

**Lower body flexibility and body mass index in adolescent recreational practitioners and non-practitioners of Futsal**

**Flexibilidade dos membros inferiores e índice de massa corporal em adolescentes praticantes recreativos e não-praticantes de Futsal**

**Flexibilidad de los miembros inferiores e índice de masa corporal en adolescentes practicantes recreativos y no practicantes de Futsal**

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**Abstract**

**Introduction:** Flexibility is a component of physical fitness, important not only for health promotion, but also for performance in several sports. Body mass index (BMI) is an easy and fast method to evaluate the nutritional status of a population. **Objective:** The objective of the present study was to compare the level of lower body flexibility and BMI between adolescent recreational practitioners and non-practitioners of futsal. **Methodology:** Twenty futsal players (age  $12 \pm 1.3$  years, weight  $48.12 \pm 3.71$  kg, height  $156.53 \pm 4.9$  cm) and twenty controls (age

11.7 ± 0.9 years, weight 41.73 ± 3.25 kg, height 153.70 ± 4.0 cm) participated in the study. The subjects had their body weight and height assessed using a digital scale and a wall-mounted stadiometer, respectively. The flexibility was assessed through the sit-and-reach test using a modified Wells Bench. One-way ANOVA was used to determine differences between the groups. **Result:** Futsal recreational athletes presented higher body mass ( $p < 0.01$ ,  $d = 1.83$ ), higher BMI ( $p < 0.01$ ,  $d = 1.07$ ) and higher flexibility levels ( $p < 0.01$ ,  $d = 2.25$ ). **Conclusion:** The practice of futsal plays an important role in the improvement of body mass management and flexibility. Further studies with other populations are suggested.

**Keywords:** Stretching; Obesity; Physical performance; Indoor soccer.

## Resumo

**Introdução:** A flexibilidade é um componente da aptidão física, importante não só para a promoção da saúde, mas também para o desempenho em diversos esportes. O índice de massa corporal (IMC) é um método fácil e rápido de avaliar o estado nutricional de uma população.

**Objetivo:** O objetivo do presente estudo foi comparar o nível de flexibilidade dos membros inferiores e o IMC entre adolescentes praticantes recreativos e não praticantes de futsal.

**Metodologia:** Vinte jogadores de futsal (idade 12 ± 1,3 anos, peso 48,12 ± 3,71 kg, altura 156,53 ± 4,9 cm) e vinte controles (idade 11,7 ± 0,9 anos, peso 41,73 ± 3,25 kg, altura 153,70 ± 4,0 cm) participaram do estudo. Os sujeitos tiveram seu peso corporal e estatura avaliados com uma balança digital e estadiômetro de parede, respectivamente. A flexibilidade foi avaliada por meio do teste sentar-e-alcançar usando um banco de Wells adaptado. ANOVA de uma via foi usada para determinar as diferenças entre os grupos. **Resultado:** Atletas recreativos de futsal apresentaram maior massa corporal ( $p < 0,01$ ,  $d = 1,83$ ), maior IMC ( $p < 0,01$ ,  $d = 1,07$ ) e maiores níveis de flexibilidade ( $p < 0,01$ ,  $d = 2,25$ ). **Conclusão:** A prática do futsal desempenha um papel importante na melhoria do gerenciamento da massa corporal e flexibilidade. Estudos futuros com outras populações são sugeridos.

**Palavras-chave:** Alongamento; Obesidade; Performance física; Futebol de salão.

## Resumen

**Introducción:** La flexibilidad es un componente de la aptitud física, importante no solo para la promoción de la salud, sino también para el rendimiento en varios deportes. El índice de masa corporal (IMC) es un método fácil y rápido para evaluar el estado nutricional de una población. **Objetivo:** El objetivo del presente estudio fue comparar el nivel de flexibilidad de los miembros inferiores y el IMC entre practicantes adolescentes recreativos y no practicantes

de futsal. **Metodología:** Participaron 20 jugadores de fútbol sala (edad  $12 \pm 1,3$  años, peso  $48,12 \pm 3,71$  kg, altura  $156,53 \pm 4,9$  cm) y veinte controles (edad  $11,7 \pm 0,9$  años, peso  $41,73 \pm 3,25$  kg, altura  $153,70 \pm 4,0$  cm). Se evaluó el peso corporal y la altura de los sujetos mediante una báscula digital y un estadiómetro montado en la pared, respectivamente. La flexibilidad se evaluó mediante la prueba de sentarse y estirarse utilizando un banco Wells modificado. Se utilizó ANOVA de una vía para determinar las diferencias entre los grupos. **Resultado:** los deportistas recreativos de futsal presentaron mayor masa corporal ( $p < 0.01$ ,  $d = 1.83$ ), mayor IMC ( $p < 0.01$ ,  $d = 1.07$ ) y mayores niveles de flexibilidad ( $p < 0.01$ ,  $d = 2.25$ ). **Conclusión:** La práctica del fútbol sala tiene un papel importante en la mejora de la gestión de la masa corporal y la flexibilidad. Se sugieren más estudios con otras poblaciones. **Palabras clave:** Estiramiento; Obesidad; Desempeño físico; Fútbol sala.

## 1. Introduction

Flexibility is regarded as one of the main physical fitness parameters related to health and performance. It is defined as the range of motion in a joint or group of joints or the ability to move joints effectively through a complete range of motion (Mayorga-Vega, Merino-Marban, & Viciano, 2014). This valence varies according to age, gender and the pattern of regular physical exercise (G. V. de L. C. Silva et al., 2014). Flexibility has been constantly associated with the prevention of postural problems and the incidence of injuries, especially in the lower back (Medeiros, Cini, Sbruzzi, & Lima, 2016). Individuals with the highest levels of flexibility move more easily and are less prone to injury when subjected to intense exercise. In addition, they generally have a lower incidence of problems in the muscle and osteoarticular region (O'Sullivan, McAuliffe, & DeBurca, 2012). The sit-and-reach tests are probably the most common measurement tools used for evaluating hamstring and lower back flexibility as it is accessible, non-invasive, and affordable (Ayala, Sainz de Baranda, De Ste Croix, & Santonja, 2011).

Body mass index (BMI) is often used in clinical practice and in epidemiological studies in order to evaluate the nutritional status of the population (de Quadros, da Silva, Gordia, & Neto, 2012). The World Health Organization (1995) recommends the use of BMI in the screening of overweight and obesity simplicity of obtaining measurements, low cost of equipment needed, and high correlation with body fat. BMI is determined by the ratio between weight and height:  $BMI = \text{weight (kg)} / \text{height (m}^2\text{)}$  (Cole, Bellizzi, Flegal, & Dietz,

2000). Excess weight is related to the increase in chronic noncommunicable diseases, which in is one of the leading causes of mortality (V. S. da Silva, Souza, Silva, Barbosa, & da Fonseca, 2018).

Futsal, formerly known as Indoor Soccer, has acquired great growth in popularity in recent years (Martin-Silva et al., 2005). It is a high intensity intermittent sport in which matches are played at ~ 86–90% of maximum heart rate (Bueno et al., 2014). Players cover about 3,000 to 4,000 meters during a game, in which about 15% is covered at high intensity speeds ( $> 18.3$  km/h) (de Freitas et al., 2017). Due to its practicality and accessibility, the sport has become a common component in Physical Education classes worldwide, including Brazil (Losado & Ceni, 2016). Therefore, this study aimed to compare the lower body flexibility and BMI between adolescent recreational practitioners and non-practitioners of futsal.

## **2. Methodology**

### **Subjects**

Forty-nine subjects were initially recruited from a public school located in Teresina, Piauí, Brazil, after previous contact with their physical education teachers. From this data set, nine subjects were removed as they were unable to complete the entire test sessions. This left forty male subjects to be used in the final analysis (age =  $12 \pm 1.1$  years; height =  $155.02 \pm 4.7$  cm; weight =  $44.93 \pm 4.72$  kg; BMI =  $18.73 \pm 2.19$  kg/m<sup>2</sup>). Of these 40 participants, 20 were recreational futsal players and 20 were not futsal players. The futsal players trained at least two times a week and had been practicing this sport for at least one year. All participants' parent or guardian signed the consent form according to resolution 196/96 of the National Health Council. The study was carried out in accordance with the ethics committee of the Federal University of Piauí, Teresina, Brazil, under protocol 2,379,617.

### **Procedures**

Body mass was measured to the nearest 0.1 kg using a calibrated electronic scale, and height was measured using a stadiometer to the nearest 0.1 cm. The participants wore light clothing without shoes. The subjects were categorized into three groups based on BMI

(kg/m<sup>2</sup>) as follows: normal weight, 18.5 - 23.9; overweight, 24.0 - 27.9; and obese, > 28.0 (Cole et al., 2000).

The level of flexibility was assessed using the sit-and-reach test. The individuals remained seated on the floor, with the knees extended, and were asked to flex the trunk with the upper limbs extended. The highest value reached was registered. The volunteers attempted to complete the test two times. The highest value reached in both attempts was used in this study. (Cardoso, Azevedo, Cassano, Kawano, & Âmbar, 2007).

### **Statistical analysis**

The data are presented as the mean  $\pm$  standard deviation of the mean. The homogeneity and normality of the data variance were analyzed via Levene and Shapiro-Wilk tests, respectively. One-Way ANOVA test was used to verify differences between group characteristics (age, height, body mass index, and flexibility). The significance level was established at  $p < 0.05$ . The effect size (ES) was calculated using Cohen's  $d$ , which was classified as:  $d < .35 =$  trivial;  $.35 \leq d < .80 =$  small;  $.8 \leq d < 1.5 =$  moderate and,  $d \geq 1.5 =$  large (Cohen, 1988). The entire statistical analysis was performed using the SPSS version 20.0 statistical software (SPSS, Inc., Chicago, IL, USA).

### **3. Results and Discussion**

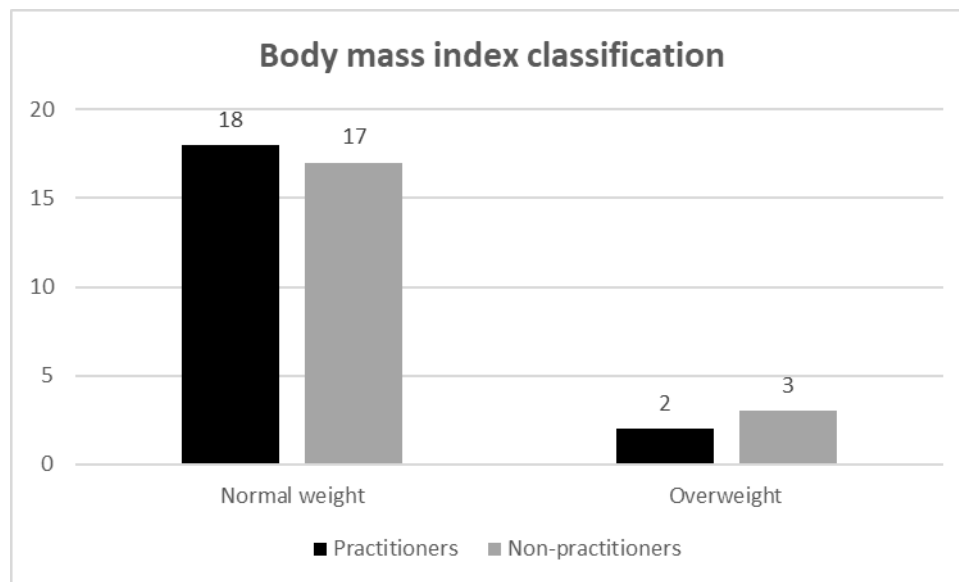
The participants were statistically similar in age and height ( $p = 0.42$  and  $p = 0.07$ , respectively). The characteristics of the volunteers are described on table 1. It was observed that the weight and BMI of futsal practitioners were significantly higher than those of the non-practitioner group ( $p < 0.01$ ,  $d = 1.83$  and  $p < 0.01$ ,  $d = 1.07$ , respectively). Among the twenty students who practice futsal, eighteen were classified as normal weight and two were considered overweight. Among the twenty volunteers who did not practice futsal, seventeen were classified as normal weight and three were overweight (Figure 1).

**Table 1.** Mean and standard deviation of the characteristics of the participants.

Variable	Futsal practitioners	Non futsal practitioners	Total	P value	<i>d</i>
Age (years)	12 ± 1.3	11.7 ± 0.9	12.05 ± 1.1	0.42	0.27
Weight (kg)	48.12 ± 3.71	41.73 ± 3.25	44.93 ± 4.72	< 0.01*	1.83
Height (cm)	156.53 ± 4.9	153.70 ± 4.0	155.02 ± 4.7	0.07	0.63
BMI (kg/m <sup>2</sup> )	19.77 ± 2.23	17.69 ± 1.61	18.73 ± 2.19	< 0.01*	1.07
Flexibility (cm)	41.21 ± 3.65	31.20 ± 5.1	36.2 ± 6.70	< 0.01*	2.25

Note: \*, values that showed statistically significant difference (p<0.05). Source: Autores.

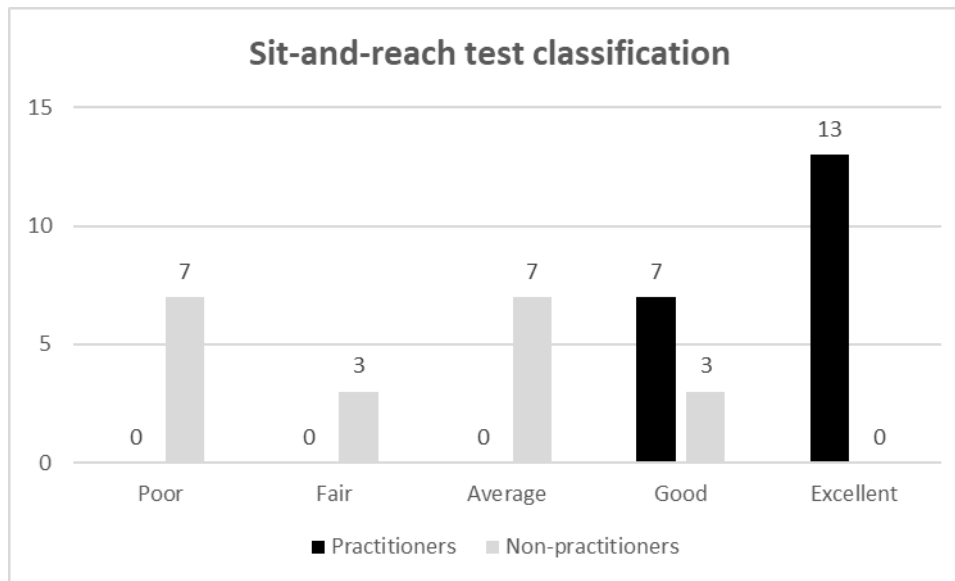
**Figure 1.** Body mass index classification of adolescent recreational practitioners and non-practitioners of Futsal.



Source: Autores.

A significant difference between the two groups was found in the sit-and-reach test performance (p <0.01, d = 2.25). Of the twenty students who practice futsal, thirteen were classified as excellent and seven were classified as good. None of the futsal recreational athletes were classified as average or below. In the non-practitioner group, of the twenty students analyzed, seven were classified as poor, three as fair, seven as average and three as good. None of the controls were classified as excellent (Figure 2).

**Figure 2.** Sit-and-reach test classification of adolescent recreational practitioners and non-practitioners of Futsal.



Source: Autores.

Our study found a significant difference in the BMI levels between futsal practitioners and non-practitioners. In fact, futsal practice is related to beneficial health and physical performance results (Barbosa, Caldas, Silva, Araújo, & Navarro, 2019; Miloski, de Freitas, Nakamura, de A Nogueira, & Bara-Filho, 2016). Burdukiewicz et al. (2014) evaluated the anthropometric parameter of twenty-two Polish university students practitioners of futsal ( $22.9 \pm 2.44$  years old). Despite the difference in maturity level when compared to our sample, the BMI values and their classification were similar to the values found in our study (23.1 vs 19.8, respectively). In addition, our results corroborate with a recent study conducted with recreational Melanesian futsal athletes (Galy et al., 2015). The authors found BMI values similar to that of our study (24.1 vs 19.8, respectively).

Body mass index, although not specific for the assessment of body composition, has been used to assess excess population weight and has gained significant relevance in epidemiological studies (Oliveira et al., 2012). An increase in risk of death from cardiovascular disease is observed in subjects with lower and higher ranges of body mass index. A high body mass index is a risk factor for mortality from overall cardiovascular disease and for specific diseases, including coronary heart disease, ischemic stroke, and hemorrhagic stroke (Chen et al., 2013). As a matter of fact, a nationwide cohort study evaluated the relationship between BMI and all-cause or cause-specific mortality in 153,484 Korean adults, using prospective cohort data by the National Health Insurance Service in

Korea. Surprisingly, moderate obesity was associated more strongly with a lower risk of mortality than with normal, underweight, and overweight groups in the general population of South Korea (Kim et al., 2015). Thus, the association between body mass index and mortality is not conclusive.

Concomitantly, it has been shown that high BMI levels are inversely related to physical performance. Shen et al. (2015) evaluated 966 individuals (average age  $67.5 \pm 6.02$ , men 435, women 531) and found that, after adjusting for all other variables, relative grip strength decreased when BMI increased in both men and women ( $P < 0.001$  and  $< 0.001$ , respectively). However, there was no apparent association between walking speed and BMI in either sex ( $p = 0.0162$ ).

Our findings point that the level of flexibility of adolescent practitioners of futsal is significantly higher than that of non-practitioners. A recent study aimed to evaluate the effect of indoor soccer training on the flexibility of college athletes. For this, they assessed the level of flexibility of twelve athletes ( $22 \pm 2.9$  years). The main findings of the study showed that there was a significant improvement in the flexibility of the athletes' lower limbs in all investigated joints (Bartholomeu Neto et al., 2013). However, it is noteworthy that the protocol used to investigate the flexibility of the subjects in the aforementioned study differs from the that used in our study. Therefore, this comparison should be considered with caution. The number of studies related to the flexibility of futsal athletes is still scarce. Bertolla et al. (2007) aimed to quantify the level of flexibility of eleven futsal athletes ( $18.1 \pm 0.83$  years of age). The study's control group obtained a lower value than that found in our investigation ( $36.3$  vs  $41.2$ , respectively). It is worth mentioning that the sample of the study mentioned above is significantly lower than that of our study ( $5$  vs  $20$ , respectively).

The benefits of improving flexibility are well established in the literature (Akkurt, Gürbüz, Karaduman, & Yilmaz, 2019; Pollock et al., 1998; Torres-Pareja et al., 2019). Adequate levels of muscle flexibility are of great importance for the proper musculoskeletal functioning. It contributes to the maintenance of muscles and joints health through the ageing process. In addition, the decline in levels of flexibility can contribute to the increase in the difficulty of performing different tasks of daily living, which often leads to the early loss of autonomy (Cyrino et al., 2004). In addition, low values of flexibility are correlated with injuries. In a study with futsal athletes at the XV Brazilian Under-20 National Team Championship, the authors found that the thigh was the most commonly injured part of the body (28.12%), and that muscle stretching was the main cause this lesion (9.37%) (Ribeiro,



Oliveira, & Costa, 2006). Considering the benefits that flexibility can bring to both athletes and the general population, training programs aimed at increasing this capacity is strongly recommended (Sandoval, 2002).

#### 4. Final Considerations

The present study aimed to compare the body mass index and lower limbs flexibility between adolescent recreational practitioners and non-practitioners of Futsal. It was observed that recreational futsal athletes had higher body weight, better body mass index classification and better level of lower limbs flexibility when compared to non-athletes. Our study was limited to a non-homogeneous sample in the control group. Future studies evaluating flexibility in other populations, as well as body composition evaluation via bioimpedance analysis, are encouraged.

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