ORIGINAL ARTICLE

Characteristics of youth soccer players aged 13–15 years classified by skill level

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Objective: To evaluate the growth, maturity status and functional capacity of youth soccer players grouped by level of skill.
Subjects: The sample included 69 male players aged 13.2–15.1 years from clubs that competed in the highest division for their age group.
Methods: Height and body mass of players were measured and stage of pubic hair (PH) was assessed at clinical examination. Years of experience in football were obtained at interview. Three tests of functional capacity were administered: dash, vertical jump and endurance shuttle run. Performances on six soccer-specific tests were converted to a composite score which was used to classify players into quintiles of skill. Multiple analysis of covariance, controlling for age, was used to test differences among skill groups in experience, growth status and functional capacity, whereas multiple linear regression analysis was used to estimate the relative contributions of age, years of training in soccer, stage of PH, height, body mass, the height×weight interaction and functional capacities to the composite skill score.
Results: The skill groups differed significantly in the intermittent endurance run ($p<0.05$) but not in the other variables. Only the difference between the highest and lowest skill groups in the endurance shuttle run was significant. Most players in the highest (12 of 14) and high (11 of 14) skill groups were in stages PH 4 and PH 5. Pubertal status and height accounted for 21% of the variance in the skill score; adding aerobic resistance to the regression increased the variance in skill accounted for to 29%. In both regressions, the coefficient for height was negative.
Conclusion: Adolescent soccer players aged 13–15 years classified by skill do not differ in age, experience, body size, speed and power, but differ in aerobic endurance, specifically at the extremes of skill. Stage of puberty and aerobic resistance (positive coefficients) and height (negative coefficient) are significant predictors of soccer skill (29% of the total explained variance), highlighting the inter-relationship of growth, maturity and functional characteristics of youth soccer players.

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The contributions of age, experience, height, body mass and maturity status to indicators of functional capacity and sport-specific skills were previously considered in a sample of adolescent soccer players aged 13–15 years.[1 2] Significant predictors, however, varied with test items, and greater percentages of variance were explained for the functional capacity in contrast with the soccer-specific skill tests.

Youth soccer players classified as elite and non-elite, or as possessing high and low levels of soccer ability differ in body size and maturity,[3] and in strength, flexibility and soccer-specific skills.[4 5] Unfortunately, size and maturity status are generally not controlled in comparisons of functional tests and sport-specific skills. Further, classifications as elite and non-elite or as having high and low ability are generally based upon coach or staff evaluations or level of competition, and as such have a degree of subjectivity. Skill in soccer is more complex than indicated by field tests, level of competition and so on, and includes a combination of physical, functional, behavioural and perceptual features.

Allowing for the complexities in quantifying skill in soccer, this study evaluates age, experience, growth, maturity status and functional capacities of youth players grouped by level of skill from two perspectives: (1) comparison of the characteristics of players classified into quintiles of skill based on a composite score for six sport-specific tests and (2) estimation of the relative contribution of players' characteristics (age, training, stage of puberty, height, body mass and functional capacities) to variance in the composite skill score.

METHODS

The sample and testing protocols have been described previously.[1 2] The sample included 69 male youth soccer players on teams from three clubs in the Porto area of Portugal which competed in the highest division for their age group at the time of the study. Approval for testing was given by club officials. Informed consent was obtained from parents or guardians and from the players.

The players were measured and tested within a 2-week period, 13–28 February 1999. Decimal age for each player was calculated from date of birth and the midpoint of the interval during which the measurements and tests were administered. Players were aged 13.2–15.1 years. Body height and body mass were measured with standard techniques to the nearest 0.1 cm and 0.1 kg, respectively. Stage of pubic hair (PH) was the indicator of biological maturity status. Stage of PH based on the criteria of Tanner[6] was evaluated at clinical examination by a paediatrician experienced in the assessment of secondary sex characteristics. The players were interviewed to estimate the number of years of regular experience/training in soccer.

Six tests of technical skills in soccer recommended by the Federação Portuguesa de Futebol[7] were administered: ball control with the body, ball control with the head, slalom dribbling with a pass (speed and accuracy), slalom dribbling (speed), passing accuracy and shooting accuracy. Protocols of each test have been reported previously.[2] Skill tests were administered outdoors on a playing field without grass (clay)

Abbreviations: PH, pubic hair; RAE, relative age effect under dry conditions. A station format was used but tests were not administered in any specific order. The players warmed up in the usual manner before the practice session (stretching and jogging), and also rested between tests.

The test battery has a tradition of use in Portugal.[8 9] Intraclass correlations for repeated measures (analysis of variance) indicated reasonable reliability: 0.70 (passing and shooting), 0.71 (dribbling speed), 0.76 (ball control with the head), 0.78 (ball control with the body) and 0.81 (dribbling with a pass). Face validity can be assumed since the tests assess specific elements of the sport. Correlations between the six tests and performances on a slalom dribble and wall volley were moderate,[9] whereas validity coefficients between performances on a slalom dribble and wall volley and judges' ratings of soccer playing ability ranged from 0.53 to 0.94.[10]

Three tests of functional capacity were also administered: running speed, 30 m dash; explosive power, the vertical jump (countermovement jump with 90° knee flexion before the extension); and aerobic resistance, yo-yo intermittent endurance test. Two trials were given for the dash and vertical jump, and the better of the two trials was retained for analysis. One trial was given for the intermittent endurance run.[1]

Correlations among the six skill tests ranged from −0.15 to 0.34. Although four correlations were significant ($p<0.05$), the correlations indicated generally low inter-relationships among the skill tests. Z scores were calculated for each test; scores were reversed for the two timed items since lower times reflect better performances. The z scores were summed to provide a composite soccer skill score for each player. Although soccer skill is more complex than performances on the six tests, the composite score provides an operational indicator of skill in the sport. It is based on skills deemed by experts as essential for success in the sport.

Quintiles were calculated from the composite skill score classifying players from the most to the least skilled. Quintiles rather than quartiles or tertiles were selected to provide a more finely tuned skill classification with reasonable sample sizes per group. Descriptive statistics for age, years of training, height, mass, the three functional capacity tests and the composite skill score were calculated for the five skill groups. Distributions of stages of PH development and players by position (defender, midfielder and forward) were also calculated by skill group.

Although the overall difference in age among players in the five skill groups was not significant ($F = 1.56$, $p = 0.20$), age was used as a covariate in testing differences among skill groups in experience, growth status and functional capacity (analysis of covariance). Multiple linear regression analysis was used to estimate the relative contributions of age, years of formal training in the sport, stage of PH, height, body mass and the height×mass interaction to variance in the composite skill score. Since height and body mass are highly related, residuals (individual values minus the mean) were used in the regressions to generate interaction terms. The height×mass interaction term was calculated as the product of the residuals for height and body mass. The regression protocol permitted all variables to enter into the equation and then sequentially removed the variables that met the criterion for elimination (backward elimination). In this procedure, the variable with the smallest partial correlation with the dependent variable was considered first for removal; if it met the criterion for removal ($p>0.10$), it was removed. The procedure was repeated for the other variables until only those variables that did not meet the criterion for removal remained. The regression was repeated with the addition of the three functional tests. An α level of 0.05 was used to indicate statistical significance in all the analyses.

RESULTS

Table 1 summarises the descriptive statistics for the composite skill score, age, experience, body size and functional capacity for players by skill score quintiles and results of comparisons. The highest skill group is, on average, slightly older, although the differences among groups are not significant. The skill groups differ significantly only in the intermittent endurance run ($p<0.01$). Subsequent pairwise comparisons with Bonferroni's adjustments indicate that only the difference between the highest and lowest skill groups for the endurance run is significant ($p<0.05$).

Table 2 shows the distribution of PH stages among players in each of the composite skill quintiles. A total of 12 of 14 players in the highest skill quintile and 11 of 14 players in the high skill quintile are in the later stages of pubertal maturation (PH 4 and PH 5). On the other hand, four or all five stages of PH are represented among players in the other three skill quartiles. The trend suggests that more highly skilled youth players tend to be advanced in pubertal maturation.

Table 3 gives the distribution of players by position in each of the skill quintiles. All skill levels are present among players by position. The majority of forwards (8 of 10) are in the high, middle and low composite skill quintiles, whereas defenders and midfielders are almost equally distributed among the skill quintiles. Although players do not differ significantly in age by position ($F = 1.17$, $p = 0.32$), forwards (mean (SE) 14.5 (0.6) years) are, on average, slightly older than midfielders (14.1 (0.6) years) and defenders (14.2 (0.6) years). Controlling for age, composite skill scores do not differ among players by position ($F = 0.39$, $p = 0.680$). Age-adjusted skill scores (mean (SE)) show a gradient from midfielders ($z = 0.24$ (3.43)) to forwards ($z = -0.02$ (1.72)) to defenders ($z = -0.25$ (2.76)).

Table 4 summarises the estimates of the relative contribution of age, years of training in soccer, stage of sexual maturity, height and body mass on the composite soccer skill score. Maturity status has a positive influence and height has a negative influence on the composite skill score; together the two characteristics account for 21% of the variance in the skill score. When the three measures of functional capacity are included among the predictors, aerobic resistance adds 8% to the total explained variance. Maturity status and aerobic resistance have a positive influence and height has a negative influence on the composite skill score; together the three variables account for 29% of the variance.

DISCUSSION

Data that form the basis of this study were collected in 1999. A question of relevance, therefore, is the characteristics of the sample compared with other youth soccer players. Data were available for body size. Mean heights and weights of the sample compared favourably with other samples of youth soccer players in Portugal and Europe,[3] and are greater than reference medians for boys in the US.[11] Note, however, that talented young athletes, including soccer players, are a reasonably select group and in some instances size is a factor in the selective process. Larger size is also associated with advanced maturity status compared with age peers, and adolescent male soccer players tend to be advanced in biological maturation.[3] Information on recent secular change in the height of Portuguese youth is not available. Nevertheless, the secular trend towards increased height in European populations has slowed considerably and/or stopped; the secular increase in weight in the general population, however, continues.[11]

Players in the highest and high quintiles of the composite skill score tend to be, on average, taller and heavier than players in the middle, low and lowest skill categories who are similar, on average, in age, height and weight (table 1). There are few

Table 1 Characteristics of players by skill quintiles and results of the multiple analysis of covariance, with age as the covariate, among skill groups

Composite skill quintile	n	Skill score*	Age (years)	Experience (years)	Height (cm)	Weight (kg)	Sprint (s)	Vertical jump (cm)	Endurance run (m)
Highest	14	4.34 (2.03)	14.5 (0.6)	5.1 (1.7)	168.6 (9.6)	57.0 (9.3)	4.75 (0.23)	30.8 (4.9)	2983 (561)
High	14	1.28 (0.81)	14.2 (0.6)	4.1 (1.8)	169.6 (9.7)	59.8 (9.5)	4.89 (0.27)	30.2 (3.9)	2394 (649)
Middle	13	−0.50 (0.46)	14.4 (0.6)	4.7 (1.9)	167.0 (10.2)	55.7 (10.6)	4.82 (0.34)	30.2 (5.5)	2591 (494)
Low	14	−1.65 (0.29)	14.1 (0.6)	4.8 (1.3)	167.8 (5.6)	55.7 (7.2)	4.92 (0.28)	27.8 (4.6)	2291 (546)
Lowest	14	−3.52 (1.21)	14.0 (0.6)	3.8 (2.1)	166.0 (8.5)	55.1 (9.2)	5.00 (0.34)	27.8 (3.9)	2094 (794)
F				1.36	0.73	1.30	0.47	0.58	2.64
p Value				0.259	0.574	0.278	0.754	0.681	0.042

Values are mean (SD).
*Sum of z scores for the six skill tests.

consistent trends in mean values for the three functional capacity tests. Players in the highest skill category tend to perform, on average, better in the sprint, vertical jump and endurance shuttle run, whereas players in the lowest skill category perform, on average, poorest in the sprint and endurance shuttle run. There is no clear trend in mean scores for the functional capacity tests among players classified as high, mid-level and low in the composite skill score. Note, however, that the difference between players in the highest and lowest skill quintiles is significant only for the endurance shuttle run (table 1). All other differences are not significant among composite skill groups.

In the earlier analysis,[1 2] maturity status appeared among the significant predictors for four of the six skill tests and for the three indicators of functional capacity. Other significant predictors varied with each test item: dribbling with a pass (age, maturity (stage of PH), 21%, $p<0.01$), ball control with the head (maturity, height, height×body mass interaction, 14%, $p<0.05$), ball control with the body (maturity, training, 13%, $p<0.05$) and shooting accuracy (maturity, height, 8%, $p = 0.06$). There were no significant predictors for dribbling speed, passing accuracy and shooting accuracy.[2] Significant predictor variables for the functional capacity tests were as follows: aerobic resistance (maturity, experience, 21%, $p<0.01$), power (height, maturity, 41%, $p<0.01$) and speed (body mass, maturity, 50%, $p<0.01$).[1] In this analysis, stage of PH and height explained 21% of the variance in the composite skill score (table 4). Age, experience, body mass and the body mass×height interaction did not contribute significantly to the composite skill score.

When the three functional capacity tests were added to the predictors, aerobic resistance (endurance shuttle run) added 8% to the explained variance for a total of 29% (table 4). The intermittent test of aerobic resistance requires not only cardiorespiratory endurance but also agility in efficiently negotiating the shuttles. This may explain partly the contribution of this measure of functional capacity to the composite soccer skill score.

In regression analysis, the standardised coefficients allow comparisons of the estimated contributions of each variable. The coefficients are not related to the scale of the raw data, and as such should be interpreted without scale. Positive β coefficients suggest an increase, and negative coefficients suggest a decrease, in performance associated with changes in particular independent variables.

The failure of age to appear as a significant predictor in all but one of the soccer-specific skill tests[2] and of the composite skill scores reflects to some extent the relatively narrow age range of the sample, 13.2–15.1 years. Age in itself reflects to some extent experience in the sport. Since motor performance and endurance capacity increase, on average, with age as boys progress through adolescence and many have their own growth spurts,[11] a positive association between age and soccer skill might be expected. Maturity status, however, is a confounding factor, especially among adolescent boys. The maturity status of the sample of soccer players ranged from the prepubertal (PH 1) to the mature (PH 5) states and positively influenced the composite soccer skill score. Speed, power and endurance are related to maturity status during male adolescence[11] and show peak development around the time of maximal growth in height in soccer players independent of age in itself.[12] Information on changes in sport-specific skills during the interval of peak height velocity is lacking.

Advanced maturity status was associated with higher composite skill scores, which was consistent with the distribution of stages of PH among players by skill quintiles. In all, 12 of 14 players in the highest skill group and 11 of 14 players in the high skill group were in PH 4 and PH 5 (table 3). This probably reflects the positive influence of maturity status on strength, speed, power, agility and other components of performance in adolescent boys.[11] Tests used to measure these capacities include significant coordination and agility components as in the vertical jump, throw for distance, shuttle run and so on, which may transfer, to some extent, to the specific skill tests. In this sample, partial correlations, controlling for age, between the three functional capacity tests and the composite skill score were at best moderate for the endurance shuttle run ($r = 0.38$,

Table 2 Distribution of stages of pubic hair development within each of the composite skill quintiles

	Composite soccer skill quintiles				
Pubic hair stage*	Highest (n = 14)	High (n = 14)	Middle (n = 13)	Low (n = 14)	Lowest (n = 14)
1	1	0	0	1	4
2	1	2	4	2	1
3	0	1	4	4	4
4	7	4	2	4	4
5	5	7	3	3	1

*Stage 1, prepubertal; stage 5, mature.

Table 3 Distribution of positions within each of the composite skill quintiles

	Composite soccer skill quintiles				
Position	Highest (n = 14)	High (n = 14)	Middle (n = 13)	Low (n = 14)	Lowest (n = 14)
Defender (29)	5	6	6	6	6
Midfielder (30)	8	4	5	6	7
Forward (10)	1	4	2	2	1

Table 4 Significant predictors of the composite skill score and estimated R^2 in youth soccer players based on the multiple regression analyses

	Predictor	Standardised β coefficients	R^2
Analysis 1	Maturity	0.628	
	Height	−0.354	0.21*
Analysis 2	Maturity	0.512	
	Height	−0.362	
	Endurance run	0.309	0.29*

*p<0.001.

p<0.01), and lower for the sprint (r = 0.31, p<0.05) and vertical jump (r = 0.23, p = 0.06).

The direction of the standardised coefficient for height was negative and implied that a higher composite skill score was associated with a somewhat shorter height. This probably reflects the importance of a lower centre of gravity in the execution of soccer skills. The latter can also be inferred from the lack of a significant height×mass interaction in explaining variance in the composite skill score. The direction of the coefficient for height was also negative in the tests of ball control with the head and shooting accuracy.[2] The direction of the coefficient for height seems to contrast with the trend in height among the five skill groups (table 1). Players in the highest and high skill categories were, on average, taller than players in the mid-level, low and lowest skill categories. The differences in height among skill groups, however, were not significant and the SDs indicated considerable overlap. Unfortunately, a measure of body proportions, specifically relative leg length, was not included in the measurement protocol. Adolescent boys advanced in maturity status tend to have, on average, proportionally shorter legs for the same height compared with boys of delayed maturity status.[11] In contrast with soccer skills, height had a positive coefficient for the vertical jump, but was not a significant predictor for the endurance shuttle run and sprint. On the other hand, pubertal status positively influenced both the composite skill score and individual functional capacity tests in this sample of youth players.

Two comprehensive studies of soccer-specific skills compared a combined sample of youth players from Germany, France and the Czech Republic in two age groups, 14–16 years (14.4–16.8) and 16–18 years (15.6–18.9), and at two levels (high and low) within each age group.[5 13] In the younger sample, players classified as top level were, on average, older by about 1½ years, taller and heavier. They also performed significantly better than those classified as low level on five juggling (ball control) tests and tests of dribbling speed, and long and short passing. The top-level players also performed significantly better in functional tests related to speed (sprints), power (jumps) and aerobic capacity (distance run). Unfortunately, the chronological age difference between the samples was not controlled in making the statistical comparisons, and the contributions of age and body size to performances were not considered. In the older age group (16–18 years), age and body size differences between high- and low-level players were reduced and not significant.[13] This reflects the catch-up in body size as boys approach maturity in late adolescence. Maturity status of the players was not considered in this comprehensive study.

Other studies of youth players generally consider specific skills, in contrast with an overall skill score. For example, elite (national team) late-adolescent soccer players performed better on a shuttle run and vertical jump compared with non-elite (regional team) players.[14] The elite players were also older, taller and heavier than the non-elite players, but the age and size differences were not controlled in making the comparisons. An indicator of biological maturity status was not included in the study.

The relative age effect (RAE) is a focus of discussion in youth soccer,[15–17] specifically an over-representation of players born in the first quarter of the selection year. Explanations for the RAE in youth generally focus on size variation within a single chronological year—that is, those born early in the year are, on average, taller and heavier than those born later in the year. In many youth sports, size in itself may be a significant factor affecting success at young age levels where strength, speed and power are often at a premium, in turn bringing successful players to the attention of coaches and trainers. Those successful at young ages, in turn, may have an enhanced opportunity for special attention—for example, selection for select teams, better coaching and so on.

Size in itself is only one factor; it is confounded by variation in maturity status. A boy may be tall or short compared with peers, especially during the transition into the adolescent growth spurt and puberty, because he is advanced or delayed, respectively, in maturity status. On the other hand, he may be tall or short because his parents are tall or short—that is, size has a major genotypic component.[11] Thus, a boy born early in the selection year who matures late may be the same size as or shorter than a boy born late in the selection year who matures

Table 5 Characteristics of 14-year-old soccer players (n = 39, 14.01–14.99 years) grouped by age quartile (n = 10 per group, except the youngest, n = 9)

Variable	Youngest	Young	Old	Oldest
Age, years	14.08 (0.06)	14.35 (0.07)	14.73 (0.11)	14.94 (0.05)
Experience, years	4.0 (1.5)	5.5 (1.5)	4.3 (2.2)	5.0 (1.9)
Height, cm	165.9 (6.4)	170.8 (9.4)	174.1 (7.1)	169.8 (4.8)
Weight, kg	57.5 (6.6)	59.3 (8.5)	61.7 (6.3)	60.9 (7.8)
Sprint, s	4.83 (0.30)	4.79 (0.27)	4.71 (0.18)	4.83 (0.23)
Jump, cm	30.1 (3.9)	29.7 (5.0)	30.8 (4.3)	30.1 (5.6)
Endurance run, m	2596 (661)	2552 (547)	2580 (446)	2932 (544)
Composite skill, z	0.44 (2.37)	0.47 (2.23)	0.94 (4.50)	0.24 (2.58)
Pubic hair stages (n)				
1	0	0	0	0
2	0	2	1	0
3	1	1	3	4
4	6	3	1	3
5	2	4	5	3

Values are mean (SD) unless otherwise indicated.

What is already known on this topic

- Youth soccer players classified as elite and non-elite or as possessing high and low levels of soccer ability differ in body size, maturity, strength, flexibility and soccer-specific skills.
- Classification as elite and non-elite players or as having high and low ability is commonly based on coach or staff evaluations or level of competition.

What this study adds

- This paper evaluates technical skill in adolescent soccer players using a composite score based on six soccer-specific field tests and relates it to growth, maturity and functional status.
- Stage of puberty (positive), height (negative) and aerobic resistance (positive) explained 29% of the variance in the composite soccer skill score in youth players aged 13–15 years.
- The negative coefficient for height reflects the importance of a lower centre of gravity in the execution of soccer skills.
- Most of the variation in the composite soccer skill score was not accounted for by the predictor variables, which highlights the need to expand studies to include other potentially important predictors—for example, perceptual–cognitive factors.
- The importance of variation in maturity status within a relatively narrow age range to skill has relevance for interpretation of the relative age effect in youth soccer.

early. Variation in body size associated with individual differences in maturity status is, on average, especially marked in boys aged between 13 and 15 years. At the extremes, maturity-related differences in size and strength appear earlier.[11]

Discussions of the RAE focus on distribution of birth dates within a selection year. Field studies of young athletes are generally conducted at various times during a year, which is a confounding factor, so that data of this study do not lend themselves directly to addressing the RAE. However, examination of age-associated variation within a single chronological year may provide insights. The sample of youth soccer players included 39 boys who were 14 years of age with ages ranging from 14.01 to 14.99 years. Table 5 shows the characteristics of this subsample divided into quartiles. Other than age, there is no clear trend from youngest to oldest 14-year-old boys in experience, size, functional capacities and composite skill score. This probably reflects pubertal variation within the sample. None of the players were prepubertal (PH 1), and most players were nearing maturity (PH 4) or already mature (PH 5). It may be of interest that the trend in mean heights paralleled the number of mature (PH 5) boys in each subgroup. Pubertal stages have limitations as maturity indicators. They only indicate stage of PH at the time of examination; they do not indicate when a boy entered the stage or how long he will be in the stage. Age at entry into a stage and duration of stages are quite variable.[11]

Those involved in the development of talented elite-level soccer players need to be aware of the contributions of growth and maturation as such to the functional and skill demands of specific sports. Greater size, speed, strength and power may afford a competitive advantage to male players who are older or more advanced in maturity status. Therefore, it is no surprise that players in elite youth soccer programmes tend to be older and physically more mature than their peers.[3] Coaches and scouts who overlook the contributions of age or maturation may, however, be selling themselves short. The physical advantages afforded by age and advanced maturity status during adolescence are largely transient and are reduced or reversed in young adulthood.[18] There is the risk that players who are equally talented but physically less mature at younger ages may be dismissed on the basis of their physical characteristics and not on their adult potential. On the other hand, players identified as being the most talented during adolescence may fail to meet adult expectations as their late-maturing peers who persist in the sport catch-up in size, strength and power.[11]

In summary, most of the variation in the composite soccer skill score was not accounted for by the predictor variables, which explained slightly more of the variance in the composite score compared with individual skill tests. Other factors probably influence sport-specific skills—for example, neural control of movement and perceptual–cognitive skills such as anticipation and visual search strategies.[19–21] Individual differences in the timing and tempo of the adolescent growth spurt are another factor. Differential timing and tempo may influence sport-specific skills as such whereas corresponding maturation-related changes in the central nervous system may influence neural control and perceptual-cognitive skills. Nevertheless, the results of this study indicate the need to extend studies of soccer-specific skills to include other potential determinants and also highlight the practical utility of a composite soccer skill score.

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COMMENTARY 1

The most original aspect of this work is the development of a composite score for the prediction of overall soccer skills. This type of approach is superior to most of the work that has been conducted previously in this area.

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COMMENTARY 2

The soccer literature on performance focuses mainly on adult and professionals. When a paper addresses youth, it has the potential to have a wider impact given the larger numbers of youth playing the game.

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Steven N Blair is President and CEO of The Cooper Institute in Dallas. He is an adjunct professor in the Schools of Public Health at the University of South Carolina and the University of Texas Health Science Center at Houston, the College of Education Academy for Research and Development at the University of North Texas, and the College of Education at the University of Houston. He also is a Benjamin Meaker Fellow at the University of Bristol, UK and a Rudd Scholar at the Rudd Institute. Dr Blair is a Fellow in the American College of Epidemiology, Society for Behavioral Medicine, American College of Sports Medicine, American Heart Association, and American Academy of Kinesiology and Physical Education; and was elected to membership in the American Epidemiological Society. He was the first president of the National Coalition for Promoting Physical Activity, and is a past-president of the American College of Sports Medicine and the American Academy of Kinesiology and Physical Education.

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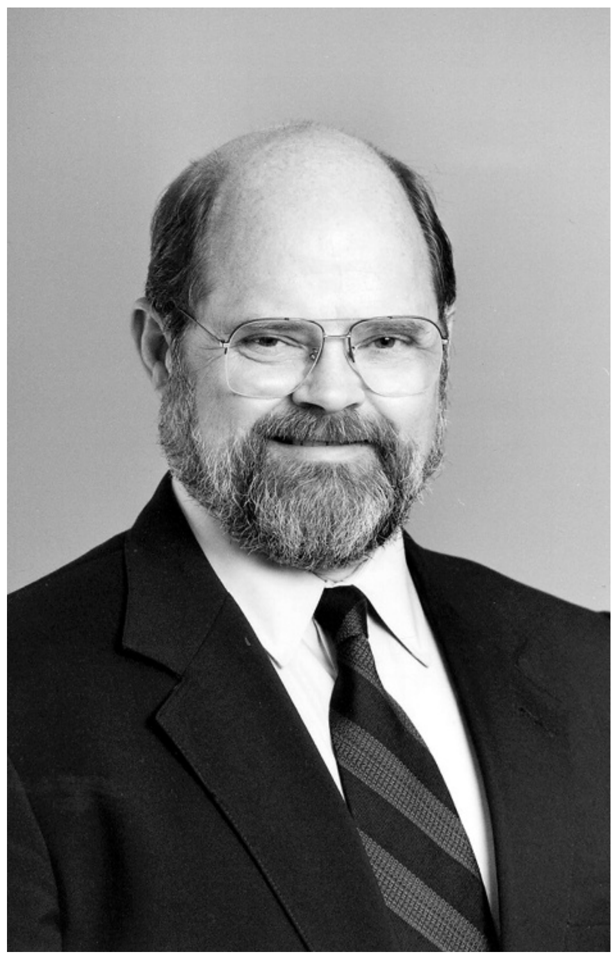

Figure 1 Steven Blair.