *raison d'être* of the bodybuilder, but that many non-bodybuilders weight train for general fitness purposes rather than to build muscle (see, for example, Fussell¹¹). The inclusion of a mixture of non-competitive bodybuilders and general fitness enthusiasts in the weight trainer group may explain this finding. Certainly, without asking participants if they view themselves as bodybuilders, this possibility cannot be ruled out. Therefore the sample in this study has not been defined and delineated clearly enough, and we suggest that a group of non-competitive bodybuilders should have been included as well as a group of non-bodybuilding weight trainers to allow additional comparisons.

This may also be indicated by the lack of significant differences in social physique anxiety between the bodybuilders and the weight trainers and the marginal difference between those groups and the controls. This result contrasts vividly with the findings of Hurst *et al*⁷ that experienced bodybuilders scored significantly lower on social physique anxiety than inexperienced bodybuilders and weight lifters. The discrepancy between these two findings may again relate to the sample used by Pickett *et al*. If some of their sample of weight trainers were indeed non-competitive bodybuilders, then perhaps it is not surprising that there is little difference between the two groups in social physique anxiety. The finding that the active controls only scored marginally higher in social physique anxiety is surprising and contradicts the findings of Hurst *et al* that there are large significant differences between bodybuilders and weight lifters. Unfortunately Pickett *et al* chose only to give this finding only cursory attention in their discussion.

Body composition measure

We have concerns about the body composition analysis, the fat-free mass index (FFMI). The researchers also used the sum of skin fold measurements to complete the FFMI equation.

According to Eston and Reilly,¹² methods of assessing body composition can be ranked in one of three categories according to the validity of the particular method. Level 1 (the most accurate measure) is cadaver dissection. The next best method (level 2) is dual energy x ray absorptiometry (DEXA), and the least accurate (level 3) methods are bioelectrical impedance and sum of skinfolds. The caliper method used by Pickett *et al* is classified by Eston and Reilly¹² as level 3, defined as such as it uses an equation that represents an empirically derived relation between the result of the skinfold measurements and either hydrostatic weighing or DEXA. A more accurate method would have been to use DEXA, as the caliper method used by Pickett *et al* incorporated all

the assumptions of DEXA and/or hydrostatic weighing (which it was calibrated against) as well as having its own limitations. Therefore DEXA would have been a much better way of assessing body composition, as it does not rely on calibration against underwater weighing, in contrast with the caliper method.

Even if DEXA was not a feasible option of assessment, then we still question the use of the sum of skinfolds method being used. Research suggests that the reliability of anthropometrics depends on standardising the caliper and site of measurement as well as the measuring skill of the anthropometrist, and is therefore prone to measurement error.¹³ This is an important limitation that was not acknowledged by Pickett *et al*. It has also been suggested¹² that the methods of Durnin and Wormersley¹⁴ used by Pickett *et al* suffer from differences in age in men because older men have lower body density than younger men because of the increasing amount of internalising fat as well as a decrease in muscle mass and bone density. In addition, skin thickness and skinfold compressibility both affect the relation between skinfolds and body density, and in turn the percentage body fat estimation.

The use of the equations to predict body composition from the skinfolds method should be derived from a sample with characteristics—for example, age, race, and athletic status—similar to the subjects to be tested. Pickett *et al* did not report doing this, an important point especially considering the age range of their subjects (18-44 years) and the differences in ethnicity (80% white and 16% black). In addition, the best method of obtaining valid anthropometric measurements is to use a reasonable variety of sites that include areas of the arms, trunk, and legs. Once again, Pickett *et al* did not do this, only taking skinfold measurements from the biceps, triceps, subscapular, and suprailiac. The use of whole body DEXA measurements makes this a far more appropriate method of obtaining body composition.¹⁵

There is also a plethora of research supporting the use of bioelectrical impedance over that of the skinfolds method.^{13, 16-20} Skinfolds have been found to overestimate muscle volume and underestimate adipose tissue, possibly because of the false assumption in the skinfold equation that muscle and limb circumference are circular in nature.¹⁸ In sum, we question the accuracy of the methods used by Pickett *et al*⁵ to measure body composition, and wonder why commonly used, more accurate measures were not used.

Muscle dysmorphia measurement

Our greatest concern with the current study relates to the claims made by the authors about muscle dysmorphia. The authors claim that their findings show that competitive bodybuilders are not more muscle dysmorphic than non-competitive weight trainers and physically active non-weight trainers. However, during this study no self report measure of muscle dysmorphia was attempted.

A further concern is the assertion that the study did not find muscle dysmorphia to be greater in competitive bodybuilders than in men who regularly lift weights or athletically active men. A previous study that used a validated measure of muscle dysmorphia, the muscle dysmorphia index (MDI²), found it to be significantly higher in bodybuilders than in weight training non-bodybuilders, such as power lifters.¹⁰ The MDI is a valid and reliable multidimensional measure of this construct (see Rhea *et al*² for a discussion of its development and psychometric properties). Muscle dysmorphia is a complex phenomenon with several clear components and therefore requires a multidimensional measure. Indeed, the research of Rhea *et al* revealed six important factors in muscle dysmorphia (size/symmetry, supplement use, exercise dependence, pharmaceutical use, dietary behaviour, and physique protection), all of which are included in the MDI. Another earlier multidimensional measure of muscle dysmorphia symptoms, the muscle appearance satisfaction scale²¹ has also been initially validated and measures bodybuilding dependence, muscle checking, substance use, injury, and muscle satisfaction. This begs the question as to why Pickett *et al*⁵ did not use either validated multidimensional measure that first appeared in the literature in 2002, but instead used measures of eating disorders and social physique anxiety, which, at best, tap only partially and indirectly into the muscle dysmorphia construct. We contend that the lack of use of a direct and comprehensive measure of muscle dysmorphia brings the validity of their conclusion on dysmorphia into question.

In addition, we are surprised that the findings of Lantz *et al*⁶ mentioned above are not discussed by Pickett *et al*. Given that these findings contradict those of Pickett *et al*, it seems reasonable to expect Pickett *et al* to mention this and explain why they think their findings differ. The absence of any reference to the study of Lantz *et al* suggests either an inadequate literature search on the part of these authors or a deliberate omission because of the contradictory findings from their weaker design.

In the same vein, it is also worth mentioning another study omitted by Pickett *et al* with findings somewhat contradictory to the present study. Smith and Hale³ found that competitive bodybuilders scored significantly higher than non-competitive bodybuilders in exercise dependence (an important component of muscle dysmorphia²). They also found significant correlations between measures of exercise dependence and muscle dysmorphia. This again appears to contradict the assertion of Pickett *et al* that competitive bodybuilders are not more inclined to be muscle dysmorphic than general weight trainers. Again, it is worth noting that Smith and Hale used a much larger sample than Pickett *et al* (135 competitive and 150 non-competitive participants compared with 40 of each).

Pickett *et al* do acknowledge the lack of a specific measure of muscle dysmorphia as a limitation of their study. However, given that such a measure has been freely available since 2002, it is puzzling as to why it was not used. If the data were collected before the publication of the MDI, the conclusions of the study should have been restricted to the body image data rather than forming possibly

unwarranted conclusions on muscle dysmorphia.

Conclusion

Muscle dysmorphia and related psychological issues in bodybuilders are both fascinating and worthwhile research topics. However, it is extremely important that such research is carried out with great care and scientific precision. Otherwise, researchers may form unwarranted conclusions on the basis of questionable data. This appears to be the case with the study of Pickett *et al*. We have shown how inadequate sampling and a lack of specific measurement of an important construct explored in their paper may have produced rather misleading research findings and created questionable internal validity. Previous studies using well validated instruments specific to bodybuilders have found evidence of differences in psychological characteristics between competitive bodybuilders and other weight training enthusiasts, which appear to contradict the findings of Pickett *et al*. However, the reader will search in vain for even a passing reference to any of these studies. It is incumbent upon researchers to familiarise themselves with previous research, to build upon these findings and also to report them to enable readers to scientifically compare methods and findings. In this case, Pickett *et al* appear to have failed in this endeavour. This central issue, combined with the problems of sampling, muscle dysmorphia measurements, and body mass measurements noted above, lead us to conclude that the results of Pickett *et al* should be interpreted with extreme caution. We also suggest that those conducting further research on this topic should pay close attention to these important methodological issues.

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