Original Article

Morphofunctional profile of Brazilian athletes under 20 years of age in state-level futsal

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Abstract:

The purpose of this study was to describe the morphofunctional profile of futsal players U-20 category. Fourteen state competition participants athletes underwent for tests to assess body composition, aerobic power, abdominal strength endurance, flexibility, leg strength, lower limbs power, speed, and agility to change direction. Athletes showed body fat percentage classified as good ($8.0 \pm 3.3\%$) and higher aerobic power (VO_{2max} : 59.7 ± 6.7 ml/kg/min). Abdominal strength endurance (45 ± 10 rep.). It was rated as above mean, while flexibility was classified as mean (33 ± 6 cm). Furthermore, it was shown suitable for speed performance (V30M: 4.8 ± 0.2 s), lower limbs power (221 ± 15 cm) and lower limb strength (101 ± 40 kgf), based on previous studies with futsal athletes. This study can be used to help the understanding of the physical and physiological aspects of futsal athletes, as well as coaches in the sport talent detection process.

Key Words: team sports, performance, body composition, physical fitness, physical assessment.

Introduction

The futsal, being an up-and-coming sport, has attracted more and more fans around the world. Due to the ease of finding space for its practice, it is one of the most widespread sports in Brazil. It is played by over 12 million people in over 100 countries (Beato *et al*, 2014). The game is played in a 38-42 m x 18-25 m court for two 20-minute each half-time (CBFS, 2009), with intervals for some events, and the match may even last a total of 70-80 minutes (Barbero-Alvarez *et al*, 2008).

Due to the characteristics of the match (Caetano *et al*, 2015) Futsal is configured as a sport with intermittent characteristics, structured by cyclic and acyclic movements, with predominant aerobic metabolism and, in its decisive actions, by anaerobic ones (Stolen *et al*, 2005).

In addition, the indoor soccer requires high intensity and short duration efforts, the events speed and actions during the game require the athlete to respond promptly and to be as efficient as possible (Gorostiaga *et al*, 2009). This variability of movements required during training and competition stimulates the athlete to develop optimum levels in all the aforementioned motor skills, naming them, aerobic endurance, anaerobic power, speed, agility, explosive strength and flexibility (Stolen *et al*, 2005).

Accordingly, the quantity of studies involving match analysis has recently increased to a great extent (Barbero-Alvarez *et al*, 2008; Doğramaci *et al*, 2015), the matches' physiological demands (Barbero-Alvarez *et al*, 2008; Caetano *et al*, 2015; Bueno *et al*, 2014) and futsal athletes' anthropometric and motor profile (Andreato *et al*, 2013; Barbero-Alvarez, *et al*, 2009). This reality has greatly assisted the coaches and trainers in the organization and planning of specific training for futsal. However, studies involving base athletes (e.g. under 20 category) are scarce, fact which limits the planning and organization of training for athletes of these categories.

Thus, the objective of this study was to describe the morphofunctional profile of futsal Brazilian athletes category under-20 state-level.

Material & methods

Subject

The sample consisted of 14 futsal athletes participating in state championship (aged: 16 ± 1 years; body mass: 65 ± 8 kg; height: 175.2 ± 5.2 cm), male, under 20 category. Formed by three goalkeepers, two defenders, six wingers, and three pivots. All subjects after informed about the procedures they would be submitted, they

signed a free and clarified term of consent. In the data collection period, the athletes were in the preparatory period. This study was approved by the Standing Committee on Ethics Local.

Anthropometry

The athletes had their body mass measured with use of Fillizola® scales precision to 0.1 kg, and a certain height in Seca® stadiometer precision to 0.1 cm, second protocol of Lohman et al. (1988). The thickness determination of skin (chest, midaxillary, triceps, subcapular, abdominal, suprailiac, and medial thigh) was performed in triplicate way, by using the average value, following the standardization of Lohman et al. (1988). For this, it was used plicometer Harpenden (John Bull British Indicators®, England) with constant pressure of 10g/mm and accuracy of 0.2 mm. From the skinfold body density thickness was determined by the formula Jackson and Pollock (1978). After being determined the body density the equation Siri (1961) was used to estimate body composition.

Cardiorespiratory evaluation

Running on a treadmill incremental tests were performed (Inbrasport, Porto Alegre – RS, Brazil) in air-conditioned laboratory, during the morning with temperature maintained between 20°C e 24°C. The athletes were instructed to have a meal previously and proper clothing to carry out maximum effort. The initial rate was 7 km/h in increments of 1 km/h every three minutes, being maintained a steady incline throughout the test equivalent to 1%. The athletes were strongly encouraged to keep the test as long as possible, until volitional exhaustion.

To determine the ventilatory variables, a gas analyzer (Spirometer VO2000, Inbrasport, Porto Alegre - Brazil) was used, in which gaseous samples were collected and measured directly during the test. The maximum oxygen consumption (VO_{2max}) was considered the largest obtained in two successive periods of 15 seconds during exercise stress testing. The speed corresponding to VO_{2max} (vVO_{2max}) was also determined. The values of the relevant physiological variables aerobic thresholds 1 and 2 are given by the device itself and visually inspected by an experienced assessor. Along with spirometry system an electrocardiograph was used for heart rate registration at the end of each stage and recovery through the program ERGO PC® (Micromed, Brasília – Brazil). Maximum heart rate (HR_{max}) was regarded as the average of the highest values obtained in the last 5 seconds of the last exercise stress testing stage.

Motor Assessment

The flexibility was measured by the Wells and Dillon's sit-and-reach test, being considered the greatest distance achieved in three attempts in the trunk flexion sitting (Pollock & Wilmore, 1993) the abdominal strength endurance parameter was assessed by sit-up test in 1 minute, where the athlete must perform as many repetitions as possible (AAHPER, 1976). The horizontal jump test was used as the lower limbs muscle power indicator, where each individual performed three attempts and the highest value obtained was recorded (Johnson & Nelson, 1979). To measure agility the SEMO test was applied measuring the overall speed of the body moving forward, backward and laterally (Johnson & Nelson, 1979), and the speed of 30 meters test (Popov, 1986), being, in both, computed the best result of two attempts performed by the athlete. In addition, the maximal isometric leg strength was assessed with the dynamometer test (Johnson & Nelson, 1979), with two tries taking advantage of the best.

Statistical Analysis

The data were processed using the SPSS 20.0 program and presented as mean, standard deviation, 95% confidence interval (95% CI) and range (maximum and minimum).

Results

Table 1 shows the physical and anthropometric characteristics of the sample.

Table 1. Sample characterization.

	Mean	SD	95% CI	Range
Age (years)	17	1	16 - 17	15 – 18
Practice time (years)	9	3	7 - 10	3 -12
Body mass (kg)	66.1	6.6	61.1 – 71.2	58.8 – 78.0
Height (cm)	175	5	171 - 179	170 – 185
BFM (%)	8.0	3.3	5.9 – 10.1	4,9 – 15.3

SD: standard deviation, 95% CI: 95% confidence interval, BMF: body fat mass.

Table 2 expresses the results of physical tests of state-level futsal athletes.

Table 2. Results of physical tests of state-level futsal athletes (n = 14).

	Mean	SD	95% CI	Range
VO _{2max} (ml/kg min)*	59.7	6.7	54.9 – 64.5	45.5 – 69.3
vVO _{2max} (km/h)*	15.4	1.2	14.6 – 16.2	14.0 – 18.0
HR _{max} (bpm)*	193	6	189 - 197	182 – 202
AT 1 (% VO _{2max})*	79.1	10.3	71.2 – 87.0	63.3 – 95.1
AT 2 (% VO _{2max})*	93.4	7.0	88.0 – 98.7	78.9 – 99.0
V30m (s)	4.8	0.2	4.6 – 4.9	4.3 – 5.2
Agility SEMO (s)	11.7	0.5	11.4 – 12.01	11.0 – 13.0
Horizontal jump (cm)	224	17	214 - 234	226 – 253
DMI (kgf)	101	40	78 - 125	39 – 177
Sit-ups (rep./min)	45	10	39 - 51	35 - 69
Flexibility (cm)	32	6	29 - 36	18 - 39

DP: standard deviation, 95% CI: 95% confidence interval, * n=10; VO_{2max}: maximum, consumption of oxygen, vVO_{2max}: speed reached at VO_{2max}, HR_{max}: maximum heart rate, V_{max}: maximum speed, AT 1: aerobic threshold 1; AT 2: aerobic threshold 2, V30m: speed at the 30m speed, DMI: lower limbs dynamometer.

Dicussion

The results of this study shows the variables, body fat percentage classified as good (Pollock & Wilmore, 1993), aerobic power ranked as superior (Cooper, 1982), abdominal endurance was ranked as above mean (Pollock & Wilmore, 1993) and flexibility classified as mean (CSTF, 1986). Furthermore, based on previous studies with futsal athletes, it was demonstrated performance compatible for speed and power of the lower limbs, as well as superior performance in the lower limbs strength.

Although body composition is an important component of physical fitness, and it is recognized that the excessive accumulation of body fat may have important health implications (Orsano *et al*, 2010) and result in damage to sports performance (Cyrino *et al*, 2002), information regarding the body constitution of futsal practitioners is limited, especially on high performance. Such lack of knowledge limits the construction of an anthropometric profile of the athletes sport, which is important to compare teams and performance levels, besides assisting greatly in headhunter detections work. The results the study here in showed body fat percentage classified as good (Pollock & Wilmore, 1993), being these results similar to those observed in statewide Brazilian athletes (n= 15; 7.0 ± 5.7%; (Andreato *et al*, 2013)). However, lower than reported in first league Brazilian athletes (n= 14; 10.0 ± 2.4%; (Rodrigues *et al*, 2011)), Iranian Team Athletes (n= 25; 12.9 ± 1.8%; (Shirazi *et al*, 2010)) and Spanish Team Athletes (n= 15; 9.7 ± 2.5%; (Gorostiaga *et al*, 2009)).

Futsal is characterized as a sport with intermittent feature (Caetano *et al*, 2015), held at high intensity. During a match the players run between 90m/min (Pollock & Wilmore, 1993) and 117m/min (Barbero-Alvarez *et al*, 2008), and the athletes' performance tend to decrease in the second half of the match (1st half 98m/min; 2nd half: 90m/min, (Bueno *et al*, 2014). The mean heart rate during the match mode is 90% of HR_{max}, 83% of the time over 85% of HR_{max}, 16% between 65-85% of HR_{max}, and 0.3% below 65% of HR_{max} (Barbero-Alvarez *et al*, 2008). Thus, due to the length of the match, and the fast intervals between high intensity efforts (Caetano *et al*, 2015), metabolically an intense activation of the aerobic systems occurs in Futsal (Castagna & Barbero Alvarez, 2010). In this aspect, a good aerobic power is indispensable to withstand the high demands of the sport. However, it is noteworthy that high levels of VO_{2max} may not be desired in the modality athletes, due the possibility of generating decrease in speed and muscle strength (Bangsbo & Lindquist, 1992).

In this regard, the athletes' aerobic power of this study was classified as superior (Cooper, 1982) and similar to that described previously in studies with the Brazilian team (n= 9; 59.6 ± 2.5 ml/kg/min; (Milanez *et al*, 2011)), professional Brazilian athletes (n= 186; 58.0 ± 6.4 ml/kg/min; (Baroni & Leal Junior, 2010), were more superior than athletes from the 3rd Italian League (n= 13; 55.2 ± 5.7 ml/kg/min (Barbero-Álvarez, *et al*, 2009)) and more inferior than Spanish athletes from the 2nd League (n= 11; 62.8 ± 5.3 ml/kg/min (Barbero-Álvarez, *et al*, 2009)), professional Spanish athletes (n= 18; 65.1 ± 6.2 ml/kg/min; (Lima *et al*, 2005)) and Brazilian First League athletes (n= 14; 71.5 ± 5.9 ml/kg/min; (Lima *et al*, 2005)). In this comparison, we use only studies which conducted direct measurements studies (gas analysis) to evaluate aerobic power, since that futsal players (n= 13) showed lower values of oxygen consumption in indirect test (58.5 ± 8.5 ml/kg/min) compared to direct test (62.8 ± 10.1 ml/kg/min; (Lima *et al*, 2005)). Agility is the physical capacity that allows the body position or direction of movement in the shortest possible time (Dantas, 1998). In this study we used the SEMO agility test (Johnson & Nelson, 1979), which is an interesting test for futsal athletes as it involves direction change at high speed, feature present in matches in the sport. At the SEMO athletes completed the test in 11.7 ± 0.5 s. However, it were not found values of this variable with futsal athletes in other studies. Knowing that speed is an essential physical ability in futsal (Matos *et al*, 2008), we evaluated through the 30-meter test.

The athletes of the present study compared to Brazilian statelevel players (n= 12; 4.55 ± 0.2s; (Santa-Cruz *et al*, 2010)) showed similar performance. However, when compared to Brazilian athletes participants of

the main national competition ($n=66$; 3.7 ± 0.2 s; (Dantas & Fernandes Filho, 2002)) showed superior results. Regarding the lower limbs power, measured by the horizontal jump test, athletes of this study showed values similar to those found in state juvenile athletes ($n= 8$; 221 ± 9 cm (Cyrino *et al*, 2002) and the special division of Santa Catarina ($n= 12$; 222 ± 17 cm; (Fachineto *et al*, 2008)); slightly lower than those observed by Brazilian athletes of the state-level adult category of ($n= 12$; 228 ± 17 ; (Andreato *et al*, 2010); $n= 15$; 226 ± 10 cm; (Andreato *et al*, 2013)) and found significantly lower values on the state-level Brazilian athletes ($n= 12$; 243 ± 5 cm; (Santa-Cruz *et al*, 2010).

In order to assess the maximum isometric strength of legs, dynamometer test was applied in which the results of the under 20 futsal athletes, of this study, were higher than those of Brazilian athletes of the same level ($n= 15$; 92 ± 20 kgf; (Andreato *et al*, 2013)). Muscular endurance along with other physical fitness variables may be predictive of good sports performance, especially in collective modalities sport like futsal. The futsal players U-20, in the present study showed muscle strength assessed by sit-up test in 1 minute above the average (Pollock & Wilmore, 1993), similar results were reported in a study involving Brazilian athletes of the U-20 state team ($n= 12$, 46 ± 3 repetitions; (Dantas & Fernandes Filho, 2002), but below the state-level Brazilian athletes ($n= 15$; 53 ± 10 repetition; (Andreato *et al*, 2013)). Flexibility is recognized as an important fitness component (Farinatti, 2000). However, futsal flexibility occupies second place because it ranks extremely important only for goalkeepers. For them, this valence becomes important, as they are required at various moments during the match (ex: defenses). The sit and reach test results achieved by the present study subjects were classified as medium (CSTF, 1986). Compared with futsal athletes, the results of this study were superior than the young athletes participating in state competition ($n= 8$; 29 ± 8 ; (Cyrino *et al*, 2002), but lower than state-level Brazilian athletes ($n= 15$; 38 ± 7 cm; (Andreato *et al*, 2013)) and junior category athletes ($n= 5$; 36 ± 6 cm; (Bertolla *et al*, 2007)). It is noteworthy that in both studies the measuring instrument and the protocol used was the same used in this study. However, further conclusions about that physical fitness component is restricted due to low existence of studies on this variable.

Conclusions

It is believed that the knowledge of morphological and physiological variables and engine performance, is essential for the technical and scientific development of the modality, as futsal is one of the team sports that most gains notoriety nowadays. Therefore, athletes of this study showed consistent performance with similar level of futsal athletes and/or higher in most morphofunctional evaluated parameters. Thus, the results of this study can be used to help understand the physical and physiological aspects of futsal athletes, as well as help coaches during the talent detection at the modality in the sport talent detection process. In addition, new studies analyzing physical performance difference between genres, categories and competitive level may help understand the futsal demands. In addition, new studies can evaluate tests with repeated sprints and/or tests involving agility to change direction, ensuring greater specificity of the tests.

Conflicts of interest - The authors declare that they have no conflicts of interest.

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