Motricidad. European Journal of Human Movement, 2012: **28**, 1-13

MORPHOLOGICAL PROFILE OF GOALBALL ATHLETES

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ABSTRACT

Many studies are aimed to determine the physical profile of athletes from different sports; however, there is a lack of studies on Paralympic sports. The aim of this study was to determine and compare the morphological profile of goalball athletes of the Santa Catarina Association of Adapted Sports (ACESA) with a Paralympic athlete from the Brazilian National Goalball Team. Anthropometric and somatotype variables of seven ACESA Goalball athletes were measured (mean age of 36 ± 12.85 years). The results show that the Goalball Paralympic athlete is taller than the others, and has a better ecto-mesomorph profile, while ACESA athletes have higher body fat and balanced mesomorphic profile. As for the proportionality values (z-scores), ACESA athletes showed averages close to 0.00, with wide variation of individual results, and the Paralympic athlete showed negative values in all variables measured, except for lean body mass. Moreover, a considerable heterogeneity among ACESA athletes was found. However, it should be considered that the set of skills and physical abilities specific to the sport is what could predict the best players. This study adds relevant information to the morphological characterization of Goalball players and serves as reference for future studies.

Key Words: morphological profile, goalball, athletes, anthropometry

RESUMEN

Muchos estudios están dirigidos a determinar el perfil físico de los atletas de diferentes deportes, sin embargo, hay una falta de estudios sobre el deporte paralímpico. El objetivo de este estudio fue determinar y comparar el perfil morfológico de atletas de Goalball de la Asociación de Santa Catarina de Deporte Adaptado (ACESA) con un atleta paralímpico del equipo de Goalball Nacional de Brasil. Variables antropométricas y somatotipo de los siete atletas de Goalball de ACESA se midieron (36 ± 12,85 años). Los resultados muestran que el atleta paralímpico de Goalball es más alto que los otros y tiene un mejor perfil ecto-mesomorfo, mientras que los atletas ACESA tienen mayor grasa corporal y el perfil mesomórfico balanceado. Sobre los valores de proporcionalidad (puntuaciones z), los deportistas ACESA mostraron promedios cercanos a 0,00 y el atleta paralímpico mostró valores negativos en todas las variables medidas, a excepción de la masa corporal magra. Por otra parte, se observó una heterogeneidad considerable entre los atletas de ACESA. Sin embargo, hay que considerar que el conjunto de capacidades físicas y habilidades específicas para el deporte es lo que podría predecir los mejores jugadores. Este estudio añade información relevante para la caracterización morfológica de los jugadores de goalball y sirve de referencia para futuros estudios.

Palabras clave: perfil morfológico, goalball, atletas, antropometría

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Fecha de recepción: *03/01/2012*
Fecha de aceptación: *13/06/2012*

Introduction

Determining an ideal profile for sports performance has always aroused the interest of many researchers. Many studies have been and are developed with the objective of determining the physical profile of elite athletes from different sports modalities (Lima, Sigwalt, Rech, & Petroski, 2007; Holway & Garavaglia, 2009; Queiroga, Ferreira, & Romanzini, 2005); thus, most sports have shown morphological and neuromotor characteristics specific of their needs, making it clear that these variables influence the athletes' performance.

Kinanthropometry stands out as an important area of knowledge applied to sports, since it provides methods for quantifying size, shape, proportions, biological maturation and motor function (ISAK, 2006), allowing the quantification of body composition (body fat, lean body mass) and somatotype measures. This is extremely useful in the analysis of changes in body shape and structure due to training or to the physical demands of the activity itself (Carter & Heath, 1990).

Goalball is a sports modality created for people with visual impairments. It was played for the first time after World War II in Germany as a form of rehabilitation of war veterans and gained such proportions over the years that it was included in the program of the 1976 Paralympic games (Toronto - Canada). In Brazil, the sports modality came only in 1984 brought by Professor Steven Dubner (Maturana, De Oliveira Filho, Fontes, & De Almeida, 2005).

The sports, practiced by three players on each team, is based on the auditory sense to detect the ball in play (the ball has rattles inside), and requires good spatial orientation, so that the athlete knows the ball location in order to intercept or throw it with his hands in attack and defense moves (Silva, 2008).

The morphological profile of goalball athletes is increasingly being observed due to the specificity of the sport, being a key factor in subsequent calls to represent Brazil in international competitions. Low but agile athletes are important and used, but the best teams worldwide are increasingly searching for taller players to protect the largest area as possible during the defense move, reducing more and more the likelihood of opponents' goals. Thus, this study aims to contribute to the advancement in the knowledge about the morphological profile of goalball players, allowing defining a profile in accordance with the requirements of the sport.

Although there studies that show some anthropometric characteristics of athletes of sports designed for blind athletes (including Goalball), they were carried out only with children and adolescents (Çolak, Bamaç, Aydin, Meric, & Özbek, 2004; Karakaya, Aki, & Ergun, 2009, Caliskan et al, 2011). Thus, there are no studies in literature that seek to rate adults goalball players according to their morphological profile. The lack of characterization of these athletes has led coaches to empirically

outline their profile based on observations and discussions on the sport. Thus, the aim of this study was to characterize the morphological profile of goalball athletes, members of the Santa Catarina Association of Adapted Sports (ACESA), and to compare their morphological profile with one athlete from the Brazilian Paralympic Goalball team.

Method

Participants

The subjects participated in the study voluntarily and were contacted through the only goalball team of the city of Florianópolis. All athletes (including the Paralympic athlete) are from the Santa Catarina Association of Adapted Sports (ACESA), being seven males, mean age of 36.00 ± 12.85 years, and five females, mean age 33.75 ± 11.41 years. The training sessions take place in the Sports Center of the Federal University of Santa Catarina, three times a week, two of which are during the week, at night, lasting two hours and thirty minutes each session, and one is held on Saturday mornings, lasting three hours. The athletes have 5.4 ± 3.2 years of experience in the sport, with minimum experience of one year and maximum experience of 10 years. The Paralympic athlete (PA) has eight years experience in the sport.

The analysis included only male athletes because two female athletes were injured during the collection period. All athletes have visual impairments, three men are blind (they have their vision classified as B1) and four have visual remnants (three classified as B2 and one as B3). This is consistent with the ophthalmic classification of the International Federation of Sports for Blind Athletes (Nascimento & Morato, 2006).

Due to the large number of variables collected, it took more than one visit for data collection. These collections took place along the month of April 2010. Before data collection, all participants were informed about the intentions of the study and, after taking science, they signed a free and cleared consent form for participation in this study.

Instruments and procedure

Body mass was measured using a digital scale label Plenna, with accuracy of 0.1 kg and height was measured using a tape measure label Vonder, with accuracy of 0.1 cm vertically fixed to a flat wall (no footer) at the time of maximal inspiration performed by the individual, according to description of Gordon, Chumlea, & Roche (1991).

The span is the distance between right and left dactyls, with arms outstretched at an angle of 90º with the trunk (Carnaval, 1997), and was measured with the individual facing the wall. The tape measure (label Vonder with accuracy of 0.1 cm) was fixed on a flat wall.

The anatomical points (marked with dermatographic pencil), for measurement of skinfolds, perimeters and diameters, were located according to procedures of the International Society for the Advancement of Kinanthropometry (ISAK, 2006). A scientific adipometer label Sanny with accuracy of 0.1 mm was used to measure the thickness of the following skinfolds: triceps, biceps, subscapular, iliac-crest, supraspinal, abdominal, medial thigh and calf. These were measured by a single examiner certified by ISAK level 1.

Measures of body perimeters, relaxed and contracted arm, forearm, thorax, waist, abdomen, hip, proximal and medial thigh and calf were collected with a flexible tape measure label Sanny, and bone diameters: biestiloid, bimalleolar, humeral biepicondylar and femoral bicondylar were measured with a metal caliper label WCS. Both tape measure and calipers have accuracy of 0.1 cm.

Arm, forearm, hand, femur, tibia and foot lengths were measured using a metal caliper with 0.1 cm resolution, label Cescorf.

For the somatotype determination, the anthropometric method of Heath-Carter (1990) was used. To determine the body density, the equation proposed by Petroski (2003) for men aged 18-66 years was used.

$$D=1.10726863 - 0.00081201(\Sigma 4SF) + 0.00000212(\Sigma 4SF)^2 - 0.00041761(AG)$$

Where D = body density; Σ4SF = sum of four skinfolds (subscapular, triceps, suprailiac and medial leg); AG = age (years).

After using the formula, the fat percentage was determined (% F) using the formula of Siri (1961).

$$\% F = [(4.95 / SF) - 4.50] \times 100$$

Where %F = relative body fat

To obtain the proportionality index (*Phantom z-score*), the equation described by Ross & Marfell-Jones (1991) was used:

$$Z = \frac{1}{S}\left[L\left(\frac{170,18}{E}\right)^{n} - P\right]$$

Where: Z = standard proportional score; s = *Phantom* typical standard deviation for the variable studied, L = measure of the individual studied; 170.18 = *Phantom stature constant*, E = height of the individual studied, P = *Phantom* value for the variable studied; Exponent n = L^1 for linear measurements; L^2 for surface measurements, L^3 for mass measurements.

Data Analysis

The statistical treatment of information used descriptive statistics (means and standard deviations). The delta percentage (Δ%) was used to briefly compare the anthropometric differences between the Paralympic and ACESA athletes, and was calculated using the following equation:

$$\Delta\% = 100*[(\frac{\text{Mean of variable of ACESA athletes}}{\text{Variable of the Paralympic athlete}}) -1]$$

Data were analyzed using the SPSS for Windows software version 17.0.

Results

The general characteristics and data related to the basic components of somatotypes of ACESA goalball athletes and a Brazilian Paralympic goalball athlete are described in Table 1.

Table 1
Anthropometric characteristics, body composition and somatotype of ACESA athletes and the Paralympic athlete

Variables	AC 1	AC 2	AC 3	AC 4	AC 5	AC 6	χ	SD	PA
Age (years)	39.00	38.00	22.00	57.00	18.00	39.00	35.50	14.00	39.00
Height (m)	1.76	1.71	1.74	1.71	1.74	1.77	1.74	0.02	1.86
Span (m)	1.75	1.75	1.84	1.72	1.76	1.87	1.78	0.06	1.87
Body mass (kg)	71.00	83.70	54.90	74.00	63.60	70.40	69.60	9.70	81.40
Lean mass (kg)	56.42	68.14	49.20	56.45	54.51	61.89	57.77	6.51	72.12
Fat mass (kg)	14.58	15.56	5.70	17.55	9.09	8.51	11.83	4.70	9.28
%F	20.54	18.58	10.38	23.71	14.30	12.09	16.60	5.18	11.40
BMI (kg/m²)	22.87	28.62	18.11	25.31	20.96	22.37	23.04	3.62	23.66
Somatotype	AC 1	AC 2	AC 3	AC 4	AC 5	AC 6	χ	DP	PO
Endomorph	4.38	3.86	1.73	4.50	3.31	1.98	3.04	1.19	1.58
Mesomorph	6.19	6.23	3.41	6.96	3.79	5.72	5.41	1.44	5.57
Ectomorph	2.54	0.47	4.94	1.23	3.33	2.80	2.59	1.58	2.84

AC: ACESA athlete; χ: average of ACESA athletes, SD = standard deviation;
PA: Paralympic athlete.

In calculating the delta percentage (Δ%), it was found that ACESA athletes had average body mass and lean mass values below those of the Paralympic athlete (PA), with values of -14.50% and -19.90%, respectively. However, the mean values of fat mass and body fat percentage of ACESA athletes were higher than those of the Paralympic athlete (+27.48% and +45.61%, respectively). These values show the better physical shape of the Paralympic athlete, compared with ACESA athletes.

Table 2 shows the individual anthropometric variables of ACESA and Paralympic athletes, classifying them as perimeters, skinfolds, diameters and lengths. This table shows that the Paralympic athlete has higher values in all perimeters except for abdomen and waist, and lower values in all skinfolds.

TABLE 2
Morphological profile of ACESA athletes and the Paralympic athlete

Perimeters	AC1	AC2	AC3	AC4	AC5	AC6	χ	SD	PA
Relaxed arm R	29.1	32.5	25.0	29.0	25.4	30.0	28.5	2.9	33.2
Relaxed arm L	30.0	32.3	25.0	32.8	25.0	30.2	29.2	3.5	33.0
Contracted arm R	31.2	34.2	28.2	31.9	27.4	33.5	31.1	2.8	36.4
Contracted arm L	33.8	33.8	26.4	30.6	27.5	32.9	30.8	3.2	35.5
Forearm R	25.0	28.5	24.4	25.5	25.8	27.3	26.1	1.5	27.9
Forearm L	26.3	27.5	23.9	26.4	25.5	27.5	26.2	1.3	27.0
Thorax	95.0	99.9	84.5	95.0	91.6	95.1	93.5	5.1	101.9
Waist	80.7	92.0	69.1	90.3	70.6	77.3	80.0	9.6	80.0
Abdomen	84.7	100.0	70.4	93.3	75.0	81.2	84.1	11.1	79.9
Hip	95.0	103.3	81.3	96.0	87.8	91.1	92.4	7.5	95.0
Proximal thigh R	53.3	61.3	44.8	50.4	50.5	45.5	51.0	6.0	55.3
Proximal thigh L	57.5	61.4	45.4	51.9	51.0	51.0	53.0	5.6	55.6
Distal thigh R	49.0	56.2	41.8	45.9	46.6	48.6	48.0	4.8	54.5
Distal thigh L	36.0	57.6	43.2	36.8	49.7	50.4	45.6	8.5	54.1
Calf R	40.0	38.3	31.6	45.9	35.5	35.4	37.8	4.9	40.4
Calf L	36.0	39.1	32.4	48.3	36.1	35.9	38.0	5.5	39.9
Skinfolds	AC1	AC2	AC3	AC4	AC5	AC6	χ	DPs	PO
Biceps	3.8	4.9	2.1	5.1	2.8	1.5	3.3	1.5	1.6
Triceps	9.2	9.8	5.8	10.6	9.6	5.2	8.4	2.3	4.4
Subscapular	12.6	10.1	6.7	17.7	7.7	6.6	10.2	4.3	6.8
Iliac-crest	22.8	18.1	6.5	16.3	15.9	9.7	14.8	5.9	7.6
Supraspinal	12.5	10.0	4.0	12.6	10.4	5.7	9.2	3.6	4.6
Abdominal	24.8	28.5	7.6	20.2	17.6	14.9	18.9	7.4	8.2
Medial thigh	11.5	11.4	11.7	10.7	13.9	4.7	10.6	3.1	5.1
Calf	6.6	5.2	5.0	5.9	8.5	2.1	5.5	2.1	2.8
Diameters	AC1	AC2	AC3	AC4	AC5	AC6	χ	DPs	PO
Biestiloid	6.2	5.4	5.6	5.6	5.8	5.9	5.7	0.3	6.1
Bimalleolar	8.0	7.0	7.6	7.8	7.6	8.5	7.7	0.5	8.8
Humeral biepicondylar	7.6	7.0	6.9	6.8	6.9	7.5	7.1	0.4	7.1
Femoral bicondylar	10.4	9.7	9.4	10.0	9.4	10.3	9.8	0.4	10.1
Lengths	AC1	AC2	AC3	AC4	AC5	AC6	χ	DPs	PO
Arm	33.7	33.3	34.95	34.8	34.3	34.25	34.2	0.6	34.45
Forearm	24.5	23.7	25.8	26.7	25.9	25.4	25.3	1.1	27.3
Hand	20.25	19.95	20.05	18.85	19	22.2	20.1	1.2	21.75
Femur	40.45	40.1	43.3	42.8	40.95	43.35	41.8	1.5	44.35
Tibia	36.75	35.1	37.45	37.65	37.15	37.7	37.0	1.0	40.6
Foot	27.55	26.3	26.6	26.9	26	28.7	27.0	1.0	29.5

AC: ACESA athletes; χ: average of ACESA athletes, SD = standard deviation;
PA: Paralympic athlete, R = right; L = left

Figure 1 shows the average characteristic of the typology of ACESA athletes and the Paralympic athlete by plotting values in the somatochart of sportsmen. The Paralympic athlete is characterized as ecto-mesomorph and the average value of ACESA athletes is classified as balanced mesomorph.

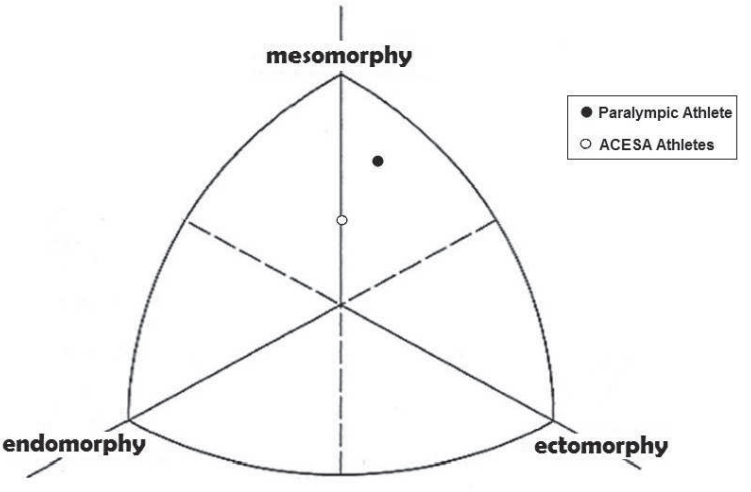

FIGURE 1. Somatochart of ACESA athletes and the Paralympic athlete

In relation to the somatotype components referenced in Table 1 and Figure 1, it was observed that ACESA athletes show a balanced profile of the mesomorphic component, while the Paralympic athlete shows an ecto-mesomorph profile.

There were no significant differences between the perimeters of the left and right hemibodies of ACESA goalball athletes compared with the Paralympic goalball athlete.

Figure 2 shows the z-scores calculated for goalball athletes using the «Phantom» strategy, comparing ACESA athletes with the Paralympic athlete. This figure shows that the z-score values of the Paralympic athlete (except for lean body mass) are below those of ACESA athletes.

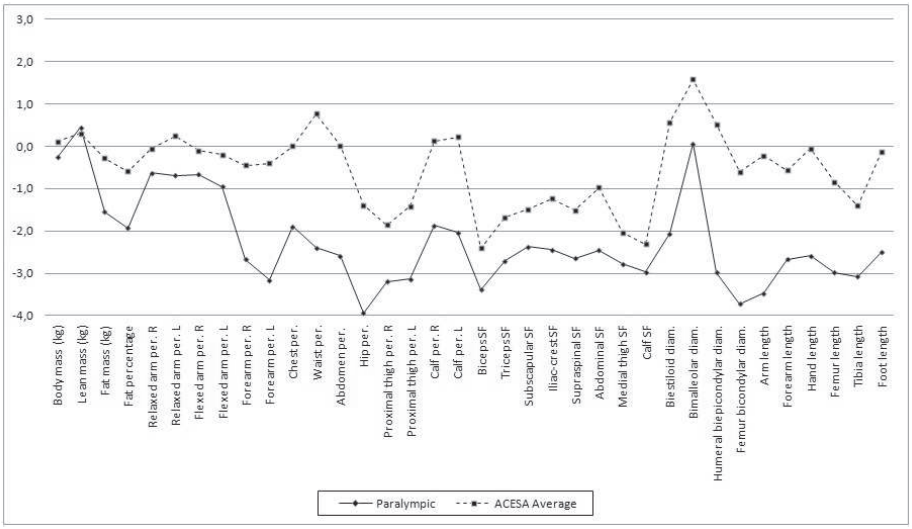

FIGURE 2. Z-scores of Paralympic and ACESA goalball athletes. Per.: Perimeter, R: right, L: left; SF: skinfold; Diam.: Diameter.

DISCUSSION

It was observed that ACESA athletes had mean age of 35.5 ± 14 years, while the Paralympic athlete had 40 years of age. Goalball is a sport that requires agility and strength; however, the experience gained over the years at the level of concentration and body, auditory and spatial perceptions are extremely important to maintain a good level of play. It is observed that among athletes, the mean age is similar to that found in the study of Palmieri & Silingardi (2005), which was aimed at verifying the inter relationship between age and performance in high-level goalball players. The authors found that the best teams were those with athletes with average age of 30 years and who were seeking a renewal, mixing with younger athletes.

Although experience is a relevant factor, since it can improve spatial orientation and concentration during the games, it is believed that it is not the only factor to be considered, especially when considering that some ACESA athletes have more practice time than Paralympics athletes. The dedication to training, physical and psychological preparation, as well as biotype (for example: height, size and amount of lean mass) can be more involved in this process than the simple practice of goalball.

For body mass (mean ACESA athletes = 69.6 ± 9.7 and Paralympic athlete = 81.4), height (mean ACESA athletes = 1.74 ± 0.03 and Paralympic athlete = 1.86) and span (mean ACESA athletes = 1.78 ± 0.06 and Paralympic athlete = 1.87), it was found that the Paralympic athlete had biotype greater than that of ACESA athletes. Coaches are more and more convinced that the most effective way to tactically win a game is to have a good defensive posture, and that athletes should have good agil-

ity, laterality and concentration for a better performance in the defense move. However, since the goal post is nine meters wide and all athletes play offensively and defensively, regardless of their position on the court, the taller the athlete and using the correct technique, the more he will occupy a larger area on the court, making the opponent's goal more difficult.

It was observed that the Paralympic athlete had greater span than ACESA athletes. According to Glaner (1999), who conducted a study with handball athletes, the power of the throw can be determined by the span, and the greater the span, the higher is its range and the higher is the acceleration the athlete can give to the ball. Thus, span seems to be a performance indicator in sports where the power of the throw is relevant, such as goalball.

With respect to fat percentage, the Paralympic athlete showed 11.49% and ACESA athletes 16.6 ± 5.2%. When body mass was fractionated into two compartments, lean body mass (Paralympic athlete = 72.12 and mean ACESA = 57.8 ± 6.5), fat mass (Paralympic athlete = 9.28 and mean ACESA = 11.8 ± 4.7), and BMI (Paralympic athlete = 23.7 and mean ACESA = 23.0 ± 3.6). The BMI of the Paralympic athlete was similar to the average ACESA value; however, when Δ%, F% and lean body mass values were analyzed, it could be observed that the ACESA athletes had less lean body mass (Δ% =- 19.90%) and higher F% (Δ% = +45.61%) than the Paralympic athlete, which is a result of the dedication with respect to training, since Paralympic athletes of collective modalities who represented the country in the last Paralympic games receive a scholarship for dedication to training, while other athletes practice the sport along with academic and professional activities. Although the values found for ACESA athletes were above those of the Paralympic athlete, a study found that Portuguese goalball players showed values above those found in this study with respect to F%, with an average of 20.4% (± 4.4%) (Santos & Bastos, 2007).

The average proportionality values (z-score) of ACESA athletes were close to 0.00 (Table 4). However, when analyzing the values individually, a large variation of results could be observed (for example, body mass shows a standard deviation of 1.26 and variation from -1.54 to 2.08), as evidenced by the high standard deviation values obtained. This reveals a considerable heterogeneity of subjects. Considering a profile more characteristic of athletes, the Paralympic athlete shows anthropometric values that could be considered ideal for the sport. By comparing the z-scores of this athlete with the mean z-scores of ACESA athletes, it appears that ACESA athletes are still far from the anthropometric profile shown by a Paralympic athlete.

Figure 2 shows that the majority of z-score values were below zero, especially for the Paralympic athlete. The negative values found for hip and thigh perimeters and skinfolds can be related to the reference theoretical model of the *Phantom* strat-

egy, which was proposed with unisexual basis. Thus, the higher values for hips, thighs and skinfolds found for women in the creation of the *Phantom* strategy may have influenced the results. These findings are consistent with data shown in other studies that examined the proportionality in men and women and found in women, z-score values close to zero for hips (Ackland, Ong, Kerr, & Ridge, 2003), thighs and some skinfolds (Ross & Ward) (1984).

The negative results for the skinfolds in all athletes, as well as the positive results for bone diameters in ACESA athletes, can be interpreted as a consequence of the regular practice of physical exercises. The regular practice of physical exercises leads to lower levels of body fat when compared to sedentary individuals (Martins and Santos, 2004). Lower z-scores values in the skinfolds of adult males are well documented in literature for athletes of various sports modalities (Ross & Ward, 1984; Ackland et al, 2003; Pérez, Taylor, Yuhasz, & Hernández, 2004).

The difference in the waist circumference values of ACESA athletes compared to the Paralympic athlete can be partly explained by the difference in skill level. The findings are consistent with the results by Keer et al (2007), who showed negative z-score values for corrected waist circumference in Olympic athletes.

The negative values of bone diameters and length of body segments of the Paralympic athlete used in the calculation of the z-score may have shown low values due to the athlete's stature.

Table 2 shows that the Paralympic athlete has higher values in all perimeters except for abdomen and waist, and lower values for all skinfolds. These values are due to the high frequency and level of training, combining basic physical preparation carried out in weekly meetings with a more strenuous bodybuilding training, which led to bigger and better skeletal muscle development.

In relation to the somatotype components shown in Table 1 and Figure 1, it was observed that ACESA athletes were characterized as balanced mesomorphic, while the Paralympic athlete showed ecto-mesomorph profile. Goalball requires the physical combination of tall, strong and agile athletes for a better performance in attack and defense moves, in which height and span are essential to a better performance in defense and attack moves, respectively. An individual with ecto-mesomorph profile, as the Paralympic athlete, seems to have some advantages with regard to the practice of high-level goalball because these athletes show good combination of elongated members with considerable amount of muscle mass, and span, which allows a greater range of motion, more effectively using the power of throw.

The sports requires constant use of the dominant body in relation to the other to make the attack (throw); therefore, since the dominant side is the most used, compensatory activities should be performed in case the training is frequent, with a higher

prevalence of use of only one hemibody. Similar results were found by Cyrino et al (2009), who found no difference in the skinfold measurements in the various muscles analyzed, both for men and women. The results of this research are consistent with Moreno et al (2002), although in different magnitudes. The authors have already reported, in their study with boys and girls from seven to nine years of age, no significant differences between measurements performed by both the right and the left sides of the body.

The lack of studies on goalball athletes and with a more detailed anthropometric analysis makes the comparison of this study with others difficult. An important aspect that deserves attention is that this is the first study to investigate the morphological profile of goalball athletes in Brazil. In addition, the standardization of methods for data collection is another aspect that deserves to be highlighted.

Some limitations found during this study must also be considered. To determine the morphological profile of goalball players, the sample used in the study can *a priori* be considered inadequate, since there are many goalball teams in Brazil, and because the study is focused on only one team in the state of Santa Catarina. However, the number of measurements taken was large, which could hinder the progress of the study in case it was conducted in an event with a high number of teams. In contrast, the relevance of this study is its pioneer feature, which could serve as a reference for other studies in different Brazilian regions in order to determine a national profile.

Paralympic sports are relatively new compared to conventional sports. Unlike other sports, goalball has not been adapted from other sports. Thus, there are few studies seeking to characterize the profile or address technical, tactical and physical issues for this Paralympic sport. Players of the Santa Catarina Association of Adapted Sports have lower stature values when compared to athletes from the Brazilian Paralympic Goalball team, as well as a somatotypology different from other athletes. Empirically, coaches have already been drawing this profile in direct contact with high-level athletes in world championships held in Brazil; however, it must take into consideration that it is not only the definition of this profile that will predict the best players, but rather a set of skills and physical abilities specific to the sport such as agility, strength, spatial orientation and good tactile and auditory perception.

Thus, this study fills a gap in literature adding information relevant to the morphological characterization of Goalball players, serving as a baseline reference for future studies. As a suggestion, studies aimed at comparing the anthropometric values and performance levels of athletes such as launch speed, can be a great research option.

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