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BODY COMPOSITION AND PHYSICAL FITNESS OF BARRANQUILLA FÚTBOL CLUB FUTSAL PLAYERS

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Abstract

Introduction. Futsal is a sport characterized by a combination of high volumes of medium- and low- intensity exercise, played between two teams of five players each, one of whom is the goalkeeper. A somatotype is a taxonomy used to describe a person's physical form. Unlike in individual sports, in team sports it is very difficult to identify the player's ideal morphotype, thus the functional and physical characteristics of team players can be better described and quantified using a science called kinanthropometry. Objective. The study aimed at determining the body composition and physical fitness of futsal players from the Barranquilla Fútbol Club in Colombia. Materials and methods. A descriptive cross-sectional study of body composition and physical fitness of futsal players was carried out. The measurements included players' age, body weight, body height, BMI, and somatotype; 5-component body composition fractionation (adipose, muscular, bone, residual, skin tissue); and physical fitness tests: endurance, strength, and maximum oxygen uptake (V02max). An Excel database and SPSS ver. 25 software package were used for statistical analysis. The normality test revealed that the variables were distributed in a normal way, which permitted the use of the Pearson correlation coefficient in the bivariate analysis. The level of statistical significance was set at $p < 0.05$. Results. The study involved a total of fourteen Barranquilla F.C. professional male futsal players aged 23.67 ± 3.5 years, with mean body weight of 71.7 ± 10.9 cm and body height of 173.6 ± 6.4. Their mean body composition (adipose mass, BMI) was within the normal range, according to the WHO guidelines. The measurements of mean muscle mass (40.97 ± 5.2 kg) and abdominal skin folds (23.0 ± 17.0 mm) revealed a high percentage of subscapular and medial thigh fat (13.57 ± 8.2 mm) and the presence of endomorphic (3.3 ± 1.8), mesomorphic 4.5 ± 1.5, and ectomorphic (2.6 ± 1.4) somatotypes, i.e. a combined meso-endomorphic somatotype, not ideal for futsal players. Conclusion. It is advisable to assess futsal players' body composition applying kinanthropometry instead of BMI as a body weight screening index.

Key words: *body composition, physical fitness, indoor football, sports training*

Introduction

Futsal is a sport characterized by a combination of high volumes of medium- and low-intensity exercise, played between two teams of five players each, one of whom is the goalkeeper. It is played on a rectangular indoor court 40 x 20 m. A futsal match consists of two periods of 20 minutes each [1].

The National Futsal League is a professional futsal tournament in Colombia held since 2011 (under the sponsorship of Cementos Argos until 2018) by the Colombian Football Federation. The league comprises 30 futsal teams, including two from Barranquilla: Barranquilleros and Independiente Barranquilla, affiliated with the Barranquilla Fútbol Club. The club has been the site of a research program in applied sports sciences, implemented by experts from the International Society for the Advancement of Kinanthropometry [2]. The program involves morphological and physiological assessments of players' performance of physical fitness tests.

The present study assesses the body composition and physical fitness of Barranquilla Club futsal players as indicators of individual and team performance.

Body composition assessment is usually carried out by measuring skin fold thickness and by applying a series of formulas to yield the results. Skin fold measurement, which is the most common assessment tool of body composition, has, however, certain limitations, since any error in data collection by the evaluator can imply that the result was not the most accurate. Also the excessive use of plicometry in the measurement of skin fold thickness can be inaccurate [3] as it focuses on body composition as body mass associated fat mass and fat-free mass.

Kinanthropometry is defined as the study of size, shape, proportion, composition and maturation of the human body, using methodological measurements to evaluate the level of general nutritional development of an individual or a population group. A kinanthropometric body composition assessment involves several components. The fractionation of five components [4] together with the somatotype [5] allow a better approximation of assessment of an individual and, consequently, more accurate selection and orientation of athletes in terms of their maximum performance capacities [6]. The kinanthropometric variables in athletes reflect their shape, proportionality, and body composition that can be decisive for success in a given sport [7]. Adipose mass is the most variable component of body composition, and there are risks associated with its excess and location [8]. The importance of body composition for athletes' morphological development have been widely recognized [5]. Many authors have found positive correlations between body weight gain and increased body mass index (BMI). The latter is a variable widely used by health professionals, physical trainers, and coaches of different sports to estimate the ideal body weight [9, 10]. However, BMI is not an effective instrument of body composition assessment in futsal players, in whose case body weight is not considered the best indicator and other body components must be also evaluated [8, 11].

Body composition is a concept used in sport science that describes and quantifies the physical characteristics of athletes. The functional assessment of athletes includes the study of the anthropometric profile as it is one of the factors influencing success in sport, both from the physiological and biomechanical points of view [12]. Toala and Aguilar [13] analyzed body composition, somatotype, proportionality and performance in futsal players according to their playing position. They found significant differences in players' body composition, somatotype, and offensive performance, with the meso-endomorphic somatotype being the most common among the players [14]. However, the sample size of that study was too small (10 players), and the study was only limited to players of Cuban nationality. In the case of futsal players from the Colombian Barranquilla Club a series of test batteries was used to evaluate their general physical condition and physical capacity. The determined variables included maximum oxygen consumption, strength of lower limbs, and physiological parameters such as resting and maximum heart rate.

The determination of futsal players' body composition, somatotype, and physical fitness is a fundamental aspect in view of players' positions on the team, and it helps facilitate the process of sports training. There have been numerous investigations regarding athletes' body composition, but no relevant data existed for the Barranquilla futsal players. Moreover, there are no scientific databases covering assessments of body composition and physical fitness of athletes from the Atlántico Department of Colombia. Ideally, futsal players should be assessed before, during, and after completing a training microcycle, in order to obtain the most comprehensive results.

The findings of studies assessing the body composition, somatotype and physical fitness of futsal players can be of great use to all sports professionals, physical education teachers, and coaches.

Materials and methods

The research involved a review of different relevant publications and a descriptive cross-sectional study on body composition and physical fitness of futsal players. The study was conducted in the first semester of 2020. The examined variables included players' age, body weight, body

height, BMI, 5-component fractionation of body composition (adipose, muscular, bone, residual, skin), physical fitness (endurance, strength, maximum oxygen uptake) [15], and heart rate. Bioimpedance calibrated balance values were calculated using a Body Composition Monitor and Scale Model BC-585F (Fitscan) and a standardized dry wall tallimeter [16].

The percentage of adipose tissue was calculated using skin fold measurements [17] with a Slim Guide fold calibrator with an accuracy of 0.5 mm. The anthropometric measurements were performed according to the International Society for the Advancement of Kinanthropometry guidelines [2]. A battery of muscle resistance tests was performed to assess futsal players' physical fitness. The tests included sit-ups, push-ups, a cardiorespiratory test (the Cooper test) measuring heart rate, and V02max.

For descriptive statistics a MS Excel database was set up, and SPSS ver. 25 software package was used for calculations. The normality test showed that the variables were distributed normally, which allowed the use of the Pearson correlation coefficient in the bivariate analysis. The level of statistical significance was set at $p < 0.05$.

RESULTS

A total of 14 male futsal players from the Barranquilla Club participated in the study. Most of the players were 23.67 ± 3.5 years old, had the mean body weight of 71.7 ± 10.9 kg, and body height of 173.6 ± 6.4 cm.

Data in Table 1 indicate that in terms of the players' mean body composition, their adipose mass (28.4 ± 6.4) was rather high for professional athletes, and their BMI (24.0 ± 3.8) was normal, according to the WHO. The calculations of muscle mass (40.97 ± 5.2 kg) and abdominal skin fold thickness (23.0 ± 17.0 mm) reflected a high percentage of body fat. With the players' subscapular and medial thigh skin fold thickness of 13.57 ± 8.2 mm, and most players being of combined meso-endomorphic somatotype (endomorphic 3.3 ± 1.8, mesomorphic 4.5 ± 1.5, ectomorphic 2.6 ±1.4) the results were far from ideal for futsal players.

With regard to associations between futsal players' adipose mass and playing position, the wingers had the highest mean percentage of body mass in body composition (43.7%) followed by the pivots (32.3%) goalkeepers (30.7%), and, finally, defenders (20.7%) being the only ones with low adipose mass (Tab. 1) .

In terms of relationships between playing position and somatotype, it can be evidenced that the goalkeepers, pivots and wingers dominated in the endomorphic range, while the defenders were mostly mesomorphic (Tab. 2).

Table 2 includes descriptions of physical fitness data of studied futsal players. The mean values of particular variables were all within a proper range for the sport of futsal: cardiorespiratory endurance (12 min) – 2785 ± 298.3 m, V02max - 51.13 ± 6.7, heart rate - 187.5 ± 7.2, push-ups - 28.6 ± 15.1, sit-ups - 46.14 ± 10.8, and squats - 65.2 ± 13.4.

Table 3 presents the qualitative assessment of futsal players' anthropometric characteristics. 46.7% of players had a normal range of body weight (as illustrated by their BMI), and 13.3% were underweight. 50.0% of players had a very high level of adipose mass, and 21.4% were within the normal range, which indicates that BMI was not predictive of their body composition. With regard to muscle mass, 35.7% of players were in the normal range, while 21.4% in the athletic range. In terms of somatotype, 42.9% of players were of mesomorphic build, while 28.6% were ectomorphic, which demonstrated low body weight not recommended for futsal players. 64.3% of studied futsal players demonstrated an excellent range of cardiorespiratory endurance, and only 14.3 a poor range. This is evident of their athletic physical fitness. In terms of futsal players' physiological parameters, 78.6% had an excellent range of their maximum heart rate, and 14.3% ranked poorly. Finally, with regard to their playing positions, 50% of the studied players were wingers, 21.4% were goalkeepers, 14.3% were pivots, and 14.3% were defenders.

Table 1. Body composition variables of futsal players.

	Variable	Min	Max	Mean	SD
Basic Measurements	Age	18	30	23.67	3.53
	Body weight (kg)	56	90	71.72	10.90
	Body height (cm)	162	186	173.07	6.40
Body Composition	Body fat (%)	18	44	28	6.4
	Muscular (%)	29	50	41	5.2
	Residual (%)	11	15	13	1.2
	Bone (%)	10	14	13	1.1
	Skin (%)	4	7	6	0.9
	BMI (kg/cm²)	18.3	30.8	24.0	3.8
Skin folds	Triceps fold (mm)	5	28	10.21	6.81
	Subscapular fold (mm)	6	37	13.57	8.21
	Suprailiac fold (mm)	5	30	11.93	7.98
	Abdominal (mm)	5	62	23.00	17.36
	Medial thigh (mm)	5	42	13.64	9.92
	Calf (mm)	4	21	9.07	5.03
Segmental Lengths	Biacromial (cm)	39	45	41.64	1.98
	Transverse chest (cm)	24	31.5	27.71	2.35
	Anteroposterior chest (cm)	26.5	32.5	29.30	1.79
	Biliocrestal (cm)	26	38.5	29.14	3.37
	Humerus (cm)	6	7.5	6.68	0.42
	Femur (cm)	9	10.5	9.71	0.54
Body perimeters	Arm (cm)	24	33	27.0	2.7
	Forearm (cm)	22	28	25.1	1.8
	Hand (cm)	19	23	21.1	1.1
	Thigh (cm)	49	68	56.4	5.3
	Calf (cm)	33	39	36.0	2.2
	Head (cm)	52	58	55.1	1.7
	Chest (cm)	14	107	86.5	22.2
Somatotype	Endomorphic	1.7	8.6	3.3	1.8
	Mesomorphic	3.2	8.6	4.5	1.5
	Ectomorphic	0.2	4.1	2.6	1.4

SD - standard deviation, BMI - body mass index.

Table 2. Physical fitness variables of futsal players.

	Variable	Min	Max	Mean	SD
Physical aptitude	Endurance 12' (Min)	2400	3000	2785.71	298.35
	V02Max	43	56	51.13	6.67
	Sit-ups (rep)	30	72	46.14	10.88
	Push-ups (rep)	0	58	28.6	15.1
	Squats (rep)	35	83	65.2	13.4
	Mean HR	174	200	187.5	7.2

SD - standard deviation, V02max - maximum oxygen uptake

Table 3. Qualitative assessment of anthropometric characteristics of futsal players.

	Variable	n	%
BMI	Underweight	2	13.3
	Normal weight	7	46.7
	Overweight	3	20.0
	Obesity	2	13.3
Fat Mass	Normal	3	21.4
	Tall	4	28.6
	Very high	7	50.0
Muscle Mass	Short	3	21.4
	Normal	5	35.7
	Athletic	3	21.4
	Excellent	3	21.4
Somatotype	Endomorphic	4	28.5
	Mesomorphic	6	42.9
	Ectomorphic	4	28.6
Endurance 12 (min)	Excellent	9	64.3
	Poor	5	35.7
Vo2Max	Excellent	9	64.3
	Average	5	35.7
MHR	Excellent	11	78.6
	Normal	1	7.1
	Poor	2	14.3
Game Position	Goalkeeper	3	21.4
	Pivot	2	14.3
	Winger	7	50.0
	Defender	2	14.3

BMI - body mass index, V02max - maximum oxygen consumption, MHR - maximum heart rate.

Table 4. Correlations between futsal players' VO2max and BMI.

Correlation			V0²max	BMI
Spearman's rank correlation coefficient	V0²Max	Correlation coefficient	1.000	.758**
		Next. (bilateral)		0.002
		N	14	14
	BMI	Correlation coefficient	.758**	1.000
		Next. (bilateral)	0.002	
		N	14	14

Table 5. Correlations between futsal players' VO2max and body weight.

Correlations			V0²Max	BMI
Spearman's rank correlation coefficient	V0²max	Correlation coefficient	1.000	.758**
		Next (bilateral)		0.002
		N	14	14
	Body weight	Correlation coefficient	.758**	1.000
		Next (bilateral)	0.002	
		N	14	14

Discussion

The results of the study demonstrate that the futsal players' age of 23.67 ± 3.53 years is correlated with players' ages in other investigations [18]. The same was noted for the players' mean body weight (71.72 ± 10.9 kg). The mean body height of futsal players was 173.07 ± 6.4, i.e. considerably lower in relation to subjects in other studies [15].

With regard to BMI, the subjects' values were within the normal range, i.e. 20 - 24.9%, for futsal players. However, their mean adipose mass was 28.45 ± 6.4 kg, i.e. very high for professional futsal players. BMI is a widely applied anthropometric tool due to its simple formula used to diagnose weight problems: (Weigth(Kg))/〖Size〗^((cm)2) [19]; however, it does not correlate strongly with the percentage of body fat [20]. Furthermore, BMI does not account for correlations between fat mass and fat-free mass, and thus it is rather the waist circumference that demonstrates changes, through exercise and nutrition, while BMI remains the same. This is evidence that overweight may correspond to the increase in muscle mass and/or bone mass [21].

The physiological parameters in futsal players yielded ranges between good and excellent. As for the somatotype it has been found that the predominating meso-endomorphic component is not ideal for futsal. Also the ideal somatotype differed in terms of players' position on the team. The analysis of the players' associations with their playing position involved body composition assessment comprising five tissue types: fat, muscle, bone, skin, and residual mass, with muscle mass and fat featuring the greatest variability. In futsal, the defenders were shown to have the lowest percentage of fat. It is

generally recommended for futsal players to increase their muscle mass.

Conclusion

The present study revealed a normal BMI range among the studied futsal players, but also a very high adipose mass within a range that is not functional for futsal dynamics. In addition, the players' muscle mass was low. This implies the necessity to apply these scientific findings in physical preparation and strength resistance training for futsal players. The futsal players in all playing positions featured a dominant meso-endomorphic somatotype, with the pivots, goalkeepers, and wingers demonstrating an endomorphic predominance, and the defenders a mesomorphic predominance. It is, therefore, advisable to assess futsal players' body composition applying kinanthropometry instead of BMI as a body weight screening index. In addition, once limitations of each anthropometric variable are considered, physical fitness tests must be carried out at the end of each training period, following its macrostructure..

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