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point-of-view

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Morphology and sport

A morfologia e o desporto

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Abstract – The assessment of the morphological characteristics of young athletes has been widely considered for some years now by coaches, technicians, and managers with a view to identifying, developing, and guiding exceptional athletes. However, the use of these results is of little use if it is not associated with reliable information on the maturity of potential sporting talent. In this opinion piece, I present what is considered the "Gold Standard" methodology in maturation assessment and offer some reflections on the guidance of young athletes.

Keywords: Maturity; Morphology; Sport; Success.

Resumo – *A avaliação das características morfológicas dos jovens atletas está sendo amplamente considerada, já há alguns anos, por treinadores, técnicos e dirigentes, com vista à identificação, ao desenvolvimento e à orientação de atletas de exceção. A utilização desses resultados é, no entanto, de pouca utilidade se não for associada a uma informação fidedigna da maturidade do potencial talento desportivo. Neste artigo de opinião, apresento aquela que é considerada a metodologia "Gold Standard" na avaliação maturacional e faço algumas reflexões relacionadas com a orientação de jovens desportistas.*

Palavras-chave: *Maturidade; Morfologia; Desporto; Sucesso.*

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REPORT

Height, weight, and the respective weight growth curves have been used as auxological parameters of great utility in determining the growth, development, and health of children and adolescents since ancient times.

Growth standards resulting from the use of increasingly global, but also more specific, groups of subjects and representative samples are periodically updated to reflect changes and dimensional alterations in populations (secular trend) which, reflecting improved living conditions, tend to be taller and heavier[1].

These progressive changes in morphology have also been observed in the characteristics of athletes in most sports, since, in a combination of social reflection and experimental laboratory work, it has been found that the morphology of sports practitioners naturally follows the growth trend of the general population, but also that height and weight are associated with achieving better sporting results. In fact, the choice to use taller and stronger athletes in most sports, combined with other factors in the sporting world, has led to performances and results that we considered unattainable a few years ago, in an association majestically exposed by Norton and Olds when they stated that 'in those situations where the potential characteristics for success of athletes differ markedly from the characteristics of the reference population, it is quite possible that these same characteristics are important for sporting success"[2].

In the younger age groups, the 'opportunistic' use of biologically (maturely) advanced athletes, with the aim of achieving immediate advantages, to the detriment of investing in those who appear to have the most appropriate morphological characteristics (but also physiological, intellectual, psychological and socio-familial, among others) has been progressively and widely replaced by an increasingly early, complex and costly, but also more effective and profitable, process of talent detection and selection.

Coaches, physiologists, physiotherapists, doctors, and sports managers have at their disposal a set of morphological assessment tools that are fundamental for identifying the athletes who are best suited to a particular sport, highlighting the relevance of morphological assessment in the complex context of national sports training.

Morphological assessment obviously refers to the study of physical characteristics (size and shape), but also to the assessment of maturational status, without which somatic identification is of little or no value.

Although using different benchmarks and indicators, the methods proposed for assessing maturational status rely on the appearance of a set of common biological indicators (sexual characteristics, bone calcification, height achieved, etc.), which are associated with the pace of biological development - timing - and the relationship between this process and chronological age – tempo[3].

The choice of one method over another must be weighed up, considering the three factors of procedural complexity, financial cost and associated error. Simpler and less expensive methodologies are usually associated with a higher margin of error, with the efficiency of a methodology being directly linked to its ability to identify the aforementioned common biological indicators and differentiate between the respective stages of biological maturation.

Given the limited space available to develop this topic, we will now address only one of the methodologies related to the assessment of biological maturation and the prediction of adult height, specifically the TW3 method (Tanner-Whitehouse III), leaving the remaining methodologies for assessing maturational status and quantifying body shape (somatotypology) for a future study.

In 1962, the research team led by Tanner, developed a methodology[4,5] for assessing bone maturity (TW1) based on the calcification of epiphyseal plates, which was more accurate and discriminatory than the method proposed in 1959 by Greulich and Pyle[6], widely used today's in the medical community. Built on more advanced statistical techniques, the TW1 method allowed bone age to be determined from the sum of a set of scores assigned to the stages of ossification (eight or nine stages) of the epiphyseal plates of each bone in the left wrist and hand. This methodology, which involved analysing all bones of the hand and wrist, was revised in 1975 based on data from a sample of 2,600 normal British girls and boys, giving rise to a new version of this method called TW2. In this version, authors introduced new scores for each stage of ossification, assigned different ossification levels to the short bones and to the carpal, radius and ulna bones, differentiated the results according to sex, and eliminated the need to evaluate the bones of the 2nd and 4th fingers of the hand making it faster, and added a module that allowed the prediction of adult height[7].

Motivated mainly by changes in the growth reference values published in the US and Europe, the team led by Tanner developed a new version of the TW2 method in 2000, which they called TW3. This new version[8], based on data from a significantly larger sample that included British, Belgian, Italian, Spanish, Argentinean, American and Japanese children, now had reference values for calculating predicted adult height from the sum of the scores, without the need to read the carpal bones (RUS version) which did not share the secular trend of the others and produced an undesirable degree of variability and to assess from A to I, with the exception of the ulna (A to H), the levels of ossification of the epiphyses of only 13 bones: radius, ulna, metacarpals (I, III and V), proximal phalanges (I, III and V), middle phalanges (III and V) and distal phalanges (I, III and V), making the reading and analysis process much faster and more accurate, and leading to the acceptance of the TW3 method by the scientific community as the most accurate procedure for determining skeletal maturity[9].

In Portugal, the TW3 method has been used for around 20 years in a laboratory environment at the Faculty of Human Kinetics – University of Lisbon, for research studies (master's and doctoral degrees) and in the field by a few internationally renowned football clubs, and more recently by the Portuguese Football Federation, to determine the maturation status and predict the adult height of young footballers.

In the extensive results obtained over more than 20 years of work in maturational assessment, we have identified a significantly larger number (>70%) of early matured young football players (biological age more than 1 year older than chronological age), a relatively low number of synchronous matured (on time) young football players (24%) (athletes whose biological age is within the range of -1 and +1 year relative to their chronological age) and an even smaller number (<6%) of young football players who are maturely delayed (biological age more than 1 year below chronological age), clearly showing that the tallest, strongest and most technically and tactically advanced athletes represent the vast majority of players who train in the football teams of clubs with greater national competitive projection, leading us to assume that coaches continue to give greater opportunities for success (practice time and competitive experience) to maturely advanced players than those offered to their biologically synchronous or delayed peers, even though the latter may have greater potential for growth and development.

This reality, known in sports research as the 'Relative Age Effect,' has alerted us to the need to individualise periodization, tasks, and training loads while simultaneously creating equal learning and development opportunities for all young athletes, regardless of their maturational status[10]. These factors are of fundamental importance when analysing data on sports dropout, which is often the result of young athletes feeling unsuccessful when competing with biologically better-prepared peers and/or being repeatedly confronted with stimuli that are too ambitious for their level of biological development.

While maturation assessment data may be important for individualising training stimuli, the prediction of adult height provided by the TW3 method is also of fundamental use, as it allows coaches to adapt the morphological characteristics of young athletes to the specificities of the sport to be practised and to start guiding young people earlier towards performing the tasks inherent to the specific positions most suited to their morphology.

Compliance with ethical standards

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Ethical approval

As this is an opinion-based article, it does not require approval from an institutional ethics committee.

Conflict of interest statement

The author has no conflict of interests to declare.

Author Contributions

A single author produced this opinion-based article.

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