ISSN No:-2456-2165

Estimation of Age in Competitive Sports

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Abstract:- The purpose of this research article to provide knowledge regarding age estimation in athletes. Now a days age estimation become a very important components in competitive sports for fair selection. Any sports competitions are classified in to several age categories, therefore, estimation of age become very important aspect. A search of multiple databases was used in order to gather review information. Age estimation terms was searched. The titles and abstracts of all articles were reviewed. Our research included reading the full texts and checking the reference lists of relevant papers. Review of related literature suggest various methods to estimate an individual age that are Forensic Age Diagnostics, X-ray examinations, dental examination, CT scan, magnetic resonance imaging and various medical examinations etc. In addition, the researcher looks at the challenges on age estimation of factors such as an athlete's socioeconomic status, the use of hormones and anabolic substances as well as chronic overuse of the growth plates.

Keywords:- *Age Estimation, Sports, Athletes, Competitive Sports.*

I. INTRODUCTION

Youth sporting competitions are commonly divided into various age groups to promote fairness and provide equal opportunities. These age groups are determined by the athletes' chronological age and can differ depending on the sport [1]. The rise of professionalization and commercialization in elite youth sports has seen significant growth in recent times. Winning these competitions not only brings significant prestige to the athletes and their coaches and managers, but it also increases the likelihood of talented athletes being scouted and recruited by clubs or associations for professional careers. Consequently, the pressure on young athletes, as well as their coaches and managers, becomes even more intense [2]. To safeguard the well-being of children and adolescents, lower age limits are implemented in adult sporting competitions in addition to upper age limits in youth sports. For example, the Olympics require a minimum age of 14 for participation [1], while the English Football Association mandates a minimum age of 16 for open age categories [2]. Age falsification in youth sporting competitions can provide unfair advantages, as athletes who exceed the designated age range may possess physical superiority compared to their peers [3]. It is worth noting that both aerobic and anaerobic performance tends to increase with age among young individuals [4]. As a result, athletes who are older than their designated age group are likely to have a significant and unjust advantage over their properly aged counterparts [1]. Moreover, athletes who misrepresent their age may falsely appear more talented than their supposed peers [5]. Conversely, certain sports may favor younger athletes, particularly those disciplines that require specific physiques or aesthetic qualities. There are several compelling reasons to prevent athletes from participating in age-ineligible competitions. Firstly, doing so upholds the principles of fairness and equal opportunities [1]. Secondly, the inclusion of overage athletes in age-restricted competitions raises the risk of injury, especially in contact sports such as football, handball, and American football [6–8]. Most importantly, the exclusion of underage athletes from adult competition is primarily aimed at safeguarding their physical and mental well-being [9]. It is crucial to differentiate between deliberate age falsification and instances where athletes inadvertently provide incorrect ages [1]. The term "age-doping" has been coined to describe intentional falsification, which aims to gain direct advantages or long-term sporting and financial benefits [10]. Unintentional misrepresentation may occur due to various factors, such as the absence of birth registration systems in certain regions or cultural and infrastructural delays [1]. Furthermore, cases of age falsification for non-sporting purposes, such as welfare benefits, can inadvertently spill over into the realm of sports [11, 12]. The issue of questionable age attributions may be further exacerbated by past increases in migration, even in countries with reliable age records [1]. With the ongoing professionalization and commercialization of youth sports, the pressure on athletes, coaches, and managers is expected to intensify.

Validated age estimation procedures are necessary in cases where an athlete's age is unclear or doubts exist about the accuracy of their stated age [13]. Relying solely on athletes' honesty and sportsmanship is not a reliable approach to addressing the problem of age falsification in sports [13]. In the following discussion, the suitability of existing age estimation methods for adolescents and young adults in competitive sports will be explored. Special consideration will be given to sport-specific factors that can influence age estimation features.

II. METHODOLOGY

A search of multiple databases was used in order to gather review information, including Google scholar, PubMed, Science Direct, BMC, Elsevier, Springer. Our key terminology age estimation was search on various databased. The titles and abstracts of all articles were reviewed. Our research included reading the full texts and checking the reference lists of relevant papers. Articles were excluded if published as case studies, editorials, or expert opinion.

III. METHODS OF FORENSIC AGE DIAGNOSTICS—AGFAD RECOMMENDATIONS

Forensic scientists have developed a validated procedure for forensic age diagnostics in living individuals, using features that progress through developmental stages in a strict chronological order. The Study Group on Forensic Age Diagnostics (AGFAD) has issued recommendations for age estimation in living adolescents and young adults. These recommendations differentiate between age estimation where X-ray examinations are legally permissible and where they are not. In cases where X-ray examinations are allowed, a medical history review, physical examination, hand X-rays, and dental examinations are recommended. The minimum age principle is applied to determine if an individual has reached a legally significant age with the highest standard of proof.

In cases where X-ray examinations are not permitted, a physical examination is recommended to record anthropometric data, signs of sexual maturity, and age-related developmental disorders. However, there is no legal basis for using X-ray examinations for age estimation in competitive sports, as the use of ionizing radiation is considered ethically unjustified. Instead, alternative imaging procedures, such as magnetic resonance imaging (MRI), should be considered. MRI-based age estimation has shown promise in various settings, including competitive sports.

IV. OBSTACLES TO ACCURATE AGE DETERMINATION IN ATHLETIC

In sports, age estimation is influenced by factors such as metabolic and endocrine status, performance enhancement, hormone use, and chronic mechanical stress. Previous studies have not adequately considered these factors, and ethnicity and socioeconomic status, which are relevant in forensic age estimation for criminal proceedings, also play a role in the sporting domain.

- *The impact of one's ethnicity as well as their economic status*

Numerous studies have investigated the effect of ethnicity on skeletal maturation in the appropriate age range. However, these studies provide evidence that ethnicity has no direct effect on skeletal development. On the contrary, it appears that socioeconomic status may influence skeletal development. Individuals from disadvantaged socioeconomic circumstances develop more slowly than the normative group. [10-11]. This indicates that socioeconomic status, not ethnicity, influences the timing of skeletal maturation. Individuals from lesser socioeconomic origins will not be disadvantaged when determining whether a person's age exceeds a maximum limit because their ages will be underestimated. It is crucial to consider this aspect in the context of competitive sports, as elite sports can often provide socially disadvantaged individuals with access to improved opportunities. It is important to note, however, that the ability of significantly socially marginalised children, who may suffer from malnutrition, to compete at an elite level is a topic of ongoing debate.

- *Advanced skeletal maturity of athletes due to selection*

In 2010, Malina et al. conducted a study on elite athletes, examining 592 footballers aged 11-17. They found that participants had advanced skeletal age, and 36 footballers would have been incorrectly prevented from competing in U17 competitions. However, the study's use of ionising radiation for age estimation in sport raises criticism. The reference population for the FELS method is questionable, as it is not possible to determine the precise socioeconomic status or whether the athletes studied falsified their ages or used hormones or anabolic substances. Malina et al. argue that advanced skeletal maturity is due to the selection of people with advanced development in sport, as they are better able to compete and are overrepresented in elite athletes. However, this approach is not able to explain the occurrence of some stages of skeletal maturity several years earlier than in the normal population[3].

- *Hormone and anabolic substance influences on skeletal maturation*

Endocrine and paracrine factors play a crucial role in normal skeletal maturation, including growth hormone, insulin-like growth factor 1, estrogens, and androgens. Growth hormone and insulin-like growth factor contribute to longitudinal bone growth, while androgens are involved in bone formation and pubertal growth spurt. Paracrine factors, such as parathyroid hormone-related protein, fibroblast growth factor, and bone morphogenetic proteins, stimulate chondrocyte differentiation and hypertrophy during bone formation and growth [15]. Estradiol plays a crucial role in the fusion of growth plates, with normal maturation occurring within a serum estradiol concentration range of 12 to 20 pg/ml. Abnormally elevated levels of male sex hormones can lead to premature ossification of growth plates, resulting in advanced skeletal maturation and potential overestimation of age during age diagnostics [16].

In sports, the illicit use of exogenous hormones and anabolic substances, known as doping, should be considered. Doping substances can induce premature ossification of growth plates and subsequent growth arrest. Age estimation is unlikely to be reliable in individuals who have used these substances, so accurate age assessment cannot be expected in athletes who have taken them.

- *Skeletal maturation and the effects of normal hormone secretion*

Elite youth sports participants have higher levels of dehydroepiandrosterone sulfate (DHEAS), a testosterone prohormone, compared to non-athletes. This may be due to the selection of developmentally advanced individuals in elite sports. However, it is important to consider the illegal use of hormones as performance-enhancing substances in the sporting context. The ratio between sports load and energy supply is crucial, as sports with energy restriction can cause developmental delays, particularly in skeletal maturation [17]. Sports like artistic gymnastics and rhythmic gymnastics, which emphasize bodyweight as a performance determinant, may lead to energy deficits due to extensive training. Age diagnostics based on delayed skeletal age pose a challenge, as it raises the possibility of athletes falling below minimum age limits.

➢ *Effects of sporting activity on growth plates*

During the growth phase, physical load significantly impacts bone metabolism, with moderate exercise promoting healthy skeletal development. However, excessive physical load can have detrimental effects on skeletal development. Chronically stressed growth plates, such as those in gymnasts' distal radius, may exhibit reactive widening and other symptoms of sports overload. Age estimation in individuals with "gymnast's wrist" can yield inaccurate results, as seen in young athletes with a skeletal age one year lower than their chronological age [18]. Chronic overload of the knee can also cause changes to growth plates, and it is important to avoid using skeletal regions subjected to high stress in a specific sport for age estimation.

➢ *Consideration of dental development*

Relying solely on skeletal age for age estimation in competitive sports is unnecessary. AGFAD recommendations recommend assessing dental development, as hormones and sporting activity influence dental development minimally. MRI and Demirjian's staging system have been validated for age diagnostics. However, ethnicity can impact third molar mineralization and eruption. If an elite athlete's dental age differs significantly from the estimated age based on epiphyseal ossification, it may indicate abnormal epiphyseal ossification and should not be relied upon for age estimation [19].

V. DISCUSSION & CONCLUSION

From this investigation it was observed that estimation play an important role in competitive sports. International and national sports competitions are classified in various age categories. To select according to their age categories age estimation is required for conducting the competition in a fair manner and give opportunity to the appropriate athletes. The researcher also discusses various methods that are medical examination, X-ray, bone ossification, MRI, etc. The author also mentions the challenges of age estimation that are faced by the sports authorities. These things should be minimized by creating good policies for the same.

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