Morphofunctional characteristics of amputee soccer players of the Mexican league

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Abstract

Objective: The objective of the study was to describe the anthropometric characteristics of a Mexican amputee soccer team, for data reference and categorization of these athletes. **Materials and methods:** Thirteen players of the amputee "Tigres" soccer team participated in the study. Measurements of body mass index (BMI), height, and body composition were made using plicometry in 6 skinfolds, which were performed on the opposite side of the amputation. Somatotype components were calculated with the Heath and Carter method, obtaining the three components of the somatotype (endomorphism, mesomorphism, and ectomorphism) with regression equations. **Results:** The means of the variables of the studied players were age: 27.5 (16-43) years, weight: 68.9 (47.7-86.7) kg, height: 172.2 (1.65-1.81), and BMI: 23.23 (16-28.7) kg/m². The most predominant somatotype found was mesoendomorphic. **Conclusions:** Through these results, we can provide adequate nutritional orientation and improve the type and training loads of the team, with the intention of enhancing their sports aptness.

Key words: Football. Amputation. Anthropometry. Nutrition. Sports science.

Introduction

Soccer is the most popular team sport worldwide¹, and the number of disabled people and athletes who join this discipline is growing every day. Since 2005, amputee soccer has been recognized as a sport. In the same year in Mexico, the Mexican Amputee Professional Soccer League was created, regulated, and registered by the Mexican Soccer Federation (FMF by its Spanish acronym)².

Besides requiring the usual physiological capabilities³, other requirements come into play, such as aerobic conditions⁴, biomechanics, and technical-tactical

skills, depending on the type of amputation the player presents and their general state of health⁵.

The identification of a dominant somatotype in a specific sport provides useful information for the development of specific training programs focused on the development of physical characteristics which predominate in said sport, which differ from other disciplines or even different positions within the same sport^{6,7}.

Several authors have measured anthropometric characteristics in different adapted sports^{5,6,8}. However, today, there is no information in literature about the characterization of the somatotype and body composition of the amputee soccer athlete in Mexico.

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The objective of this study is the description of the anthropometric characteristics of a team belonging to the professional amputee soccer league, to categorize its players and be able to have reference parameters for this sport in Mexico.

Materials and methods

Design

A descriptive transversal study was conducted, including a medical assessment of a population of 13 male soccer players of the Mexican amputee soccer league. Evaluated voluntarily, all participants verbally agreed to an informed consent. The registry of the evaluations to determine anthropometric characteristics (somatotype and body composition) was performed within the facilities of the Department of Sports Medicine and Rehabilitation at the “Dr. Jose E. Gonzalez” University Hospital. The procedure was conducted first thing in the morning, where the participants were scheduled with an 8-h fasting period before the measuring tests. A clinical history was gathered with questions related to their health and nutrition to obtain a full health profile.

The Research Ethics Committee of the institution approved this study with the following registry number: MD17-00007.

Anthropometry

A certified person using techniques described in the international protocol manual for anthropometric assessment took the anthropometric measurements⁹. All measurements were taken twice with the purpose of obtaining an average. The technical error of the measurements was considered acceptable when the margins were within 5% for skinfolds and 1% for the rest of the measurements.

Weight and height were measured according to the protocol of the American College of Sports Medicine¹⁰, regarding the Frankfurt horizontal, their standing height was recorded without the use of their prostheses, using an SECA® measuring tape (206 model, Seca GmbH & Co. KG, Hamburg, Germany) as a standalone with the participant barefoot with their back against a vertical wall registering closest to 0.1 cm. The anthropometry was performed following the restricted profile according to the guidelines established by the International Society for the Advancement of Kinanthropometry (ISAK). Skin-fold measurements were done in six places (tricipital,

subscapular, supraspinal, abdominal, medial thigh, and lower leg) using a Slim Guide® Skinfold Caliper (Creative Health Products, Inc., Ann Arbor, MI). All measurements were performed on the opposite side of the amputation. The circumferences (relaxed arm, flexed arm, waist, hips, and calves) were measured using a Lufkin® Metallic Tape (model W696PM, Apex Tool Group, Sparks, MD) and bone diameters (humerus and femur) using a Cescorf® Sliding Segmometer (Innovare 16 cm).

Data collection

Using the anthropometric measurements of all participants, we calculated the components of the somatotype, applying the Heath and Carter method^{11,12}, dividing them into three body types – (1) endomorphy, which refers to relative adiposity, (2) mesomorphy, where we are able to find relative muscle development, and (3) ectomorphy, where relative linearity is presented. Through three regression equations, we were able to obtain these three components of the somatotype¹³.

Statistical analysis

A descriptive analysis was performed for all variables. The distribution of numerical variables was verified using the Kolmogorov–Smirnov test for normality, and our findings showed that all variables followed a parametric distribution. Thus, they were informed as average and standard deviation.

Results

The anthropometric profiles of the amputee soccer players are shown in [table 1](#). Age, weight, height, skinfolds, circumferences, and bone diameters were measured in average and standard deviation for all variables.

The total of patients (13) was divided by their positions: four forwards, three defenders, three midfielders, and three goalkeepers. The group with the higher average age was the defenders, while the youngest were the forwards. The height of the goalkeepers and defenders was higher on average compared to the midfielders and forwards. The highest on body weight were the defenders and the lowest, the forwards. Body mass index was higher among the defenders, and body fat percentage was higher in defenders, while the forwards had a lower percentage. Concerning the components of the somatotype, the midfielders were more endomorphic, the defenders tended toward mesomorphy, and the forwards toward ectomorphy, with a general

Table 1. Anthropometric characteristics of amputee players

Anthropometric features	Goalie (n = 3)	Defense (n = 3)	Mid-field (n = 3)	Forward (n = 4)
Age (years)	24.33 ± 4.93	36.66 ± 3.09	30.00 ± 9.93	21.25 ± 5.21
Height (cm)	174 ± 7.11	174.33 ± 2.86	171.5 ± 4.7	170 ± 4.94
Weight (kg)	73.4 ± 20.24	82.33 ± 4.49	70 ± 7.08	54.85 ± 7.11
BMI (kg/m ²)	24.17 ± 5.9	27.10 ± 1.62	23.97 ± 3.41	19.06 ± 2.97
BF%	22.27 ± 7.73	26.67 ± 2.22	25.55 ± 2.88	15.97 ± 5.06
Endomorphy	4.2 ± 1.7	4.76 ± 1.57	4.9 ± 1.13	3.2 ± 1.63
Mesomorphy	4.9 ± 2.32	6.43 ± 0.30	5.53 ± 0.91	4.25 ± 0.74
Ectomorphy	2.5 ± 2.56	0.96 ± 0.44	2.13 ± 1.40	4.3 ± 1.86
6F+	97.13 ± 38.16	109.6 ± 26.79	109.73 ± 28.25	74.7 ± 38.42

BMI: body mass index; BF%: body fat percentage; 6F+: 6-fold sum. Average and standard deviation.

Figure 1. Somatocard with somatotype distribution of amputee players. Deviation of the anthropometric characteristics of amputee players.

average of a mesoendomorphic somatotype. In the sum of all six skinfolds, mid-fields and defenders who added the highest numbers. The sum of six skinfolds in millimeters (mm) was considered as a significant value. Through this sum, it is possible to have a comparative idea of the amount of fat present, which transcends any other methods of estimation; therefore, midfielders and defenders obtained the highest sum.

An analysis of the somatotype of each player was conducted; the result was expressed in numbers used to identify each result: goalkeepers 7, 11, and 12, defenders 1, 3, and 6, midfielders 5, 9, and 10, and

forwards 2, 4, 8, and 13. This is all expressed in figure 1. We were able to observe a trend for midfielders and forwards toward endomorphy, and goalkeepers had a better ectomorphy profile.

Discussion

Anthropometric measurements are crucial for the physical evaluation of athletes, providing relevant information which could be critical to significant information in the detection of talent and athlete selection¹⁴. Unfortunately, in this adapted sport, there is little evidence

to categorize the ideal somatotype, let alone one for each position¹⁵.

The results compared to a professional team of the Mexican first division are similar in general aspects such as age, weight, and height, but the somatotype in these players is balanced mesomorphy¹⁶ versus amputee players, which is mesoendomorphy. In Mexican university players¹⁷, there is a higher fat component with the same characteristics of weight and height, but not in fat percentage, which is higher in the amputee player. Another study in the Latin population, soccer amputee players from the official team in Brazil compared general characteristics where no significant differences were found. The fat percentage is clearly higher in the Mexican team, with 22.10% versus the Brazilian team's 15.73%¹⁸. Another point of comparison is the soccer amputee players of Turkey, with 10.1% fat percentage⁶. These differences with the Mexican team regarding the other teams could be explained by different factors, among the most important being to establish the type of training and nutrition for these athletes. Physical demands during the game demand considerable development of aerobic resistance, strength, and potency from a player. It is possible that greater exposure to these types of training in players of a higher level contributes to explain their higher values in mesomorphy¹⁹. Hence, a player has less predominance of the ectomorphy, and the lesser muscle mass of these players could increase the possibilities of suffering a sport-related injury²⁰.

It is worth mentioning that from the obtained results, we can perform cycled studies to observe changes over a determined period of time through direct and indirect interventions, which one may have with the team and its players, in particular.

Body composition is a difficult parameter to measure since there is no specific protocol for this population. Moreover, each handicap generates individual consequences that can affect the measurement location. However, the determination of body composition is important to control individual training requirements for each athlete and to maintain adequate health levels. The results of body composition in this study were more significant in the fat component in comparison with recent researches on this sport.

Conclusions

The present study allows us to have a reference of the morphofunctional characteristics of players from the amputee "Tigres" soccer team, giving us a reference to establish measurement strategies of their anthropometric

profiles, as well as to document the current state of the players who practice this sport at a professional level.

With these results, we are able to give nutritional orientation, improving the type and load of training for the team, in general, with the sole purpose of improving their skills in the sport, for an optimal general performance, which without a doubt will impact the athletic and physical performance of each and every one of the players²¹, resulting in an improvement in results in the league.

Conflicts of interest

All members of the working group have declared the absence of conflicts of interest.

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

References

1. FIFA. Big Count 2006-Comparison 2006-2000. Canada: FIFA Communication Division Information Services; 2007. p. 1-12.
2. FIFA. FIFA eWorld Cup 2019. Fútbol Para Amputados: Reglas del Juego; 2019. Available from: <https://www.es.fifa.com/fifaeworldcup/news/futbol-para-amputados-reglas-del-juego-636381>.
3. Bangsbo J, Mohr M, Krstrup P. Physical and metabolic demands of training and match-play in the elite football player. *J Sports Sci.* 2006;24:665-74.
4. Bastidas AR, Pernet FB. Consumo de oxígeno en militares amputados y sujetos sanos previo al ascenso a gran altitud. *Rev Colomb Neumol.* 2009;21:170-4.
5. Samanes J. Deportes adaptados. *Arch Med Del Deport.* 1998;15:323-34.
6. Ozkan A, Kayihan G, Köklü Y, Ergun N, Koz M, Ersöz G, et al. The relationship between body composition, anaerobic performance and sprint ability of amputee soccer players. *J Hum Kinet.* 2012;35:141-6.
7. Coutts KD, Stogryn JL. Aerobic and anaerobic power of canadian wheelchair track athletes. *Med Sci Sports Exerc.* 1987;19:62-5.
8. Cortes J, Ojeda M, Gomez F. Aproximación práctica para un diagnóstico morfológico y funcional de deportistas discapacitados. *Estud Antropol Biol.* 2003;11:241-63.
9. Marfell-Jones M, Stewart A, Ridder J. International Standards for Anthropometric Assessment. New Zealand: International Society for the Advancement of Kinanthropometry; 2012.
10. American College of Sports Medicine. Guidelines for Exercise Testing and Prescription. Philadelphia, PA: Lippincott Williams and Wilkins; 2005.
11. Carter J, Ross W, Duquet W. Advances in somatotype methodology and analysis. *Am J Phys Anthropol.* 1983;213:193-213.

12. Carter J. The Heath-Carter Somatotype Method. San Diego: San Diego State Univ Syllabus Serv.; 2002.
13. Carter J, Heath B. Somatotyping Development and Applications. Cambridge: Cambridge University Press; 1990.
14. Galaviz U, Gutiérrez A. Somatotipo en jugadores de 1ra y 1ra división pertenecientes a la liga Mexicana de futbol. *Cienc en la Front.* 2009; 7:107-17.
15. Maehana H, Miyamoto A, Koshiyama K, Tanaka Yanagiya T, Yoshimura M. Profile of match performance and heart rate response in Japanese amputee soccer players. *J Sports Med Phys Fitness.* 2018; 58:816-24.
16. Zúñiga U, Osorio A, Toledo I. Somatotipo en futbolistas mexicanos profesionales de diferente nivel competitivo. *Retos Nuevas Tendencias Educ Física Deport Recreación.* 2018;34:100-2.
17. Sosa JM. Valoración del somatotipo y proporcionalidad de futbolistas Universitarios Mexicanos respecto a futbolistas profesionales. *Rev Int Med Cienc Act Fís Deporte.* 2006;6:16-28.
18. Simim M, Silva B, Marocolo M, De Mello M, Lacerda E, Mota G. Anthropometric profile and physical performance characteristic of the Brazilian amputee football soccer team. *Mot Rev Educ Fis.* 2013;1:641-8.
19. Stølen T, Chamari K, Castagna C, Wisløff U. Physiology of soccer: an update. *Sports Med.* 2005;35:501-36.
20. Jorquera C, Rodríguez F, Torrealba M. Composición corporal y somatotipo de futbolistas Chilenos Juveniles sub 16 y sub 17. *Int J Morphol.* 2012; 30:247-52.
21. Yazicioglu K, Taskaynatan MA, Guzelkucuk U, Tugcu I. Effect of playing football (soccer) on balance, strength, and quality of life in unilateral below-knee amputees. *Am J Phys Med Rehabil* 2007;86:800-5.