INFLUENCE OF AGE, MATURITY AND BODY DIMENSIONS ON SELECTION OF UNDER-17 ALGERIAN SOCCER PLAYERS

Samir Chibane [1, 2], Christophe Hautier [1], Claudio Gaudino [1], Raphaël Massarelli [1], and Nabila Mimouni [2]
[1]Centre of Research and Innovation on Sport (CRIS), University Claude Bernard – Lyon I, 27-29 Boulevard du 11 novembre 1918, 69622 Villeurbanne cedex, France.
[2]Laboratory of physical and motor adaptations, institute superior of sciences and technology of sport, INFS/STS, BP 71 El Biar, Algeria.

1. INTRODUCTION

Soccer is unarguably the world's most popular sport (Malina and Bouchard, *et al.*, 2004) as can be judged from the estimated 352,6 million television audience of the 2006 FIFA World Cup matches. Many authors have shown the importance for clubs and national teams to detect and recruit talented players in order to develop their full potential. Identifying talent at an early age is far from being a mechanistic process (Reilly *et al.*, 2000), as the selection of young elite soccer players requires the analysis of several factors (Maguire and Pearton, 2000). Strong inter-individual variations in these measures are observed in childhood and adolescence. However, sports governing bodies neglect this significant point and generally gather together youngsters to a common chronological age within the same 12-month period.

Within the same category, there are differences between individuals born shortly after the cut-off date relative to those born almost one year after the cut-off date. Dividing the population under study in four quarters relative to the month of birth, it has been observed that individuals who are born at the beginning of the year are more likely to be selected, since they are physically stronger and more experienced than those who are born late (Helsen *et al.*, 2005; Vincent and Glamser, 2006). The authors concluded that relative age has an important implication for selection of youth players. Additionally, at the same chronological age, individual differences in maturity status are associated with variations in the functional capacities of the youth and may influence his selection (Malina *et al.*, 2004). Adolescence is characterized by rapid changes in size, proportions, body composition and physical performance. Timing and tempo of the adolescent growth spurts and sexual maturation vary among subjects, hence children of the same chronological age vary considerably in biological maturity status. Within the same age group boys who are advanced in maturity for their chronological age are taller, heavier, stronger, more powerful and have a greater aerobic power and a

large fat free mass than boys whose maturity is delayed (Malina *et al.*, 2004). Consequently, in sports in which these characteristics are advantageous, early maturing adolescents, within the same age group, are likely to be selected over the majority of male athletes who are late maturing (Vaeyens *et al.*, 2005). For these reasons, evaluation and detection of young players should always be done considering their physiological age and maturity status. Several techniques to evaluate or measure the maturity of the children have been proposed by these authors.

Traditionally, biological age in children has been determined by the use of standardized hand-wrist radiographs for assessment of bone age or by determining Tanner's stages of maturity by physical examination of secondary sex characteristics. For a number of reasons, however, these methods may not be suitable or feasible for research studies of healthy children. Radiographs can be costly, and they involve irradiation, which may not be acceptable to parents of healthy children in the absence of a clinical necessity. 'Tanner staging' also has several drawbacks in a research setting. It is invasive to the extent that it involves undressing and, therefore, may be regarded as an invasion of privacy for many children.

In contrast, there are non-invasive methods to determine physical maturity which can be used without ethical problems. Mirwald *et al.*, 2002, established a maturity offset according to regression equations based on anthropometric measurements to predict the age at peak height velocity (PHV). This maturity offset, computed from age, standing height, sitting height, weight and leg length, gives the number of years before or after the predicted age at PHV. *Malina et al.*(2005) proposed a classification of youths as late, average or advanced in maturation from the percentage of predict adult stature.

In this study, we chose the more suitable method of Mirwald *et al.* (2002) as it was very difficult to assess parent stature necessary for the application of the method of Mali*na et al*,(2005), because of the sociocultural dimensions of our specific population.

The aim of the present study was to compare age, anthropometric measures and maturity status (years from PHV) among young adolescent male Algerian soccer players. The first hypothesis at the base of the study was that players with a greater relative age (chronological age) are more likely to be identified as ''talented'' and consequently selected. The second hypothesis was that early maturing adolescents are more represented in the national team. The confirmation of the two (or either) hypotheses may lead to the conclusion that elite players should be characterized by greater body dimensions partly responsible for their selection in Algerian national team.

2. METHODS

Ninety-one (28 elite and 63 sub-elite) young male Algerian soccer players were studied (mean age = 16.6 years). Elite players were selected to play in the national youth soccer teams. Sub-elite players played in regional selections.

Anthropometric measurements and the determination of body composition were made according to classical methods. The players and their parents gave an informed written consent to participate to the study, approved by the Algerian ethics committee.

Subjects were grouped according their month of birth. The first month of the selection year was ‘‘month 1’’ (September), while ‘‘month 12’’ represents the last month of the selection period (August). The subjects were subsequently divided into 4 quarters (first quarter from September to November, second quarter from December to February…etc) according to the literature which specifies that it is necessary to begin separation with the month which corresponds to the beginning of the competitive sport season (Helsen *et al.*, 2005;Philippaerts *et al.*, 2006).

The evaluation of biological maturity was performed on the basis of age at PHV calculated as shown in the following equation (1) (Mirwald, *et al.*, 2002):

Maturity Offset = - 9.236 + 0.0002708·Leg Length and Sitting Height interaction - 0.001663·Age and Leg Length interaction + 0.007216·Age and sitting Height interaction + 0.02292·Weight by Height ratio (1).

Anthropometric measurements are in centimetres and weight measurements are in kilograms; the weight by height ratio is multiplied by 100

Thus a maturity offset of -1.0, 0 or +1.0 indicate respectively that the subject was measured 1 year before maturity (before PHV), at the time of maturity or 1 year after maturity (Beunen *et al.*, 2002).

Results were expressed as mean ± standard deviation (SD). All data sets were checked for normality of distribution. Student’s t-test was used to assess the significance of the differences for anthropometric, PHV, and total lean mass data. Chi-square test was used to assess differences between the observed birth-dates distribution in regional and national groups. Significance level was set at $P<0.05$.

3. RESULTS

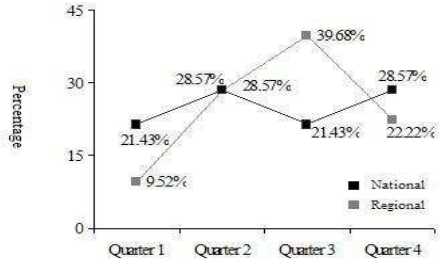

Figure 1. Quarter distribution of under-17 Algerian soccer players.

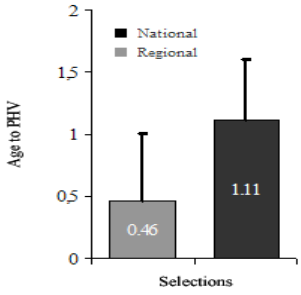

Figure 2. Mean age to PHV of under-17 Algerian soccer players.

The two groups (elite and sub-elite) were of similar chronological age (Table 1) and the chi-square test demonstrated no difference between the observed birth-dates distribution in regional or national groups. Accordingly, no difference was

observed concerning the quarter distribution between national and regional selection (P = 0.64) (Figure 1).

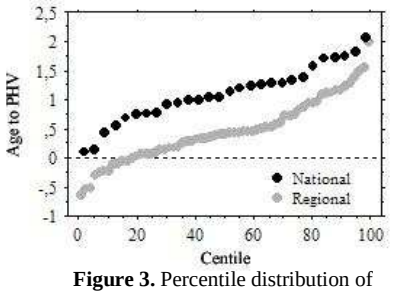

Figure 3. Percentile distribution of under-17 Algerian soccer

After calculation of the PHV, the subjects selected in the national team were significantly more mature than the players in the regional selection (P< 0.01) (Figure 2). All subjects of the national selection reached or exceeded the peak of maturity (Figure 3), 42.9 % of the subjects ranged between 0 and 1, 53.57% between 1 and 2 and 3.57% at the top of 2; whereas the regional selection showed that 32% of the subjects were below the peak of maturity, namely 57.62% between 0 and 1 and 10.16% between 1 and 2.

Body mass and height were significantly higher in national athletes (P< 0.001) who also presented significantly higher lean body mass (P< 0.01) compared to the regional players. Additionally, the national soccer players presented a significantly higher thigh circumference (P< 0.001) compared to regional players Table 1).

Table 1. Mean and standard deviation of age, mass, height, body fat, lean body mass and thigh circumference of regional and national under-17 Algerian players.

	Regional selection		National selection	
Age (years)	16.60	± 0.27	16.59	± 0.28
Height (m)	1.72	± 0.05	1.76***	± 0.07
Mass (kg)	61.45	± 7.71	69.23***	± 7.77
Lean body mass (kg)	49.74	± 7.22	53.99**	± 7.32
Thigh circumference (cm)	53.03	± 3.59	55.87***	± 3.56

4. DISCUSSION

In the present study, mean ages of regional and national selections (16.6 years) were not significantly different. National and regional players performed a similar training volume and contest in the national Algerian championship. As all were born in Algeria it can be considered that socio-cultural, economic and nutritional factors are broadly similar among subjects.

The main result was that birth date distribution was not significantly different between regional and national teams. This is in opposition to the conclusions of Helsen *et al*,(2005), who showed a clear relative age effect in European national youth selection indicating an over-representation of players born in the first months of the selection year. Helsen *et al*,(2000) had previously observed that players born

early in the selection year were more likely to be identified as talented and to be exposed to higher levels of coaching. More generally, soccer is characterized by a significant over-representation of players born in the early part of the selection year among youth and senior professional players (Helsen *et al.*, 2005). A similar relative age effect should be observed in our population. Even when subjects were grouped in four quarters, no relative age effect was observed. This finding may be attributed to the specificity of the population i.e. regional selection is the result of a first detection process which may dissimulate the relative age effect. However, no significant difference was observed in each selection group between representation of subjects born early and late in the sport season.

In the population studied, chronologic age seems to have no further effect on selection. It may be due to the fact that the differences of body constitution between subjects at this age depend much more on biological age than chronological age.. For this reason, influence of maturation status should be greater in this study than relative age.

A comparison of the PHV showed a highly significant difference between the national selection and the regional selection. Players of the national selection presented an age to PHV (1.11 ± 0.49) much higher than that of the regional players (0.46 ± 0.54; $P < 0.001$). All subjects of the national selection reached or exceeded the peak of maturity whereas 32% of the subjects in the regional selection were below the peak of maturity (Figure 3). This observation confirms our hypothesis that more players having crossed the peak of maturity are present in national rather than in regional selections.

Reasons for this discrepancy may be: **1**. the youngsters who are advanced in maturity tend to perform better in tasks requiring strength, power and speed compared with average and late maturing boys of the same age (Malina *et al.*, 2005). Philippaerts *et al.* (2006) showed that speed of limb movement, trunk strength, upper-body muscular endurance, explosive strength, agility, cardiorespiratory endurance and anaerobic capacity showed peak development at PHV. **2.** Mature young players present larger body dimensions that give them a better physical performance. These results are in accordance with those of different authors, who confirmed that boys and girls advanced in maturity (age at PHV) are, on the average, taller, heavier and possessed a greater muscular volume than peers who are either in the mean time values or late in the biological maturation process (Malina *et al.*, 2005;Mirwald *et al.*, 2002). The present results are in accordance with these findings. In soccer, where advanced physical development is a clear advantage (Helsen *et al.*, 2000), early morphological development appears to be an important characteristic that coaches eagerly search when they scout for “talents”.

It is difficult to determine which of the two factors, anthropometric and/or physical capacities, influence the selection of early under-17 soccer players of the Algerian national team. Physical performance and body dimensions are strongly related in young subjects. Martin and Dore, *et al.* (2004) reported leg volume and lean leg volume to be predictive of anaerobic performance (maximal power, optimal velocity and optimal torque) in boys and girls aged between 7 and 16 years. In the same way, differences in body size lead to differences in VO_{2max}

(Malina *et al.*, 2004) and partly explain differences in endurance performance and sprint repetition capacity.

REFERENCES

Beunen G. and Baxter-Jones A. D., Mirwald R. L., Thomis M., Lefevre J., Malina R. M. and Bailey D. A., 2002, Intraindividual allometric development of aerobic power in 8- to 16-year-old boys. Medicine and Science in Sports Exercise, 34, 503-510.

Helsen W. F., Hodges N. J., Van Winckel J.and Starkes J. L., 2000, The roles of talent, physical precocity and practice in the development of soccer expertise. Journal of Sports Sciences, 18, 727-736.

Helsen W. F., van Winckel J. and Williams A. M., 2005, The relative age effect in youth soccer across Europe. Journal of Sports Sciences, 23, 629-636.

Maguire J. and Pearton R., 2000, The impact of elite labour migration on the identification, selection and development of European soccer players. Journal of Sports Sciences, 18, 759-769.

Malina R. M., Beunen G., Wellens R.and Claessens A., 1986, Skeletal maturity and body size of teenage Belgian track and field athletes. Annals of Human Biology, 13, 331-339.

Malina R. M., Bouchard C. and Bar-Or O., 2004, Growth, maturation and physical activity. 2, Human Kinetics (Champaign, IL), 337-362.

Malina R. M., Cumming S. P., Morano P. J., Barron M. and Miller S. J., 2005, Maturity status of youth football players: a noninvasive estimate. Medicine and Science in Sports Exercise, 37, 1044-1052.

Malina R. M., Pena Reyes M. E., Eisenmann J. C., Horta L., Rodrigues J. and Miller R., 2000, Height, mass and skeletal maturity of elite Portuguese soccer players aged 11-16 years. Journal of Sports Sciences, 18, 685-693.

Martin R. J., Dore E., Twisk J., van Praagh E., Hautier C. A. and Bedu M., 2004, Longitudinal changes of maximal short-term peak power in girls and boys during growth. Medicine and Science in Sports Exercise, 36, 498-503.

Mirwald R. L., Baxter-Jones A. D., Bailey D. A. and Beunen G. P., 2002, An assessment of maturity from anthropometric measurements. Medicine and Science in Sports Exercise, 34, 689-694.

Philippaerts R. M., Vaeyens R., Janssens M., Van Renterghem B., Matthys D., Craen R., Bourgois J., Vrijens J., Beunen G. and Malina R. M., 2006, The relationship between peak height velocity and physical performance in youth soccer players. Journal of Sports Sciences, 24, 221-230.

Reilly T., Williams A. M., Nevill A. and Franks A., 2000, A multidisciplinary approach to talent identification in soccer. Journal of Sports Sciences, 18, 695-702.

Vaeyens R., Philippaerts R. M. and Malina R. M., 2005, The relative age effect in soccer: a match-related perspective. Journal of Sports Sciences, 23, 747-756.

Vincent J. and Glamser F. D., 2006, Gender differences in the relative age effect among US Olympic development program youth soccer players. Journal of Sports Sciences, 24, 405-413.