

Correlations between Areas, Volumes or Body Fat and Anthropometric Variables

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ABSTRACT: Body fat is an important determinant of nutritional status and health. This paper aims to demonstrate the existence of significant correlations between areas, or volumes of fat and anthropometric variables.

KEY WORDS: body fat, anthropometric variables, computed tomography

Introduction

Individual health and population level are determined by body composition and processes of growth and development, and fat is an important component of body composition.

Are known to the expert studies that aim to quantify body fat, both anthropometric and imaging methods.

This paper aims to highlight correlations between areas, or volumes of fat and anthropometric variables in a group of men.

In terms of imaging, computed tomography was used, which were calculated areas and volumes of fat and anthropometric variables studied are height, weight, skin fold thickness, waist, hips and body mass index.

Material and Methods

We studied 142 men, aged between 20 and 68 years. In selecting subjects we considered their health, have excluded those with chronic cardiovascular diseases, which the therapeutic diuretics, those with diabetes, subjects with body mass index <18.5 (underweight) or ≥40 (morbid obesity), subjects with lipid-lowering therapy or corticosteroid.

Computed tomography scanning technique

HITACHI CT scan completed PRESTO, software version 3.02. Subjects were scanned in the supine position, we used a single slice thickness of 10 mm at the L4-L5 intervertebral space.

Using Hitachi software, we manually defined region of interest (ROI), namely total fat area and visceral fat area by using tracer, as shown in the pictures below.

Fat was identified correctly, taking into account threshold pixel values between -50 and -250 Hounsfield units.

Subcutaneous fat area was calculated by subtraction visceral fat of total fat area.

Still using the software, we calculated the volumes of total fat, visceral and subcutaneous device expressed in mm³, then transformed into liters.

Anthropometric measurements

Height (size) was measured with a stadiometer the results are expressed in centimeters.

Weight was measured with a scale calibrated to 0.1kg.

Measurement of skin folds was performed using a caliper type Holtain

There have also been carried out by two measurements for each skin fold, and measurement was performed by the same person on all subjects group.

Skin folds were measured following:

- tricipital the midpoint of the rear face of the arm, between the ends of the olecranon and the acromial, parallel to the longitudinal axis of the arm;
- subscapularis under the inferior angle of the scapula at 45° to the vertical;
- abdominal fold horizontally at the umbilicus, 5cm side

Values are expressed in millimeters skin folds.

Measuring circumferences

Waist circumference was measured midway between the edge of the last rib and the anterior superior iliac spine.

Hip circumference was measured at the level of trochanters.

The results of measurement of these two circumferences are in centimeters.

BMI=weight (kg)/height²(m).

Results and Discussion

The correlation coefficients obtained are to be found in the following table (Table 1)

Table 1. Correlation coefficients between the areas, or the volume of body fat and anthropometric variables in men ($p < 0.01$)

Anthropometric variables						
Variables	Weight (kg)	Height (cm)	BMI (kg/m ²)	Waist Circ (cm)	Hip Circumference (cm)	Waist Circ/ Hip Circ
Adipose tissue areas (cm ²)						
VAT	0,615	0,251	0,825	0,433	0,698	0,132
SAT	0,945	0,004	0,732	0,638	0,622	0,319
TAT	0,865	0,062	0,824	0,598	0,697	0,253
Adipose tissue volumes (litre)						
VAT	0,569	0,343	0,798	0,370	0,627	0,104
SAT	0,744	0,195	0,874	0,254	0,837	0,034
TAT	0,706	0,277	0,897	0,326	0,788	0,066

VAT - visceral adipose tissue; SAT - subcutaneous adipose tissue; TAT - total adipose tissue

The highest values of correlation coefficients are found in BMI, both to the country and if fat volumes, this observation shows that body mass index is a good predictor of the volumes and areas of fat all age groups in men studied group. And specialized studies in the field [1-3] mentions and demonstrates that BMI is the best and most important predictor of volume and area of fat at all ages, in healthy subjects.

Height shows no correlation with TAT, VAT or SAT or if areas or volumes, and in terms of this correlation, male group studied fall into the results of other similar studies [3,4].

The significant correlation between weight and adipose tissue areas and volumes, even there is a highly significant correlation, $R = 0,945$, where subcutaneous adipose tissue area and volume of $0,744$ R subcutaneous fat, it can be said that this variable is predictive anthropometric for area and volume of subcutaneous adipose tissue, given the fact that

adipose tissue plays an important subcutaneous about 3 times higher than the visceral and fat accumulation, with age is primarily due to fat subcutaneously.

Waist circumference is a significant correlation, $R = 0,638$ in the area of subcutaneous fat, the same correlation is observed for waist circumference with total fat area. For volumes no significant correlations with waist circumference, and in this case, our observation falls in the results of field studies [3-6].

Correlation coefficient approximately equal is found in the timing of hip circumference with areas of fat, the correlations are significant, by volume, a highly significant correlation between hip circumference and SAT volume, where R^2 has a value of $0,837$, similar to a R^2 of $0,788$ corresponds to a highly significant correlation between this variable anthropometric and total body fat.

Table 2. Correlation coefficients between the areas, or the volume of fat tissue and skin fold thickness, in men ($p < 0.001$)

Anthropometric variables			
Variables	Tricipital Fold (mm)	Subscapular Fold (mm)	Abdominal Fold (mm)
Adipose tissue areas			
VAT	0,615	0,251	0,825
SAT	0,945	0,004	0,732
TAT	0,865	0,062	0,824
Adipose tissue volumes			
VAT	0,569	0,343	0,798
SAT	0,744	0,195	0,874
TAT	0,706	0,277	0,897

VAT - visceral adipose tissue; SAT - subcutaneous adipose tissue; TAT - total adipose tissue

Specialized studies in the field [5,7,8] mentions similar correlation coefficients for hips, emphasizing highly significant correlation

between hip circumference and total body fat, respectively SAT volume.

Relationship between waist circumference and hip circumference no correlation with the areas and volumes of fat, contrary to studies in the field, the values of this ratio is significantly lower than that found in other studies: 0.75 to 0.91 vs 0.82 to 1.17.

Fold tricipital significantly correlated highly with the area of visceral fat, R^2 is 0.945, the same correlation exists between fold tricipital and total area of adipose tissue, consistent with similar studies in the field, in relation to the area of visceral fat, the coefficient correlation has a value of R^2 0.615, slightly higher than the data from specialized literature (6,8), which mentions an R^2 of 53 to 58 (Table 2).

With fat volumes, the correlation coefficients are comparable to those resulting from similar studies and reveal significant correlations between tricipital fold volumes of fat.

Subscapular fold no correlation with adipose tissue areas and volumes.

Abdominal fold is highly correlated significantly with all the volumes and areas of fat, on this correlation, we ordered comparison data from the literature, similar studies using only tricipital and subscapular fold, the male group studied this correlation is observed high significant, which suggests that abdominal fold is a predictor of area and volume of fat.

Conclusion

The most important predictor of areas and volumes of fat is the body mass index in both sexes and all age groups, which is supported by the high values of correlation coefficients.

Has high predictive value and fold tricipital, and the abdominal also body fat percentages may be used as predictive factors for the areas and volumes of fat.

Highly significant correlations between anthropometric variables and adipose tissue areas and volumes calculated by imaging methods, demonstrating the importance and value still current anthropometric methods to quantify body fat.

References

1. Baumgartner, R.N., Heymsfield, S.B., Lichtman, J., Wang, J., Pierson, R.N. Body composition in elderly people: effect of criterion estimates on predictive equations. *Am. J. Clin. Nutr.* 53: 1345-1353, 1991
2. Movsesyan, L., Tankó, L.B., Larsen, P.J., Christiansen, C., Svendsen, O.L. Variations in percentage of body fat within different BMI groups in young, middle-aged and old women. *Clin Physiol Funct Imaging.* 23(3):130-133, 2003
3. Wang, J., Gallagher, D., Thornton, J.C., Yu, W., Weil, R., Kovac, B., Pi-Sunyer, F.X. Regional body volumes, BMI, waist circumference, and percentage fat in severely obese adults. *Obesity* 15: 2688-2698, 2007
4. Han, T.S., McNeill, G., Seidell, J.C., Lean, M.E. Predicting intraabdominal fatness from anthropometric measures: the influence of stature. *Int. J. Obes. Relat. Metab. Disord.* 21: 587-593, 1997
5. Greenfield, J.R., Samaras, C., Chisholm, D.J., Campbell, L.V. Regional intrasubject variability in abdominal adiposity limits usefulness of computed tomography. *Obes. Res.* 10: 260-265, 2002
6. Nordhamn, K., Sodergren, E., Olsson, E., Karlstrom, B., Vessby, B., Berglund, L. Reliability of anthropometric measurements in overweight and lean subjects: consequences for correlations between anthropometric and other variables. *Int. J. Obes. Relat. Metab. Disord.* 24: 652-657, 2000
7. Arden, C.I., Janssen, I., Ross, R., Katzmarzyk, P.T. Development of health related waist circumference thresholds within BMI categories. *Obes. Res.* 12: 1094-1103, 2004
8. Garcia, A.L., Wagner, K., Horthorn, T., Koebnick, C. Improved prediction of body fat by measuring skinfold thickness, circumferences, and bone breadths. *Obes. Res.* 13: 626-634, 2005

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