

Anthropometric Parameters of Cadets Among Different Military Sports

Parámetros Antropométricos de Cadetes entre los Diferentes Deportes Militares

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SUMMARY: This study compared anthropometric parameters among different military sports. One hundred and seventy male cadets of the Brazilian Air Force Academy, who were participants of athletics (n= 33, 20.5±1.3 years), basketball (n= 11, 19.9±1.8 years), fencing (n= 10, 19.9±0.7 years), soccer (n= 21, 20.9±1.6 years), judo (n= 17, 20.7±1.0 years), swimming (n= 15, 20.4±1.2 years), orienteering (n= 10, 21.3±1.6 years), military pentathlon (n= 11, 20.7±1.2 years), water polo (n=10, 21.1±0.9 years), shooting (n= 18, 21.3±1.2 years) or volleyball (n= 14, 20.9±1.7 years) military competitive teams, participated in this study. Height, body mass, body mass index, fat percentage, lean body mass, fat mass, waist and hip perimeters, and waist-hip ratio were measured. Main effects were detected for height, body mass, body mass index, lean body mass, waist and hip perimeters. The only significant finding was that orienteers present lower lean body mass than volleyball and water polo players. These results point out the homogeneity of group anthropometric parameters (except lean body mass), suggesting that military coaches do not rely on the anthropometric parameters, but on specific skills demonstrated during initial period of practice to choose athletes for their teams.

KEY WORDS: Cadets; Anthropometric parameters; Military sports.

INTRODUCTION

Different sport disciplines have distinct physical requirements and anthropometric characteristics. For example, in basketball and volleyball, height is an important anthropometrical parameter (Bayios *et al.*, 2006). Also, there is a positive influence of the maximum height an athlete can reach in vertical jumping on the performance of specific game actions, such as block and spike in volleyball (Aouadi *et al.*, 2012). In military context, researches on anthropometric parameters have been performed aiming at assessing their relationship with physical fitness (Kobermann *et al.*, 2012) and monitoring the effectiveness of military physical training programs (Harwood *et al.*, 1999; Wen-chyuan Chen *et al.*, 2007). However, some longitudinal studies with cadets indicate that anthropometric parameters are slightly influenced during cadet training schedule (Aandstad *et al.*, 2012; Crombie *et al.*, 2012).

Particularly in Brazilian Air Force Academy, physical characteristics are part of cadet selection process (Ministério Da Defesa do Brasil, 2009). Thus, physical profile of the entrants is fairly homogeneous. After admittance, cadets are

asked to participate in one or more sport disciplines practice during the first 40 days. Available sport disciplines are: basketball, volleyball, soccer, water polo, swimming, athletics, orienteering, military pentathlon, shooting, judo and fencing. Then, following this initial period, coaches empirically choose some of these cadets to be part of their team during their entire formation.

Considering that some anthropometric characteristics may play a role in being successful in a given sport discipline, it is possible that coaches analyze and choose athletes based on these determinants characteristics, such as body mass, and height. Therefore, this study aimed at comparing anthropometrical characteristics of cadets among different military sports.

MATERIAL AND METHOD

Subjects. One hundred and seventy male cadets of Brazilian Air Force Academy, who were participants of athletics (n= 33, 20.5±1.3 years), basketball (n= 11, 19.9±1.8 years), fencing (n= 10, 19.9±0.7 years), soccer (n= 21, 20.9±1.6

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years), judo (n= 17, 20.7±1.0 years), swimming (n= 15, 20.4±1.2 years), orienteering (n= 10, 21.3±1.6 years), military pentathlon (n= 11, 20.7±1.2 years), water polo (n= 10, 21.1±0.9 years), shooting (n= 18, 21.3±1.2 years) or volleyball (n= 14, 20.9±1.7 years) military competitive teams. The data analyzed in this study are ordinary measurements yearly conducted in the academy. Written informed consent was obtained and all procedures received approval from the ethics committee (Process number: 233,722).

Experimental procedure. Height, body mass, fat percentage, lean body mass, fat mass, waist and hip perimeters, body mass index (BMI) and waist-hip ratio were assessed in a private room, on the same week day and at the same time of the day (i.e. between 16:00 and 18:00), by the same examiner. Athletes were barefoot and wore shorts and were instructed not to perform any vigorous physical activity 24h prior to these measurements.

Anthropometric measurements and body composition. The height was measured by means of a 1-mm graded stadiometer. Body mass was obtained from an electronic scale (Body Composition Analyzer BF-558, Tanita, Arlington Heights, USA), with an accuracy of 0.1 kg. The body mass index (BMI) was obtained by ration between body mass and height squared.

Body composition was estimated by a bioelectrical impedance device (Body Composition Analyzer BF-558, Tanita, Arlington Heights, USA). Participants stood on the platform with their feet aligned to the electrodes and remained so for a few seconds. The lean body mass was represented by the difference between absolute body fat of total body mass.

Hip and waist perimeters were measured by a 1-mm flexible and inextensible tape, exerting slight pressure on the skin, avoiding compressing soft tissues (Callaway *et al.*, 1991). The median of three measures of the same perimeter was retained for analysis. Then, the waist/hip ratio was individually calculated.

Statistical Analysis. Analyses were conducted using SPSS for Windows (Version 16.0; SPSS, Inc., Chicago, USA). Data are presented according do descriptive statistics (Means±SD). As data did not present normal distribution (Komogorov-Smirnov test) and/or homogeneity (Levene test), anthropometric parameters of different sports were compared by the Kruskal-Wallis test. When necessary, the Mann-Whitney test with Bonferroni adjustment was used to detect significant differences among pairwise comparisons. The significance level was set at p<0.05.

RESULTS

The statistical analysis showed a main effect for height ($X^2= 32.680$; $p<0.0001$), body mass ($X^2= 28.289$, $p= 0.002$), lean body mass ($X^2= 36.189$, $p<0.0001$), BMI ($X^2= 35.934$, $p<0.0001$), waist ($X^2= 25.617$, $p= 0.004$) and hip ($X^2= 22.122$, $p= 0.01$) perimeters. No differences were found for fat percentage, fat mass and waist-hip ratio. The post-hoc test detected that lean body mass is different between the following pairwise comparisons: orienteering x water polo ($p<0.0001$) and orienteering x volleyball ($p<0.0001$). Descriptive statistics are shown in Table I.

Table I. Mean and standard deviation of height, body mass, fat percentage, lean body mass, hip and waist perimeters, body mass index and waist-hip ratio in the different sports analyzed.

	Athletics	Basketball	Fencing	Soccer	Judo	Swimming	Orienteering	Military pentathlon	Water polo	Shooting	Volleyball
Height (m)	1.79±0.07	1.80±0.05	1.78±0.08	1.76±0.06	1.73±0.06	1.74±0.05	1.71±0.04	1.75±0.05	1.78±0.04	1.75±0.06	1.81±0.07
BM (kg)	74.1±10.8	80.5±10.1	71.4±8.3	75.6±8.3	78.3±11.6	72.2±6.1	69.4±6.9	69.4±6.8	82.5±7.3	70.8±7.1	79.2±8.4
BMI (kg/m ²)	23.2±2.6	24.7±2.2	22.6±1.4	24.4±2.3	26.1±2.6	23.7±1.7	23.8±2.4	22.5±1.9	26.0±2.1	23.2±2.1	24.1±2.1
Fat %	11.7±5.5	11.1±3.0	9.7±4.1	11.6±4.0	11.1±4.9	10.9±4.6	13.7±6.5	10.4±5.0	17.0±4.6	14.4±5.9	10.9±5.0
LBM (kg)	65.1±7.5	71.4±8.6	64.3±6.5	66.7±6.0	69.3±8.8	64.3±5.6	59.5±2.8	62.1±5.3	68.3±5.1 ^a	60.8±7.9	70.4±6.4 ^a
FM (kg)	9.0±5.3	9.1±3.0	7.1±3.6	8.9±3.6	9.0±4.8	7.9±3.6	9.9±5.3	7.3±4.1	14.2±4.8	10.1±3.8	8.9±4.8
Waist (cm)	77.7±6.0	80.9±4.1	75.6±3.5	79.7±4.5	82.0±6.1	77.9±4.8	77.8±6.0	76.4±4.7	83.7±6.7	77.2±4.7	80.6±4.6
Hip (cm)	95.5±5.5	99.2±4.9	94.0±4.6	97.7±5.5	96.9±7.2	95.9±3.8	86.2±7.7	93.5±3.9	100.4±4.4	94.4±5.8	97.9±4.1
W/H _{ratio}	0.81±0.03	0.82±0.02	0.80±0.04	0.82±0.03	0.85±0.04	0.81±0.03	0.83±0.02	0.82±0.03	0.83±0.04	0.82±0.07	0.82±0.02

a= significant difference from Orienteering.

DISCUSSION

The purpose of this study was to compare cadets' anthropometrical parameters among different military sports. Data demonstrate a high homogeneity in this group of cadets. We have, however, observed differences only in lean body mass, which is lower in orienteers compared to water polo and volleyball players.

We expected to observe differences in anthropometrical parameters among athletes from different disciplines. For instance, we supposed that basketball and volleyball players would be taller than athletes from other sports such as shooters. It has been demonstrated that height influences how high an athlete can reach in game actions, such as blocks and spikes in volleyball, and shots and rebounds in basketball (Gaurav *et al.*, 2010). On the other hand, a tall individual might have his balance negatively affected during shooting which would impair performance (Hawkins & Sefton, 2011). Thus, we expected that volleyball and basketball would present the highest and shooters the lowest values for height. However, there were no significant differences among military athletes from different sports. It seems that anthropometrical parameters are not as important in military sports as they are in elite sports.

The only significant finding was that orienteers present lower lean body mass than volleyball and water polo players. This finding is not unexpected, since individuals with low body mass and fat % should perform better in the long runs during orienteering, due to lower load they should bear. It is surprising, though, that in spite of lower lean body mass, orienteers presented fat percentage similar to shooters, and, although non-significantly, slightly higher than swimmers and basketball players. Thus, only lean body mass was significantly lower in orienteers than in volleyball and

water polo players. It is possible that the lack of difference in fat percentage and body mass is a consequence of military activities other than sport specific training.

Alternatively, it is conceivable that the elevated number of pair wise comparisons in each parameter reduced statistical power. Low statistical power represents a greater chance of type II error, that is, to accept the null hypotheses (no difference between sports) when there is a statistically significant difference.

In Brazilian Air Force, entrant cadets are required to take part in one or more sport disciplines practice during a 40-day period before being selected to one team. Thus, in the light of the present results, it is possible to suggest that military coaches do not rely on the anthropometric parameters, but on specific skills demonstrated during initial period of practice to choose athletes for their teams. There is a need for further research in the military sports as there are no standard scores of anthropometrical parameters to compare our data. We also suggest that in addition to anthropometrical parameters, physical fitness test, such as speed, agility, muscle power and endurance, should be assessed in order to provide a more comprehensive evaluation of military athletes.

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RESUMEN: Este estudio comparó los parámetros antropométricos entre cadetes que practican diferentes deportes militares. Ciento setenta cadetes hombres de la Academia de la Fuerza Aérea, que eran participantes de equipos militares competitivos de atletismo (n= 33, 20,5±1,3 años), baloncesto (n= 11, 19,9±1,8 años), esgrima (n= 10, 19,9±0,7 años), fútbol (n=21, 20,9±1,6 años), judo (n= 17, 20,7±1,0 años), natación (n= 15, 20,4±1,2 años), orientación (n= 10, 21,3±1,6 años), pentatlón militar (n= 11, 20,7±1,2 años), polo acuático (n= 10, 21,1±0,9 años), tiro (n= 18, 21,3±1,2 años) y voleibol (n= 14, 20,9±1,7 años) participaron en este estudio. Se midió la altura, masa corporal, índice de masa corporal, porcentaje de grasa corporal, masa magra, masa grasa, perímetros de cintura y cadera, y la relación cintura-cadera. No se detectaron variaciones de altura, masa corporal, índice de masa corporal, masa magra corporal, perímetro de cintura y cadera. El único hallazgo significativo fue que los orientadores tenían una masa corporal magra más baja que los jugadores de voléibol y polo acuático. Estos resultados apuntan a la homogeneidad de los parámetros antropométricos en grupos (excepto la masa magra), lo que sugiere que los instructores militares no dependen de los parámetros antropométricos, sino de las habilidades específicas demostradas durante el período de la práctica inicial en la selección de los atletas para sus equipos.

PALABRAS CLAVE: Cadetes; Parámetros antropométricos; Deportes militares.

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