

ANTHROPOMETRIC PROFILE AT U-15 TO PROFESSIONAL ON BRAZILIAN NATIONAL TEAM SOCCER PLAYERS

PERFIL ANTROPOMÉTRICO DE JOGADORES SUB-15 A PROFISSIONAIS DA SELEÇÃO BRASILEIRA DE FUTEBOL

ORIGINAL ARTICLE
ARTIGO ORIGINAL
ARTÍCULO ORIGINAL

PERFIL ANTROPOMÉTRICO DE JUGADORES SUB-15 A PROFESIONALES DE LA SELECCIÓN BRASILEÑA DE FÚTBOL

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ABSTRACT

Introduction: Although competitiveness rises progressively increases according to age groups, players must stand out in their playing position at all ages to win a spot on their National Teams. The differences among match physical and technical demands could also influence which anthropometrical aspects would be most importantly considered for National Team selection. **Objectives:** This study aimed describe and compare the anthropometric profile of soccer players from U15 to professional categories of the Brazilian National Soccer Team. **Methods:** The sample consisted of 673 players from the categories U15, U17, U20, U23 and PRO. Measurements of height, body mass, and sum of seven skinfolds from the Brazilian Football Confederation database between 2013 and 2021 were used to describe the players' anthropometric profile. Players were grouped according to categories, playing position, and those who were selected or not selected. **Results:** As expected, the results indicate that body mass increases with age and stabilizes from category U23 onwards. Body mass and the sum of seven skinfolds increase within the U15 category (U15.1 vs. U15.2), while height and body mass increase within the U17 category (U17.1 vs. U17.2). Defenders and fullbacks stabilize body mass and stature prior to U17, while midfielders, strikers, and goalkeepers stabilize body mass later, with midfielders and strikers at U20, and goalkeepers at U23. Goalkeepers and defenders were the players with the greatest height and body mass compared to the other positions in all categories. The selected and non-selected players in the different categories had similar anthropometric profiles. **Conclusion:** From the results, there is a diversity in anthropometric profile within the positions and a difference in maturation according to the players' positions. This study can be used by coaches, physical trainers and sport scientists as normative data about the anthropometric profile of Brazilian men's soccer teams, establishing a benchmark. **Level of Evidence III; Retrospective and Comparative Study.**

Keywords: Anthropometry; Soccer; Youth; Athletes; Athletes, Professional.

RESUMO

Introdução: Embora a competitividade aumente progressivamente de acordo com as faixas etárias, os jogadores devem se destacar em sua posição de jogo em todas as idades para conquistar uma vaga em suas equipes nacionais. As diferenças entre as exigências físicas e técnicas dos jogos também podem influenciar quais aspectos antropométricos seriam mais importantes para a seleção da equipe nacional. **Objetivo:** Este estudo teve por objetivo descrever e comparar o perfil antropométrico de jogadores de futebol da categoria sub 15 ao profissional da Seleção Brasileira de Futebol. **Métodos:** A amostra consistiu de 673 jogadores das seguintes categorias: sub 15 (U15), sub 17 (U17), sub 20 (U20), sub 23 (U23) e profissional (PRO). Medidas da estatura, massa corporal e soma das sete dobras cutâneas do banco de dados da Confederação Brasileira de Futebol entre 2013 e 2021 foram utilizadas para descrever o perfil antropométrico dos jogadores. Os jogadores foram agrupados de acordo com as categorias, posição de jogo e aqueles que foram selecionados ou não selecionados. **Resultados:** Como esperado, os resultados indicam que a massa corporal aumenta com a idade e estabiliza a partir da categoria U23. A massa corporal e a soma das sete dobras cutâneas aumentam dentro da categoria U15 (U15.1 vs. U15.2), enquanto a estatura e a massa corporal aumentam dentro da categoria U17 (U17.1 vs. U17.2). Os zagueiros e laterais estabilizam a massa corporal e a estatura antes do U17, enquanto os meio campistas, atacantes e goleiros estabilizam a massa corporal posteriormente, com os meio campistas e atacantes no U20, e goleiros no U23. Os goleiros e os zagueiros foram os jogadores que apresentaram maior estatura e massa corporal comparados às outras posições em todas as categorias. Os jogadores selecionados e não-selecionados nas diferentes categorias apresentam perfil antropométrico semelhante. **Conclusão:** Baseando-se nos resultados, há uma diversidade no perfil antropométrico dentro das posições e uma diferença na maturação de acordo com as posições dos jogadores. Este estudo pode ser utilizado por treinadores, preparadores físicos e cientistas do esporte como dados normativos sobre o perfil antropométrico das seleções masculinas do futebol brasileiro, estabelecendo um benchmark. **Nível de Evidência III; Estudo Retrospectivo Comparativo.**

Descritores: Antropometria; Futebol; Jovem; Atletas; Atletas Profissionais.



RESUMEN

Introducción: Aunque la competitividad aumenta progresivamente según los grupos de edad, los jugadores deben destacar en su posición de juego a todas las edades para ganarse un puesto en sus selecciones nacionales. Las diferencias entre las exigencias físicas y técnicas de los partidos también pueden influir en qué aspectos antropométricos serían más importantes para la selección nacional. *Objetivos:* Este estudio tuvo como objetivo describir y comparar el perfil antropométrico de futbolistas masculinos de menores de 15 años a categorías mayores de las selecciones brasileñas de fútbol. *Métodos:* La muestra estuvo compuesta por 673 jugadores de las siguientes categorías: Sub 15 (U15), Sub 17 (U17), Sub 20 (U20), Sub 23 (U23) y Profesional (PRO). Se utilizaron medidas de estatura, masa corporal y la suma de 7 pliegues cutáneos de la base de datos de la Confederación Nacional de Fútbol de Brasil entre 2013 y 2021 para describir el perfil antropométrico de los jugadores. Los jugadores se agruparon según los tramos de edad oficiales, la posición de juego y los seleccionados y no seleccionados. *Resultados:* Como era de esperar, los resultados indican que la masa corporal aumenta con la edad y se estanca a partir de la categoría U23. La masa corporal y la suma de 7 pliegues cutáneos aumentan dentro de la categoría U15 (U15.1 vs. U15.2), mientras que la estatura y la masa corporal aumentan dentro de la U17 (U17.1 vs. U17.2). Los defensas centrales y los laterales estabilizan antes la masa corporal y la estatura a partir de la U17, mientras que los mediocampistas, delanteros y porteros estabilizan la masa corporal más tarde, con los mediocampistas y delanteros en la U20 y los porteros en la U23. Los porteros y defensas centrales fueron los grupos que mostraron mayor estatura y masa corporal respecto a otras posiciones en todos los tramos de edad. Los jugadores seleccionados y no seleccionados en diferentes tramos de edad tienen un perfil antropométrico similar. *Conclusión:* Con base en los resultados, existe diversidad en el perfil antropométrico dentro de las posiciones de juego y diferencia en la maduración según la posición de los jugadores. Este estudio puede ser utilizado por entrenadores, preparadores físicos y científicos del deporte como dato normativo sobre el perfil antropométrico de las selecciones masculinas de fútbol de Brasil, estableciendo un punto de referencia.

Nivel de Evidencia III; Estudio Retrospectivo Comparativo.

Descriptor: Antropometría, Fútbol, Joven; Atletas; Atletas Profesionales.

DOI: http://dx.doi.org/10.1590/1517-8692202430012022_0425i

Article received on 07/18/2022 accepted on 02/16/2023

INTRODUCTION

In addition to technical and tactical skills, international-level soccer requires players to present good levels of physical capacities to cope with the high match demands. Physical fitness is developed throughout their careers from youth to professional teams under the influence of both external factors such as quality of training, economic and social aspects, as well as internal factors, including maturation.^{1,2} In this context, higher physical attributes, including anthropometric characteristics (e.g., stature, body mass and body composition), may influence field performance^{3,4} through benefiting match-performance, and also future player success.⁵

Such influence may be more evident in youth teams, where biological maturation may diverge up to 4 years from the chronological age, and the look for competitive advantage may benefit early-matured players.⁶ For instance, evidence indicates that players selected for national teams generally present higher physical performance compared to sub-elite⁷ or beginner players.⁸ The two birth-year range in each age category could induce player selection to be highly influenced by anthropometrical profiles at young ages. On the other hand, elite soccer teams are characterized by a relative heterogeneity in body size.⁹

Although competitiveness progressively increases according to age groups, players must stand out in their playing position at all ages to win a spot on their National Teams. The differences among match physical and technical demands could also influence which anthropometrical aspects would be most importantly considered for National Team selection. Consequently, coaches and physical trainers seek normative data from National Teams players to partially guide their players' development programs (i.e., definition of playing position, selection to older teams). Therefore, providing this anthropometric profile from various categories can be valuable information.¹⁰

In view of the above, the aims of this study were: 1) to describe and compare the anthropometric profile of male soccer players from the Under 15 (U15) up to senior categories from the Brazilian national

soccer teams considering age, official age brackets and playing positions; 2) to compare the anthropometric profile between selected (players who competed in international tournaments) and non-selected players (those who participated in training camps during the season but were not selected to compete in international tournaments).

MATERIALS AND METHODS

Experimental approach to the problem

A descriptive, comparative, retrospective and cross-sectional study aimed at characterizing the anthropometric profile of elite soccer players across all age brackets defined by the Fédération Internationale de Football Association, South American Football Confederation and International Olympic Committee, i.e. Under 15 (U15), Under 17 (U17), Under 20 (U20), Under 23 (U23) and Professional (PRO). Measures of stature, body mass and the sum of 7 skinfolds from the Brazilian National Football Confederation database between 2013 and 2021 were used for analysis.

Ethical considerations

The study was approved by the Federal University of Minas Gerais State Ethics Committee (protocol #4.983.415).

Subjects

The study comprised data from 673 male soccer players officially invited by the Brazilian National Football Confederation to take part in training camps (7 - 10 days) or official competitions (10 - 50 days) between 2013 and 2021. Events included South American Tournament (U15, U17 and U20), World Championships (U15, U17 and U20), South American Olympic Trial (U23), Olympic Games 2016 (U23), World Cup 2014 and 2018 (PRO) and Copa America 2019 and 2021, and 2022 FIFA World Cup Qualifiers (PRO). The Brazilian senior team was ranked between the first and third positions in FIFA's official ranking during the study period.

Field players were divided according to the official age brackets to which they were summoned (U15: n = 133; U17: n = 198; U20: n = 135; U23: n = 68; PRO: n = 60). Given each youth age bracket includes 2-3 birth years which may influence anthropometric data due to maturation effects,¹¹ field players were also divided according to the year within the age bracket they were at e.g., U17.1 = first year within U17; U17.2 = second year within U17 (U15.1: n = 29; U15.2: n = 104; U17.1: n = 98; U17.2: n = 100; U20.1: n = 107; U20.2: n = 28; U23.1: n = 24; U23.2: n = 24 and U23.3: n = 20). All players were divided according to their primary playing position (e.g., goalkeeper (n = 81), central defenders (n = 117), full-backs (n = 108), midfielders (n = 182) and forwards (n = 185)). Finally, field players were also divided between selected and non-selected to the championships within each category: U15 (selected: n = 30; non-selected: n = 103), U17 (selected: n = 44; non-selected: n = 154), U20 (selected: n = 74; non-selected: n = 61), U23 (selected: n = 52; non-selected: n = 16), PRO (selected: n = 48; non-selected: n = 12).

Goalkeeper data was only included in analyses comparing playing positions due to the distinct match demands.¹²

Assessments

All assessments were performed in the morning of the second day after arrival to the training or competition period.

Stature was measured to the nearest 0.5 cm using a stadiometer (Filizolla, São Paulo, Brazil). Body mass was measured to the nearest 0.1 kg using a digital scale (Filizolla, São Paulo, Brazil) with players wearing only standard sporting shorts.

The thickness of 7 skinfolds (subscapular, triceps, chest, axillary, suprailliac, abdominal and thigh) were measured by two qualified and experienced professionals, using a skinfold caliper (Lange, California, USA). Three measurements of each fold were performed, and the mean value was attained for analysis. The sum of the seven skinfolds (sum 7 skinfolds) was used as an index of body fat.

Statistical analysis

The data are presented as the mean ± standard deviation, 95% confidence interval, minimum and maximum values. The Shapiro-Wilk test was used to test all variables for normal distribution. Parametric data were compared using the Student's t-test or one-way ANOVA followed by the Tukey post-hoc test when applicable. Non-parametric data were analysed using the Mann-Whitney test or Kruskal-Wallis test followed by Dunn's post-hoc test when applicable. The correlations were assessed using Pearson's correlation coefficient. The significance level was set at 5%.

RESULTS

Initial analysis focused on comparing anthropometric values amongst the different age brackets. U15 players were shorter than U20, U23 and professional players and lighter than U17, U20, U23 and professional players ($p < 0.05$). U17 players were shorter than U20 and professional players and lighter than U20, U23 and professional ($p < 0.05$). U20 players were lighter than professional players ($p < 0.05$). The sum of 7 skinfolds was similar amongst all age groups ($p > 0.05$). (Table 1)

Within-category comparisons (Table 2), showed that U15.1 players were lighter and had a lower sum of 7 skinfolds than U15.2 ($p < 0.05$). In addition, the U17.1 players were lighter and shorter than U17.2 ($p < 0.05$).

Table 3 shows the comparison of players' anthropometric values between age groups, when allocated to different playing positions. Goalkeepers, full-backs and midfielders showed similar stature between the different categories ($p > 0.05$). Among central defenders, all age brackets were taller than U15 ($p < 0.05$). Professional forwards were taller than U17 and U15's ($p < 0.05$); and U20 forwards were taller than U17 ($p < 0.05$). Professional and U23 goalkeepers were heavier than U15

Table 1. Anthropometric values of national teams' players of each official age bracket.

Category	n	Mean ± SD	95% CI	Min. - Max.
Stature (cm)				
U15	133	175.2 ± 5.8	174.2 - 176.2	162 - 187
U17	198	176.9 ± 7.3	175.9 - 178.0	162 - 195
U20	135	179.6 ± 6.6 ^{ab}	178.5 - 180.7	162 - 195
U23	67	178.7 ± 6.7 ^a	177.0 - 180.3	164 - 195
PRO	59	180.3 ± 6.6 ^{ab}	178.6 - 182.1	168 - 192
Body mass (kg)				
U15	133	65.1 ± 6.2	64.1 - 66.2	51 - 83
U17	198	69.0 ± 7.3 ^a	67.9 - 70.0	49 - 95
U20	135	73.4 ± 7.7 ^{ab}	72.1 - 74.7	54 - 92
U23	68	76.0 ± 7.5 ^{ab}	74.2 - 77.8	60 - 95
PRO	60	79.5 ± 7.5 ^{abc}	77.5 - 81.4	67 - 97
Sum 7 skinfolds (mm)				
U15	133	47.0 ± 9.5	45.4 - 48.7	28 - 81
U17	198	50.3 ± 10.3	48.9 - 51.8	32 - 90
U20	135	50.9 ± 12.4	48.8 - 53.0	31 - 95
U23	61	47.0 ± 8.2	44.9 - 49.2	28 - 64
PRO	37	50.0 ± 10.2	47.1 - 53.9	36 - 74

SD: standard deviation. Min: Minimum value. Max: Maximum value. ^a $p < 0.05$ vs. Under 15.1. ^b $p < 0.05$ vs. Under 17.1. ^c $p < 0.05$ vs. Under 20.1. ^d $p < 0.05$ vs. Under 23.1. ^e $p < 0.05$ vs. Under 23.2

Table 2. Anthropometric values of national teams' players at each year of the different age brackets.

Category.year	n	Mean ± SD	(95% CI)	Min. - Max.
Stature (cm)				
U15.1	29	173.4 ± 5.1	171.5 - 175.4	167 - 183
U15.2	104	175.6 ± 5.9	174.5 - 176.8	162 - 187
U17.1	98	175.8 ± 7.5	174.3 - 177.3	162 - 195
U17.2	100	178.1 ± 7.1 ^b	176.7 - 179.5	162 - 194
U20.1	107	179.3 ± 6.7	178.1 - 180.6	162 - 195
U20.2	28	180.5 ± 5.8	178.3 - 180.6	169 - 190
U23.1	24	178.6 ± 7.0	175.7 - 181.6	164 - 190
U23.2	23	178.2 ± 7.1	175.1 - 181.3	164 - 195
U23.3	20	179.3 ± 6.2	176.3 - 182.2	169 - 191
Body mass (kg)				
U15.1	29	62.0 ± 4.9	60.1 - 63.9	53 - 72
U15.2	104	66.0 ± 6.2 ^a	64.8 - 67.2	51 - 83
U17.1	98	67.6 ± 6.6	66.2 - 68.9	48 - 80
U17.2	100	70.3 ± 7.8 ^b	68.8 - 71.9	57 - 95
U20.1	107	73.5 ± 7.6	72.1 - 75.0	55 - 92
U20.2	28	72.9 ± 8.3	69.7 - 76.2	54 - 89
U23.1	24	76.7 ± 7.2	73.7 - 79.8	61 - 92
U23.2	24	74.8 ± 7.75	71.6 - 78.0	60 - 89
U23.3	20	76.7 ± 7.8	73.0 - 80.3	67 - 95
Sum 7 skinfolds (mm)				
U15.1	29	52.0 ± 9.2	48.4 - 55.5	36 - 81
U15.2	104	45.7 ± 9.2 ^a	43.9 - 47.5	28 - 71
U17.1	98	51.5 ± 11.0	49.3 - 53.7	32 - 90
U17.2	100	49.2 ± 9.5	47.3 - 51.1	32 - 72
U20.1	107	50.4 ± 12.7	47.9 - 52.8	31 - 95
U20.2	28	53.0 ± 11.3	48.6 - 57.3	32 - 74
U23.1	21	48.4 ± 8.8	43.9 - 50.9	37 - 64
U23.2	21	47.4 ± 7.6	42.9 - 50.6	34 - 63
U23.3	19	46.8 ± 8.4	42.6 - 51.4	28 - 64

SD: standard deviation. Min: Minimum value. Max: Maximum value. ^a $p < 0.05$ vs. Under 15.1. ^b $p < 0.05$ vs. Under 17.1. ^c $p < 0.05$ vs. Under 20.1. ^d $p < 0.05$ vs. Under 23.1. ^e $p < 0.05$ vs. Under 23.2.

Table 3. Anthropometric values of national teams' players according to their playing position in each official age bracket.

Category	n	Mean ± SD	(95% CI)	Min. - Max.	n	Mean ± SD	(95% CI)	Min. - Max.	n	Mean ± SD	(95% CI)	Min. - Max.
Stature (cm)				Body Mass				Sum 7 skinfolds (mm)				
Goalkeeper												
U15	17	186.5 ± 4.9	184.0 – 189.0	178 - 196	17	79.5 ± 7.4	75.7 – 83.4	67 - 89	17	60.6 ± 15.0	52.9 – 68.3	42 - 92
U17	25	188.3 ± 5.5	186.1 – 190.6	178 - 202	25	80.5 ± 6.3	77.9 – 83.1	69 - 93	25	54.6 ± 13.1	49.1 – 60.0	35 - 87
U20	18	190.4 ± 5.6	187.6 – 193.2	177 - 198	18	83.2 ± 8.9	78.8 – 87.7	65 - 100	18	65.8 ± 14.2	58.8 – 72.9	48 - 90
U23	8	191.0 ± 4.8	187.0 – 195.0	185 - 198	8	93.1 ± 7.1 ^{a,b,c}	87.1 – 99.0	84 - 108	8	70.4 ± 13.1	59.5 – 81.3	48 - 85
PRO	13	189.6 ± 2.5	188.1 – 191.1	186 - 194	13	89.6 ± 6.6 ^{ab}	85.7 – 93.6	81 - 104	7	67.6 ± 51.5	47.6 – 87.5	47 - 100
Central defender												
U15	25	181.6 ± 2.9	180.4 – 182.8	173 - 187	25	71.7 ± 5.0	68.5 – 73.5	65 - 83	25	48.1 ± 10.2	43.9 – 52.3	33 - 71
U17	38	186.1 ± 4.8 ^a	184.6 – 187.7	175 - 195	38	76.6 ± 7.7 ^a	74.0 – 79.1	61 - 95	38	52.4 ± 11.4	48.6 – 56.1	34 - 90
U20	28	187.5 ± 3.1 ^a	186.3 – 188.7	179 - 195	28	78.2 ± 7.8 ^a	75.1 – 81.2	54 - 89	28	52.8 ± 12.1	48.1 – 57.5	37 - 82
U23	11	186.5 ± 4.2 ^a	183.7 – 189.4	181 - 195	11	82.7 ± 6.9 ^a	78.1 – 87.4	71 - 92	9	50.8 ± 8.4	44.3 – 57.2	39 - 64
PRO	15	186.6 ± 4.2 ^a	184.3 – 188.9	180 - 192	14	85.3 ± 7.0 ^{a,b,c}	81.5 – 89.0	75 - 97	8	47.0 ± 10.7	39.3 – 54.7	38 - 69
Full-back												
U15	22	172.4 ± 4.3	170.6 – 174.3	167 - 182	22	62.4 ± 6.0	59.8 – 65.1	54 - 79	22	47.4 ± 9.4	43.2 – 51.5	31 - 66
U17	40	175.2 ± 6.4	173.1 – 177.3	163 - 189	40	67.5 ± 4.8 ^a	65.2 – 69.0	57 - 76	40	48.0 ± 9.8	44.8 – 51.1	32 - 70
U20	22	177.3 ± 4.9	175.1 – 179.5	169 - 188	22	72.1 ± 4.9 ^{ab}	69.9 – 74.3	65 - 82	22	49.0 ± 11.0	44.1 – 53.9	33 - 74
U23	13	175.1 ± 4.7	172.2 – 178.0	166 - 181	14	70.9 ± 3.7 ^a	68.8 – 73.0	67 - 81	14	41.2 ± 7.6	36.8 – 45.6	28 - 54
PRO	11	177.2 ± 5.0	173.9 – 180.6	168 - 184	11	76.7 ± 5.3 ^{ab,d}	73.1 – 80.1	70 - 89	7	48.0 ± 9.7	39.0 – 57.0	36 - 67
Midfielder												
U15	46	174.2 ± 5.4	172.6 – 175.8	162 - 185	46	63.2 ± 4.6	61.8 – 64.5	53 - 73	46	47.4 ± 8.7	44.8 – 50.0	31 - 67
U17	56	175.0 ± 6.5	173.3 – 176.7	162 - 195	56	66.1 ± 5.5	64.6 – 67.5	54 - 78	56	50.9 ± 11.1	48.0 – 53.9	33 - 82
U20	42	177.9 ± 5.9	176.1 – 179.8	162 - 188	42	71.8 ± 8.2 ^{ab}	69.2 – 74.3	55 - 89	42	50.2 ± 13.1	46.1 – 54.3	31 - 92
U23	19	178.5 ± 5.9	175.6 – 181.3	169 - 188	19	77.3 ± 5.5 ^{a,b,c}	74.7 – 80.0	70 - 91	19	51.8 ± 7.0	48.5 – 55.2	40 - 63
PRO	19	176.8 ± 6.4	173.7 – 179.9	169 - 187	19	75.3 ± 6.2 ^{ab}	72.3 – 78.3	67 - 90	11	52.5 ± 11.2	45.0 – 60.0	39 - 74
Forward												
U15	40	173.7 ± 5.7	171.9 – 175.5	162 - 187	40	65.2 ± 5.7	63.4 – 67.0	51 - 80	40	45.9 ± 10.3	42.6 – 49.2	28 - 81
U17	64	174.2 ± 5.5	172.9 – 175.6	164 - 187	64	67.9 ± 6.9	66.2 – 69.6	48 - 80	64	50.1 ± 9.0	47.8 – 52.4	32 - 76
U20	43	177.2 ± 5.7 ^a	175.5 – 179.0	167 - 192	43	72.6 ± 7.4 ^{ab}	70.3 – 74.9	62 - 92	43	51.3 ± 12.8	47.3 – 55.2	32 - 95
U23	24	177.2 ± 6.6	174.4 – 180.0	164 - 191	24	75.0 ± 8.3 ^{ab}	71.4 – 78.5	60 - 95	19	44.8 ± 6.5	41.7 – 48.0	35 - 64
PRO	14	180.9 ± 5.5 ^{ab}	177.7 – 184.0	172 - 189	14	80.8 ± 7.1 ^{a,b,c}	76.7 – 84.9	70 - 92	9	53.9 ± 8.2	47.6 – 60.2	41 - 65

SD: standard deviation. Min: Minimum value. Max: Maximum value. ^a p < 0.05 vs. Under 15. ^b p < 0.05 vs. Under 17. ^c p < 0.05 vs. Under 20. ^d p < 0.05 vs. Under 23.

and U17 ($p < 0.05$), and U23 goalkeepers were also heavier than U20 ($p < 0.05$). Among central defenders, all age brackets were heavier than U15 ($p < 0.05$), and professional players were heavier than those from U20 and U17 ($p < 0.05$). All age brackets for the full-backs were heavier than U15 ($p < 0.05$), professional and U20 players were heavier than those in U17 ($p < 0.05$), and professionals were heavier than U23 ($p < 0.05$). U20, U23 and professional midfielders were heavier than U15 and U17 ($p < 0.05$), and those from U23 were heavier than from the U20 ($p < 0.05$). U20, U23 and professional forwards were heavier than U15 and U17 ($p < 0.05$), and professional midfielders were heavier than U20 ($p < 0.05$). No differences were found for the sum of 7 skinfolds amongst the different age brackets considering each specific playing position ($p > 0.05$).

Correlations were performed to assess the association of body mass and stature with age in different positions in the youth categories (U15, U17 and U20). Moderate correlations between body mass and age were observed for the full-backs ($r = 0.54$, $p < 0.05$), midfielders ($r = 0.51$, $p < 0.05$) and forwards ($r = 0.42$, $p < 0.05$). In contrast, only a weak correlation was found between body mass and age for the goalkeepers ($r = 0.25$, $p < 0.05$) and central defenders ($r = 0.29$, $p < 0.05$) (Figure 1). Weak correlations were also observed for stature and age of the central defenders ($r = 0.25$, $p < 0.05$), full-backs ($r = 0.29$, $p < 0.05$), midfielders ($r = 0.30$, $p < 0.05$) and forwards ($r = 0.27$, $p < 0.05$); while there was no correlation between stature and age of goalkeepers ($r = 0.23$, $p > 0.05$) (Figure 2).

Table 4 shows players from different positions compared within the same age brackets. Central defenders and goalkeepers were taller than full-backs, midfielders and forwards in all age brackets ($p < 0.05$). Moreover, goalkeepers and defenders were heavier than full-backs, midfielders and

forwards in the U15, U17 and U20 age brackets ($p < 0.05$). U15 goalkeepers were heavier than the central defenders ($p < 0.05$). Goalkeepers were heavier than full-backs, midfielders and forwards in the U23 and professional age brackets ($p < 0.05$). U23 central defenders were heavier than U23 full-backs and forwards ($p < 0.05$). Professional central defenders were heavier than professional full-backs and midfielders ($p < 0.05$). U15 goalkeepers showed higher values regarding the sum of 7 skinfolds than U15 midfielders and forwards ($p < 0.05$). Goalkeepers in the U20 and U23 age brackets showed higher sum of 7 skinfolds than all other positions ($p < 0.05$). U23 midfielders showed higher sum of 7 skinfolds than the full-backs ($p < 0.05$). Finally, no differences were found for the sum of 7 skinfolds amongst the different positions in the U17 and professional age brackets ($p > 0.05$).

Table 5 shows the comparison of players that were selected to play in official competitions and those that participated of the National Teams only in the training camps, but were not selected for official tournaments. Stature and body mass of the selected and non-selected players was similar in all categories ($p > 0.05$). U15 selected players showed a higher sum of 7 skinfolds than the non-selected ($p < 0.05$).

DISCUSSION

This study is the first to compile anthropometric information from the different categories of male national soccer teams in a high cohort of subjects, establishing a benchmark for the anthropometric profile of elite youth and professional soccer players according to category, playing position and selection for international competitions. In general, we observed that: (I) players' body mass increases from the U15 to the U23 category, though the sum of 7 skinfolds is similar among all categories;

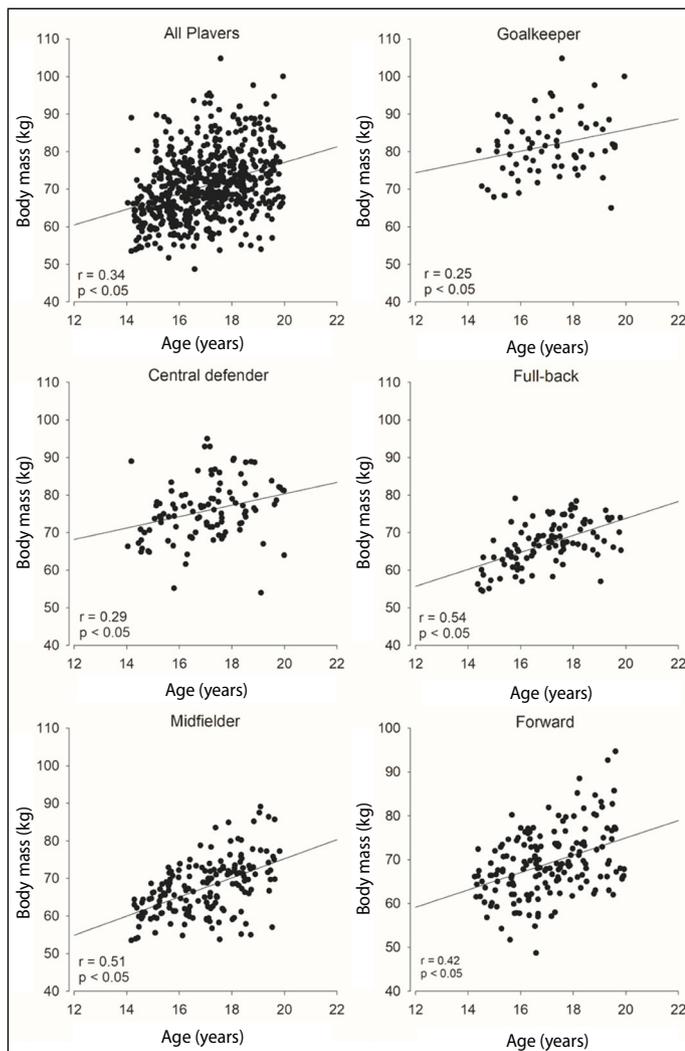


Figure 1. Correlations between body mass and age in different positions in the youth categories (U15, U17 and U20).

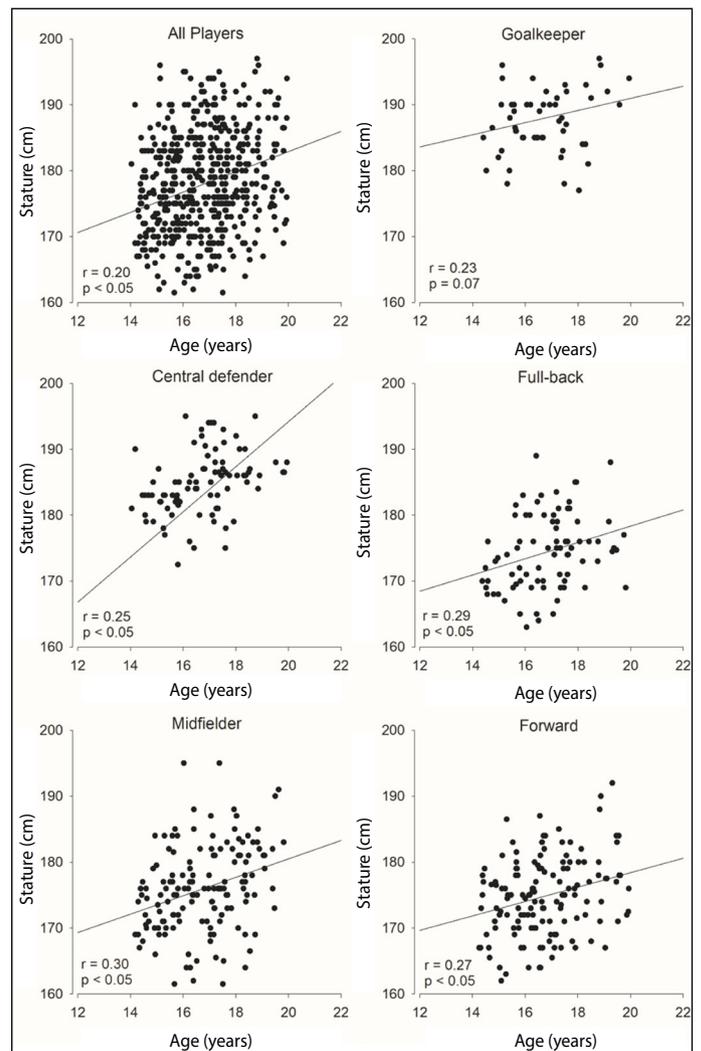


Figure 2. Correlations between stature with age in different positions in the youth categories (U15, U17 and U20).

(II) professional players are taller than U17 and U15 players; (III) within the U15 category (U15.1 vs. U15.2), body mass and the sum 7 skinfolds increase in the second compared to the first year, while stature and body mass increase within the U17 (U17.1 vs. U17.2); (IV) central defenders and full-backs present similar body mass and stature from the U17 category onwards, while body mass of midfielders and forwards only stabilize from U20, and goalkeepers from U23; (V) goalkeepers and central defenders have greater stature and body mass compared to other positions in all age brackets; and (VI) players selected for international tournaments have a similar anthropometric profiles than those only participating in the national teams' training camps.

Due to maturation, there is an expectation for both stature and body mass to increase throughout age brackets.^{11,13} Specifically, an increase in lean body mass from the Under 18 to the Under 20 categories was observed in English Premier League, potentially influencing players' physical capacities of strength, speed and power.¹⁰ When including all players in the analysis, stature and body mass was higher in the U20, U23 and senior players compared to their younger counterparts (U15 and U17), although no differences were observed in the sum of 7 skinfolds.

Additionally, given age brackets may include players with an age difference of almost two years, such maturation influence could be expected within the same age bracket, especially in the U15 and U17 groups. Our results agree with such expectation, since body mass and the sum 7 skinfolds were higher in U15.2 players compared to U15.1, and stature and body mass were higher in U17.2 compared to U17.1 players.

In addition to age, playing position has also been reported as a factor differentiating anthropometric values.^{14,15} Our results show that goalkeepers and central defenders are taller and heavier than players from the other positions in all age brackets. These observations corroborate previous studies.^{13,16,17} Taller goalkeepers and central defenders can have advantages in some technical actions, which makes the players' stature a target for the selection process in the position.⁹ In fact, there was a lack of association between stature and age only among goalkeepers, showing an importance for selecting taller players in this position from early ages. Additionally, goalkeepers showed higher sum of seven skinfolds compared to midfielders and forwards in the U15, and compared to all other playing positions in the U20 and U23 categories, partially agreeing with previous results showing that goalkeepers present higher body fat mass compared to outfielders.¹⁸

Players selected for national teams routinely achieve higher physical performance compared to sub elite athletes¹⁹ or beginners,¹⁷ demonstrating their importance for athletes' development and influence on players' selection.²⁴ Similarly, it is recognized that body fat index often distinguishes those successful at the highest standard from their less successful counterparts.^{20,21} No differences were found between selected and non-selected athletes in our analysis, except in the sum of skinfolds for U15. This can be partially explained by the high-level sport in the sample, recruited from one of the main national teams in the world, and thus it is likely that all athletes have an adequate anthropometric profile for this sport.

Table 4. Anthropometric values of national teams' players according to their playing position within each official age bracket.

Position	n	Mean ± SD	95% CI	Min. - Max.	n	Mean ± SD	95% CI	Min. - Max.	n	Mean ± SD	95% CI	Min. - Max.
Stature (cm)				Body mass (kg)				Sum 7 skinfolds (mm)				
Under 15												
Goalkeeper	17	186.5 ± 4.9	184.0 – 189.0	178 - 196	17	79.5 ± 7.4	75.7 – 83.4	67 - 89	17	60.6 ± 15.0	52.9 – 68.3	42 - 92
Central defender	25	181.6 ± 2.9	180.4 – 182.8	173 - 187	25	71.0 ± 6.0 ^a	68.5 – 73.5	55 - 83	25	48.1 ± 10.2	43.9 – 52.3	33 - 71
Full-back	22	172.4 ± 4.3 ^{ab}	170.6 – 174.3	167 - 182	22	62.4 ± 6.0 ^{ab}	59.8 – 65.1	54 - 79	22	47.4 ± 9.4	43.2 – 51.5	31 - 66
Midfielder	46	174.2 ± 5.4 ^{ab}	172.6 – 175.8	162 - 185	46	63.2 ± 4.6 ^{ab}	61.8 – 64.5	53 - 73	46	47.4 ± 8.7 ^a	44.8 – 50.0	31 - 67
Forward	40	173.7 ± 5.7 ^{ab}	171.9 – 175.5	162 - 187	40	65.2 ± 5.7 ^{ab}	63.4 – 67.0	51 - 80	40	45.9 ± 10.3 ^a	42.6 – 49.2	28 - 81
Under 17												
Goalkeeper	25	188.3 ± 5.5	186.1 – 190.6	178 - 202	25	80.5 ± 6.3	77.9 – 83.1	69 - 93	25	54.6 ± 13.1	49.1 – 60.0	35 - 87
Central defender	38	186.1 ± 4.8	184.6 – 187.7	175 - 195	38	76.6 ± 7.7	74.0 – 79.1	61 - 95	38	52.4 ± 11.4	48.6 – 56.1	34 - 90
Full-back	40	175.2 ± 6.4 ^{ab}	173.1 – 177.3	163 - 189	40	67.5 ± 4.8 ^{ab}	65.2 – 69.0	57 - 76	40	48.0 ± 9.8	44.8 – 51.1	32 - 70
Midfielder	56	175.0 ± 6.5 ^{ab}	173.3 – 176.7	162 - 195	56	66.1 ± 5.5 ^{ab}	64.6 – 67.5	54 - 78	56	50.9 ± 11.1	48.0 – 53.9	33 - 82
Forward	64	174.2 ± 5.5 ^{ab}	172.9 – 175.6	164 - 187	64	67.9 ± 6.9 ^{ab}	66.2 – 69.6	48 - 80	64	50.1 ± 9.0	47.8 – 52.4	32 - 76
Under 20												
Goalkeeper	18	190.4 ± 5.6	187.6 – 193.2	177 - 198	18	83.2 ± 8.9	78.8 – 87.7	65 - 100	18	65.8 ± 14.2	58.8 – 72.9	48 - 90
Central defender	28	187.5 ± 3.1	186.3 – 188.7	179 - 195	28	78.2 ± 7.8	75.1 – 81.2	54 - 89	28	52.8 ± 12.1 ^a	48.1 – 57.5	37 - 82
Full-back	22	177.3 ± 4.9 ^{ab}	175.1 – 179.5	169 - 188	22	72.1 ± 4.9 ^{ab}	69.9 – 74.3	65 - 82	22	49.0 ± 11.0 ^a	44.1 – 53.9	33 - 74
Midfielder	42	177.9 ± 5.9 ^{ab}	176.1 – 179.8	162 - 188	42	71.8 ± 8.2 ^{ab}	65.2 – 69.0	55 - 89	42	50.2 ± 13.1 ^a	46.1 – 54.3	31 - 92
Forward	43	177.2 ± 5.7 ^{ab}	175.5 – 179.0	167 - 192	43	72.6 ± 7.4 ^{ab}	70.3 – 74.9	62 - 92	43	51.3 ± 12.8 ^a	47.3 – 55.2	32 - 95
Under 23												
Goalkeeper	8	191.0 ± 4.8	187.0 – 195.0	185 - 198	8	93.1 ± 7.1	87.1 – 99.0	84 - 108	8	70.4 ± 13.1	59.5 – 81.3	48 - 85
Central defender	11	186.5 ± 4.2	183.7 – 189.4	181 - 195	11	82.7 ± 6.9	78.1 – 87.4	71 - 92	9	50.8 ± 8.4 ^a	44.3 – 57.2	39 - 64
Full-back	13	175.1 ± 4.7 ^{ab}	172.2 – 178.0	166 - 181	14	70.9 ± 3.7 ^{ab}	68.8 – 73.0	67 - 81	14	41.2 ± 7.6 ^a	36.8 – 45.6	28 - 54
Midfielder	19	178.5 ± 5.9 ^{ab}	175.6 – 181.3	169 - 188	19	77.3 ± 5.5 ^a	74.7 – 80.0	70 - 91	19	51.8 ± 7.0 ^{ab}	48.5 – 55.2	40 - 63
Forward	24	177.2 ± 6.6 ^{ab}	174.4 – 180.0	164 - 191	24	75.0 ± 8.3 ^{ab}	71.4 – 78.5	60 - 95	19	44.8 ± 6.5 ^a	41.7 – 48.0	35 - 64
Professional												
Goalkeeper	13	189.6 ± 2.5	188.1 – 191.1	186 - 194	13	89.6 ± 6.6	85.7 – 93.6	81 - 104	7	67.6 ± 51.5	47.6 – 87.5	47 - 100
Central defender	15	186.6 ± 4.2	184.3 – 188.9	180 - 192	14	85.3 ± 7.0	81.5 – 89.0	75 - 97	8	47.0 ± 10.7	39.3 – 54.7	38 - 69
Full-back	11	177.2 ± 5.0 ^{ab}	173.9 – 180.6	168 - 184	11	76.7 ± 5.3 ^{ab}	73.1 – 80.1	70 - 89	7	48.0 ± 9.7	39.0 – 57.0	36 - 67
Midfielder	19	176.8 ± 6.4 ^{ab}	173.7 – 179.9	169 - 187	19	75.3 ± 6.2 ^{ab}	72.3 – 78.3	67 - 90	11	52.5 ± 11.2	45.0 – 60.0	39 - 74
Forward	14	180.9 ± 5.5 ^{ab}	177.7 – 184.0	172 - 189	14	80.8 ± 7.1 ^a	76.7 – 84.9	70 - 92	9	53.9 ± 8.2	47.6 – 60.2	41 - 65

SD: standard deviation. Min: Minimum value. Max: Maximum value. ^a p < 0.05 vs. Goalkeeper. ^b p < 0.05 vs. Central defender. ^c p < 0.05 vs. Full-back. ^d p < 0.05 vs. Midfielder.

Table 5. Anthropometric values of selected vs non-selected players to compete in the national teams, in each official age bracket.

Category	n	Selected (n)	n	Non-Selected	p
Stature (cm)					
U15	30	176.4 ± 5.7	103	174.8 ± 5.8	0.130
U17	44	177.5 ± 7.5	154	176.7 ± 7.3	0.625
U20	74	179.7 ± 6.2	61	179.4 ± 7.0	0.782
U23	51	178.2 ± 7.1	16	180.1 ± 5.3	0.257
PRO	47	179.7 ± 6.4	12	182.9 ± 7.3	0.182
Body mass (kg)					
U15	30	66.2 ± 6.1	103	64.8 ± 6.2	0.298
U17	44	69.2 ± 7.1	154	68.8 ± 7.4	0.612
U20	74	73.4 ± 7.8	61	73.4 ± 7.6	0.956
U23	52	75.0 ± 7.1	16	79.2 ± 7.8	0.070
PRO	48	79.2 ± 7.0	12	80.4 ± 9.5	0.679
Sum 7 skinfolds (mm)					
U15	30	51.1 ± 8.7	103	45.9 ± 9.5*	0.004
U17	44	52.1 ± 10.4	154	49.8 ± 10.2	0.235
U20	74	52.3 ± 11.5	61	49.2 ± 13.4	0.056
U23	45	46.8 ± 8.7	16	47.8 ± 6.7	0.638
PRO	23	51.9 ± 10.2	12	46.5 ± 9.2	0.127

* p < 0.05 selected vs. non-selected.

The limitations of this work are that measurements were performed by different professionals, whereas it is known that anthropometric variables are evaluator-dependent. However, the assessments were performed following a defined protocol in order to reduce this limitation and anthropometric assessment is commonly used with degrees of accuracy and precision in athletes.^{22,23}

CONCLUSION

Based on the results, there is a diversity in the anthropometric profile within the game positions and a difference in maturation according to the player's position. This study can be used by coaches, strength and conditioning coaches, sports scientists and nutritionists as normative data on the anthropometric profile of male Brazilian national soccer players, establishing a benchmark considering age, official FIFA categories, playing positions, and national vs international tournament-level.

ACKNOWLEDGMENTS

This study was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and

Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG). The funding institutions had no role in the study design, data analysis, decision to publish or preparation of the article.

All authors declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. HOC: analysis of the data, statistical analysis, writing and revision; CFW: analysis of the data, writing and revision LRD: analysis of the data, writing and revision; FRD: analysis of the data, writing and revision; CCC: intellectual concept, writing and revision; GPR: analysis of the data, intellectual concept, writing and revision.

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