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**MORPHOLOGICAL PROFILE OF ATHLETE STARTERS AND NONSTARTERS OF FEMININE FUTSAL****PERFIL MORFOLÓGICO DE ATLETAS TITULARES E RESERVAS DE FUTSAL FEMININO**

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**ABSTRACT**

The objective of the study was to compare the morphological characteristics of female futsal athlete starters and nonstarters. The study included 115 athletes, 60 starters and 55 nonstarters, belonging to 10 teams that competed in the XX Brazilian Cup of Clubs, special division. Anthropometric measurements were obtained with the purpose of characterizing and determining body somatotype. The analyzes were performed with the aid of a commercial statistical package (SPSS version 18.0), adopting a significance level of  $p < 0.05$ . The results showed that the athlete starters were older ( $p=0.024$ ), had a longer practice time ( $p=0.019$ ), and lower fat percentage ( $p=0.047$ ) and femur diameter ( $p=0.048$ ) than the nonstarters, however, the last two variables lost significance after adjustment for practice time. Nevertheless, they presented a similar somatotypological classification (mesomorph-endomorph). Considering that body composition and sports experience are attributes associated with performance, the observed differences between the athlete starters and nonstarters could contribute to the decision making of coaches in the formation of the titular team in women's futsal matches.

**Keywords:** Body Composition. Soccer. Physical activity. Women. Anthropometry.

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**RESUMO**

O objetivo do estudo foi comparar as características morfológicas de atletas de futsal feminino titulares e reservas de alto nível competitivo. Participaram 115 atletas, 60 titulares e 55 reservas pertencentes a 10 equipes que disputaram da XX Taça Brasil de Clubes, divisão especial. Medidas antropométricas foram obtidas com a finalidade de caracterizar e determinar o somatotipo corporal. As análises foram realizadas com auxílio de um pacote estatístico comercial (SPSS versão 18.0) adotando como nível de significância  $p < 0,05$ . Os resultados revelaram que as atletas titulares são mais velhas ( $p=0,024$ ), possuem maior tempo de prática ( $p=0,019$ ), menor percentual de gordura ( $p=0,047$ ) e diâmetro do fêmur ( $p=048$ ) do que as reservas, porém, as duas últimas perdem a significância ao serem ajustadas pelo tempo de prática. As atletas apresentaram semelhante classificação somatotipológica (mesomorfo-endomorfo). Considerando que a composição corporal e a experiência esportiva são atributos associados ao desempenho, as diferenças observadas entre as atletas titulares e reservas podem contribuir para a tomada de decisão do treinador na formação da equipe titular em jogos de futsal feminino.

**Palavras-chave:** Composição corporal. Futebol. Atividade física. Mulheres. Antropometria.

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**Introduction**

Futsal is a collective sport characterized by intermittent high intensity and rapid motor actions, predominantly involving speed, agility, and muscular power abilities, present in displacements (lateral and back), exits and quick stops, jumps, kicks, and fast running<sup>1-3</sup>. The physiological demand required in the practice of the modality, both during training and a game, is an indicator of the need for constant exchanges of athletes. In this case, the allowed number of athletes who start a futsal game (four players and a goalkeeper) has remained unchanged since the first reports of this modality. However, the number of substitutions has undergone several changes in recent years. The current format has made futsal more dynamic, enabling substitutions of all players during a match. However, the number of exchanges and athlete replaced depend on complex decisions made by the coach, which can change from one game to another.

The evolution of futsal, in relation to changes in the rules, has contributed to technical, tactical, and psychological specificity of the player. This is also reflected in the morphological characteristics that are, in part, inherited, which allow players to achieve better sport performance in relation to athletes who do not have these characteristics<sup>4</sup>. In this sense, morphological attributes such as structure and body composition, as well as age and sports experience, are considered essential for the success of an athlete/team not only during a game but also throughout the season<sup>5,6</sup>. Experience is a factor that influences sporting success and is directly related to the time of training and participation in competitions<sup>7-9</sup>.

In relation to the perceptual and cognitive characteristics, information suggests that players who accumulate more participation in games as starters present advantages over reserves<sup>10</sup>. In this regard, experienced athletes present more developed declarative and procedural knowledge as well as structural and organizational knowledge than less experienced athletes. The expert player is able to make faster and more accurate decisions, having a greater capacity for tactical regulation, anticipating game events, and opponent actions. These players are more efficient in planning actions in advance and accessing specific information stored in long-term memory in competitive situations<sup>10</sup>. These conditions, attributed to titular/experienced athletes, can support coaches' decisions, directly or indirectly, to maximize team performance through tactical changes<sup>11</sup>.

With few exceptions, team sports allow substitution of athletes during matches. The number of athletes who start the match, as well as the number of substitutions, is regulated by rules specific to each modality. It is common to designate the team athletes that start the game as "starters" and those that, at the discretion of the coach, substitute an athlete on the court after the beginning of the game as "nonstarters". The reasons that contribute to the coach's decision regarding the formation of the main team and substitutes, as well as in the establishment of internal norms, goal setting, planning, supervision, and evaluation of tasks are diverse and complex<sup>12</sup>. In other words, coaches must have the expertise, ability, and competence to control a large number of variables that determine the development of their activity.

Identifying variables that are able to positively influence sports results, such as potential specific characteristics according to their tactical function, is an important area of interest in competitive physical activities, as these variables will serve as a basis for better structuring and individualization of training<sup>13</sup>. It is a fact that the formation of a team, including the choice of the athletes who start a game is the responsibility of the coach (technical committee) who uses technical-tactical information to decide who the starters are and when/who should replace them. However, considering that body structure and composition as well as time of practice can contribute to sporting performance, our hypothesis is that titular athletes have greater sport experience and a more appropriate morphological structure for the motor actions of the modality than reserve athletes. Thus, the objective of this study was to compare the morphological characteristics of female futsal athletes, starters and reserves, of high competitive level participants of the XX Brazilian Cup of Clubs.

## Methods

### Participants

The sample was composed of 115 female athletes ( $22.0 \pm 3.9$  years) from 10 teams of the special division who participated in the XX Brazilian Women's Futsal Clubs Cup held in Criciúma-SC-BR (03 to 09 October 2011). This is one of the most traditional competitions of the Brazilian Confederation of Indoor Soccer (CBFS) and in this edition, nine champion state

teams participated as well as the host city team. The number of teams and representation per state were: Paraná (1), São Paulo (1), Rio Grande do Sul (1), Santa Catarina (2), Brasília (1), Goiás (1), Pará (1), Ceará (1), and Bahia (1). The competition is an annual championship and the first edition of the Brazilian Women's Futsal Cup was played in 1992.

Prior to data collection, athletes and technicians received information about the intentions of the study, after which they signed the consent form. No athletes refused to participate in the study. The study was approved by the Human Research Ethics Committee of the Midwest State University (UNICENTRO), process number 039/2011, and complies with the regulations of Resolution 196/96 of the National Health Council on research involving human beings.

### *Procedures*

Initially the athletes and technicians were interviewed with the purpose of obtaining personal and specific information on their functions. For the study purpose, the athletes answered questions such as "what is your function on the court", "when a game starts, are you included as a starting player, thus, starting the game, or do you enter during the game?", "how many hours of weekly training", etc. It is worth mentioning that some athletes declared that they changed starter status with another athlete in most games. In turn, this and other information that characterized the athletes in the training and games, were compared and confirmed with the technicians who answered questions such as: "Who are your top athletes", "what position do the athletes play ...", "how many hours of training per week", etc. From this information the participants were grouped according to their playing conditions, as starters ( $n = 60$ ) and nonstarters ( $n = 55$ ).

Next, individually, the athletes were submitted to anthropometric measurements (body mass, height, and skinfold thickness). Necessary measurements for the determination of the somatotype were obtained according to the guidelines of Ross and Marfell-Jones<sup>14</sup>. A cescorf compass (Cescorf<sup>®</sup> Equipamentos / Porto Alegre / RS / BR) was used to perform skinfold measurements. Body mass was verified using an anthropometric scale (Filizola<sup>®</sup> Brazil) with a 100g precision and height was determined by means of a wooden stadiometer with a measurement scale of 0.1 cm. The body mass index (BMI) was obtained through the relation between body mass (kg) and height in square meters ( $m^2$ ). The measurements of circumference were obtained using an inextensible tape measure (Mabis<sup>®</sup>, model Gulik, Japan) and bone diameters with a metal paquimeter (Somet<sup>®</sup>).

Body density was determined by a regression equation with three skinfolds<sup>15</sup> and fat percentage (%BF) was calculated from the formula proposed by Siri<sup>16</sup>. The measurement of body somatotype was obtained from the modified proposal of Heath and Carter<sup>17</sup>.

The anthropometric measurements were checked twice on the right side of the body. If the difference was greater than 0.2 mm for skinfolds, or 0.5 cm for other variables, a third measurement was taken. The final result used for data analysis was the average of the two or three measurements. The championship format enabled each team to take one day off. In this sense, the data collection was performed in a room, in the same gym where the games were played, coinciding with each team's day off, which allowed a minimum interval of 15 hours between the previous game and the evaluation.

### *Statistical analysis*

The information was processed and analyzed using IBM SPSS Statistics version 18.0 (IBM Corporation, Armonk, NY, USA). A significance level of  $p < 0.05$  was assumed for all analysis. Initially, an association between condition and game position (goalkeepers, fixed,

wings and pivots) was tested using the Chi-Square test. Next, the Shapiro Wilk test was used to analyze the normality of the data for starters and reserves. For data that did not present normality (weekly training and body mass), the Mann-Whitney u test for independent samples was used, with values expressed as Median and Interquartile Range (25-75%). For data that presented normality, the student t-test for non-paired values was used, with variables expressed as mean and standard deviation (mean  $\pm$  SD). For the anthropometric/morphological variables the effect sizes were calculated, classified as trivial (<0.2), small (0.2 to <0.6), moderate (0.6 to <1.2), and large ( $\geq$ 1.2)<sup>18</sup>. To test if the differences between anthropometric / morphological variables were influenced by possible covariates, covariance analysis (ANCOVA) was performed, controlling the assumption of regression homogeneity.

## Results

Significant differences were observed for age (P=0.024) and practice time (P=0.019), revealing that reserves were younger and had less time of practice in the modality compared to starters (Table 1). Additionally, no association was observed between condition and player position.

**Table 1.** Characteristics of futsal athletes according to the game condition

Game positions	All (n=115)	Starters (n=60)	Reserves (n=55)	p
Goalkeeper n (%)	20 (17.4)	10 (16.7)	10 (18.2)	
Defender n (%)	26 (22.6)	14 (23.3)	12 (21.8)	
Winger n (%)	49 (42.6)	27 (45)	22 (40)	
Pivot n (%)	20 (17.4)	9 (15)	11 (20)	
Age (years)	22.0 $\pm$ 3.9	22.8 $\pm$ 3.6	21.1 $\pm$ 4.0	0.024*
Time of practice (years)	9.0 $\pm$ 4.3	9.9 $\pm$ 4.4	8.0 $\pm$ 4.0	0.019*
Weekly training (hs/week)	3.0 (1.0)	3.0 (1)	3.0 (1)	0.609

**Note:** \*P<0.05 comparison between starters and reserves; *Chi-square test for trend* for association between condition and game position. *Mann-Whitney U test* for independent samples expressed as median and interquartile range (training); *Student t test* for independent samples expressed as mean and standard deviation (age and practice time)

**Source:** The authors

In relation to the morphological variables, the data emphasize a higher %BF (P=0.047) and longer femur diameter (P=0.048) in favor of the reserve athletes. Regarding the somatotype, the starters (4.3-4.1-2.1) and reserves (4.7-4.2-2.0) did not differ and showed a similar classification of somatotype, that is, mesomorph-endomorph. It is important to point out that the mean value corresponding to the endomorphic component was higher, but not significantly, among the reserve athletes (Table 2).

**Table 2.** Anthropometric characteristics of futsal athletes according to the game condition

Variables	All (n=115)	Starters (n=60)	Reserves (n=55)	p	Effect size	Classification
Body mass (kg)	57.8 (9.1)	56.9 (12.1)	58.2 (7.8)	0.975	0.03	Trivial
Height (cm)	161.8±6.5	162.2±6.3	161.3±6.8	0.457	-0.14	Trivial
BMI (kg/m <sup>2</sup> )	22.3±2.1	22.2±2.1	22.5±2.3	0.607	0.14	Trivial
Body fat (%)	22.2±5.2	21.3±5.1	23.2±5.2	0.047*	0.37	Small
Lean mass (kg)	45.4±4.5	46.0±4.7	44.7±4.2	0.128	-0.29	Small
Humerus diameter (cm)	6.1±0.3	6.1±0.3	6.0±0.3	0.523	-0.33	Small
Femur diameter (cm)	8.8±0.5	8.7±0.4	8.9±0.5	0.048*	0.40	Small
C. contracted arm (cm)	27.4±2.1	27.5±2.1	27.3±2.2	0.713	-0.09	Trivial
C. medial leg (cm)	35.3±2.1	35.2±2.1	35.4±2.1	0.919	0.10	Trivial
Endomorphy	4.5±1.1	4.4±1.0	4.7±1.3	0.094	0.25	Small
Mesomorphy	4.1±0.9	4.1±0.8	4.2±1.0	0.509	0.11	Trivial
Ectomorphy	2.0±1.0	2.1±0.9	2.0±1.1	0.557	-0.10	Trivial
Somatotypological classification	Mesomorph-endomorph	Mesomorph-endomorph	Mesomorph-endomorph	-	-	-

**Note:** BMI: body mass index; C: circumference; \* P <0.05 comparison between starters and reserves; *Mann-Whitney U test* for independent samples expressed as median and interquartile range (body mass); *Student's t test* for independent samples expressed as mean and standard deviation (stature, BMI, body fat, lean mass, humeral diameter, femur diameter, contracted arm, medial leg circumference, endomorphy, mesomorphy, and ectomorphy)

**Source:** The authors

With the objective of confirming the differences observed in %BF and Femur diameter (cm) between the starters and nonstarters, a co-variance analysis was performed (Table 3), controlled by age (years) and practice time (years), which presented significant differences between the conditions (Table 1). The results revealed that, after controlling by age, the differences remained for both morphological variables. However, when controlling by practice time, the differences did not remain significant.

**Table 3.** Covariance analysis involving age (years) and practice time (years) as covariates in the comparisons between starters and reserves for body fat (%) and femur diameter (cm)

Variable	Covariable	Starters (n=60)	Reserves (n=55)	P
Body fat (%)	Age (years)	21.2±0.7	23.3±0.7	0.032*
	Time of practice (years)	21.4±0.7	23±0.7	0.102
Femur diameter (cm)	Age (years)	8.7±0.1	8.9±0.1	0.030*
	Time of practice (years)	8.8±0.1	8.9±0.1	0.061

**Note:** \*P<0.05 comparison between starters and reserves; Analysis of covariance (ANCOVA). Data expressed with estimated marginal mean and standard error (adjusted without the bias of the covariate)

**Source:** The authors

## Discussion

With the purpose of verifying and comparing the anthropometric profile of female athletes and reserves of the special division of women's futsal, the results of the present study confirmed in part our hypothesis. In this respect, the starters demonstrated significantly greater practice time and age, as well as a lower %BF and femur diameter in relation to the reserves. It is important to note that the differences between %BF and femur diameter did not remain significant after adjusting for the covariate practice time, remaining only when

adjusting the analysis by age. In addition, both groups presented similar somatotipological classifications (mesomorph-endomorph).

Anthropometric and physiological characteristics at the beginning and end of the season were determined in 66 pre-teen soccer players and reserves<sup>19</sup>. No significant differences were found in the anthropometric measures, but the starter players presented superior values of stature and body mass when compared to the reserves, both at the beginning and at the end of the season. At the beginning of the season the starters presented a lower %BF ( $11.0 \pm 1.9\%$  vs  $11.6 \pm 3.0\%$ ) and a higher percentage of muscle mass ( $46.3 \pm 3.5\%$  vs  $44.9 \pm 2.8\%$ ) than reserves, respectively (not significant). At the end of the season the differences in %BF had increased, although without statistical significance ( $P=0.06$ ). While the %BF increased for the nonstarters ( $11.8 \pm 3.2\%$ ), for the starters this variable remained unaltered ( $10.8 \pm 1.9\%$ ) over the season<sup>19</sup>. This fact was also found in a study with 25 football starters and reserves from Pennsylvania State University, indicating changes in %BF of reserve athletes during the season. A significant increase of 1.6% in body fat was verified at the end of the season in relation to the pre-season levels. The starters did not present any variation in %BF during the season<sup>20</sup>.

The differences between the titular versus reserve conditions observed by Gravina et al.<sup>19</sup>, when combined with the lack of differences in the present study, suggest that in the period of pre-adolescence/adolescence, anthropometric variables have a greater burden on the determination of team members, variables that tend to lose relevance in adulthood. Although the present study has a cross-sectional design, special consideration is necessary of the differences between starters and reserves for the %BF based on the findings of Kraemer et al.<sup>20</sup>, which suggest changes in body fat for the reserves over the season. The evaluations of the present study were performed in a month preceding the end of the season (October), a factor which may have contributed to the differences between the conditions.

Reserve athletes demonstrated significantly longer femur diameters than starters. However, no studies were found on this aspect which would allow comparisons. It should also be noted that the absolute difference was only 0.2 cm, which in pragmatic terms will not influence performance. Additionally, when considering other anthropometric/morphological indicators, the similarities in these characteristics between starters and reserves are evident.

Some studies investigated the anthropometric profile and age in samples of female futsal athletes. In this regard, Alves Filho et al.<sup>21</sup> and Giusti et al.<sup>22</sup> demonstrated mean values for age ( $21.4 \pm 5.4$ ,  $22.6 \pm 3.8$  years), body mass ( $61.5 \pm 11.3$ ,  $62.0 \pm 11.4$  kg), height ( $161 \pm 0.1$ , BMI ( $23.7 \pm 4.1$ ,  $22.8 \pm 3.4$  kg/m<sup>2</sup>), %BF ( $22.4 \pm 4.8$ ,  $19.8 \pm 6.6\%$ ), and lean mass ( $47.5$ ,  $49.2 \pm 6.2$  kg) respectively, similar to the sample of the present study.

In relation to the somatotipological profile, the total number of athletes (4.5-4.1-2.0), starters (4.3-4.1-2.1) and nonstarters (4.7-4.2-2.0), of the present study showed mesomorph-endomorph classification, in other words, a balance between fat and muscle mass. In a study performed with 112 female futsal athletes, the morphological profile was classified as mesomorph-endomorph (5.0-3.3-2.1), thus the component of %BF exceeds the component of muscle mass and linearity<sup>13</sup>. However, there was a ten year interval between the studies, suggesting a discreet modification in these components. Although the muscular component can be improved, the somatotipological profile presented by the athletes of the present study (mesomorph-endomorph) may suggest a greater association with the physiological demands of the modality (e.g., potency and strength of lower limbs) than a classification where the fat component is higher<sup>13</sup>, considering that a greater amount of fat was correlated positively with maximum sprint time and negatively with the production of power in leg extensions<sup>23</sup>.

Regarding age, there is a suggestion in the literature that starter female soccer players are significantly older than reserves ( $20.5 \pm 1.2$  vs.  $19.5 \pm 0.86$  years respectively)<sup>24</sup>. A

difference was also reported in a case study with elite Australian rugby players, revealing that the starters were older than the reserves ( $24.0 \pm 3.3$  vs.  $20.2 \pm 2.0$  years, respectively)<sup>25</sup>. It is worth noting that there were no statistical differences in height and body mass among the samples investigated in the studies of Jajtner et al.<sup>24</sup> and Young et al.<sup>25</sup>, agreeing with the results of the present study. Comparing starters and reserves in the junior elite categories of rugby, Gabbett et al.<sup>26</sup> observed significant differences in height ( $179.3 \pm 6.2$  vs  $175.1 \pm 4.2$  cm) and body mass ( $80.3 \pm 10.4$  vs  $71.8 \pm 6.2$  kg), favoring the starter athletes. In the same study, no significant differences were found between starters and reserves in the sub-elite junior category<sup>26</sup>.

Different from the present study, Ré<sup>27</sup> did not find differences for age among Futsal athletes in the condition of starters and reserves, despite the discrete advantage for the starters ( $14.0 \pm 1.1$  vs.  $13.8 \pm 0.9$  years, respectively). In addition, the practice time indicators revealed that the group of starters began the modality at a lower age than the reserves ( $6.7 \pm 1.9$  vs  $8.3 \pm 2.8$  years) and, consequently, demonstrated longer accumulated practice time ( $1047.6 \pm 375.7$  vs  $854.4 \pm 333.7$  hours)<sup>27</sup>. Values close to the present study were reported for male soccer players, with a practice time of  $11.5 \pm 4.1$  years, and mean age of  $24.9 \pm 4.6$  years<sup>28</sup>.

In the present study, the practice time for the starter athletes was significantly higher than the reserves ( $9.9 \pm 4.4$  vs.  $8.0 \pm 4.0$  years, respectively), although they presented equivalent training hours per week (3h). This is important, since there is evidence suggesting that practice time in sports is a determining factor for players' tactical knowledge<sup>7,29</sup>. Barnabé et al.<sup>30</sup> reported that age-related experience of soccer players tends to influence their collective behavior in offensive and defensive situations. For the authors, experienced athletes have basic knowledge of the broader modality, making them better able to identify relevant signs and, consequently, better able to make decisions in any game situation than less experienced players. In psychology, two classes of knowledge structures are distinguished, which can be interpreted in the sports environment, declarative knowledge and procedural knowledge. According to Greco<sup>31</sup>, declarative tactical knowledge in sport is understood as the ability of the athlete to "know what to do" in a particular game situation, while procedural knowledge, refers to actions that involve a high degree of motor skill, i.e., "knowing how to perform" a technical gesture in a game situation. For Giacomini et al.,<sup>32</sup> the practice time that athletes accumulate in a modality directly influences their level of declarative tactical knowledge. In this sense, the comparison of declarative tactical knowledge among soccer players of the U-14 and U-15 categories suggested that older athletes (U-15 category) had significantly better knowledge than younger athletes (U-14)<sup>33</sup>. This information indicates that the time of practice is determinant for the development of declarative tactical knowledge in soccer players.

The longer practice time also demonstrated a positive effect on declarative tactical knowledge in state and national level tennis athletes<sup>34</sup>. In basketball, young athletes with greater experience presented superior performance of procedural knowledge in comparison to athletes with less sports experience<sup>35</sup>. It has also been reported that greater sports experience of volleyball players was associated with better performance and stability in complex reactions than the group with less experience<sup>36</sup>. In this respect, sports experience favored the technical-tactical development of young volleyball players, especially in the infant and child categories<sup>37</sup>.

As a limitation of the study, further comparisons (e.g., physical, physiological, and psychological performance characteristics) were impossible between female futsal athletes in the conditions of starters and reserves. However, it is worth mentioning that the objective was to compare training variables and anthropometric characteristics between starter and reserve

athletes, and studies based on the theme, even using samples with men, other sporting modalities, or varied ages, point out similar differences between starters and reserves to our results (e.g., age, practice time, anthropometric characteristics, and body composition).

## Conclusions

The starter athletes had more practice time and age as well as lower %BF and femur diameter than the reserves. The differences between %BF and femur diameter did not remain significant after adjusting for the covariate time of practice, remaining only when adjusting the analysis by age. In terms of practical application, considering that body composition and sports experience are attributes that appear to be associated with performance, the differences observed between the starter athletes and reserves can be used in a way that complements the criteria for the coach's decision making in the training of the titular team in women's futsal games.

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