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Original

Anthropometric characteristics, physical fitness components and technical skills, a comparison between Brazilian and Portuguese young soccer players

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ABSTRACT

Objective: Compare physical and technical performances and anthropometric characteristics between Brazilian and Portuguese young soccer players.
Method: The participants were 281 Portuguese and 254 Brazilians from Under-15 and Under-17 categories. Measures were body weight and height, tests for strength, speed, agility, aerobic resistance, and a ball conduction drill as a motor skill test.
Results: Comparing Portuguese and Brazilian young soccer players from the same age, the European players presented a better anthropometric profile, physical fitness and motor skill than the Brazilians.
Conclusions: Our hypothesis that the regular transferences from Brazilian players to Europe could suggest similar performances between the two competitive levels was not supported by the evidences.
Keywords: Soccer; Physical fitness; Motor skills

Características antropométricas, componentes de la aptitud física y habilidades técnicas, una comparación entre jóvenes futbolistas brasileños y portugueses

RESUMEN

Objetivo: Comparar los desempeños físicos y técnicos y las características antropométricas entre los jugadores de fútbol jóvenes brasileños y portugueses.
Método: Los participantes fueron 281 portugueses y 254 brasileños de las categorías sub-15 y sub-17. Mide el peso corporal y la altura, prueba de fuerza, velocidad, agilidad, resistencia aeróbica y un taladro de conducción de bolas como prueba de habilidad motora.
Resultados: Comparando futbolistas jóvenes portugueses y brasileños de la misma edad, los jugadores europeos presentaron un mejor perfil antropométrico, aptitud física y habilidad motora que los brasileños.
Conclusiones: Nuestra hipótesis de que las transferencias regulares de jugadores brasileños a Europa podrían sugerir desempeños similares entre los dos niveles competitivos no fue apoyada por las evidencias.
Palabras clave: Fútbol; Aptitud física; Destreza motora

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Comparação entre jovens futebolistas brasileiros e portugueses quanto às características morfológicas, funcionais e destreza motora

RESUMO

Objetivo: Comparar as características antropométricas e o desempenho físico e técnico de jovens futebolistas brasileiros e portugueses.
Método: Participaram do estudo 281 portugueses e 254 brasileiros das categorias sub-15 e sub-17. As medidas peso corporal e estatura, teste de força, velocidade, agilidade, resistência aeróbia e uma tarefa de condução de bola como teste de destreza motora.
Resultados: Ao comparar jovens portugueses e brasileiros da mesma faixa etária, os futebolistas europeus apresentaram melhor perfil antropométrico, aptidão física e destreza motora do que os brasileiros.
Conclusão: Nossa hipótese de que as transferências regulares de jogadores brasileiros para a Europa poderiam sugerir desempenhos semelhantes entre os dois níveis competitivos não foram apoiados pelas evidências.
Palavras-chave: Futebol; Aptidão física; Destreza motora.

Introduction

International soccer players migration is considered a growing phenomenon worldwide, being Brazil the most represented foreign homeland[1] and Portugal the main destiny for those Brazilian internationalized players.[2,3] Thus, which performance variables distinguish and how to evaluate the performance and identify a potential talent in very young ages? Specifically about Portugal, the sports marketing and management consultant Mauro de Almeida, declared [4] that Portugal invests in Brazilian youth to further develop their talent.

Sports performance is an outcome derived from the interaction of multiple factors related to environmental and ecological contexts.[5] The evaluation of those characteristics[6] should be analysed taking into account genetic constitution, age, sex, maturation, maturation of psychomotor function, and social, cultural and ethnic differences. Understand and explain over different age levels the variability of these factors and their relation to sports performance have being challenging for researchers and coaches interested in the identification, selection and development of young soccer players.[7,8]

As we previously highlighted, further research is required to improve the understanding of the effect of ethnicity on anthropometric characteristics, physical fitness components and technical skills. Moreover, once the number of transferences has been growing every season, the identification of performance related variables that distinguish different competitive level players is paramount.

Additionally, as top performance teams commonly engage talented younger players for further development, the aim of this study was to compare anthropometric characteristics and physical and technical skills performances from sub-elite Brazilian and elite Portuguese young soccer players. We expect that the performance and morphological profiles from Brazilian would match with the Portuguese ones.

Methods

Subjects

We evaluated 281 Portuguese boys between 14-17 years, from 13 teams in categories Under-15 (n=165) and Under-17 (n=116) at the first division of the national youth league, and 255 Brazilian boys between 14-17 years, from 5 teams in the categories Under-15 (n=165) and Under-17 (n=90) at the regional division of local and state leagues. We conducted this study in accordance with accepted ethical standards and it was approved by the Scientific Committee of the University of Porto (#12/13) and by the Research Ethics Committee of the Federal University of *Juiz de Fora* (#09/11). Written consents were also provided by players and their parents or legal guardians.

Procedures

We evaluated all Portuguese players in December 2013 at the University of Porto and all Brazilian players in March 2011 at the Federal University of *Juiz de Fora*. The protocol used for both countries included an interview, anthropometry, physical fitness and soccer-skill tests. Each player was tested on two occasions within a 1-week period. Anthropometric dimensions, soccer-specific skills, speed and agility were measured during the initial visit. Jumping test and intermittent endurance performances were assessed during the second visit. With the exception of anthropometry, all tests were administered outdoors on a soccer field with artificial grass. Prior to physical capacities and soccer skill testing, the players performed a 12-min warm-up consisting of jogging and dynamical stretching exercises, as well as familiarization trials of each test. Players wore soccer clothing and shoes during all tests.

Height was measured with a fixed stadiometer (Holtain Ltd., UK); body mass and fat percentage with a body fat monitor (Tanita®, BC-418 MA, USA). Measurements were taken twice and the mean retained for analysis. Players wore light clothing and no shoes. Speed was evaluated with a 5- and 30-m sprint test, agility by a T shape circuit run named T-test,[9] and a soccer-specific technical skill, the dribbling test, was adapted from the Ghent Youth Soccer Project,[8] consisting in dribbling the ball around nine cones (2-m apart) in a slalom fashion as fast as possible. Those performances were measured using photoelectric cells (Speed Trap II, Brower Timing Systems, USA). Jumping height was evaluated with a counter movement jump (CMJ)[10] on a special mat (Digitime 1000, Digitest, Finland). The Yo-Yo intermittent endurance test – level 2 (YYIE2) was performed according to Bangsbo.[11] The descriptions of the tests are explained in detail and can be seen at Pedretti and Seabra.[12]

Statistical Analysis

Descriptive data are presented as mean and standard deviation. Brazilian and Portuguese differences into anthropometric characteristics and physical and motor performance were tested using a univariate analysis of covariance (ANCOVA), for each competitive category. Chronological age and years of practice were considered covariates. Pared comparisons used the LSD post-hoc test. All analysis was conducted with SPSS v.20, considering a significance level of 5%.

Results

Differences for anthropometric characteristics, physical and motor performance by home country are presented at Table 1. Significant differences were observed for the anthropometry at the Under-15 and the Under-17 categories, with Portuguese

players being taller and heavier, with a lower body fat percentage and higher body mass index when compared to the Brazilian players.

Statistically significant differences were observed for all physical fitness tests, with better performances for the Portuguese in relation to the Brazilians. At both Under-15 and Under-17 categories, the Portuguese soccer players were faster at the 5- and 30-meters Sprint test, had greater agility and aerobic performance, performed better at CMJ test, and showed greater motor skills at the ball conduction test than their Brazilian counterparts.

Table 1. Mean values (standard deviations). F-test and *P* value for univariate analysis of variance (ANCOVA) of different anthropometric characteristics, physical fitness and technical skills for Under-15 and Under-17 soccer players according to countries.

Age Category	Variable	Brazil	Portugal	*Covariates*	
				F	*P*
U15	Height	1.64 (0.08)	1.68 (0.07)	15.54	≤0.01
	Weight	53.19 (9.03)	59.14 (8.73)	22.07	≤0.01
	Perfat	18.45 (6.53)	16.51 (3.22)	7.44	≤0.01
	BMI	19.66 (2.40)	20.75 (2.24)	11.44	≤0.01
	CMJ	30.16 (5.17)	33.55 (5.86)	19.17	≤0.01
	Sprint 5m	1.20 (0.08)	1.10 (0.10)	57.81	≤0.01
	Sprint 30m	4.88 (0.42)	4.65 (0.31)	17.23	≤0.01
	Agility	10.44 (0.64)	9.72 (0.50)	86.98	≤0.01
	YYIE2	620.62 (299.89)	768.48 (351.99)	8.34	≤0.01
	Dribbling	20.12 (2.86)	17.67 (2.43)	45.18	≤0.01
U17	Height	1.69 (0.07)	1.73 (0.06)	8.49	≤0.01
	Weight	60.41 (11.48)	66.73 (8.01)	13.88	≤0.01
	Perfat	18.62 (6.53)	16.51 (3.22)	13.79	≤0.01
	BMI	20.88 (3.25)	22.23 (1.99)	8.29	≤0.01
	CMJ	32.59 (4.86)	37.89 (4.76)	26.68	≤0.01
	Sprint 5m	1.15 (0.08)	1.08 (0.09)	12.43	≤0.01
	Sprint 30m	4.59 (0.36)	4.37 (0.19)	21.55	≤0.01
	Agility	10.01 (0.42)	9.21 (0.38)	133.62	≤0.01
	YYIE2	855.00 (326.08)	1057.78 (366.27)	7.09	≤0.01
	Dribbling	19.30 (2.43)	16.35 (1.95)	55.84	≤0.01

U15: Under 15; U17: Under 17; Perfat: fat percentage; BMI: body mass index; CMJ: counter movement jump; m: meters; YYIE2: *Yo-Yo intermittent endurance test – level 2*; The results took into account the covariates: U15: age = 14.3 years old; Practice = 3.8 years; U17: age = 16.2 years old; Practice = 6.3 years

Discussion

Definition and refinement of players' profile and talent selection has become vital, as international transferences and minor's engagement followed the ongoing globalization of soccer. Aligned with significant efforts to facilitate the achievement of higher levels of sports performance,[13] the present study compared phenotypically different player's (Portuguese vs. Brazilian) in relation to their anthropometric profile, physical fitness and motor skills. To our knowledge, this is the first time that anthropometric and performance measures between European and South American young soccer players were compared.

Similarly to our results, research indicates that European players are higher and heavier than non-Europeans players. As reported by Buchheit et al.[14] for Under-15 French in relation Qatari soccer players and Vaeyens et al.[8] for Belgian players' in comparison to the Qatari from Bucheeit's work and the Brazilians from our sample. Height is strongly related to pubertal timing,[15] and substantial weight gain occur during puberty,[15] however, they become non-significant during adulthood.[16] Height and weight are, consequently, of little reliability to the identification, selection and development of young soccer players because of its large variation during the growing process.

Although the identification of data patterns related to soccer players is a tough work, recent research have found evidences that support differentiation by competitive level through functional tests.[7] Comparing our work with another three studies that applied the CMJ test to evaluate strength, with players from France,[17] Qatar[18] and Belgium,[8] all European players but the Portuguese had higher values than the Brazilian and Qatari players at Under-15 category. Data from Under-17 was available only for the Qatari players, presenting superior values than the Portuguese and Brazilians.

In relation to speed, Deprez et al.[19] 5-m *Sprint* test results showed faster Belgian players at both Under-15 and Under-17 categories than our Portuguese players and the Brazilians at the Under-15, with similar performance at the Under-17. For the 30-m Sprint test,[20] reported speed values close to our Under-15 Portuguese players but faster than the Brazilians. Similarly, Rebelo et al.[21] observed in relation to agility, better results for the Under-19 Portuguese non-elite players when compared to our Portuguese Under-15 and Under-17 players. However, the elite soccer players from Capela[22] study presented lower agility scores when compared to our Under-15 and Under-17 entire sample.

Strength development is related to the maturational status and associated to body size and serum testosterone levels,[23] with early matured boys presenting higher muscular strength than the late matured ones.[24] Likewise, motor dexterity and agility have the potential for significant improvements during adolescence.[25] However, its relationship with maturation is still under investigated, making any definitive statement about the possible relations between those variables a difficult task.

Rebelo et al.[21] evaluated aerobic performance in their study using the YYIE2 test, reporting sub-elite values very close and elite values superior to our Under-17 Brazilian and Portuguese players. Longitudinal research in men states that the absolute oxygen consumption (L min-1) apex increase constantly between 8-16 years old,[26] with the peak improvements occurring between 11-15 years old.[27]

Our results for the ball conduction test were similar to Vaeyens et al.[8] findings for both Under-15 and Under-17 categories, with better performances for our Portuguese and Brazilian players, respectively related to their elite and non-elite Belgian players. Matta et al.[28] work shows a positive relation between practice and years of training to motor skill performance, indicating that maturation doesn't seem to have big influences over the soccer specific motor skills.

The great variability reported at published works for somatic characteristics, physical fitness and motor skills of young soccer players, within the same age and sex, can be observed at our sample. Although the present study adds evidences in an attempt to help the clarification of player's selection and development processes, some limitations should be considered.

First, the generalization of the results is limited because of our relative small sample. Second, the data collection occurred at different times for the Portuguese and Brazilian (December/2013 vs. March/2011), being our investigated players not strictly contemporary. Third, weather differences may be a confounding factor for the results, although much warmer[29] and colder[30] environments have failed to show interference in soccer performance. And fourth, despite research have shown that height and weight do not differ in long term observations in function of maturation, the presence of maturation markers would be of great value for a deeper understanding of our results.

Those limitations are not exclusive from this study, but must be considered for its interpretation and future research. Moreover, to define a complete variable profile pertinent to the young soccer player selection and development, future investigations should focus in the separate analysis of each one of them, at bigger samples, including the maturational status.

The Portuguese young soccer players from both Under-15 and Under-17 categories presented a better anthropometric profile,

physical fitness and motor dexterity than Brazilian players from the same age but distinct competitive levels. Our hypothesis that the regular transferences from Brazilian players to Europe could suggest similar performances between the two competitive levels was not supported by the evidences. Consequently, the pursuit of a consensus about the weight of factors like the training, the maturational status and the used criteria for player selection over those variations is still a reality on the field.

Authotship. All the authors have intellectually contributed to the development of the study, assume responsibility for its content and also agree with the definitive version of the article. **Provenance and peer review.** Not commissioned; externally peer reviewed. **Ethical Responsabilities.** *Protection of individuals and animals:* The authors declare that the conducted procedures met the ethical standards of the responsible committee on human experimentation of the World Medical Association and the Declaration of Helsinki . *Confidentiality:* The authors are responsible for following the protocols established by their respective healthcare centers for accessing data from medical records for performing this type of publication in order to conduct research/dissemination for the community. *Privacy:* The authors declare no patient data appear in this article.

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