11 - AEROBIC CAPACITY AS DISCRIMINANT OF FEEDING CONSUMPTION AND PHYSICAL APTITUDE

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INTRODUCTION

The sedentarism, associate to the process of aging and metabolic disorders, according to Blair and Pate (1995), causes modifications in the distribution of corporal fat and antropometric measurements of skinfolds and perimeters. Thus, these measurements are good indicators for the nutritional status of the individual, as well as the last one is an important aspect to detection of risk factors for the obesity. Therefore, a program of physical exercises must be developed concomitant with a suitable nutrition, since exercises and diet influence the composition of free fatty acids, collaborating to metabolize the total corporal fat, as well as the visceral adipose tissue, and hence, modifying the high taxes of adiposity (TURNER; LEE; BRUCE, 2004).

With the aim of analyze the corporal adiposity, Costa, Guimarães and Fonsêca (1991) developed a study of the eight skinfolds somatorium **(SS)**: subscapular (**SB**), axillary (**AX**), suprailiac (**SI**), abdominal (**AB**), tricipital (**TR)**, bicipital (**BI**), thigh (**TH)** and calf (**CA**), enabling to verify a proportional distribution in all the body. From the study of corporal adiposity is possible to determine the rate of the sum of skinfolds of trunk by the skinfolds somatorium of members (relation trunk/members - **RT/M**), which indicates the distribution, balanced or not, of the adiposity of the individual, besides the predisposing risk factors. The expected product must be the same or inferior to 1 (one) unity, which is equivalent to a balanced distribution of fat between trunk and extremity (QUEIRÓGA, 1988).

The relation waist/hip **(RW/H)**, as well as the measurement of circunference of waist **(CW)**, are also antropometric measurements strongly related to nutritional status and the levels of distribution of corporal fat of an individual, hence, predisposing facts of deposit of visceral fat, since the values of **RW/H** = 0,95 and the **CW** = 94cm, for young men, represent high risk of adverse health consequences (MELO et al. 2005). However, to know better the health conditions of an individual, is necessary to obtain quantitative information of energetic consumption and quality of feeding habits from the 24 hour recall method **(RM24)** and the questionnaire of feed frequency **(QFF)**, to determine the profile of feeding consumption (SEQUEIRA, 2000). Guedes and Guedes (1996) related that the individuals physically more active present low values of skinfolds, superior aerobic capacity and levels of cholesterol and triglyceride lesser than the less actives. On the other hand, a suitable aerobic capacity provides to the individual good maximal oxygen consumption (**VO_2max.**) and cardiovascular benefits, which provide higher quantity of nutrients and better oxygenation for the continuous muscular contractions (CAMARGO; GÖCKS, 1999). The submaximal protocol Astrand to estimate the **VO_2max.** is one validate and internationally recognized test to evaluate the functional capacity, acting as an effective discriminant and therefore an indicator of the real condition of physical aptitude of the individual. According to what was found, it is important to study the **"Aerobic capacity as discriminant of feeding consumption and physical aptitude"** to identify the alterations in the distribution of corporal fat and aerobic capacity provided by the practice of physical exercises, and consequently, to provide subsidies about the general physical aptitude of the individuals studied. Thus, contributing to the feeding reeducation and the establishment of a program of physical exercises that aims the health and improvement of life quality of individuals.

MATERIAL E METHODS

The sample was constituted by 90 university students, volunteers of male sex, from the health area of University of Pernambuco (UPE) - Recife/PE, 18-30 age range, which were presented to a term of free and clarified assent, in the Center of Sportive Excelence (CENESP/UPE) and Experimental Nutritional Laboratory of the Federal University of Pernambuco (UFPE). The sample was divided in quartis, taking the **VO_2max.** as cut point, forming 4 groups (A, B, C and D). A descriptive analysis was realized with the aim of verify the behavior of data, afterwards the t-student test, the ANOVA taking the F Snedecor statistic as reference, followed by Sheffé's test and Pearson's correlation. The level of significance adopted by the present study was p = 0,05. The software SPSS for Windows, version 11.0 analysed all samples. The variables studied are related to the nutritional aspects, **RM24** and **QFF** were applied to the antropometric parameters, verifying the corporal mass, stature, body mass index (**BMI**), the folds **SB**, **AX**, **SI**, **AB**, **TR**, **BI**, **TH**, **CA**, the **SS**, the **RT/M**, the **RW/H** and by the functional aspect, it was evaluated the **VO_2max.** The **RM24** was applied with the aim of identify the dietetic habits of students, while the **QFF** was used to identify the week frequency of ingestion of food grouped according to the table of micronutrients and macronutrients (MARTINS, 1982). To the measurement of the eight folds, it was used an adipometer Lange, of 10g/mm^2, with scale of 0,1 cm, according to Petroski (1999). The relation trunk/members (**RT/M**) was realized applying the following formula: **RT/M = SB+AX+SI+AB/TR+BI+TH+CA** (COSTA; GUIMARÃES; FONSÊCA, 1991). To the measurement of the relation waist/hip (**RW/H**), it was used a flexible measuring tape

(not elastic) with accuracy of 1 (one) milimeter, using the following equation: **CW/CH** (QUEIRÓGA, 1998). The **VO_2max.** was estimated by the submaximal effort ergometer

test, according to the Astrand protocol (POLLOCK; WILMORE, 1993). The test was realized in an electromagnetic bycicle ergometer BPM 3600 (Cateye ergociser - EC 1600), with the charge in watts.

RESULT AND DISCUSSION

Applying the ANOVA (Tables 1 and 2), it was observed a significant difference among the average values of **VO_2max.** and the antropometric variables: **SB, AX**, **SI**, **AB**, **TR**, **TH** and **CA**; **SS** and **RW/H**. It was verified that the values of **VO_2max.** (Table 1) increased in the group A related to the group D, while the **SS** decreased progressively in the group B related to the grup D, which verified a negative correlation between these two variables. The found data are in accordance with the ones of Guedes (1985), which described that a better physical condition provides significant modifications in the parameters of distribution of the corporal fat and the aerobic capacity, which are important factors to regulate and keep the physical aptitude.

TABLE 1- Antropometric variables of the (university) students, of the health area of University of Pernambuco.

Antropometric variable	GROUP A n = 21 Mean ± DP	GROUP B n = 23 Mean ± DP	GROUP C n = 26 Mean ± DP	GROUP D n = 20 Mean ± DP	Value of p(1)	Value of p(2)
Maximum consumption of oxygen	23,48 ± 2,86 a(a)	30,70 ± 1,79 b(b)	37,50 ± 1,53 c(c)	47,80 ± 8,60 d(d)	0,000 (*)	0,000 (*)
Skinfold somatorium	136,45 ± 58,60 a	144,07 ± 59,03 b	106,46 ± 35,85 c	86,58 ± 22,41 d	0,005 (*)	0,003 (*)
Body mass index	24,54 ± 2,73	24,67 ± 2,21 a	23,04 ± 1,96 b	23,14 ± 1,92 b	0,055	0,061
Waist/hip ratio	0,85 ± 0,04 a(a)	0,85 ± 0,03 ab(ab)	0,81 ± 0,04 c(c)	0,82 ± 0,03 bcd(bcd)	0,000 (*)	0,000 (*)
Trunk/members ratio	1,58 ± 0,45	1,59 ± 0,43	1,57 ± 0,45	1,53 ± 0,42	0,993	0,781

(*) Significant difference in the level of 5%.
(1) By the F test (ANOVA).
(2) By the t-student test.
NOTE: Different letters indicate sgnificant difference among the average of correspoding groups, obtained by the test t-student.
Different letters, in brackets, indicate signficant difference among the average of the corresponding groups, otained by the test of Scheffé.

When the t-student test were used in the comparisons among the groups (Tables 1 and 2), analysing the **VO_2max.**, it was verified a significant difference among all the groups (A, B, C and D), which also occurred with the **SS**. When each fold was analysed separately, it was observed this difference in **TR** between the groups A-D; among the groups C-A and C-B in the skinfolds **CA**; among the groups A-D and B-C in the 5 skinfolds (**SB, AX, SI, AB e TH**). In the analysis of the eight folds in relation to the groups, when the Sheffé's test was applied (Table 2), it was observed a fast increase between A-B and a considerable decrease among A-C and A-D. The fold **AB** was statistically different among the groups A and B related to the group D.

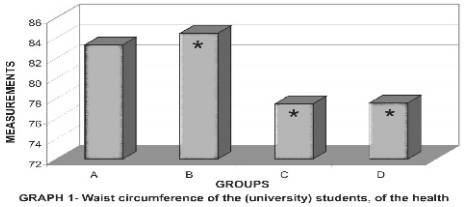
The results showed a higher level of significant difference (t-student test) for the folds **SB**, **AX**, **SI** and **AB** (Tabela 2), which is possibly related to a higher incidence of risk factors according to Guedes (1985), due to these folds are located in the central region of the body, which has a higher accumulation of fat. It is also verified that the values of measurements of skinfolds (**SB**, **AX**, **SI**, **AB**, **TR**, **BI**, **TH** and **CA**), separately, allow to validate where specifically happened the increase of subcutaneous fat, what was also observed by Costa, Guimarães and Fonsêca (1991). Among the skinfolds of trunk, the behavior of **AB**, validates the results of Després and Bouchard (1990) and Evans and Cyr-Campbell (1997), which described that the adipose tissue found in the abdominal region of the body is related with the risks, moderate and high, for the health, like cardiac diseases.

TABLE 2- Value average of the skinfold of the (university) students, of the health area of University of Pernambuco.

Skinfold	GROUP A n = 21 Mean ± DP	GROUP B n = 23 Mean ± DP	GROUP C n = 26 Mean ± DP	GROUP D n = 20 Mean ± DP	Value of p(1)	Value of p(2)
Subscapular	18,50 ± 7,48 a	19,35 ± 6,24 ab	16,17 ± 4,55 ac	13,13 ± 3,27 bcd	0,025 (*)	0,006 (*)
Axillary	16,19 ± 8,57 a	16,22 ± 7,76 ab	12,62 ± 6,29 ac	10,23 ± 3,74 bcd	0,055	0,016 (*)
Suprailiac	19,81 ± 10,41 a	20,61 ± 8,87 ab	14,10 ± 6,51 ac	11,55 ± 4,14 bcd	0,008 (*)	0,003 (*)
Abdominal	28,57 ± 13,35 a(a)	29,96 ± 13,12 ab(a)	21,62 ± 9,53 ac	,45 ± 6,21 bcd(b)	0,002 (*)	0,001 (*)
Tricipital	13,48 ± 5,26 a	14,26 ± 5,92	11,67 ± 4,39	9,55 ± 2,77 b	0,037 (*)	0,013 (*)
Bicipital	6,33 ± 4,07	6,63 ± 2,90	5,10 ± 2,06	4,43 ± 1,41	0,240	0,094
Thigh	21,14 ± 10,70 a	23,35 ± 14,87 ab	15,38 ± 6,45 ac	13,0 ± 4,88 bcd	0,027 (*)	0,022 (*)
Calf	12,43 ± 4,87 a	13,70 ± 7,48 ab	9,81 ± 4,39 c	8,25 ± 3,99	0,032 (*)	0,039 (*)

(*) Significant difference in the level of 5%.
(1) By the F test (ANOVA).
(2) By the t-student test.
NOTE: Different letters indicate sgnificant difference among the average of correspoding groups, obtained by the test t-student.
Different letters, in brackets, indicate signficant difference among the average of the corresponding groups, otained by the test of Scheffé.

The **BMI** not showed significant difference in the observed results. This index was analysed by Melo et al. (2005) and according to the authors, despite of had shown a good correlation with the amount of total corporal fat, the **BMI** lost its reliability in the analysis of athletes with a big muscular mass, and also can underestimate the percentage of fat in individuals with little muscular mass, like aged and sedentary people, besides, it can not make a reliable characterization of the distribution of the corporal fat. The graph 1 shows the values of the measurement **CW**, verifying a significant difference among the group B in relation to C and D.

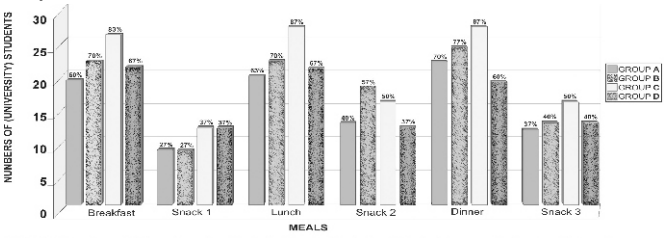


GRAPH 1- Waist circumference of the (university) students, of the health area of University of Pernambuco.
(*) p ≤ 0,05 for the group B in relation to C and D.

Concerning about the variable **RW/H** there were significant results for the groups: A in relation to C and D, and between B-C (Table 1). According to Després et al. (1991) and Heyward and Stolarczyk (2000), the results were relevant in the **RW/H** and in the **CW** too, however, the separate measurement of the circunference is considered a better predisposing fact of deposit of visceral fat than the **RW/H**. Because the **CW** increases despite of the adipose tissues are accumulate in deeper and superficial points, while the index **CH** is influenced by the deposit only in the subcutaneous region; so the accuracy of **RW/H** in evaluate the visceral fat, responsible for the increase of risk factors, decreases with the increase of levels of fat. The found value for the **RT/M**, in this survey were not significant, despite of its

relevance according to the distribution of corporal fat, what is different from the study of Queiróga (1998), which showed a considerable predominance of this index.

In relation to the number of daily meals of the groups, which values are shown in graph 2: 60% of participants had the three main meals, while 27% to 57% ate only snacks.



GRAPH 2- Number of daily meals realized by the (university) students, of the health area of University of Pernambuco.

The table 3 shows the most consumed food by the students, verifying that in group C, there was a higher consumption of builder, energetic and regulator food, and in the other groups the consumption was varied.

TABLE 3- Frequency of food consumed by the (university) students, of the health area of University of Pernambuco.

Food	GROUP A n = 21 Mean ± DP	GROUP B n = 23 Mean ± DP	GROUP C n = 26 Mean ± DP	GROUP D n = 20 Mean ± DP
BUILDERS				
Meat	14	16	20	12
Poultry	16	14	17	15
Milk	19	12	22	16
Derivatives of milk	15	19	24	19
Total	63	61	83	62
ENERGETICS				
Rice	19	22	25	19
Beans	17	18	21	17
Macaroni	13	10	16	14
Bread	19	21	21	18
Total	68	71	83	68
REGULATORS				
Vegetables and legumes				
Lettuce	12	6	7	7
Onion	10	8	14	14
Carrot	7	9	16	10
Tomato	61	13	21	14
Total	54	36	58	45
Fruit				
Banana	16	16	19	15
Orange	11	15	13	11
Apple	9	3	9	10
Papaya	7	5	7	6
Total	43	38	48	42

With the use of **RM24**, it was verified that the feeding of undergraduate is not balanced, concerning about the amount of meals. Occurred a predominance of the three main meals (breakfast, lunch and dinner) what was also observed by Quaioti et al. (1999). Besides, Angel et al. (1999) verified that ±80% of students not practice systematic execises. It was observed that group C stood out, because showed a higher diversity in the consumption of food, representing 75% of group C in the sample, which indicates more suitable feeding habits, according to feeding guides, which is possibly related to an increased energetic necessity due to a good level of aerobic capacity of the individuals of this group. Concerning about feeding frequency, it is observed, among the builder food (proteins), an increased consumption of milk and derivatives, which are data similar to the ones found by Tomita and Cardoso (2002), perhaps to these food are popularly considered as source of the increase of muscular mass.

CONCLUSION

Among the macronutrients, the protein was consumed above the recommendation in all groups. The nutritional information showed a quantitative and qualitative unbalance, showing a necessity of a suitable nutritional orientation. There was a significant decrease in the skinfolds somatorium among the different groups, emphasizing the increase of oxygen consumption with the decrease of the corporal fat. Concerning about the distribution of the corporal fat (central and peripheral), it were not observed alterations in the standard among the groups. However, the maximal oxygen consumption is suitable for the classification of the individuals and its distribution in groups for the development of specific works in the orientation of an exercise program associated to a diet.

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AEROBIC CAPACITY AS DISCRIMINANT OF FEEDING CONSUMPTION AND PHYSICAL APTITUDE
ABSTRACT
The maximum consumption of oxygen is an indicative of aerobic capacity and its estimative constitutes a proper method to analyze nutritional and anthropometric variables of a given subject. This study aimed to evaluate the food intake and body fat distribution of 90 college students of health sciences. Their ages where between 18 and 30 years old, with a maximum intake of oxygen as a differentiation parameter. We determined the indicators, such as: nutritional aspects (macronutrients); anthropometry (body mass index, skinfolds somatorium, waist/hip ratio and trunk/members ratio) and aerobic capacity (maximum consumption of oxygen). In order to evaluate the food intake, we performed a 24 hours memory based questionnaire together with a questionnaire of feeding frequency. The statistical analysis was done using with: ANOVA, t-student, Scheffé and correlation test. The results indicated significant differences and negative correlation for the maximum consumption of oxygen and skinfolds somatorium, concluding that, when there is a higher aerobic capacity, there is a better body fat distribution proportional too. There was also a significant difference for: skinfolds at trunk, waist circumference and waist/hip ratio, predictors of health risks, due to fat accumulation at the central region of the body. We also noticed increased protein intake and regularity at three meals. We noticed a lack of specialized orientation, food intake that does not answer to recommendations and a need for routine physical exercise in order to improve health and quality of life.
Key words: food intake, body fat distribution and aerobic capacity.

CAPACITÉ AÉROBIE COMME DISCRIMINANT DE LA CONSOMMATION ALIMENTAIRE ET DE L'APTITUDE PHYSIQUE
RÉSUMÉ
La consommation maximale d'oxygène est un indicateur de la capacité aérobie et son estimative est une méthode adéquate pour analyser des variables nutritionnelles et anthropométriques du individu. Le but de la recherche était d'analyser la consommation alimentaire et la distribution du gras corporel de 90 élèves universitaires des cours en Santé, entre 18 et 30 ans, en utilisant comme discriminant la consommation maximale d'oxygène. On a determiné les indicateurs nutritionnels (macronutriments), anthropométriques (l'indice de masse corporelle, la somme des plies de la peau, la relation ceinture/hanche et la relation membres/tronc) et capacité aérobie (la consommation maximale d'oxygène). Pour évaluer la consommation alimentaire, une enquête était faite, basée sur de souvenirs des dernières 24 heures, et aussi un questionnaire de fréquence alimentaire. L'analyse statistique était faite d'après les essais ANOVA, t-student, Scheffé et corrélation. Les résultats sont indicateurs d'une différence significative et une corrélation négative entre la consommation maximale d'oxygène et la somme des plies de la peau: it était donc constacté que une plus grande capacité aérobie est associée a une meilleure distribution du gras corporel. Il y a eu aussi des différences significatives pour la circunference de la ceinture et la relation ceinture/hanche, des prédicteurs de risques à la santé, dû à l'accumulation d'adiposité dans la région centrale du corps. On a verifié une ingestion protéinique augmentée et regularité en trois ingestions quotidiennes. On a observé la manque d'orientation spécialisé, une ingestion alimentaire qui ne respect pas les recommendations et la besoin de la pratique d'exercices physiques pour améliorier la santé et la qualité de vie. **Mots clés:** consomation alimentaire, distribution du gras corporel et capacité aérobie.

CAPACIDAD AERÓBIA COMO DISCRIMINANTE DEL CONSUMO ALIMENTA Y DE LA APTITUD FÍSICA
RESUMEN
El consumo máximo de oxígeno es un indicativo de la capacidad aeróbia y su estimativa constitui un método adecuado para analizar variables nutricionales y antropometrías del individuo. la encuesta objetivó avaliar el consumo alimentar y la distribución de grasa corporal de 90 universitarios de el área de salud, en la faja relativa a edad entre 18 y 30 años, tiendo como discriminante el consumo máximo de oxígeno. Fueron determinanados los indicadores: nutricionales (macronutrientes); antropométricos (índice de masa corporal, somatorio de arrugas cutáneas, relación cintura/cuadril y relación miembros/tronco) y capacidad aeróbica (consumo de oxígeno. Para avaliar el consumo alimentar fue realizado averiguación recordatorio de 24 horas y aplicado cuestionario de frecuencia alimentar. El análisis estadística fue realizada utilizando los testes: ANOVA, t-student, Scheffé y correlación. Los resultados indicaran diferencia significativa y correlación negativa para consumo máximo oxígeno y somatorio de arrugas cutáneas, constatándose que, cuando mayor la capacidad aeróbia, mejor la distribución de grasa corporal. Hube aun diferencia significativa para: arrugas cutáneas del tronco, circunferencia de la cintura y relación cintura/cuadril, preeditores de riesgos a la salud, debido al acumulo de adiposidad en la región central del cuerpo. Verificose ingestión proteica aumentada y regularidad en tres comidas diarias. Observose falta de orientación especializada, ingestión alimentar que no atiende las recomendaciones, y necesidad de la práctica de ejercicios físicos para mejorar a la salud y calidad de vida.
Palabras llaves: consumo alimentar, distribución de grasa corporal y capacidad aeróbia.

CAPACIDADE AERÓBIA COMO DISCRIMINANTE DO CONSUMO ALIMENTAR E DA APTIDÃO FÍSICA
RESUMO
O consumo máximo de oxigênio é um indicativo da capacidade aeróbia e sua estimativa constitui um método adequado para analisar variáveis nutricionais e antropométricas do indivíduo. A pesquisa objetivou avaliar o consumo alimentar e a distribuição de gordura corporal de 90 universitários da área de saúde, na faixa etária entre 18 e 30 anos, tendo como discriminante o consumo máximo de oxigênio. Foram determinados os indicadores: nutricionais (macronutrientes); antropométricos (índice de massa corporal, somatório de dobras cutâneas, relação cintura/quadril e relação tronco/membros) e capacidade aeróbia (consumo máximo de oxigênio). Para avaliar o consumo alimentar foi realizado inquérito recordatório de 24 horas e aplicado questionário de freqüência alimentar. A análise estatística foi realizada utilizando os testes: ANOVA, t-student, Scheffé e correlação. Os resultados indicaram diferença significativa e correlação negativa para consumo máximo de oxigênio e somatório de dobras cutâneas, constatando-se que, quanto maior a capacidade aeróbia, melhor a distribuição de gordura corporal. Houve ainda diferença significativa para: dobras cutâneas do tronco, circunferência da cintura e relação cintura/quadril, preditores de riscos à saúde, devido ao acúmulo de adiposidade na região central do corpo. Verificou-se ingestão protéica aumentada e regularidade em três refeições diárias. Observou-se falta de orientação especializada, ingestão alimentar que não atende as recomendações, e necessidade da prática de exercícios físicos para melhorar a saúde e qualidade de vida.
Palavras chaves: consumo alimentar, distribuição de gordura corporal e capacidade aeróbia.