

## Profile of body composition and cardiorespiratory fitness in brazilian aeronauts.

## Perfil de la composición corporal y de la condición cardiorespiratoria en aeronautas militares brasileños.

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### Abstract

The objective of this study was to verify the profile of body composition and cardiorespiratory fitness in brazilian military aeronauts, correlating them. The sample include 1550 aviators of the masculine sex ( $31,82 \pm 9,70$  years). The individuals were divided and classified in normal group (GN), overweight (GOW) and obesity (GOB). It was realized an anthropometric and cardiorespiratory fitness evaluation. The Pearson correlation test was used to investigate the mean correlation, but significant ( $r=-0,44$ ;  $p=0,01$ ), suggesting a relation of dependency between the variables  $VO_{2max}$  and BMI. The total sample was classified as a good cardiorespiratory fitness showing a mean value ( $41,15 \pm 7,54$  ml.kg.min<sup>-1</sup>). The sample presented mean values of BMI ( $25,29 \pm 3,39$  kg.m<sup>-2</sup>) and WC ( $0,87 \pm 0,06$  cm) and showed a light overweight classification with moderate risks to the health. These results suggest for the aeronauts group, that independent of cardiorespiratory fitness, only regular exercise not seems enough to prevent the weight excess.

### Resumen

El objetivo de este estudio fue verificar el perfil de la composición corporal y del nivel de condición cardiorespiratoria en aeronautas brasileños, correlacionándoles. Participaron en el estudio 1550 aviadores de sexo masculino ( $31,82 \pm 9,70$  años). La muestra fue dividida en tres grupos: Grupo Normal (GN), Sobrepeso (GOW) y Obesidad (GOB). Fue realizada una evaluación antropométrica y una evaluación de la aptitud cardiorespiratoria. También se realizó la prueba de Kolmogorov-Smirnov para determinar la normalidad de la muestra y se utilizó la Correlación de Pearson para verificar la relación, entre las variables  $VO_{2max}$  e IMC ( $r=-0,44$ ;  $p=0,01$ ). Se evidenció que la mayoría de los aeronautas presentaban una buena aptitud física ( $41,15 \pm 7,54$  ml.kg.min<sup>-1</sup>). La muestra total analizada presentó valores medios de IMC ( $25,29 \pm 3,39$  kg.m<sup>-2</sup>) y CA ( $0,87 \pm 0,06$  cm) permitiendo clasificarla con grado de obesidad leve teniendo riesgos para la salud. Estos resultados sugieren que el grupo de aeronautas, independientemente del nivel de condición cardiorespiratoria, solamente con ejercicio regular no fue suficiente para prevenir el exceso de peso.

**Key words:** cardiorespiratory fitness, anthropometric evaluation, aeronauts.

**Palabras clave:** aptitud cardiorespiratoria, evaluación antropométrica, aeronautas.

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## Introduction

Obesity may be considered one of the greatest health problems nowadays, being considered a world wide epidemic (Bray, 2004; Hauser et al., 2004; James et al., 2001). According to the World Health Organization (WHO, 2003), the excess of body fat (overweight and obesity) is considered a significant public health problem, because it is strongly associated with several chronic diseases, such as of the high cardiovascular disease, stroke, type 2 diabetes mellitus, hypertension, dyslipidemia, cancers (of the breast, endometrium, prostate, colon) and others, that contribute to reduce the quality and expectancy of life (Dantas et al., 2003; Lemura; Maziekas, 2002; Santos et al., 2002; Willett et al., 1999; Wilson et al., 2002).

Obesity can be defined as an excessive amount of body fat, derived from a chronic imbalance between energy intake and energy expenditure (Lopes et al., 2004). For some authors, the excess of body fat can be attributed to genetic background, environmental factors (socialized overeating, a highfat diet), behavioural factors (decreased rates of physical activity), underlying illness and socioeconomic status (Adams et al., 2003; Janssen et al., 2002; Savage et al., 2003; Whelton et al., 2002).

One of the parameters used for its characterization in individuals is given by the determination of body composition (ACSM, 2005; Rech; Santos; Silva, 2006). The anthropometrics measures have been frequently used to determine the health risk. The most widely used classification scheme for defining obesity is the body mass index and the waist circumference. (Ardern et al., 2004; Pitanga; Lessa, 2006; Poirier et al., 2000; 2003; Zhu et al., 2002).

Aviation, as a professional modality, has proper characteristics and qualities in achievement of its objectives (scales of work, alterations of last hour, inactive days, in transit and the quality of feeding) that collaborate so that the aeronauts have difficulties to practice regular exercise and have healthful alimentary habits (Soter, 2000).

The use of profiles in professional activities of high risk, as the aviators, is a valid way when it is intended to lead these analyses for a selection and physical preparation from organized and effective forms (Freitas; Fernandes Filho, 2004). Being thus, the objective of this study is to verify the body composition and cardiorespiratory fitness in Brazilian military aeronauts, tracing a specific profile of individuals, to reach favorable results in the training and get effectiveness in the missions to be carried out.

## Methods and Materials

### *Subjects*

The sample was composed by 1550 aviators of masculine sex ( $31,82 \pm 9,70$  years), of three categories of aviation: of hunting, of load and helicopter. The subjects were divided in three groups according to the classification of body mass index (BMI) : Normal Group (GN), Overweight Group (GOW) and obesity Group (GOB).

### *Body Composition*

It was measured through anthropometrics methods. Subjects were weighed in Kilograms (to the nearest 0,1 kg) on a calibrated scale (Filizola, Brazil). Each subjects's height was measured via a standard stadiometer connected to the scale. The body mass index (BMI), is determined by dividing weight in kilograms by height<sup>2</sup> in meters. According to Arden et al. (2004) and WHO (2001) a healthy BMI is defined as 18.5 to < 25 kg/m<sup>2</sup>. Overweight is defined as 25–29.9 kg/m<sup>2</sup>, and obesity is a BMI  $\geq 30$  kg/m<sup>2</sup>.

The percent body fat was calculated from three-skinfold measurements (abdominal, frontal thigh and pectoral) according to Jackson and Pollock (1978) using a manual skinfold calliper (Lange) and classified according to a normality table considered by Pollock and Wilmore (1993).

The Waist circumference was measured to the nearest centimeter with a flexible a metric ribbon (Sanny) while the subjects were in the standing position at the end of expiration. It was measured by trained observers between the lower rib margin and the iliac crest (Wang; Thornton; Bari et al., 2003).

### *Cardiorespiratory Fitness*

It was estimated by the test of 12 minutes, proper to measure the physical fitness related to the health, and can be used in people with low physical fitness or in the majority of the athletes (Cooper, 1995). For the classification of the individuals, the criteria considered for Cooper had been used (1982).

### *Statistics*

It was used descriptive statistics (Triola, 1999), objectifying to get the profile of the data set, through measures of localization (mean) and dispersion (SEM). The normality of variables was warranted with Kolmogorov-Smirnov test and Pearson correlation test to verify the relationship between variables  $VO_{2max}$  and BMI. Significance was set at  $p < 0,05$ .

## Results

In Table 1 are exposed the mean values of variables: Age (years), Body Mass (kg), Height (cm). The groups GN (n=785), GOW (n=631) and GOB (n=134) didn't followed a normal distribution in none of variables analyzed ( $p=0,001$ ;  $< 0,05$ ).

Table 1. Profile of Brazilian Aeronauts

	GN	GOW	GOB
Age (years)	29,84 ± 9,3	33,51 ± 9,58	35,36 ± 9,76
Body Mass (kg)	68,74 ± 6,88	81,62 ± 7,03	97,36 ± 8,34
Height (cm)	1,74 ± 6,03	173,6 ± 6,15	173,25 ± 6,18

GN – Normal Group; GOW – Overweight Group; GOB – Obesity Group.

In Table 2 we can observe the relative data of variables: Body Fat (BF), Waist Circumference (WC) and BMI. The sample was classified in each variable according to mean age (31,82 ± 9,70 years).

Table 2. Profile of Body Composition in Brazilian Aeronauts

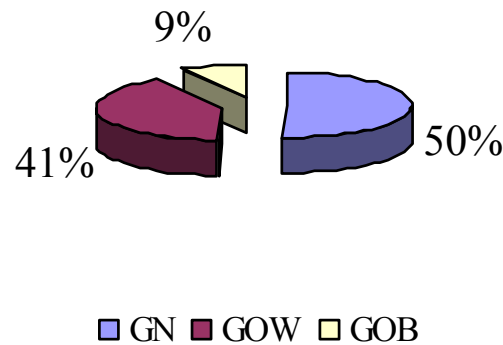
	GN	GOW	GOB
BMI (kg.m <sup>-2</sup> )	22,60 ± 1,04	27,02 ± 1,36	32,14 ± 2,00
BF (%)	12,89 ± 5,12	19,11 ± 4,46	24,94 ± 5,46
WC (cm)	0,84 ± 0,06	0,88 ± 0,05	0,93 ± 0,08

GN – Normal Group; GOW – Overweight Group; GOB – Obesity Group.

The total sample presented a mean values ( WC = 0,87 ± 0,06 cm ; BMI = 25,29 ± 3,39 kg.m<sup>-2</sup> ), that allows to classify it as a light obesity with risks to the health.

According to the Graphic 1, we can observe that 50% of analysed sample presented weight excess.

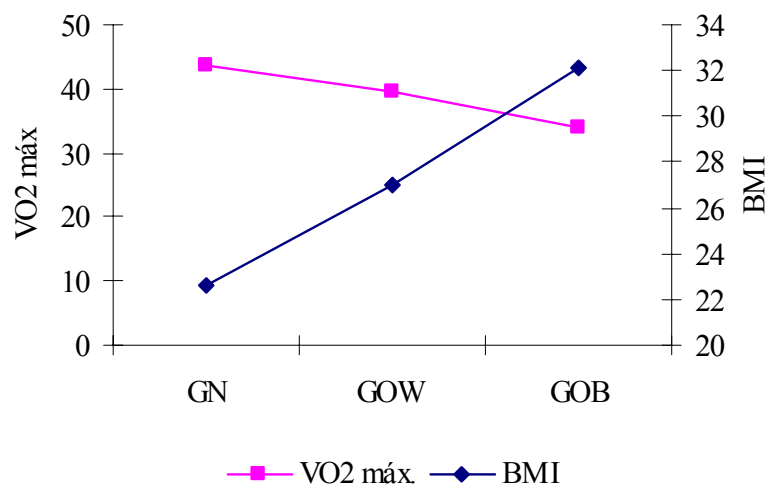
Graphic1. BMI Classification



Graphic 2 describes the characteristics of cardiorespiratory fitness in brazilian aeronauts. The groups GN ( $43,56 \pm 7,47 \text{ ml.kg.min}^{-1}$ ) and GOW ( $39,57 \pm 6,22 \text{ ml.kg.min}^{-1}$ ) presented a good conditioning level, however, the group GOB ( $33,79 \pm 7,17 \text{ ml.kg.min}^{-1}$ ) presented a weak conditioning level. The total sample was classified as a good cardiorespiratory fitness showing a mean value ( $41,15 \pm 7,54 \text{ ml.kg.min}^{-1}$ ).

The Pearson correlation test inquired a mean correlation, but significant ( $r = -0,44$ ;  $p=0,01$ ) suggesting a dependency between the variables  $VO_{2\text{máx}}$  and BMI. The graphic 2 allows to observe the relationship between those variables. How much bigger is the BMI, lesser is the results of  $VO_{2\text{máx}}$ .

Graphic 2 : Profile of Cardiorespiratory Fitness



## Discussion

According to this data we can observe that the sample presented excessive body mass. These data corroborate with the study of Amorim et al (1999) that had analyzed the BMI of Brazilian commanders of civil aviation and had found mean values ( $25,5 \text{ kg.m}^{-2}$ ).

Soter (2000) presented the evaluation of the body composition in Brazilian aeronauts ( $n=50$ ) mean age ( $41,1 \pm 7,9$  years), body mass ( $77,2 \pm 11,0$  kg), height ( $173,9 \pm 6,9$ cm) and showed the mean values of BMI in the inferior limit of overweight ( $25,3 \pm 3,0 \text{ kg.m}^{-2}$ ). Comparing these studies we can observe that the groups GOW and GOB showed superior mean values. Therefore, suggests that the aeronauts lifestyle can become a factor of risk for development and prevalence of obesity.

Silva et al (1998) verified the morphologic aspects in Brazilian aeronauts ( $37,00 \pm 6,10$  years) and showed mean values between 15 and 20 % for the variable body fat, suggesting that such results could be associated with the development of problems related to the obesity. These values are similar to the group GOW ( $19,11 \pm 4,46$  %) and inferior to the group GOB ( $24,94 \pm 5,46$ %), indicating the necessity of a nutritional intervention associated to practical regular physical exercise as instrument of prevention to the pertinent factors of risk to the weight excess.

Grund et al. (2001) verified the mean values of BMI variable ( $25,6 \pm 2,7 \text{ kg.m}^{-2}$ ) in 13 sedentary men ( $30,2 \pm 8,1$  years). Moro et al. (2005) had also verified this same variable in sedentary men ( $26,0 \pm 1,4$  years) presenting similar values ( $27,6 \pm 1,4 \text{ kg.m}^{-2}$ ). When comparing these studies with the present research we can observe that the group GOW showed almost the same results ( $25,29 \pm 3,39 \text{ kg.m}^{-2}$ ), indicating that diet and exercise are factors of bigger impact on the body mass (Voleck et al., 2005).

Lacerda et al. (2004), verified the mean values of Body fat ( $23,10 \pm 5,64$  %) in 46 trained men ( $42,93 \pm 3,20$  years). Those are similar to the group GOB ( $35,36 \pm 9,76$  years) in the same variable ( $24,94 \pm 5,46$  %BF), indicating that factors as intensity, volume and frequency of training, and others, can influence in the answers, because the aeronauts were inserted in a conditioning program and thus presented weight excess (overweight).

Filardo; Pires Neto (2006) realized a study about anthropometrics indicators and body composition, making a relationship between sex and age (20 – 39,9 years). The group of 20 – 29,9 years, the values were inside of the normality band (14,5% BF) and the group of 30 - 39,9 years (18,8%BF) was verified a increase in body fat. The authors suggest that to each decade of life the distribution and storage of the body fat can be influenced by age and phase of life that individual finds. These studies are similar in percent body fat classification, corroborating with the affirmation that genetic and social factors can influence the body composition.

The maximum aerobic power ( $VO_{2\text{máx}}$ ) is an important component of the physical aptitude related to the health and the qualification for work (Zwart et al., 1995).

In this data was observed that 91,4% of aviators presented a good physical conditioning. Lima et al. (2005) verified the correlation between direct (ergoespirometry) and indirect (3200m test) measurements of  $VO_{2\text{máx}}$ . in active young man ( $18,6 \pm 1,9$  years;  $177,1 \pm 3,5$  cm;  $68,5 \pm 9,5$ kg and  $21,7 \pm 2,3$   $\text{kg}\cdot\text{m}^{-2}$ ) and the mean values were ( $58,5 \pm 8,5$   $\text{ml}\cdot\text{kg}\cdot\text{min}^{-1}$ ), therefore superiores to this data. Making a comparison of these two studies, can be suggested that the age can influence the results, because the mean age was inferior than the present research supporting the affirmation that new individuals possess a bigger  $VO_{2\text{máx}}$  (HEPPLE, 2000).

Another factor that can have interfered the results mentioned above can be related to the different protocols used in the measurements of oxygen consumption. This fact corroborate to Grant et al., (1995) that verified the  $VO_{2\text{máx}}$  in different protocols, showing differences between the tests.

Silva; Nascimento (2005) realized a study about body composition and physical fitness in 13 brazilian soccer referees ( $38,00 \pm 5,31$  years), pointing mean values of  $VO_{2\text{máx}}$  ( $51,20 \pm 7,7$   $\text{ml}\cdot\text{kg}\cdot\text{min}^{-1}$ ). Therefore when comparing these results with the present research, were noticed that the values of this variable had been superior in the previous research and it can be justified by the necessity of a good level of physical conditioning to exert the function of soccer referee (Rebelo et al., 2002).

## Conclusion

From the mean values of variables BMI and WC, it was observed that the mayor of aeronauts presented weight excess. The mean of cardiorespiratory fitness was great, but these results suggest for the aeronauts group, that independent of cardiorespiratory fitness, only regular exercise not seems enough to prevent the weight excess. A viable strategy to impede the progression of the obesity epidemic is therefore to reduce sedentary behaviour by encouraging participation in greater amounts of self selected physical activities that are accumulated throughout the day termed "lifestyle physical activity" and dietary modification.

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