



Proposition of an anthropometric criterion for diagnosis suspicion of muscle dysmorphia

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ABSTRACT

Introduction: The muscle dysmorphia (DYSMUS) is a psychiatric syndrome that occurs to both genders with higher prevalence in men, in which the individual perceives his body as small and weak when in fact it is strong and muscular. There are no anthropometric approaches in literature about DYSMUS. **Objective:** To obtain data from a reference population in order to suggest an anthropometric criterion for the diagnosis of DYSMUS. **Methods:** The sample was composed of 1,825 individuals who participated in a medical-functional evaluation (1,108 men and 717 women) between years of 1994 and 2003, with ages higher or equal to 15 years, non-athletes and not presenting significant locomotive physical disorders or clinical diagnosis of DYSMUS. Two non-dimensional proportionality indexes B/P_1 and B/P_2 were individually calculated with and without correction through the measure of the skinfold thickness, respectively. The presence of a ratio above 1 between the contracted and inflected arm and leg perimeters associated to the inexistence of three other cut-off points of ectomorphy, ΣSKF (sum of measures of triceps and medial leg skinfold thickness) and abdominal perimeter variables; these last ones with the purpose of excluding individuals with high B/P_1 and B/P_2 values primarily due to the excess of body fat. **Results:** The ratio $B/P_1 > 1$ was observed in 16 individuals, eight from each gender. Analyzing the other cut-off points, all women could be identified as obese and, therefore, not carrier of DYSMUS, while among men, seven out of eight individuals could be classified as suggestive DYSMUS cases. **Conclusions:** Based on the wide and heterogeneous sample used in this study, it is possible to suggest an anthropometric criterion to identify DYSMUS. Other studies are being conducted in order to validate the DYSMUS anthropometric criterion proposed in the present study and to determine the sensibility and specificity used in samples willfully selected due to their high prevalence of DYSMUS.

INTRODUCTION

Kinanthropometry, characterized as the knowledge branch dedicated to the study of anthropometrical measures in movement conditions, is applicable in several health areas⁽¹⁾, and its clinical interpretation is an important and relevant tool for epidemiological screening⁽²⁾. Some anthropometrical variables may provide important aids for both the diagnosis and for the prognosis of some diseases⁽³⁾. For instance, methods based on weight and height ratios such as the body mass index (IMC) have a strong association with chronic degenerative diseases, among which we could emphasize: ischemic disease⁽³⁾, systemic arterial hypertension⁽⁴⁾ and anxiety and depression symptoms⁽⁷⁾, although this simple mathematic relation has several theoretical limitations⁽⁸⁾. Other anthropometric

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characteristics also have clinical implications, such as the ligamentous hyperlaxity, whose prevalence is higher among adult women with mitral valve prolapse⁽⁹⁾.

Morbid concerns with body image were exclusive of female gender until not long ago⁽¹⁰⁾, being associated to the reverse anorexia and nervous bulimia conditions^(11,12). More recently, these concerns have also been found in men, initially defined as reverse nervous anorexia and later renamed as muscle dysmorphia (DYSMUS). This syndrome, rarely found in the general population, involves individuals of both genders although far more prevalent in the male gender, whose main characteristic is a specific distortion of the body self-image. The individual with DYSMUS perceives his body as small and weak when in fact it is strong and muscular⁽¹³⁾.

This distorted image tends to lead such individuals to seek in muscle strengthening exercises the "correction" for their problem⁽¹³⁾. Thus, a remarkable aspect of this syndrome is the permanent search for the increase on the muscular mass through muscle strengthening exercises, besides the frequent and indiscriminate use of ergogenic substances and hyperprotein diets. This constant concern with body self-image has a negative effect on their social life, affecting significantly the quality of life of these individuals.

Furthermore, there are no precise laboratorial or clinical criteria for the clinical characterization of DYSMUS that allow an accurate and precise diagnosis. In late review, we observed that there are instruments that were developed to diagnose DYSMUS^(14,15) by means of questionnaires that, at first, are distinguished from others with regard to the number of items. In that manner and considering a possible anthropometric expression of the DYSMUS syndrome, the proposition of an anthropometric criterion that could contribute for its characterization and clinical diagnosis would be important and suitable.

The objective of the present study is to propose an anthropometric criterion that could contribute for the DYSMUS characterization.

METHODS

Sample

All individuals with more than 15 years of age who participated in a medical-functional evaluation were included in the study. Most times this evaluation included maximal exercise cardiopulmonary test, 4-seconds test for the evaluation of the cardiac vagal tonus and a wide kinanthropometric evaluation, performed by three specialized physicians, from January 1994 to August 2003. This convenient sample was composed of individuals who searched for the Exercise Medicine Clinic – Clinimex, as part of their routine medical evaluations or as orientation for the practice of physical exercises or even for the admission in supervised exercise programs. Individuals presenting one or more of the following conditions were excluded: a) clinical evidence of DYSMUS; b) participant of competitive sports; c) carrier of significant locomotive disorder; and d) absent or incomplete relevant anthropometric clin-

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ical data. Thus, a final sample of 1,825 individuals was obtained (1,108 men and 717 women). Almost all men were white with high socioeconomic level. All individuals evaluated signed a specific consent form allowing the anthropometric data collecting and the use these information in the research. The main anthropometric and demographic data are presented in table 1.

TABLE 1
Anthropometric description of sample

Variables	Male (n = 1108)	Female (n = 717)
Age (years)	51 ± 15 (15 a 91)	50 ± 15 (15 a 86)
Body weight (kg)	82 ± 15 (42 a 165)	68 ± 15 (35 a 135)
Height (cm)	174 ± 7 (143 a 199)	162 ± 7 (139 a 189)
Ectomorphy	0.9 ± 1.5 (-5.2 a 6)	0.9 ± 1.9 (-5 a 5.9)
BC (cm)	31 ± 3 (21 a 45)	29 ± 4 (15 a 45)
P (cm)	37 ± 3 (26 a 55)	36 ± 4 (23 a 54)
T (mm)	11 ± 5 (3 a 41)	19 ± 8 (3 a 51)
PM (mm)	10 ± 5 (2 a 48)	13 ± 7 (12 a 50)
ΣDC (T + PM) (mm)	21 ± 9 (6 a 79)	28 ± 14 (6 a 92)

Average ± SD (maximum and minimum); BC = Contracted and inflected arm; P = Leg perimetry; T = Triceps skinfold; PM = Medial leg skinfold.

Measures

Among the several variables measured, the following measures were used for the present study: body weight, height, contracted and inflected arm and leg perimeters, triceps and medial leg skinfold thickness. For the assessment of the body weight measure, balances (*Filizola*) or *Plenna Personal Line* (Brazil) were used with the individuals bare-footed and wearing the lesser amount of clothes as possible. Following, the height was determined by means of clinical stadiometer especially produced for this purpose or steel estadiometers label WCS (United States); the individual should be positioned in standing position with trunk the most elongated as possible and head positioned at Frankfurt level⁽¹⁶⁾. The body weight and height measures were performed at 0.1 kg and 0.1 cm, respectively, and the values used for the calculation of ectomorphy (ecto), according to specific equation. The contracted and flexed arm girth (BC) was determined with tape measure perpendicularly around the central region of the arm, aiming to reach the largest value. The individual in sitting position should maintain the shoulder joint at 90° of flexion in relation to the trunk and the elbow joint inflected as to form an angle of 90° between arm and forearm with hand at supine position. The left hand was used in such way that the palm region of hands touched each other in order to provide resistance on the performance of the static contraction. Still at sitting position, the calf girth was determined (P) with tape measure perpendicularly, aiming to reach the largest value. Abdominal girth was measured at the umbilical scar region, maintaining the measure tape fully parallel in relation to the floor. For the girth measurements, a flexible measure tape Gullick (United States) was used, which performs the measurements with accuracy of 0.1 cm and allows the tension performed to be controlled and standardized. The measure of the triceps skinfold thickness (T) was made with individual with relaxed and extended arms. This thickness should be measured at the arm medium point (between the acromial and radial anatomical point) at the posterior side with the arm fold vertical and parallel to the longitudinal axis with arm along the body. The measure of the medial leg skinfold thickness (PM) was determined with individual maintaining the knee articulation at 90°; the skinfold thickness assessment was performed at the leg medial region considering the largest perimeter. A digital skinfold caliper *Skyindex II* (United States) was used with accuracy of 0.1 cm and constant pressure of 10 g/mm².

Proportionality indexes

Two non-dimensional proportionality indexes were calculated for each individual (B/P), one of them with no correction and the other

with correction through the skinfold thickness measures, which express the relation between perimeters BC and P. The first is the ratio between variables BC and P. The second is the ratio between BC subtracted from T and P subtracted from PM, adjusted for the respective measure units, in other words, centimeters and millimeters. Both indexes are exemplified in table 2. The values above 1 were hypothesized, in other words, the measure of the contracted and inflected arm perimeter higher than the leg perimeter would correspond to the anthropometric expression of DYSMUS in adult men and women.

TABLE 2
Examples of proportionality indexes calculation

Indexes B/P	Example	Results
$B/P_1 = \frac{BC}{P}$	$B/P_1 = \frac{32}{26}$	$B/P_1 = 1.23$
$B/P_2 = \frac{BC - T}{P - PM}$	$B/P_2 = \frac{32 - 1.2}{26 - 0.8}$	$B/P_2 = 1.22$

BC = 32 cm; P = 26 cm; T = 12 mm; PM = 8 mm, where BC = Contracted and inflected arm; P = Leg perimetry; T = Triceps skinfold; PM = Medial leg skinfold.

Additional criteria

Considering that individuals extremely obese may present atypical anthropometric proportions and eventually be classified as DYSMUS carriers, we intended to control the influence of the weight excess and the amount of fat on values found for the proportionality indexes by adopting other additional criteria. The variables ecto, ΣDC and abdominal perimetry were found with the following cut-off points: < 1.45⁸, > 45 mm and > 100 cm, respectively; these last two variables presented values near to P90 in their respective distributions.

Statistical analysis

Data have been analyzed by gender separately. The descriptive analysis was used through the average, standard deviation and percentiles. In order to assess the association level between B/P₁ and B/P₂, the Pearson moment-product correlation was applied. All calculations were performed in the SPSS software version 10.0 (SPSS, Chicago, United States), where the significance level of 5% was adopted.

RESULTS

The descriptive statistics for the anthropometric variables was presented in table 2. The indexes B/P₁ and B/P₂ showed high association in both groups: male (r = 0.98; p < 0.001) and female (r = 0.98; p < 0.001), emphasizing the similarity between indexes.

The percentile values of the proportionality indexes presented in table 3 suggest that values above 1 compatible with DYSMUS would be extremely scarce. Indeed, we have found only 16 indi-

TABLE 3
Percentiles of the proportionality indexes for both genders

	P5	P50	P95
Male (n = 1,108)			
B/P ₁	0.77	0.85	0.95
B/P ₂	0.76	0.84	0.94
Female (n = 717)			
B/P ₁	0.69	0.79	0.94
B/P ₂	0.68	0.78	0.92

B/P₁ = BC/P; B/P₂ = (BC-T)/(P-PM) where BC = Contracted and inflected arm; P = Leg perimetry; T = Triceps skinfold; PM = Medial leg skinfold. All expressed as cm.

viduals with the mentioned values in B/P_1 , eight of each gender. The results of these individuals were tested for fat extreme excess using the criteria previously mentioned. In the female group, 100% of individuals presented valued below the cut-off point of the ecto and above the cut-off point proposed for ΣDC , while 75% presented values of abdominal perimetry above 100 cm, indicating that the B/P_1 value, above 1, was caused by problems of fat excess. Unlike in the male group, no individual obtained values above 45 mm for ΣDC and only one of them exceeded the cut-off point adopted for the abdominal perimetry. However, it was observed that 75% presented values below 1.45 for the ecto.

In a later and more detailed analysis, two adult young men with ages ranging from 21 to 26 years were excluded from sample by reporting high dissatisfaction degree with muscular level during anamnesis, compatible with the clinical suspicion of DYSMUS and B/P values above 1. Table 4 presents some anthropometric data of these two individuals; it is worthy emphasizing that these two adult young men do not suit in none of the cut-off points proposed for the investigation of weight excess.

TABLE 4
Anthropometric data of two individuals excluded for DYSMUS suspicion

	PC (kg)	Height (cm)	BC (cm)	P (cm)	AB (cm)	ΣDC (mm)	B/P_1^*	B/P_2^*
A	70	171.4	38.6	35.4	77.7	14.1	1.09	1.09
B	86	184.4	39.3	38.1	85.8	9.8	1.03	1.04

* Non-dimensional; PC = Body weight; Ecto = Ectomorphy; BC = Contracted and inflected arm; P = Leg perimetry; AB = Abdomen perimeter; $B/P_1 = BC/P$; $B/P_2 = (BC \cdot T)/(P \cdot PM)$; A and B correspond to both examples of individuals.

DISCUSSION

The anthropometric proportionality has been objective of several clinical and sportive studies^(17,18). Among the several strategies, the most recommendable is the *Phantom*⁽²⁾, based on a unisex and standard height model, from which all anthropometric measures are proportionally compared and the results expressed as how many standard deviations above or below the mentioned model a given individual measure is found. However, the authors of the original proposition limited themselves primarily to the model's description, without establishing or discussing more deeply the implication and potential cut-off points for the clinical utilization. In the present study, we intended to suggest a proportionality criterion that would represent an objective and potentially valid approach as an anthropometric evidence of the presence of DYSMUS.

Two features of our sample and methodology of data collecting must be previously discussed and more deeply understood. Firstly, the non-randomness of the sample that more likely represents a subgroup of the highest socioeconomic stratum, favoring the white-colored skin with higher prevalence of chronic-degenerative diseases, mainly cardiovascular diseases. One should, therefore, consider that the generalization of these results for the adult Brazilian population might not be suitable. On the other hand, the data collecting performed by only three specialized physicians in a large number of individuals during a long period of time represents a high point and a sufficiently high control level of possible sources of error in the measure.

A possible limitation of our study was the impossibility to test or to question the self-perception of the individuals tested in relation to their muscular development degree. However, in practice, it would have been difficult to identify an instrument or a valid protocol of such heterogeneous characteristic for the application in our sample.

The reason why we decided to propose an anthropometric analysis of DYSMUS based on a ratio between the contracted and inflected arm and leg perimeters based on the empiric observation

that individuals who attend to academies aiming at the development of the muscular hypertrophy trend to emphasize the muscular strengthening of arms and thorax upper region, parts of the body more easily seen by the others and by themselves. Particularly, it is common that these individuals would dress T-shirts with no sleeves in order for their hypertrophied muscles to be easily seen.

The interpreted results show that the high magnitude of associations between indexes B/P_1 and B/P_2 presented no practical advantage of correcting the circumferences for the respective skinfolds, simplifying the analysis and data collecting and allowing adopting only the proportionality index B/P_1 (without correction for the measures of the skinfold thickness) or just the index B/P for the diagnosis of DYSMUS. The rareness on the attainment of B/P_1 values above 1 within a wide and heterogeneous sample of adult individuals showed to be this arbitrary and easy-assimilation value a practical and probably suitable cut-off point. Although participants of competitive sports have been excluded from the sample, values above 1 in the index B/P_1 also seem to be unusual or absent in this group (data not published), except for elite bodybuilders⁽¹⁹⁾.

When the strategy of *Phantom* was considered, we could simulate, with data from BC and P sufficient to generate indexes B/P equal to 1, that the difference between the proportionality scores for the respective measures was of 2.5 standard deviations, similar to the score found recently by Silva *et al.*⁽¹⁹⁾ for elite bodybuilders, corroborating the idea that this type of result would be extremely improbable to be found in a general population.

While the female sample for all cases of false positive of DYSMUS could be properly classified through the skinfold or abdominal perimetry measures, the same was not verified for the male group, when only one individual had in the obesity the explanation of finding such values in B/P_1 . The other seven cases presented values non-compatible with obesity, what suggests that they could be carrier of DYSMUS not identified in the clinical approach or be compulsive participants of muscular strengthening exercises, or even representing some keyboarding or measure error.

Considering results as a whole, among the 16 individuals presenting results of $B/P_1 > 1$, all but seven could be classified as extremely obese or carrier of important weight excess. Among these seven individuals, four presented severe reduction on the body linearity, compatible with large muscular mass and/or with severe mesomorph and endomorph combination. The other individuals presented severe anthropometric disproportion not clearly related to muscular strengthening exercises, self-image disturbances or perception of muscular underdevelopment.

Due to what has been previously presented, it is wise to suggest that the index B/P_1 only be used to define DYSMUS in women who do not suit in at least two of the three following differential diagnosis criteria: ecto < 1.45 , $\Sigma DC > 45$ mm, and abdominal perimetry > 100 cm.

Furthermore, it is important that experienced evaluators measure the perimeters, preferentially adopting the procedure used in the present study in order to avoid false interpretations of the values calculated of B/P_1 .

Based on the large sample of adult individuals without clinical DYSMUS evidences analyzed in this study, it is possible to propose a DYSMUS anthropometric criterion based on the result above 1 for the relation between the contracted and inflected arm and leg perimeters in men and women, and for these last individuals, after the exclusion of extreme obesity cases from the adoption of three other criteria previously discussed. The decisive and interpretative process is illustratively presented in table 5.

In the clinical practice, the presence of a ratio $B/P > 1$ should be understood as an evidence of DYSMUS, and the diagnosis should be confirmed based on the analysis of other clinical and psychological parameters. Other studies are in progress with the application of this simple anthropometric criterion for the suspicious or

TABLE 5
Anthropometric criterion of DYSMUS suspicion

Men	Women
B/P > 1*	B/P > 1*
	** Ecto > 1,45*
	** Σ DC < 45 mm
	** AB < 100 cm

* Non-dimensional; ** at least two of these criterion should be filled for DYSMUS suspicion in women, B = Contracted and inflected arm; P = Leg perimetry; Ecto = Ectomorphy; * DC = Triceps skinfold + medial leg skinfold; AB = Abdomen perimetry.

characterization of muscle dysmorphia, using a specific questionnaire and samples willfully selected due to their high DYSMUS prevalence.

All the authors declared there is not any potential conflict of interests regarding this article.

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