153 - ANALYSIS OF THE PERCEPTUAL OF BODY FAT OBTAINED BY DIFFERENT METHODS OF ASSESSMENT (ANTHROPOMETRY AND OF HYDROSTATIC WEIGHING)

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INTRODUCTION

The assessment of body composition is an indispensable procedure for several health professionals, in relation to the excess of body fat that is frequently associated with metabolic alterations or low levels of fat associated with hormonal problems to men and women.

The fat mass and the thin mass are two components of the body composition and their predictions become indicative of fundamental importance, because through these ones the current status of the evalued is known and in order to reach the purpose from the information obtained and the objectives of this a training is structured so that the drawn goals are reached.

There are many sophisticated indirect methods to assessment the body fat, however, a lot of times, these methods cannot be use in a routine of assessment, because are necessary expensive equipments, they spend a considerable time and they need highly qualified professionals, as for instanee DEXA. However, there are other simpler methods that can be used for the assessment of body fat, such as hydrostatic weighting (HW) and anthropometry.

HW is a method thoroughly used and considered highly accurate. In agreement with Foss et al. (2000) the techniques anthropometrics and HW are the most accessible methods for many health professionals area and to those ones that specifically, work with the development/refirenement of physical fitness. Nonetheless, most of times, the HW, becomes an unviable method in function of necessary physical infrastructure (tank with heating of water and scale coupled) to HW method can be used to the estimate of the body fat.

On the other hand, from the use of the anthropometry we can also quantify the body fat in simple and practical way. The anthropometric method includes common techniques, it uses economical materials, because it demands experience and domain of the measure technique regarding the obtaining of data of skinfolds (SF), body circumferences (C), bone diameters, and so on.

Through the data obtained in the anthropometric method the perceptual of body fat (%BF) can be estimate through equations, as specific as generalized. It's important to emphasize that the use specific equations consider the characteristics of the population that gave it origin to and these specific equations have to be used to similar groups. Otherwise the results are not reliable, and underestimation or overestimation of the% BF can happen.

Among the anthropometrics techniques that one which use the measures of circumferences we made special reference to dispose of a metric tape. Therefore it characterized a viable and economical form to predict the %BF that can be used in a assessment of great number of individuals. In relation to the use of the measures of circumferences, authors like Guedes & Guedes (2006), refer to the fragility of this methods while variable predicted of the amount of body fat due to the fact that when circumferences are measured, their dimensions include other tissue and organs besides the fat tissue. Queiroga (2005) is against to this view, he relates that the technique can give precise information regarding the body composition. In addition, it can be more simple to be used if it is compared with other methods and/or techniques, like HW and SF.

Considering the information above and base in the above exposed and considering that information on the applicability of the most usual methods, in relation to the estimation of the body fat, they are valuable for professionals that make use of the same techniques ones. The present study has objective verifies there is difference between the values of %BF obtained by the methods anthropometric (through the techniques of SF and C) and of HW.

MATERIALS AND METHODS

In the *Laboratório de Cineantropometria do Centro de Educação Física e Desportos* of *Universidade Federal de Santa Maria CEFD/UFSM*, physically active university students, 13 women and 23 men, accomplished voluntarily the following procedures: a) signature of the Informed Consent and Enlightned Term; b) anthropometric assessment; and c) hydrostatic weighting.

Assessment anthropometric - the evaluated students were subjected to the following mensurations: the) body mass (Arja balance of transom with resolution of 0,100 kg) and stature (wooden toll with resolution of 0,5 cm); c) SF (scientific caliper of the mark Cescorf™ with resolution of 0,1 mm): it was realized the of biceps, triceps, subscapular, midaxillary, suprailiac, vertical abdominal, thigh and calf skinfolds mensurations; d) corporal circumferences (metric tape with accuracy of 1mm): it was measured the circumferences of the forearm, abdomen (umbilical scar), waist, hip, superior thigh and calf; and e) bone diameters (caliper rule of metal bar accuratecy of 0,01 mm): it was measured the diameters knee and wrist.

Making use of the results obtained in the anthropometric assessment of C and of SF associated to C, it was estimated the men's and women's corporal density based on equation by Jackson et. al (1978; 1980), transforming it, in %BF through the Lohman's (1986) equations. In relation to C, three equations were used to estimate the %BF, based on the obtained data. The generalized protocol were used (GC) was McArdle et al. (2003) for men and women, and the specific protocols (SC) were Tran & Weltman (1989 apud HEYWARD, 2004) for women and Wilmore and Behnke (1969 apud QUEIROGA, 2005) for men.

Hydrostatic Weighting - Filizola balance, with maximum capacity of 6 kg and divisions of 50g, was used to this method, in which a PVC platform was coupled, submerged in a tank with 1,71m for 1,50m of diameter. The mensuration was accomplished in agreement with the instructions proposed by Heyward (2004). In other words, the water of the tank must be between 34º and 36º C, and the subjects should wear light swimming clothes, have their empty void and eliminated the possible maximum of gases and feces before the test, have ingested no meal about two and a half hours before the procedure, assume the seating position in the chair, start the maximum expiration in the same time that start the immersion in the water, inclinate the trunk towards portion previous of the thighs. After the accomplishment of the attempts (between 3 and 10) of well successful weightings, it was made the average of the three biggest weights, considering this as the result of underwater weight.

To esteem the corporal density through HW the following equation was used (GOLDMAN & BUSKIRK, 1961 apud MAUD & FOSTER, 1995):

$$Db\ (g/cc) = \frac{Wa}{(Wa - Ww) - (RV + 100)}{Dw}$$

Where:
Db = body density
Wa = body weight in the air (kg)
Ws = body weigh in water (kg)
Dw = density of the water in the effective temperature (g/ml)
RV = residual lung volume (ml) estimed through equations proposed by McArdle et al. (2003)
Based on the results of Db, it was calculate the %BF of the subjetcs through the Lohman's (1986) equations.
The obtained data were analyzed using the Test t of Student for paried samples, adopting as significance level 5%.

RESULTS AND DISCUSSION

Physically active university students, 23 men (MG) and 13 women (FG) were analyzed in this study, whose characteristics (average and shunting line standard) they are presented in table 1.

Table 1 - Caracterization of the studied groups occording to age, corporal mass and stature.

	G M		GF	
	Average	Shunting line standard (DP)	Average	Shunting line standard (DP)
	21,90	2,28	20,92	1,70
ure (cm)	176,11	6,26	162,47	3,61
ght (kg)	73,98	8,54	57,22	6,96

Considering the objective proposed in the present study, it was obtained data considering the estimate body fat in MG and FG in function of the different methods [anthropometric (SF+C and C) and HW]. The results (average and shunting line standard) are presented in table 2.

Table 2 - Results of %BF obtained through of anthropometry [equations using SF and C (A-SF+C), generalized equations using C (A-GC) and specific equations using C (A-SC)]

Method	GM		GF	
	Average	Shunting line standard (DP)	Average	Shunting line standard (DP)
HW	14,36[a]	5,38	19,18[a]	5,57
A-SF+C	12,02[b]	4,40	24,25[b]	5,08
A-CG	16,09[c]	5,86	23,78[b]	5,53
A-CE	09,30[d]	2,78	25,95[b]	4,87

a, b, c, d data different statistically. Adopted significance level 5%.

When observing the results presented in the table above, we verified that all the values of %BF for the investigated methods are different statistically (HW vs A-GC p <0,05; HW vs A-SF+C, HW vs A-SC, A-SF+C vs A-GC, A-SF+C vs A-SC, A-GC vs A-SC p <0,01), when considering GM. In relation to GF, the %BF appeared different statistically (HW vs A-GC p<0,05; HW vs A-SF+C, HW vs A-SC p <0,01) when the two methods were considered, however, when analyzed the anthropometric method, it was observed that the estimate results, considering the different techniques and/or equations, did not differ significantly among themselves.

As for the use of HW, it is known that the %BF estimate can have a mistake around 3,7% for to the men and 2,9% for women, in function of adopting the indirect determination of the residual volume (RV). The literature (MORROW et al., 1986; WILMORE & BEHNK, 1968; TERAN et. al, 1991 apud QUEIROGA, 2005) presents such consideration in function of the equations used for the calculations, starting from the obtained dada in the HW, they have been originated with base in values of RV obtained by the technique of dilution of nitrogen, oxygen or helium. Nevertheless, this procedure is, most of the time, unviable to be adopted in an evaluation routine, in function of the high cost and of the need of sophisticated equipments. However, it cannot be attributed to this fact the discrepancy of the results, particularly when it is made reference to GM, which did not present similarity among none of the methods and/or adopted techniques.

In relation to the use of C as means to estimate the relative body fat Durnin & Rahaman (1967) emphazise its advantage to enable the reduction of the intra and inter-appraisers measurement mistake, being still, considered by the authors, more reproductive than when the use of SF is made, because it requests smaller technical ability for the measurement besides being adapted to evaluate obese individuals. The anthropometric method shown itself more appropriate to estimate the %BF of FG here analyzed, presenting a variation among the used techniques and/or equations, statistically not significant, from 0,47 to 2,17 percentile points. It is speculated that the same did not happen with MG, because it takes care of young, active individuals, and that can present a more developed muscular mass, being likely to interfere in the estimate of the %BF, because larger perimeters, in this specific case, may not be related with larger corporal adiposity.

Making reference to the specific equation used starting from the obtaining of the data of C, it is pointed out that a limitation of the same exists, concerning only the age group of the people to be evaluded, facilitating its use, because according to Guedes & Guedes (2006), the larger the specificity of the equation, smallest is its application. This applicability becomes even wider, allowing a great number of subjects to be evaluded, regardless of their personal characteristics, as age or level of adiposity, when it generalized equations are used (QUEIROGA, 2005), as the proposal in the present investigation.

CONCLUSION

Based in the obtained data and considering the appraised groups, it is concluded that the prediction of the %BF can be made starting from circumferences values of certain segments, being able, in this case, to use specific equations or generalized equations when the evaluded public is composed by women. Considering the facility in the application of the technique of circumferences and in the obtaining of the results, the obtained information translates itself in an useful tool for the professionals that make use of the corporal composition evaluation. In relation to the masculine public the obtained data was not conclusive, being necessary for that, an deepening of the investigations.

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ANALYSIS OF THE PERCEPTUAL OF BODY FAT OBTAINED BY DIFFERENT METHODS OF ASSESSMENT (ANTHROPOMETRY AND OF HYDROSTATIC WEIGHING)

ABSTRACT

This study was aimed at verifying if there is difference among the values of perceptual of body fat (%BF) obtained by the methods anthropometric [through the techniques of skinfolds (A-SF+C) and circumferences - generalized equations (A-GC) and specific (A-SC)] and of hydrostatic weighing (HW). Physically active university students were assessed, divided into 2 groups: 23 men (MG) (age of 21,90±2,28, stature of 176,11±6,26cm, 73,98±8,54kg), 13 women (GF) (age of 20,92±1,70, stature of 162,47±3,61cm, 57,22±6,96kg). According to the results obtained all the values of %GC for the methods investigated differed statistically (HW vs A-GC p <0,05; HW vs A-SF+C, HW vs A-SC, A-SF+C vs A-GC, A-SF+C vs A-SC, A-GC vs A-SC p <0,01), when considering MG. In relation to FG the %BF became statistically different HW vs A-GC (p <0,05), HW vs A-SF+C (p <0,01) and HW vs A-SC (p <0,01) when the two methods were considered, however, when analyzed the anthropometric method it was observed that the valued results, considering the different techniques and/or equations, did not differ significantly among themselves. Concerning the obtained data and evaluated groups, it is conclued that the prediction of the %BF can be made from values of circumferences, being able to use specific or generalized equations when the evaluated public was composed of women. Considering the facility in the application of the technique of circumferences and in the obtaining of the results, the obtained information becames an useful tool for the professionals that make use of the assessment of body composition. In relation to the masculine public the obtained data were not conclusive being necessary further investigations.

Keywords: perceptual of body fat, assessment methods, men and women.

ANALYSE DU POURCENTAGE DE GRAISSE CORPORELLE OBTENUE PAR DIFFÉRENTES MÉTHODES D'ÉVALUATION (ANTHROPOMÉTRIQUE ET PAR PESÉE HYDROSTATIQUE)

RÉSUMÉ

Le but de cette étude a été de vérifier s'il existe une différence entre les valeurs de pourcentage de graisse corporelle (%GC) obtenues par les méthodes anthropométriques [par des techniques de plis cutanés (A-PC+C) et circonférences - équations généraliséss (A-CG) et spécifiques (A-CS)] et de pesée hydrostatique (PH). Nous avons analysé des étudiants universitaires, physiquement actifs, divisés em deux groupes: masculin (GM) (n= 23, âge=21,90±2,28 ans, taille=176,11±6,26cm et masse corporelle=73,98±8,54 kg) et féminin (n=13, âge=20,92±1,70 ans, taille=162,47±3,61cm et massa corporelle=57,22±6,96kg). Selon les résultats obtenus, toutes les valeurs de %GC évaluées par les méthodes analysées sont différentes statistiquement (PH *vs* A-CG p<0,05; PH *vs* A-PC+C, PH *vs* A-CE, A-PC+C *vs* A-CG, A-PC+C *vs* A-CE, A-CG *vs* A-CE p<0,01) pour ce qui est du GM. Par rapport au GF o %GC a été statistiquement différent PH *vs* A-CG (p<0,05), PH *vs* A-PC+C (p<0,01) e PH *vs* A-CE (p<0,01) lorsque l'on a considéré les deux méthodes. Cependant en analysant la méthode anthropométrique, on a observé que les résultats estimés en considérant les différentes techniques et/ou équations, n'ont pás différé de façon significative entre eu. Em ayant camme base les données obtenues et en considérant les groupes étudiés, on a conclu que la prédiction du %GC peut être faite a partir de valeurs de circonférences de segments determinés nous pouvons pour cela utiliser des équations spécifiques ou dês équations généralisées lorsque lê public étudié est composé de femmes. Em considérant l'aspect pratique dans l'application de la technique de circonférences et dans l'obtention des résultats, les informations obtenues deviennent um outil utile pour les professionnels qui utilisent l'évaluation de la composition corporelle. Pour ce qui est du public masculin, les données obtenues n'ont pas été concluantes, il sera donc nécessaire de continuer les recherches.

Mots clés: pourcentage de graisse corporelle, méthode d'évaluation, hommes et femmes.

ANáLISIS DEL PORCENTUAL DE GRASA CORPORAL OBTENIDO POR DIFERENTES MéTODOS DE EVALUACIóN (ANTROPOMéTRICO Y DE PESAJE HIDROSTáTICO)

RESUMEN

Con el presente estudio se propuso a verificar si hay diferencia entre los valores del porcentual de grasa corporal (%GC) obtenidos por los métodos antropométricos [por medio de técnicas de dobladuras cutáneas (A-DC+C) y circunferencias - ecuaciones generalizadas (A-CG) y específicas (A-CE)] y de pesaje hidrostático (PH). Fueron evaluados estudiantes universitarios, físicamente activos, divididos en 2 grupos: masculino (GM) (n=23, edad=21,90±2,28años, estatura=176,11±6,26cm y masa corpórea=73,98±8,54kg) y femenino (GF) (n=13, edad=20,92±1,70años, estatura=162,47±3,61cm y masa corpórea=57,22±6,96kg). De acuerdo con los resultados obtenidos todos los valores de %GC estimados por los métodos investigados son diferentes estáticamente (PH *vs* A-CG p<0,05; PH *vs* A-DC+C, PH *vs* A-CE, A-

DC+C *vs* A-CG, A-DC+C *vs* A-CE, A-CG *vs* A-CE p<0,01), al considerar el GM. En relación al GF el %GC se presentó estáticamante diferente PH *vs* A-CG (p<0,05), PH *vs* A-DC+C (p<0,01) y PH *vs* A-CE (p<0,01) cuando fueron considerados los dos métodos, sin embargo, al analizar el método antropométrico se observa que los resultados estimados, considerando las diferentes técnicas y/o ecuaciones, no se difirieron significativamente entre sí. Con base en los datos obtenidos y considerándose los grupos evaluados, se concluye que la predicción del %GC puede ser hecha a partir de valores de circunferencia de determinados segmentos, siendo posible, por tanto, utilizar ecuaciones específicas o ecuaciones generalizadas cuando el público evaluado sea compuesto de mujeres. Considerando la practicidad en la aplicación de la técnica de circunferencia y la obtención de los resultados, las informaciones obtenidas se traducen en una herramienta útil para los profesionales que hacen uso de la evaluación de la composición corporal. En relación al público masculino los datos obtenidos no fueron conclusivos siendo necesario que se haga una profundización de las investigaciones.

Palabras-clave: porcentual de grasa corporal, métodos de evaluación, hombres y mujeres.

ANÁLISE DO PERCENTUAL DE GORDURA CORPORAL OBTIDO POR DIFERENTES MÉTODOS DE AVALIAÇÃO (ANTROPOMÉTRICO E DE PESAGEM HIDROSTÁTICA)

RESUMO

Objetivou-se com o presente estudo verificar se existe diferença verificar se existe diferença entre os valores de percentual de gordura corporal (%GC) obtidos pelos métodos antropométrico [através das técnicas de dobras cutâneas (A-DC+C) e circunferências - equações generalizadas (A-CG) e específicas (A-CE)] e de pesagem hidrostática (PH). Avaliaram-se estudantes universitários, fisicamente ativos, divididos em 2 grupos: masculino (GM) (n=23, idade=21,90±2,28anos, estatura=176,11±6,26cm e massa corpórea=73,98±8,54kg), e feminino (GF) (n=13, idade=20,92±1,70anos, estatura=162,47±3,61cm e massa corpórea=57,22±6,96kg). De acordo com os resultados obtidos todos os valores de %GC estimados pelos métodos investigados são diferentes estatisticamente (PH *vs* A-CG p<0,05; PH *vs* A-DC+C, PH *vs* A-CE, A-DC+C *vs* A-CG, A-DC+C *vs* A-CE, A-CG *vs* A-CE p<0,01), ao considerar o GM. Em relação ao GF o %GC apresentou-se estatisticamente diferente PH *vs* A-CG (p<0,05), PH *vs* A-DC+C (p<0,01) e PH *vs* A-CE (p<0,01) quando foram considerados os dois métodos, no entanto, ao analisar o método antropométrico observa-se que os resultados estimados, considerando as diferentes técnicas e/ou equações, não diferiram significativamente entre si. Com base nos dados obtidos e considerando-se os grupos avaliados, conclui-se que a predição do %GC pode ser feita a partir de valores de circunferências de determinados segmentos, podendo para tanto utilizar equações específicas ou equações generalizadas quando o público avaliado for composto de mulheres. Considerando a praticidade na aplicação da técnica de circunferências e na obtenção dos resultados, as informações obtidas traduzem-se em uma ferramenta útil para os profissionais que fazem uso da avaliação da composição corporal. Em relação ao público masculino os dados obtidos não foram conclusivos sendo necessário para tanto, um aprofundamento das investigações.

Palavras-chave: percentual de gordura corporal, métodos de avaliação, homens e mulheres.