# 75 - RELATIONSHIP AMONG NUTRITIONAL STATUS, BODY FAT PERCENTAGE AND CARDIOVASCULAR FITNESS FOR ADULT INDIVIDUALS.

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## INTRODUCTION

Epidemiological studies conducted recently found changes in lifestyle and eating habits in the last decades due to urbanization and industrialization. In association, the increased availability of food and less physical activity resulted in alarming changes in the level of adiposity in developed and developing countries in all around the world and constitute a preoccupation for health (LERARIO et al., 2002). The main result of these transformations in lifestyle is a higher incidence of overweight and obesity, independently of age observed.

Risk conditions present due to a frame of obesity in childhood and adolescence tend to express in adult life, occurring the develop of diseases like hypertension and obesity (ROSA et al., 2007). Because of this, it is necessary to monitor changes in body fat over a lifetime (POWERS and HOWLEY, 2000).

Given the influence of body fat in the state of health of individuals, methods are needed that can assess accurately and reliably, the amount of body fat relative to total body mass (REZENDE et al., 2006). Obesity has been identified by some methods, the most frequently used have the Body Mass Index (BMI) and Fat Percentage.

BMI is commonly used in epidemiological studies, public health and clinical area due to its easy application (ACSM, 2003). According to Powers and Howley (2000), one of the main problems associated with this method is that there is no way of knowing the actual body composition, irrespective of muscle and fat, thus false results can occur.

The skinfold method has also been widely employed in the study of body composition, in order to predict relative body fat and fat mass using regression equations (MACHADO and BARILLO, 2005) and also because of its wide applicability and low cost operational (GUEDES and GUEDES, 2003). The calculation of body fat percentage using skinfold thickness provides more precise estimates, because unlike the BMI are direct measurements of subcutaneous fat (ACSM, 2003).

Thus, high body weight deserves special mention among the risk factors for cardiovascular disease, these being among leading causes of mortality in most industrialized countries (BANZ et al., 2002). Since this is a predisposing factor for hypertension, may be responsible for a high incidence of hypertension directly attributable to overweight and obesity (MARTINS et al., 2010). The comparative analysis between the Brazilian research showed an increase of the disease in women and obese men (TADDEI, 1995).

Low or excessive body fat can cause several systemic disorders, and the variation of the anatomical distribution of body fat is an important morphological indicator (GRAVES and Franklin, 2006). The effective participation of the excessive amount of visceral fat in metabolic balance is related to endocrine and metabolic complications that predispose to the emergence and development of cardiovascular diseases, increasing rates of mortality due to disease and its consequences, such as coronary artery disease (SILA et al., 2006).

According to Graves and Franklin (2006), blood pressure (BP) and heart rate (HR) are important parameters in evaluating the cardiovascular system, for its proper maintenance is essential to allow for the exchange of nutrients and excrete the proper functioning of the body. Studies also have found that overweight and obesity are strongly associated with elevated blood pressure.

Given the above findings, the present study has as main objective correlate nutritional status with the variables of physical fitness related to health.

## METHODS

This research characterized as cross-sectional descriptive (THOMAS et al., 2007), conducted with 1323 individuals in the city of Maringá - PR, Brazil, from January to December 2009, and 481 (36.36%) female and 842 (63.64%) males. Data were collected from the evaluation sheets of freshmen in the sport of bodybuilding an academy of that city, carried out by trained professionals and skilled in order to minimize the error within and between raters.

Were analyzed the following anthropometric variables: gender, age, weight, stature, percentage body fat (%BF) and BMI, and cardiovascular fitness variables related to health: heart rate (HR), systolic blood pressure (systolic BP) and diastolic blood pressure at rest (diastolic BP). Skinfold measurements were performed according to the guidelines of Petroski (2003), and its estimated calculation based on the equation proposed by Jackson an Pollock (1978) and classified according Lohman (1992).BMI was obtained respecting the reason (BMI = weight / stature ²) and the classification recommended by WHO (1995) and systolic and diastolic BP classified according to Brazilian Guidelines on Hypertension (2002).

The data were organized in Microsoft Excel 2007® spreadsheet to obtain the mean and standard deviation, is also submitted to descriptive statistics (t-test and $X^2$) in SPSS®. To search for an association between the method used to identify the nutritional status and fitness, we calculated the correlation coefficient of Pearson (r) were considered significant at $p \leq 0.05$.

## RESULTS AND DISCUSSION

Table 01 presents the overall scores obtained from both sexes as well as the general sample, and values are expressed as mean and standard deviation. It was found that the male population had the highest average height, weight and resting BP. Since the female population had higher rates of age, BMI,% BF and HR at rest, significant differences among genders in Weight, BMI and HR. ($P < 0.0001$).

**Table 01.** General characteristics of the sample (mean and standard deviatation).

| Variables | Female | Male | Total |
|---|---|---|---|
| Age (decimal) | 21,54 ± 2,96 | 21,45 ± 2,95 | 21,48 ± 2,95 |
| Stature (m) | 1,63 ± 9,64 | 1,75 ± 12,62 | 1,71 ± 13,03 |
| Weight (Kg)* | 58,34 ± 9,77 | 73,60 ± 12,11 | 68,06 ± 13,48 |
| BMI (Kg/m$^2$)* | 21,79 ± 3,20 | 23,68 ± 3,31 | 23,00 ± 3,39 |
| %BF* | 26,45 ± 6,28 | 15,58 ± 6,97 | 19,52 ± 8,52 |
| BP | 110/90 ± 11,02 | 124/10 ± 12,12 | 120/80 ± 12,51 |
| HR* | 88,72 ± 12,50 | 81,66 ± 13,23 | 84,22 ± 13,41 |

*significative difference (p<0,0001).

Table 02 shows the classification of individuals according to BMI, according to WHO (1995). With the same analysis it appears that most individuals of both populations are within the range considered normal, with 76.30% and 67.69% for women and men respectively. The proportion of individuals who present a state of overweight and obesity was higher in the male population, significant differences between genders in the category of normal and overweight.

These findings differ from other similar studies conducted in other brazilian's region populations, and this and on this as a whole and also in other countries regions where the proportion of overweight and obesity was higher than that obtained in this study (BOSSAN et al., 2007; VELÁSQUEZ-MELÉNDEZ, 2004; IBGE, 2004; WHO, 2000; CDC, 2003).

**Table 02.** Sample classification according BMI.

| | Female | | Male | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Low Weight | 54 | 11,23 | 27 | 3,21 | 81 | 6,12 |
| Normal* | 367 | 76,30 | 570 | 67,69 | 937 | 70,82 |
| Overweight* | 49 | 10,19 | 212 | 25,17 | 261 | 19,73 |
| Obesity | 11 | 2,28 | 33 | 3,93 | 44 | 3,33 |

*significative difference (p<0,0001).

The table 03 shows the classification of %BF according to Lohman (1992). It was found that most women find themselves with percent body fat considered above average (47.61%) and the majority of the men meets securities classified as below average (46.09%). When applied the chi-square difference was found between genders only in the category Below Average.

Therefore, since the %BF an important index for the identification of the risk to health associated with very low or excessive body fat and intra-abdominal (HEYWARD and STOLARCZYK, 2000), with the data obtained there was a higher incidence of overweight and obesity in that population, when compared with data obtained with BMI, but the majority of the male population has values considered below average. The highest figures were contacted in the female population, this fact is considered normal in view of the typical characteristics of body composition in female subjects (MCARDLE et al., 1998).

**Table 03.** Sample classification according %BF.

| | Female | | Male | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Very Low | 0 | 0,00 | 30 | 3,57 | 30 | 2,27 |
| Below Mean* | 131 | 27,23 | 388 | 46,09 | 519 | 39,23 |
| Mean | 32 | 6,65 | 60 | 7,12 | 92 | 6,95 |
| Above mean | 229 | 47,61 | 277 | 32,89 | 506 | 38,25 |
| Very High | 89 | 18,51 | 87 | 10,33 | 176 | 13,3 |

*significative difference (p<0,0001).

Table 04 presents the results of data analysis through the correlation coefficient of Pearson (r) were considered significant at $p \leq 0.05$.

**Table 04.** Obtained values of correlation and significancy.

| Variables | r | p |
|---|---|---|
| BMI x %BF | r = 0,39935 | p<0,001 |
| BMI x HR | r = -0,04782 | p>0,05 |
| BMI x systolic BP | r = 0,31615 | p<0,01 |
| BMI x diastolic BP | r = 0,24158 | p<0,01 |
| %BF x HR | r = 0,21853 | p<0,05 |
| %BF x systolic BP | r = - 0,08147 | p>0,05 |
| %BF x diastolic BP | r = - 0,04671 | p>0,05 |

After statistical analysis we obtained a correlation among the BMI and systolic BP (r = 0.31, p <0.01), BMI and diastolic BP (r = 0.24, p <0.01), %BF and HR (r = 0.22, p <0.05) and BMI and %BF (r = 0.39, p <0.01). There was correlation among BMI and HR and among %BF and systolic and diastolic rest BP.

Thus, one can observe that BMI scores are positively correlated with indices of blood pressure and %BF with a resting heart rate, however, worth noting that this indicates that the variables have correlated an increase in the same direction but does not indicate that successive increases in one variable cause successive increases in the other variable (VIEIRA, 2008).

Although it was a significant correlation between BMI and %BF, studies confirm that BMI does not classify any individual incorrectly as overweight, but fails to qualify as a series of obese individuals (CHIARA et al,. 2003; REILLY et al. 2000).

**FINAL CONSIDERATIONS**

It is possible to conclude, therefore, that in accordance with the rates obtained in the population, the BMI has a significant correlation with blood pressure and %BF with CF. Thus, a body fat index within the normal range is necessary for the maintence of health status, as well as for optimal functioning of cardiac work capacity, and measures of prevention and awareness should appear among the most important priorities of the Publicly Health Authorities.

**REFERENCES**

**American College of Sports Medicine. Manual de pesquisa das diretrizes do ACSM para os testes de esforço e sua prescrição**. 4 ed. Rio de Janeiro. Guanabara Koogan S.A., 2003.

BANZ, W.J.; MAHER, M.A.; THOMPSON, W.G. et al. **Effects of resistance versus aerobic training on coronary artery disease risk factors**, 2002.

BOSSAM, F. M.; ANJOS, L. A.; VASCONCELLOS, M. T. L.; WAHRLICH, V. **Nutritional status of the adult population in Niterói,** Rio de Janeiro, Brazil: the Nutrition, Physical Activity, and Health Survey. Cad. Saúde Pública, Rio de Janeiro, 23(8), 2007.

**Centers for Disease Control and Prevention. Prevalence of physical activity, including lifestyle activities among adults** – United States, 2000-2001. Morb Mortal Wkly Rep. 52, 2003.

CHIARA V.; SICHIERI, R.; MARTINS, Patrícia D. **Sensibilidade e especificidade de classificação de sobrepeso em adolescentes,** Rio de Janeiro. Revista de Saúde Pública, v. 37, n. 2, 2003.

GUEDES, D.P; GUEDES, J.E.R.P. **Controle do peso corporal: composição corporal, atividade física e nutrição.** Rio de Janeiro, Ed. Shape, 2003.

**Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2002-2003: análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil.** Rio de Janeiro: Instiuto Brasileiro de Geografia e Estatística; 2004.

HEYWARD, V.H., STOLARCZYK, L.M. **Avaliação da composição corporal.** São Paulo: Manole, 2000.

KYLE, U.G.; BOSAEUS, I.; DEURENBERG, A.D.L.P. et al. **Bioelectrical impedance analysis – part 1: review of principles and methods.** Clinical Nutrition, v.23, p.1226-1243,2004.

LERARIO, D.D.G.; GIMENO, S.G.; FRANCO, L.J. et al. **Excesso de peso e gordura abdominal para a síndrome metabólica em nipo-brasileiros.** Rev Saúde Pública, v.16, n.1, p.4-11, 2002.

LOHMAN, T.G. **Advances of body composition assessment.** Champaign, Illinois: Human Kinetics, 1992.

POWERS, S.K. e HOWLEY, E.T. **Fisiologia do Exercício Teoria e Aplicação ao Condicionamento e ao Desempenho**. 3 ed. Barueri. Manole LTDA, 2000.

REILLY, J.J., DOROSTY, A.R., EMMETT, P.M. et al. **Identification of the obese child: adequacy of the body mass index for clinical practice and epidemiology.** Int j Obes Relat Metab Disord, v.24: 1623-1627,2000.

REZENDE, F.A.C.; ROSADO, L.E.F.P.L.; PRIORE, S.E. et al. **Aplicabilidade de equações na avaliação da composição corporal da população brasileira**. Rev Nutr, v.19, n.3, 357-367, 2006.

ROSA, M.L.G.; MESQUITA, E.T.; ROCHA, E.R.R. et al. **Body mass índex and waist circumference as markers of arterial hypertension in adolescents**.

Arq Bras Cardiol, v.88, n.5, p.508-513, 2007.

SILVA, J.L.T.; BARBOSA, D.S.; OLIVEIRA, J.A. et al. **Distribuição centrípeta da gordura corporal, sobrepeso e aptidão cardiorrespiratória: Associação com sensibilidade insulínica e alterações metabólicas**, 2006.

MCARDLE,W.D. KATCH, F.I., KATCH, V.L. **Fisiologia do exercício: energia, nutrição e desempenho humano.** 4ed. Guanabara Koogan, 1998.

MACHADO, A. F; BARILLO, J. **Estudo comparativo entre dois diferentes tipos de compasso de dobras cutâneas.** Anais da sessão científica. FIEP. 2005, (1):102.

MALAVOLTI, M.; MUSSI, C.; POLI, M.; et al. **Cross-calibration of eight-polar bioelectrical impedance analysis versus dual-energy X-ray absorptiometry for the assessment of total and appendicular body composition in healthy subjects aged 21–82 years.** Annals of Human Biology, v.30, n.4, p. 380-391, 2003.

MARTINS, M.C.C.; RICARTE, I.F.; ROCHA, C.H.L. et al. **Pressão arterial, excesso de peso e nível de atividade em estudantes de Universidade Pública.** Arq Bras Cardiol, v.95, n.2, p.192-199, 2010.

TADDEI, J.A. **Obesidade na Infância e na Adolescência. Epidemiologia da Obesidade na Infância.** In: FISBERG, M. São Paulo: Fundação BYK, 1995.

THOMAS, J.R.; NELSON, J. K.; SILVERMAN, S. J. **Métodos de Pesquisa em Atividade Física.** 5 ed. Porto Alegre: Artmed, 2007.

VELÁSQUEZ-MELÉNDEZ, G., PIMENTA, A.M.; KAC, G. **Epidemiologia do sobrepeso e da obesidade e seus fatores determinantes em Belo Horizonte (MG),Brasil: estudo transversal de base populacional.** Rev Panam Salud Publica/Pan Am J Public Health 16(5), 2004.

World Health Organization. **Obesity: preventing and managing the global epidemic. Report of a WHO consultation.** Geneva: World Health Organization; 2000. (WHO Technical Report Series, 894).

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**RELATIONSHIP AMONG NUTRITIONAL STATUS, BODY FAT PERCENTAGE AND CARDIOVASCULAR FITNESS FOR ADULT INDIVIDUALS.**

**ABSTRACT**

Epidemiological studies conducted recently found changes in lifestyle and eating habits in the last decades due to urbanization and industrialization, resulting in an increase in cases of overweight and obesity. Low or excessive body fat can cause several systemic disorders, and the variation of the anatomical distribution of body fat an important morphological indicator. BP and HR are important parameters in evaluating the cardiovascular system, as their proper maintenance is essential to allow for the exchange of nutrients and excrete the proper functioning of the body. Thus, this research has the main objective correlate indices of nutritional status and body fat percentage to those with the aptitude variables related to cardiovascular health. The research as a descriptive study conducted in the city of Maringá-PR, were evaluated 1323 adults, being 481 women and 842

men. Statistical analysis involved Student t tests, chi-square ($X^2$) and linear correlation coefficient of Pearson (r). Thus, one can observe that BMI scores are positively correlated with indices of blood pressure and %BF with a resting heart rate. Therefore, maintaining a body fat index within the normal range is necessary for the maintenance of health status, as well as for optimal functioning capacity of cardiac work.

**KEYWORDS**: Nutritional Status, Fitness and Correlation.

**CORRÉLATION ENTRE L'ÉTAT NUTRITIONNEL, POURCENTAGE DE GRAISSE CORPORELLE ET LA SANTÉ CARDIOVASCULAIRE DES ADULTES.**

**RÉSUMÉ**

Les études épidémiologiques menées récemment constaté des changements dans le mode de vie et les habitudes alimentaires dans les dernières décennies en raison de l'urbanisation et l'industrialisation, ce qui entraîne une augmentation des cas de surpoids et d'obésité. Low ou de la graisse du corps excessive peut causer plusieurs maladies systémiques, et la variation de la distribution anatomique de la graisse corporelle un indicateur important morphologiques. BP et les RH sont des paramètres importants dans l'évaluation du système cardio-vasculaire, que leur bon entretien est essentiel pour permettre l'échange de nutriments et d'excréter le bon fonctionnement du corps. Ainsi, cette recherche a pour objectif principal corrélation des indices de l'état nutritionnel et pourcentage de graisse corporelle à ceux qui ont l'aptitude variables liées à la santé cardiovasculaire. La recherche a été une étude descriptive réalisée dans la ville de Maringa-PR ont été évalués en 1323 adultes, dont 481 femmes et 842 hommes. L'analyse statistique impliqués test t de Student, corrélation chi-carré ($X^2$) et coefficient linéaire de Pearson (r). Ainsi, on peut observer que l'IMC est positivement corrélé avec les indices de la pression artérielle et BF% avec une fréquence cardiaque au repos. Par conséquent, le maintien d'un indice de graisse du corps dans la plage normale est nécessaire pour le maintien de l'état de santé, ainsi que pour la capacité de fonctionnement optimal du travail cardiaque.

**MOTS-CLÉS:** l'état nutritionnel, la condition physique et de corrélation.

**LA CORRELACIÓN DEL ESTADO NUTRICIONAL, PORCENTAJE DE GRASE CORPORAL Y LA SALUD CARDIOVASCULAR DE LOS ADULTOS.**

**RESUMEN**

La correlación del estado nutricional, porcentaje de grasa corporal y la salud cardiovascular de los adultos. Los estudios epidemiológicos realizados recientemente se encuentran los cambios en el estilo de vida y los hábitos alimentarios en las últimas décadas debido a la urbanización y la industrialización, lo que resulta en un aumento de casos de sobrepeso y obesidad. Bajo o exceso de grasa corporal puede provocar varias enfermedades sistémicas, y la variación de la distribución anatómica de la grasa corporal un indicador morfológico importante. PA y la FC son parámetros importantes para evaluar el sistema cardiovascular, ya que su mantenimiento adecuado es esencial para permitir el intercambio de nutrientes y excretar el buen funcionamiento del cuerpo. Por lo tanto, este trabajo tiene como principal objetivo correlacionar los índices del estado nutricional y el porcentaje de grasa corporal a las personas con las variables de aptitud relacionados con la salud cardiovascular. La investigación fue un estudio descriptivo, realizado en la ciudad de Maringá-PR se evaluó en 1323 los adultos, con 481 hombres y mujeres 842. Análisis estadístico de los tests t de Student, correlación de chi-cuadrado ($X^2$) y el coeficiente lineal de Pearson (r). Por lo tanto, se puede observar que las puntuaciones de IMC se correlacionó positivamente con los índices de presión arterial y BF%, con una frecuencia cardíaca en reposo. Por lo tanto, mantener un índice de grasa corporal en el rango normal es necesaria para el mantenimiento del estado de salud, así como para la capacidad óptima de funcionamiento del trabajo cardíaco.

**PALABRAS CLAVE:** Estado nutricional de fitness, y correlación.

**CORRELAÇÃO ENTRE ESTADO NUTRICIONAL, PERCENTUAL DE GORDURA CORPORAL E APTIDÃO CARDIOVASCULAR DE INDIVÍDUOS ADULTOS.**

**RESUMO**

Estudos epidemiológicos realizados recentemente constataram mudanças no estilo de vida e hábitos alimentares ocorridos nas últimas décadas decorrentes da urbanização e industrialização, acarretando em aumento nos casos de sobrepeso e obesidade. Níveis baixos ou excessivos de gordura corporal podem acarretar diversas disfunções sistêmicas, sendo a variação da distribuição anatômica da gordura corporal um importante indicador morfológico. A PA e a FC são parâmetros importantes na avaliação do sistema cardiovascular, pois suas adequadas manutenções são fundamentais para permitir a realização das trocas de nutrientes e excretas apropriadas ao funcionamento do organismo. Assim, esta pesquisa possuiu como objetivo principal correlacionar os índices de estado nutricional e percentual de gordura com as com as variáveis de aptidão cardiovascular relacionadas à saúde. O delineamento da pesquisa foi descritivo de corte transversal, realizado na cidade de Maringá-PR, onde foram avaliados 1.323 indivíduos adultos, sendo 481 mulheres e 842 homens. A análise estatística envolveu os testes t de Student, Qui-quadrado ($X^2$) e o coeficiente de correlação linear de Pearson (r). Desta forma, pode-se observar que os índices de IMC possuem correlação positiva com os índices pressóricos e os de %GC com os de freqüência cardíaca de repouso. Portanto, a manutenção de um índice de gordura corporal dentro da normalidade se faz necessário para a manutenção do estado de saúde, bem como para funcionamento ótimo da capacidade de trabalho cardíaco.

**PALAVRAS CHAVE:** Estado Nutricional, Aptidão e Correlação.