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Biopsychosocial insights for the identification of sports talents: A scoping review

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Abstract: This review aims to identify the processes, concepts, and order of studies on the identification of sporting talent, to interpret them critically, and to generate a proposal for a sports talent identification system (STIS) that is flexible and adaptable to different contexts and ages. The studied population consisted of children and young people. The concept focused on talent identification systems within the sports context across various locations. The study was registered on the Open Science Framework (OSF). Searches were conducted in indexed databases and search engines utilizing AI. For the study selection process, the protocol called Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) was applied, using the COVIDENCE systematic review tool. A total of 58 papers were selected, primarily original studies and reviews, with 47 considering biomedical and physiological aspects, 19 psychological, and 19 environmental and sociocultural components. Geographically, most of the works were developed in Europe, North America, and Asia. An effective STIS should be a continuous and cyclical process, considering physical and anthropometric characteristics, maturational status, and psychosocial aspects. Utilizing easy-to-apply batteries will facilitate the identification, database creation, monitoring, and performance follow-up of sports talents efficiently.

Keywords: *Development, Performance parameters, Performance tracking, Sport talent, Sports training, Talent identification, Youth athletes.*

1. Introduction

The systems are an ordered set of interrelated components, existing in systems of conceptual and material types. In this sense, conceptual systems represent sets of concepts and ideas related to each other with an order and coherence established or designed according to the objective that is intended. They are then abstract and intangible since they are not composed of physical elements. In sport, it is common to use systems to organize competitions, establish the development route of one or several sports, and select and identify talents. In the above-mentioned classification, we can find the systems for the identification of sport talent (SITS), which require multiple stages and dimensions of the process [1], considering the particularities of each sport. Understanding that there are arguments for and against STIS at an early age [2]. There are cases where the success of STIS has been demonstrated at different stages of sport development [3], although they are regularly performed with subjects at infant ages [4-7], including Paralympic sport [8, 9].

Each system has coincidences and particularities, with a wide variety of criteria based on the results

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of the process carried out; therefore, it is difficult to establish which would be the adequate or ideal system to identify children with greater possibilities of future sporting success. Although STIS is necessary to guarantee the sporting reserve of a discipline and to project the future possibilities of success of a club in a region or country where it is developed, it is necessary to accompany its progress. Although science provides multiple tools at present, in different contexts it is usual that STIS are based on the expertise of the coach in charge to identify extraordinary characteristics in a child or young person that can predict high probabilities of sporting success.

It should also be considered that STIS eventually include anthropometric and physical performance variables that can be observed in competition or through physical tests; psychological, social, and environmental components are also taken into account, and although there is talk of genetic aspects, they are not usually evaluated, nor are biochemical aspects; however, taking into account the limitations and potentialities of each system, it is important to know what would be the appropriate characteristics and components of the STIS, as a process of estimating the future probability of sporting success in different contexts and sporting disciplines.

Until now, systematic reviews related to the identification of sport talent have highlighted the need to deepen research on STIS, given the inconsistencies and unreliability of some predictors [10]. A commentary on the aforementioned work indicates that current definitions and measures of talent may not adequately reflect the complexities of sport performance across different sports [11]. Other reviews have focused on coaches' knowledge of STIS, indicating that instinctive expertise, or the so-called "coach's eye," is common in decision-making within coaching [12]. A scoping review on research on talent in sport over an 18-year period found an imbalance in studies according to sex and age, emphasizing the necessity to continue research in early ages and in contexts such as Africa, Asia, and South America [13]. In summary, the reviews identified predictor variables, coach experience criteria, sex, and variables such as types of tests and ages. However, they do not address the system as a whole, specifically the STIS. Therefore, this review aims not only to describe the studies analyzed but also to identify the processes, concepts, and the sequence of studies on sports talent identification. The goal is to interpret these critically and to develop a flexible STIS proposal that can be adapted to different contexts and age groups.

2. Materials and Methods

This scoping review was drafted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines [14]. The review protocol has been published in BMJ Open [15]. This methodology has improved the transparency and quality of the finalized scoping review [16]. The identification of the research question involves structuring it according to the population, concept, and context (PCC), which is the first step recommended for conducting studies of this type [17]. Therefore, the population studied was children and young people. The concept was talent identification systems, and the context was sports in different locations. The study was registered on the Open Science Framework (OSF) on 03 July 2024.

In this case, to follow the good practices of a scoping review [18], the following steps were developed: (i) the research question was identified, (ii) the relevant studies were identified, (iii) the studies were selected, (iv) the data were plotted in the results, (v) the results were collated, summarized, and communicated in the discussion.

2.1. Stage 1: Identifying the Research Question

What do we know about the existing literature on the processes, concepts, and order that make up an STIS? Two sub-questions underpin the analysis: 1) What are the studies that address the identification of sports talent, with emphasis on children or youth, and relate to a system? 2) What would be the structure of a flexible STIS, prioritizing early ages and adaptable to different contexts? 3) What would be the structure of a flexible STIS, prioritizing early ages and adaptable to different contexts?

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2.2. Stage 2: Identifying Relevant Studies: Data Sources and Search Strategy

For the identification of relevant studies, a search strategy was designed in which several options of formulas with Boolean operators were tested. The decision was made to use the simplest formula, but it was considered to be the one that yielded the best results in terms of stability and number of possible relevant studies: (System) AND (Identification) AND (Sport Talent).

This formula was used in academic databases and artificial intelligence (AI) search engines, the latter considering that AI tools for research transform the search and analysis of scientific literature through personalized recommendations, intuitive visualizations, and evidence-based responses, facilitating access to and understanding of relevant information. Subsequently, for the study selection process, the protocol known as Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) was applied, using the COVIDENCE systematic review tool [19], obtaining the summary of the process shown in Figure 1.

2.3. Stage 3: Study Selection

References are imported, and duplicates in the databases were automatically eliminated in Covidence; Scopus, PubMed, SportDiscus, Google Scholar, and AI search engines: Research Rabbit app, Open Knowledge Map, Consensus, and Search.carrot2. Subsequently, in the next round, the reviewers began the process, for which several inclusion criteria were developed, starting with the eligibility of the studies, which required that the papers published in English be added as outstanding, that the population addressed be children or young people, that they include the terms "system, process, or methodology," that they speak of identification; excluding studies with adults, as well as those that used the term "selection." In the first instance, the works were selected by screening from the titles and abstracts; then a round of review of the complete text was made, where the above criteria were also applied, indicating the reason for exclusion.

Once the selection was made, the final extraction began for the organization of the data, taking into account what is summarized in Table 1. The selection of the papers was carried out by two reviewers; in case of conflicts in the concordance, the first reviewer conducted a verification round for the papers where consensus was not evident.

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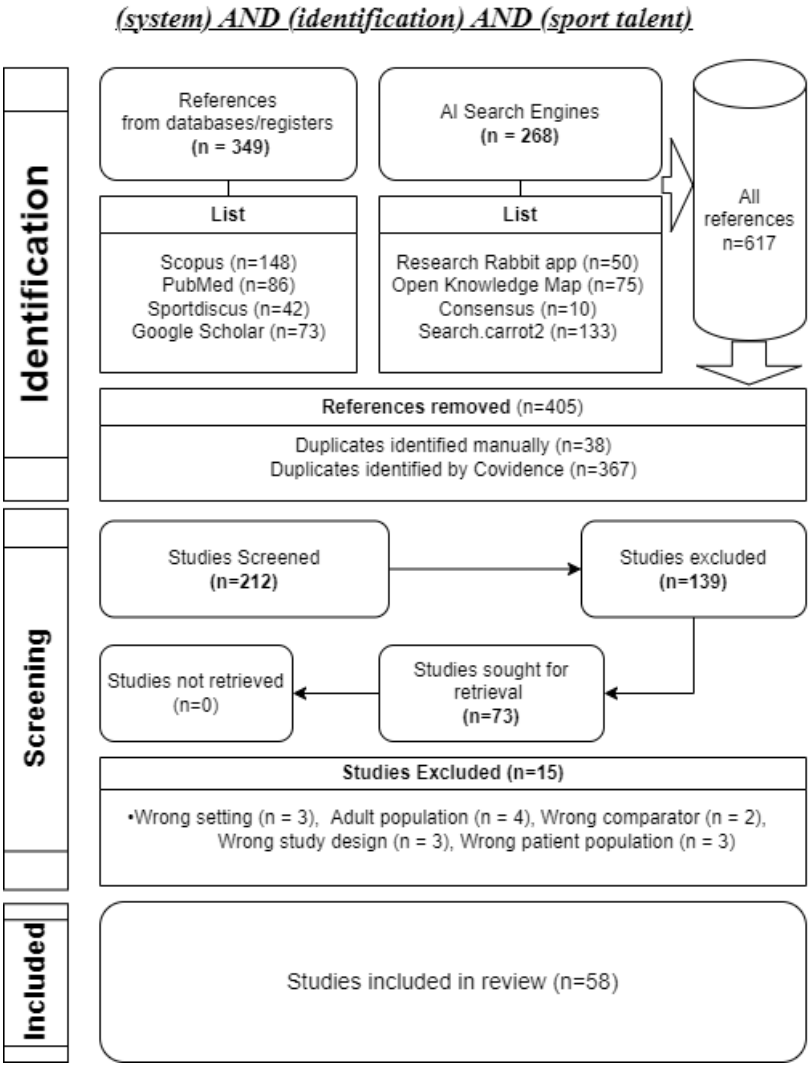

Figure 1.
PRISMA ScR flow diagram.

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Table 1.
Data Extraction Template.

Category	Data observed in the full text
System for	• One sport • Several sports
Type of study	• Original studies • Systematic review • Meta-analysis • Textual articles • Opinion articles • Gray literature (conferences, theses, dissertations, reports) • Institutional guidelines or policies • Letters • Mixed model studies and accuracy studies • Diagnostic test
Categories	• Biomedical and physiological aspects of sporting talent • Environmental and sociocultural influences • Psychological factors in the identification • Early identification and long-term development of sporting talent
Variables considered	• Anthropometry • Physical testing • Biochemical tests • Genetic testing • Psychological testing • Social or environmental studies • Medical tests
Variables for social or environmental studies	• Social status • Geographic location • Environmental influence • Contextual culture
Variables for biochemical tests	• Hemoglobin and red series • Enzymes • Other
Main anthropometric variables	• Weight (body mass) and height • Somatic maturation • Height projection • Somatotype • Proportionality indexes • Nutritional status or indices • Body composition • Other
Main variables considered for physical testing	• Motor skills • Strength and resistance • Endurance • Speed • Reaction speed • Competitive performance • Other
Variables for psychological testing	• Temperament • Willingness • Personality traits • Well-being • Motivation • Intelligence • Other

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3. Results

3.1. Stage 4: Charting the Data

Figure 2 shows that the largest volume of studies included after screening is between 2018 and 2023, with 7 papers having the highest rate of production, which indicates a greater interest in addressing STIS in the last 8 years.

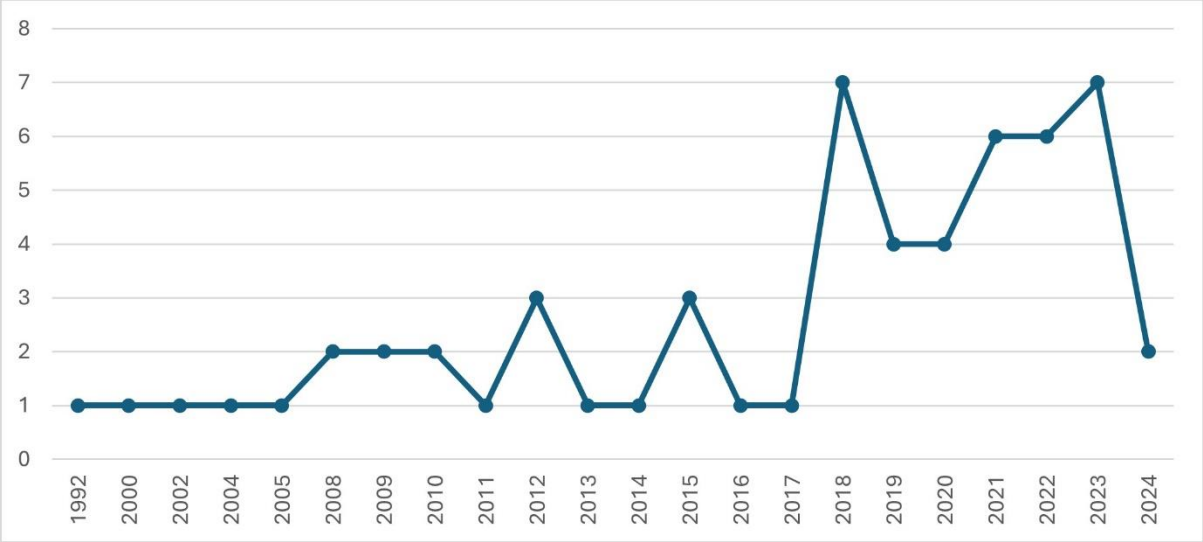

Figure 2.
Annual production rate of studies addressing STIS.

Figure 3 shows that original works have the highest volume of production with 17 papers, compared to other types of literature. Textual articles and literature reviews follow, while mixed model studies only present one work.

Figure 4 shows that the production of textual articles has been constant since 2008, with at least one article per year, while original studies in the period 2022-2024 present 10 papers. Since 2020, only one literature review related to STIS topics has been published. The highest density of studies is concentrated in Europe and North America (Figure 5).

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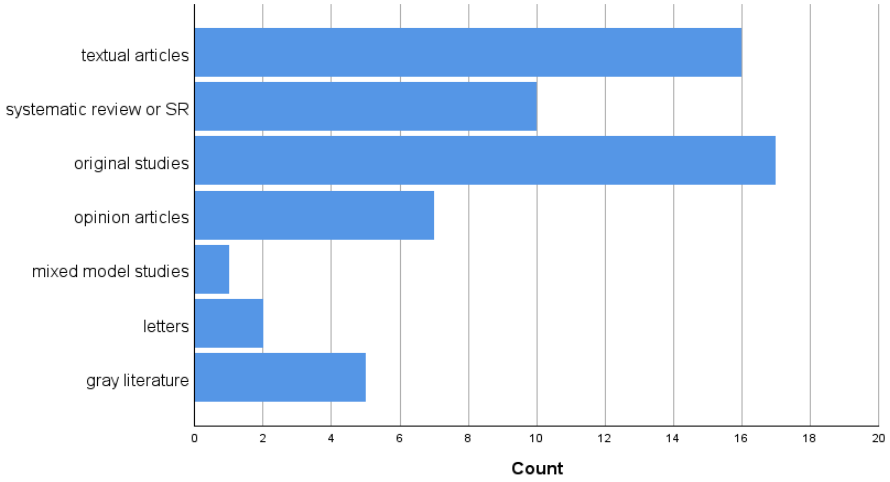

Figure 3.
Volume of studies addressing STIS by type of publication.

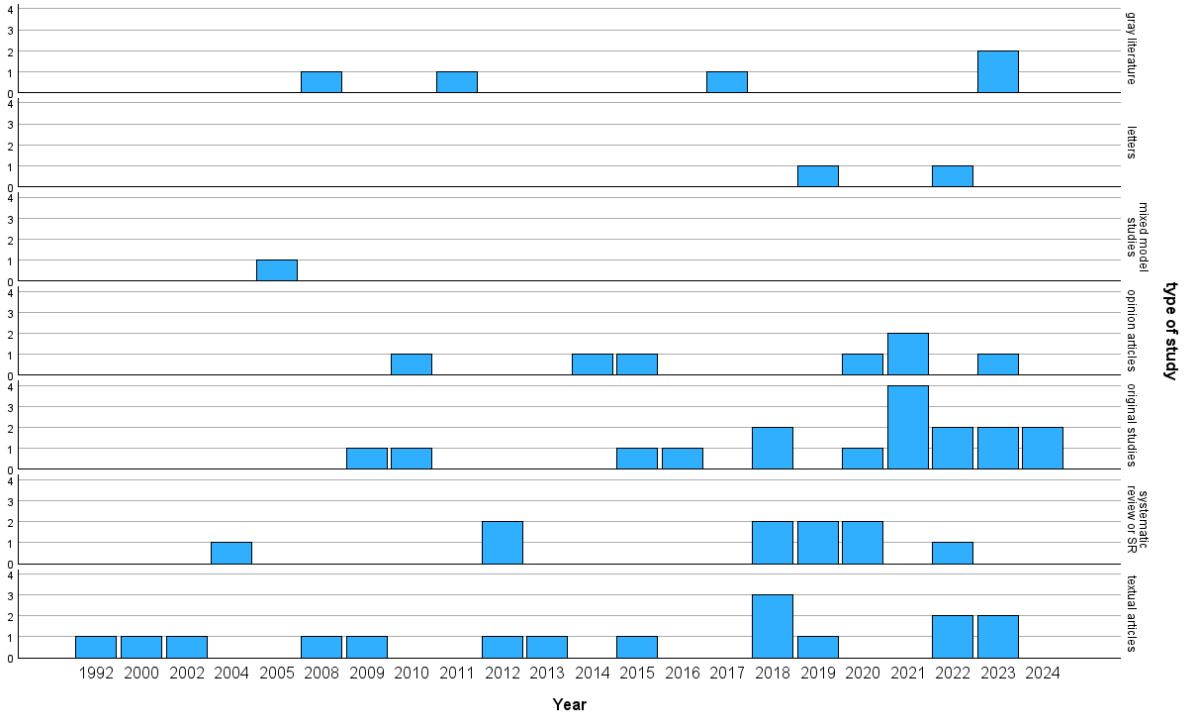

Figure 4.
Volume of studies addressing STIS by year and type of publication.

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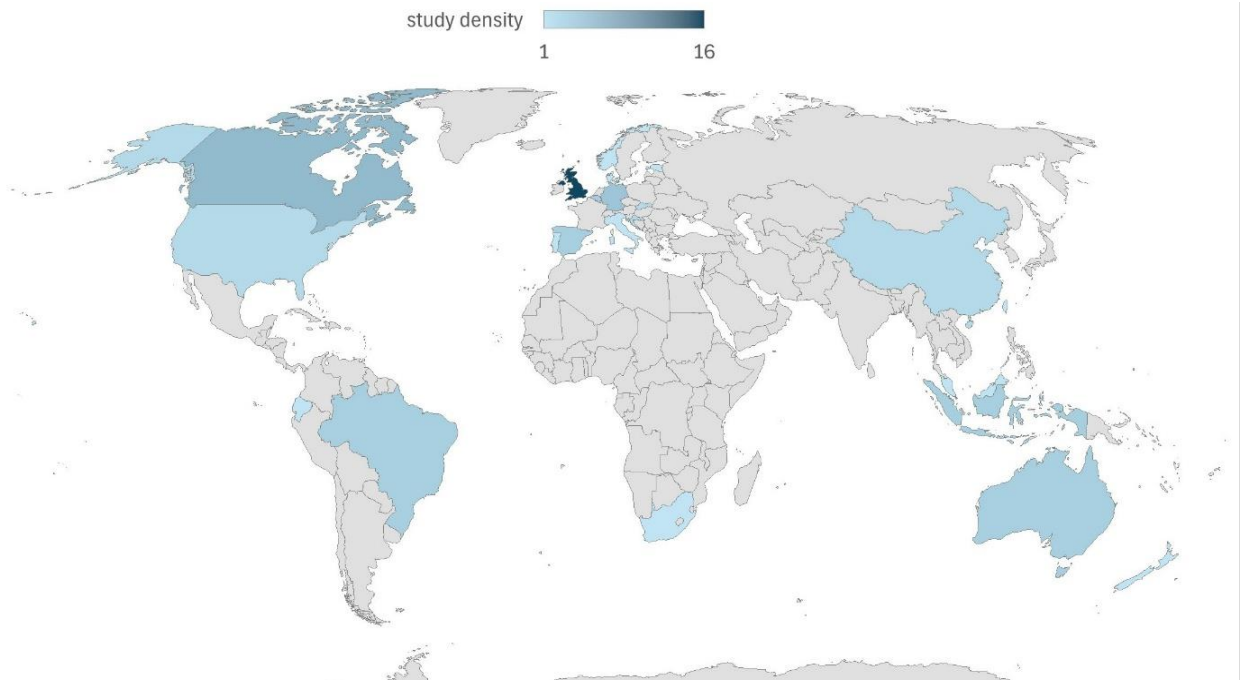

Figure 5.
Density of studies by country and region.

Table 2 shows the selected papers and indicates that 47 of them consider the study of biomedical and physiological aspects, 19 focus on psychological components, and 19 on environmental and sociocultural factors. The sports addressed are diverse; however, there is a significant group of works that focus solely on soccer, confirming that it is a sport extensively studied, likely due to its commercial prominence today and the teams' urgency to find star players because of its economic significance.

Table 2.
Sports and general categories of the evaluations considered by the studies selected through PRISMA.

Author and Year	Sports where the system is emphasized	BMaPhy	Phy	EnvSoc
Abbott and Collins [20]	Athletics	X	X	
Abbott et al. [21]	Several Sports	X	X	
Howell [22]	Soccer			X
Huang et al. [23]	Cross-Country Skiers	X		
Jacob et al. [24]	Several Sports	X		
Janssens et al. [25]	Cycling	X		X
Johnston and Baker [26]	Several Sports	X	X	X
Johnston et al. [10]	Several Sports			X
Jürimäe [27]	Soccer	X		
Kandrac et al. [28]	Soccer, ice hockey, artistic gymnastics	X		
Kerr [29]	Rhythmic gymnastics	X		X
Krasilshchikov [1]	Several Sports			X
Kelly et al. [30]	Several Sports	X		
Leite et al. [31]	Several Sports	X		

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Author and Year	Sports where the system is emphasized	BMaPhy	Phy	EnvSoc
Li et al. [32]	Several Sports	X	X	
Anshel and Lidor [33]	Several Sports		X	
Lorenzo et al. [34]	Several Sports			X
Louzada et al. [35]	Soccer	X		
MacNamara and Collins [36]	Several Sports		X	
Martindale et al. [37]	Several Sports		X	
McAuley et al. [38]	Several Sports	X		
Morganti et al. [39]	Several Sports			X
Müller et al. [40]	Several Sports	X		
Pankhurst and Collins [41]	Several Sports	X	X	X
Papić et al. [42]	Several Sports	X		
Papić et al. [42]	Several Sports	X		
Peltola [43]	Several Sports	X		
Pickering et al. [44]	Several Sports	X		
Prasetyo et al. [45]	Archery	X		
Prieto-Ayuso et al. [46]	Several Sports	X	X	X
Buhari et al. [47]	Several Sports	X		
Roberts et al. [48]	Several Sports	X	X	X
Roberts et al. [12]	Boxing, judo, and taekwondo	X	X	X
Rommers and Rössler [49]	Several Sports	X	X	X
Rongen et al. [50]	Several Sports	X		
Røsten et al. [51]	Ice hockey	X		X
Rütten and Ziemainz [52]	Several Sports	X		
Schorer et al. [53]	Handball	X		
Šimonek and Židek [54]	Several Sports	X		
Spies et al. [55]	Several Sports	X		
Staff et al. [56]	Cycling	X		X
Susanto et al. [6]	Athletics	X		
Till and Baker [57]	Several Sports	X	X	
Till et al. [58]	Rugby		X	
Till [59]	Several Sports	X		
Tsao et al. [60]	Tennis	X		
Tucker and Collins [61]	Several Sports	X		
Unnithan et al. [7]	Soccer	X		
Vaeyens et al. [62]	Several Sports		X	
Keulen et al. [63]	Athletics			X
Varillas-Delgado et al. [64]	Several Sports	X		
Vinueza Tapia and Aldas Arcos [65]	Several Sports	X	X	X

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Author and Year	Sports where the system is emphasized	BMaPhy	Phy	EnvSoc
Visalim et al. [66]	Several Sports	X	X	X
Wattie and Baker [67]	Several Sports	X		
Williams and Reilly [68]	Soccer	X	X	X
Williams et al. [69]	Soccer	X		X
Wood [3]	Canoeing, cycling, rowing, triathlon, athletics, beach volleyball	X	X	
Wrang et al. [70]	Soccer	X	X	X

Note: Leyend: BMaPhy: Biomedical and physiological; Phy: Psychological; EnvSoc: Environmental and sociocultural.

4. Discussion

It has been considered that sports talent is a condition that involves the combination of different factors, such as physical fitness, structural aspects from the morphological, anthropometric, biological, and genetic conditions, psychological abilities, social, and environmental environments which it develops. All must be presented in a favorable way and above the common denominator; in other words, with extraordinary conditions. This linkage is sensitive to any change and can positively or negatively affect the development of the athlete. Traditionally, subjects with superior biological predispositions have been referred to as talented; this approach has been called deterministic, while the dynamics and evolution resulting from the socio-cultural environment are considered to increase the probabilities of developing sports talent; this approach has been called probabilistic [39]. In consideration of the above, it can be said that subjects with evident extraordinary abilities from the biological point of view also require an environment that favors the use of their innate abilities to be considered sports talents.

In this study, it was found that most of the selected studies contemplate within their SITS the evaluation of biomedical and physiological variables; almost half of the works consider the psychological component, environmental, and sociocultural aspects, being the physical and anthropometric tests the most prioritized by the researchers for the detection of talent, as well as their criteria and expertise within the experience of each one.

On the other hand, within the medical tests, those involving biochemical controls, including enzymes and genetic markers, have been taken into account [24, 54, 59, 64], also hemoglobin and red blood cells, mainly for endurance and ultra-endurance sports [23]. As for the psychological component, it has been evaluated mainly through temperament, willpower, and motivation. Other works have also considered intelligence [10, 34, 49], even within the criteria of coaches, intelligence and willpower are factors that they take into account for talent detection [12, 48]. Well-being is another factor of interest [36, 68] assessed by psychometric questionnaires [32], being able to be summarized in neurocognitive and personality trait aspects.

In the environmental and sociocultural aspect, the variables of environmental influence [12, 25, 32, 61, 63] social status [12, 32, 41, 67] geographic location [22, 51, 52] and cultural context [1, 22, 31, 41, 66, 68] indicating basic social aspects related to the economic component and the geographic area inhabited.

As for the physical tests, 34 of the 58 papers mainly considered the following variables: motor skills, strength and endurance, speed, reaction speed, mobility, and competitive performance, while 38 of the 58 papers considered the following anthropometric variables: body mass, height, body composition, body proportionality, and somatic maturation. In this sense, it is evident that the early identification of talents is of great interest; however, it is not a linear or unidimensional action, as it has been intended to expose in various models of identification in several countries [6, 29, 52, 71] in the face of which identification and development models have been proposed that contemplate four major stages: initiation, development, improvement, and enhancement [21] it should be considered that psychological

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aspects such as attitude and motivation enhance the performance of extraordinary talents, provided that specific objectives have been set [20].

Some talent identification systems consider competitive outcomes using predictive algorithms [25] for other sports such as soccer, they have taken into account sociological, physical, psychological, and motor skill aspects to predict adult performance [69], somewhat coinciding with the "instinct" of coaches, who prioritize "ambition and drive," as well as "game intelligence" and "physical and technical skills" [48]. In turn, computer tools have also been developed that are used as data processing systems, allowing comparisons among young people based on their age and sporting interests, thereby establishing classifications according to the potential for certain sports [47]. Most systems, in any case, share the monitoring of structural aspects related to phenotype, such as body size and proportions [63, 67, 70] and the degree of maturation [27, 40], considering that these factors can provide a competitive advantage in the medium and long term.

Recent proposals take into account genetic aspects, such as ACE and ACTN3 genes [24], which are associated with predicting athletic prowess in both endurance and strength; although there is an increase in access to this type of tests and a progressive decrease in their cost [38], their access to most countries remains limited because they are still expensive and not very effective in contrasting the cost-benefit ratio [59]. Additionally, the limitations in proper interpretation mean they are not an efficient resource for coaches and professionals dedicated to training athletes. Therefore, regardless of individual and underlying conditions, to be considered a talent with potential success in a specific sport, the individual must practice it and develop skills specific to that sport, investing time until reaching the necessary proficiency for success [49].

In synthesis, according to what has been observed, it is necessary to identify sports talents at early ages; however, it will depend mainly on the maturational state of the subject rather than only the chronological age. In this way, it is important to identify subjects in a mature state before reaching the peak height velocity (PHV) and genetic potential, evidenced by the projection of their adult height and structural predisposition suitable for certain disciplines, as well as outstanding physical abilities, favorable social environments, and competitive systems with increasing and healthy demands in their sporting nature. In other words, integrated management is required, without vices of administrative corruption or segregation of any kind, favoring participation and equality of competitive conditions, without any advantage beyond their own qualities as a team or as an athlete. Consequently, the competitive level, motivation, and resilient attitude in the pursuit of medium and long-term goals will be enhanced.

Although different sports, their sports disciplines and modalities, as well as subspecialties or playing positions, will have favorable phenotypic and genotypic requirements for future competitive performance, psychological and social environment aspects are of continuous construction, monitoring, and care so that those subjects identified initially reach their best potential in adulthood, being able to reach the international elite.

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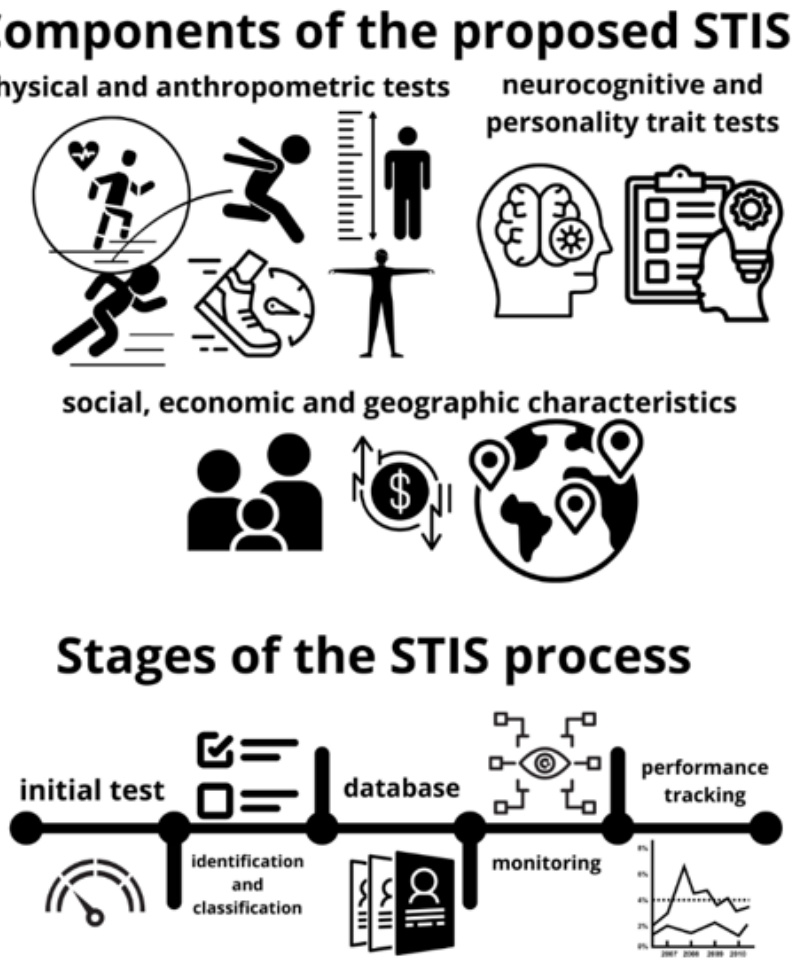

Figure 6.
Components and stages of the proposed STIS.

Therefore, identification is not a transversal evaluative activity but a longitudinal process of continuous adaptation to sport and social contexts. For this reason, the standardization of reproducible physical tests, as well as the monitoring of social and psychological aspects through tools that are easy to apply and interpret by coaches and trainers, is a fundamental step in the construction of solid bases for the identified children, since they would go from being detected with probabilities of success to consolidating their potential. Along the way, newly identified talents can be added that will enhance the demand and performance of the constituted groups.

Finally, for the development of future STIS, it is proposed to follow the stages (Figure 6) of initial execution of the tests, where physical, anthropometric characteristics, and psychosocial aspects are evaluated by means of easily applied batteries that collect relevant information to cover the performance of strength, speed, endurance, agility, maturation, growth projection, social, economic, and geographic characteristics, as well as psychological, neurocognitive, and personality traits. The next step is the creation or feeding stage of the database that allows the establishment of comparisons appropriate to their age, maturity, and competitive level, where they perform, among other variables. Subsequently, once incorporated into a sports discipline, the monitoring stage can be implemented, applying the same initial tests and thus demarcating the stage that completes the system, by tracking their performance

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and tracing the evolution curve of each individual. It should be noted that the system, once started, can incorporate new subjects from the first stage.

5. Conclusions

Most studies agree that in the identification of sports talent, it is necessary to perform functional and biomedical evaluations, considering physical-motor and anthropometric tests; also, a significant number of studies agree on the importance of performing psychological and social evaluations, which are summarized in neurocognitive aspects and personality traits, as well as socioeconomic characteristics and geographic location.

Finally, it is concluded that a continuous and cyclical identification process, considering physical and anthropometric characteristics, including maturational status and psychosocial aspects, using simple and easy-to-apply batteries, will allow for the identification, creation of databases, monitoring, and follow-up of the performance of identified talents in an efficient way.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

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