MRI age verification of U-17 footballers: The Ghana study

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ABSTRACT

Background: A fair playground is absolutely necessary in any age limited sports. Age determination in countries where birth registration is not compulsory can often be difficult making it a challenge to determine ages of people born in such countries.

Objective: To determine correlation between chronological ages of under 17 Ghanaian footballers and the FIFA MRI grading.

Method: The degree of radial epiphyseal fusion was evaluated in 286 male Ghanaian footballers aged 13–16 years over a 4 year period (June 2012–November 2016) using 1.5 T Magnetic Resonance Imaging. The ages of the participants used in the study were those provided by the football players and confirmed with their national passports.

Results: Over 48% of these Ghanaian players below the age of 17 years had completely fused radial epiphysis. No significant correlation between the given chronological ages and the degree of fusion was found. The Spearmans correlation was given as ($r = 0.069$; $p = 0.540$).

Conclusion: There was no correlation between chronological age and degree of radial fusion among Ghanaian players. Normative study among Ghanaian/black African players is long overdue to ensure the U-17 players from these countries are not unfairly disadvantaged.

1. Introduction

Accurate age determination is vital in any competitive age-restricted sport such as football. Inconsistencies in age lead to unequal chances and counter both the spirit of the game and 'fair play'. The determination of skeletal maturity has an important place in the practice of pediatrics, especially in relation to endocrinological problems and growth disorders [1]. Standard radiographs of the wrist are widely used for assessment of skeletal age, although they are also associated with radiation risk [2,3].

Whereas standard radiographs with the associated radiation risk cannot be justified as a screening tool in soccer populations, age estimation on the basis of grading of fusion of the distal radial epiphysis by magnetic resonance imaging (MRI) has been shown to be a reliable and valid method in 14–19 year-old soccer players [3].

In Ghana, the identification of chronological age has often been a difficult challenge, as registration at birth is not compulsory [4]. This gives room for falsification of true age, which could lead to cheating

[2]. It has been suggested that age, experience, body size and stage of puberty contribute considerably, in different combinations, to the variance of some football skills such as dribbling with a pass, ball control with the body and shooting accuracy [5]. Also, players with a greater relative (or possibly false lower) age are more likely to be identified as 'talented' because of the likely physical advantages that they have over their 'younger' peers [5].

Because of lack of normative studies in black African populations especially Ghana, discrepancies seen in age of players and the MRI results often present an age dilemma.

The aim of this study therefore is to evaluate the age of aspiring Ghanaian under-17 (U17) footballers using the degree of fusion of the distal radius on MRI and to compare it with Federation of International Football Associations (FIFA) MRI grading.

2. Method

A cross-sectional study design was employed using 1.5 T MRI scans

of the left wrist of 286 male football players. The ages of the participants were determined by what was provided by the players and confirmed on their national passports. These players were aspiring to play for the national U17 football team and were mandated to undergo compulsory MRI scan to determine if they qualify to play by comparing the grades of their radial bone epiphyseal fusion to a previously developed FIFA Medical and Research Centre (F-MARC) standard.

Per the ages, participants with chronological ages of 14–16 years were recruited during a series of 'justify your inclusion tournaments' organised by the Ghana Football Association (GFA) between June 2012 and August 2016. The study was conducted at the C and J Mediclinic and the Korle-Bu Teaching Hospital, both in Accra. This was mandatory because it was part of the criteria to have this MRI scans as a basis for qualification into the team. The MRI examinations of the left wrists were acquired using a protocol by the Confederation of African Football (CAF).

2.1. CAF/FIFA protocol

The wrist was positioned above the head or at the side of the body. The third metacarpal was placed as close as possible to the same axis as the radius. Coronal sequences were planned parallel to the distal volar radial surface. The imaging parameters were not pushed to the level of the top of the line magnets in order to allow protocol transfer to the equipment available worldwide. The following parameters were applied: T1weighted spin echo, TR 350–500 ms, TE 12–20 ms, slice thickness 3 mm, interslice gap .3 mm (1.1 distance factor), pixel size ⩽ 0.5 mm (eg 12 cm field of view with a 256 matrix), 2–4 acquisitions and 9 images (to cover the entire distal radius from anterior to posterior).

2.2. Grading system

CAF/FIFA grading parameters for evaluating footballers were used as the grading tool in evaluating the participants in this study. The grading parameters are as follows:

Grade I; T1weighted spin echo images of completely unfused distal left radius
Grade II; T1weighted spin echo images of early fusion of distal left radius showing minimal hyperintensity within the physis.
Grade III; T1weighted spin echo image of distal left radius showing trabecular fusion of < 50% of the radial cross sectional area.
Grade IV; T1weighted spin echo image of distal left radius showing trabecular fusion of > 50% of the radial cross-sectional area.
Grade V; T1weighted spin echo image of distal left radius showing residual physis < 5 mm on any one section.
Grade VI; T1weighted spin echo image of complete fusion of distal left radius.

The degree of fusion of the left distal radius was determined by a team comprising three consultant radiologists who were double blinded and reported images independently. Their inter rater agreement were assessed prior to accepting the results.

2.3. Statistical analysis

All data were entered into Excel and later analysed with SPSS version 20.0. The Spearman's correlation was used to assess the relationship between the MRI grading and the chronological ages. The level of significance was chosen at p-value < 0.05.

3. Results

3.1. Age and degree of fusion

A total of 286 football players ranging between of 13 and16 years

Table 1
Characteristics of MRI machines used for the study.

	Center 1/C & J Mediclinic	Center 2/Korle-Bu
MRI make	GE	Toshiba
Strength of Magnet	1.5 T	1.5 T
Model	Brivo355	Vintage
Type of coil	Wrist	Wrist

Table 2
Chronological ages and the corresponding MRI grade of radial epiphyseal fusion.

Grade/Age	13	14	15	16
I	0	4	0	0
II	0	4	24	12
III	0	0	8	0
IV	0	4	20	4
V	8	12	28	20
VI	0	24	40	74

participated in the study. The mean age of the players was 15.16 years (SD ± 0.8). The median age was 15. Table 2 below shows the chronological ages and the corresponding MRI grade of radial epiphyseal fusion. Out of those who participated in the study, the majority 120(41.9%) gave their ages as 15 years while 8(2.8%) were 13 years (Table 3). The proportion of players who qualified and those who did not is presented in Fig. 1. Fig. 1 shows that all 8 (100%) of the players who gave their ages as 13 years were below grade IV category, however, half 24(50%) of the 14 year old players were in Grade VI while the other half were ≤ Grade V. Also, 40 (41.7%) of the 15 year old and 74(44%) of the 16 year old players were in the grading category of Grade VI. The characteristics of the MRI machines used for the study are also given in Table 1. In addition, the variance of distribution results of the grade and the age categories are presented in Fig. 2.

3.2. Inter rater agreement

Inter rater agreement: kappa was calculated to determine the level of agreement between the three radiologists who were double blinded and reported images independently. A kappa value of 0.95(95%) was registered indicating very good agreement (Table 4).

3.3. Correlation between chronological age and MRI grade of fusion

No significant correlation between the given chronological ages and the degree of fusion was found. The Spearmans correlation was given as ($r = 0.069; p = 0.540$)

4. Discussion

Since the acceptance of MRI as a valid and a reliable method for estimating age in 14–19 year-old soccer players in a normative population [3], FIFA continues to use it as a mandatory test before and during U17 regional and world cup football tournaments. In this study, 286 football players with self-reported and passport-**verified** age range of 13–16 years underwent MRI scans and the results were evaluated and

Table 3
Age frequency of participant.

Ages/years	Total no (%)
13	8(2.8)
14	48(16.8)
15	120(41.9)
16	110(38.5)