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Talent Identification and Development in Youth Sports: A Systematic Review

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Resumen

Introducción: El talento se ha asociado tradicionalmente al concepto de condiciones esenciales para el éxito del deportista. Los estudios longitudinales pueden evaluar las características asociadas con el desempeño mientras evalúan los cambios y desarrollos a lo largo del tiempo. Por lo tanto, el objetivo de esta revisión fue identificar y resumir la literatura longitudinal que aborda el impacto del desarrollo de indicadores de talento potencial en la infancia/adolescencia sobre el éxito posterior en los deportes de élite. **Métodos:** En consecuencia, la metodología de búsqueda de esta revisión de síntesis sistemática se guió por los puntos de notificación preferidos para las revisiones sistemáticas. Se incluyeron artículos que examinaron el desarrollo de niños/adolescentes a lo largo del tiempo de los posibles indicadores de talento para el éxito en futuros atletas de élite. Se revisaron completamente un total de seis manuscritos. **Resultados:** En general, los resultados de estos estudios muestran que los hallazgos no son concluyentes y que los indicadores de talento han cambiado con el tiempo, y este cambio tiene un ritmo e intensidad diferente según el crecimiento acelerado. **Conclusión:** El resultado de esta revisión sistemática muestra que no es posible afirmar si se puede identificar o no el talento en niños/adolescentes en relación con el éxito en el deporte de élite. Esto se debe al desarrollo no lineal de los adolescentes ya la emergente, dinámica y simbiótica conceptualización del talento.

Palabras Clave: Identificación de Talento, Desarrollo de Talento, Juventud, Crecimiento y Madurez

Abstract

Introduction: Talent has traditionally been associated with the concept of an athlete's essential conditions for success. Longitudinal studies can assess characteristics associated with performance while evaluating changes and developments over time. Therefore, the goal of this review was to identify and summarize the longitudinal literature that addresses the impact of the development of potential talent indicators in childhood/adolescence on later success in elite sports. **Methods:** Accordingly, the search methodology of this systematic synthesis review was guided by the preferred reporting points for systematic reviews. Articles were included that examined child/adolescent development over time of potential talent indicators for success in future elite athletes. A total of six manuscripts were fully reviewed. **Results:** Overall, the results of these studies show that the findings are inconclusive and that talent indicators have changed over time, with this change having a different pace and intensity depending on the growth spurt. **Conclusion:** The result of this systematic review shows that it is not possible to say whether talent can be identified in children/adolescents in relation to success in elite sports. This is due to the non-linear development of adolescents and the emerging, dynamic, and symbiotic conceptualization of talent.

Keywords: Talent Identification, Talent Development, Youth, Growth, Maturity

Introduction

A talent identification program is defined as the "recognition of players who participate in the sport and have the potential to excel" (Shahidi, Kingsley, & TAŞKIRAN, 2022). Identifying athletes with the greatest potential to excel in sports presents a major and relevant challenge for coaches and researchers (Shahidi, Kingsley, Svensson, TAŞKIRAN, & Hassani, 2021). Reliable identification of future elite performers at an early age would also permit clubs to focus their expenditure on the development of a small number of young players (Morais, Silva, Marinho, Lopes, & Barbosa, 2017). Predicting future athletic performance is inherently multifaceted and complex. Player development trajectories are rarely linear, as physical performance and motor skills are intertwined and evolve through dynamic interactions with the individual athlete's performance environment (Bennett, Vaeyens, & Fransen, 2019). Nevertheless, scientific knowledge about talent identification and future athletic success has not advanced far enough to truly influence and inform sports practice. On the other hand, research on athlete development also shows that biological age is more important than chronological age (Abarghoueinejad, Baxter-Jones, Gomes, Barreira, & Maia, 2021). Maturity level (early, normal, late) refers to the biological maturity level of an individual at the time of observation, which is significantly associated with anthropometric and physical performance (Golle, Muehlbauer, Wick, & Granacher, 2015). Thus, the success or failure of young athletes is influenced by their different levels of maturity. The early maturing child is characterized by advanced anthropometric characteristics, such as being taller, heavier, and stronger, or by talent indicators such as muscular strength, muscle power, cardiovascular endurance, and speed (Toselli et al., 2022). Thus, maturation has a critical impact on the physical performance of young athletes, as previous researchers have shown. Thus, the identification of talent in sports is dynamic and multifactorial, changing as the athlete matures (Kevin Till, Steve Cobley, John O'Hara, Chris Chapman, & Carlton Cooke, 2013a). Most studies about talent identification have limitations in being retrospective and often utilize cross-sectional 'one-off' testing, comparing age grades (e.g., Under 13 vs. Under 14) to demonstrate the development and change in qualities over time (Chaalali et al., 2016; Craig & Swinton, 2021; Fragoso, Massuca, & Ferreira, 2015; Malina et al., 2000). Baker et al. (2020) recently showed that 68% of studies use cross-sectional designs, which are the most common methodological approach. Cross-sectional studies often measure specific characteristics within different disciplines-physical, technical, and psychological-at a single point in time and make comparisons between two or more different groups (Baker et al., 2020). However, assumptions regarding the athlete's development of talent indicators are based on the general principles observed between individual athletes, rather than a true change over time. For example, the difference in body mass, body height, or muscular strength between two age groups is not equivalent to the within athlete development (Marceau, Ram, Houts, Grimm, & Susman, 2011). As a result, such designs are limited in their ability to account for the effects of differences between athletes (e.g., chronological age, skeletal age, biological age, training age, relative age) on physical development. On the other hand, longitudinal research has been used to follow a cohort of athletes and assess changes in characteristics at two or more time points. By repeatedly measuring an athlete or group of athletes, a longitudinal research design can evaluate characteristics that may be related to performance and assess changes and developments over time. Philip and colleagues (2006) examined long-term changes in physical performance related to peak elevation velocity in young soccer players aged U-12 years who were followed for five years. The researchers finally explained that physical performance abilities such as strength, endurance, speed, agility, and balance are directly related to the growth spurt and that all of these abilities reach their maximum at the age of peak velocity (Vaeyens et al., 2006). Therefore, in light of the above, the aim of this systematic review was to examine whether childhood/adolescent individual differences in change over time of physique or physical abilities (anthropometric, speed, power, and endurance) predict individual differences in a later performance or, in other words: Whether higher and lower-performing athletes at an older age had previously differed in their childhood/adolescent progress over time of physical variables.

Methods

Systematic Review Protocol

No formal protocol was published before the study was started. The report was guided by the preferred reporting items for systematic reviews (PRISMA) (Page et al., 2021).

Eligibility Criteria

This study was designed to examine the prognostic effects of childhood/adolescent physical fitness on the future careers of athletes. Baseline measurements of physical fitness had to be performed in children/adolescents aged 8-18 years. Eligible studies must have been longitudinal over at least 3-time points of measurement, including two observation periods: t1-t2 (or more) recording childhood / adolescent development over time of physique and/or physical abilities and t3 recording later performance level (i.e., t2-t3 is the prediction period). Finally, only studies published in English were included.

Information Source and Search Strategy

A comprehensive electronic search of the literature in PubMed, Sport DISCUS, and Scopus was conducted on 10 February 2022 with a date restriction of 01 January 2000 onwards. Keywords utilized in the search using multiple combinations of AND/OR phrases included; Talent identification, Sports success, Growth and Maturity, Talent indicators, and Longitudinal study. One of the authors (SHS) independently screened references and abstracts to identify articles potentially enclosing the inclusion criteria.

Study Selection

Studies were selected as stated by the eligibility criteria from information in the title, abstract, and full text according to PRISMA guidelines (Ardern et al., 2022; Shamseer et al., 2015). Two of the authors (SHS, BC) selected the studies, and disagreements were solved by discussion. A customized Microsoft Excel™ spreadsheet was developed to register the study data and EndNote software (version X9.0, X7.0.1, Clarivate Analytics, and Philadelphia, PA, USA) was used as the citation manager during the processes of searching, deduplication, selection, and management of the studies.

Data items

Included studies were read in full and the following items were extracted: First author name, publication year, number of participants, age range, sport type, physical performance variables, validation of physical performance variables, duration of follow-up, and outcome, as shown in Table 1.

Table 1. Characteristics of studies included in the review

Authors	Leyhr et al. 2018	Dugdale et al. 2020	Till et al. 2017	Matthys et al. 2013	Gonaus et al. 2012	Roescher et al. 2010
Aim	To investigate young soccer players' motor development	To investigate the age of recruitment between a successful and unsuccessful athlete	To compare the longitudinal physical development of adolescent	To investigate longitudinal changes in anthropometric and physical performance	To compare the physiological factors of elite and non-elite	To investigate the relationship between the development of endurance capacity
Sport	Soccer	Soccer	Rugby	Handball	Soccer	Soccer
Athletes (n)	1134 (12 to 15 Years old)	537 (10 to 17 Years old)	51 (13 to 15 Years old)	94 (13 to 15 Years old)	3000 (14 to 17 years old)	130 (14 to 18 years old)
Genders	Male	Male	Male	Male	Male	Male
Study Design	Prospective Longitudinal	Longitudinal	Retrospective Longitudinal	Longitudinal	Longitudinal	Longitudinal
Study Duration	3 Years	12 Years	3 Year	3 Years	4 years	6 Years
Constraints Examined	Speed, Agility, dribbling	Anthropometric, sprint, Countermovement Jump, Yo-Yo IR-1	Anthropometric, Sprint, Countermovement jump, Medicine ball throwing, Multi-stage shuttle run test	Anthropometric, countermovement jump, sit and reach, Distance jump, Sit-ups, Hand grip, sprint, agility, Coordination, Yo-Yo IR1	sprint, shuttle sprint, agility, countermovement, Reaction, medicine ball throw, Sit and Reach Yo-Yo IR1	Interval Shuttle Run Test

Risk of Bias in individual studies

The Cochrane Risk of Bias tool for Non-Randomized Studies of Interventions (ROBINS-I) (J. A. C. Sterne et al., 2016; Jonathan A. C. Sterne, Savović, Page, Elbers, Blencowe, Boutron, Cates, Cheng, Corbett, Eldridge, Emberson, Hernán, Hopewell, Hróbjartsson, Junqueira, Jüni, Kirkham, Lasserson, Li, McAleenan, Reeves, Shepperd, Shrier, Stewart, Tilling, White, Whiting, & Higgins, 2019; Jonathan A. C. Sterne, Savović, Page, Elbers, Blencowe, Boutron, Cates, Cheng, Corbett, Eldridge, Emberson, Hernán, Hopewell, Hróbjartsson, Junqueira, Jüni, Kirkham, Lasserson, Li, McAleenan, Reeves, Shepperd, Shrier, Stewart, Tilling, White, Whiting, Higgins, et al., 2019) was used by two independent authors (SHS, BC) to assess the risk of bias in the included studies. The risk of bias was scored as either “low risk”, “moderate risk”, “high risk” or “serious risk” for each domain. Articles were assessed based on seven dimensions that were inspected in this assessment tool: (1) Bias due to confounding; (2) Bias in the selection of participants for the study; (3) Bias in the classification of interventions; (4) Bias due to deviations from intended interventions; (5) Bias due to missing data; (6) Bias in the measurement of outcomes; and (7) Bias in the selection of the reported results (As shown in the appendix).

Synthesis of Results

Due to the large differences between the number, and type of, measured talent indicators in the different studies, no quantitative meta-analysis was possible.

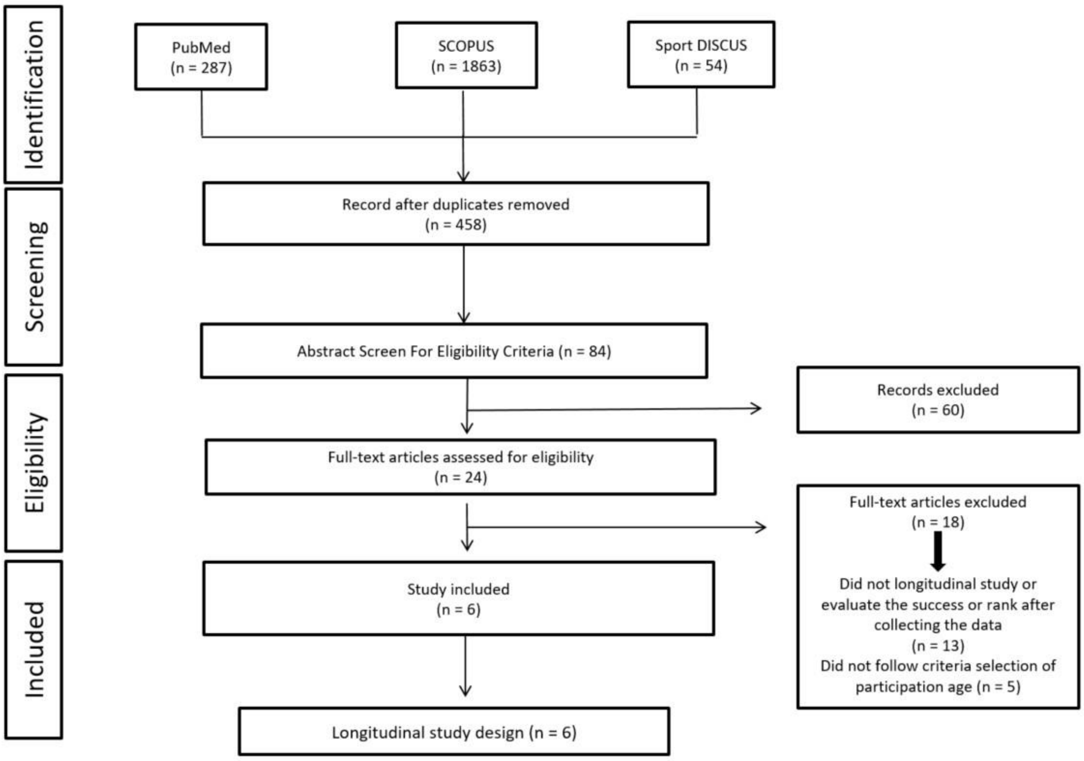
Risk of Bias across Studies

No meta-analysis was performed; it is not possible to perform a traditional assessment of risk for publication bias and selective reporting with funnel plots.

Results

Study Selection

The first search found 2204 titles in the various databases. After removing duplicates in EndNote and excluding studies based on information in the title, 84 abstracts were screened for eligibility criteria. Sixty abstracts did not meet the inclusion criteria and the remaining 24 were read in full text. In the end, 6 studies met the inclusion criteria. The reasons for the exclusion of 18 studies are shown in Figure 1.



Study Characteristics

As displayed in Table 1, one study was reported to be a longitudinal prospective study. The other studies were reported to have a longitudinal retrospective design or did not describe if the study was prospective or retrospective. The studies included all together 4946 young Soccer (Dugdale, Sanders, Myers, Williams, & Hunter, 2021; Gonaus & Müller, 2012; Leyhr, Kelava, Raabe, & Höner, 2018; Roescher, Elferink-Gemser, Huijgen, & Visscher, 2010), Handball (Matthys et al., 2013), or Rugby (Till et al., 2017a) players. Sample sizes ranged from 51 to 3000 per the study, with ages ranging from 10 to 18 years old. The mean duration of follow-up ranged from two to twelve years. The studies included only boys, no girls were included (Table 2).

Table 2. List of studies included with results and limitations

Studies	Results	Summary	Limitation
Leyhr et al 2018	Using multilevel regression analyses, each motor performance was predicted by time, time2 (level 1 predictors), adult performance level, and relative age.	No effect of the development of predictor over time.	Selection bias (i.e., the sample consisted of individuals who belong to the top 4% of youth soccer players of the U12 age class in Germany).
Matthys et al. 2012	Elite players performed better on the Yo-Yo Intermittent Recovery test ($P < 0.01$) and on the speed and coordination items ($P < 0.05$).	No interaction of age time point × on the later player level on any of the predictor variables.	A low number of participants, also, the level of athletes is not very high because the Handball sport is not very popular and famous in Belgium.
Gonaus et al. 2012	Drafted players performed significantly better in all other measurements with the largest effects in shuttle sprint, $\eta 2 = 0.08$, medicine ball throw, $\eta 2 = 0.05$, hurdles agility run, $\eta 2 = 0.04$, and 10 and 20 m sprints, $\eta 2 = 0.04$.	Yes, the effect of age time point × on the later player level on any of the predictor variables.	The study did not estimate peak high velocity and maturation state. In addition, the test performance could limit the study because they did not analyze the technical and tactical of the players.
Dugdale et al. 2020	The regression model shows that successful players reduced their 5-10-20 meter sprint time. The Bayesian regression model shows that successful players increased jump height by 2.6 cm per year.	Yes, the effect of the interaction of group × age for physical performance measure.	The assessment of the athlete just from one club that can affect the result of the study can be biased. Another limitation of the study they did not calculate and predict the age of peak high velocity and maturation rate.
Till et al. 2017	Logistic regression analysis revealed physical changes between those Under 13s and 14s at years in Peak high velocity ($p = 0.029$), sitting height ($p = 0.025$), and body mass ($p = 0.031$).	The finding is inconclusive.	The low number of participants and not following them for up to 18 years old
Roescher et al. 2010	Anthropometric characteristics and playing position did not improve model fit ($p > 0.05$).	Yes, there is an effect of the interaction of the later playing status × age. However, the effect size is weak.	The most important limitation of the current study is that the authors did not estimate other factors related to talent identification.
Lidor et al. 2005	In the specific performance test (slalom), in 2 of the 4 tests (50%), a	No, the effect of age time point × on later	Few participant characteristics were presented. The Reasons for

	significant difference was observed between the selected and nonelected players ($p < 0.06$).	players' predictor's variables.	athletes dropping out are not presented.

In general, studies were focused on topics such as physical performance tests and maturation evaluation. Four of the studies included soccer athletes (Dugdale et al., 2021; Gonaus & Müller, 2012; Leyhr et al., 2018; Roescher et al., 2010), one rugby athlete (Till et al., 2017a), and one study of handball athletes (Matthys et al., 2013). Studies used tests such as Anthropometric (Dugdale et al., 2021) and Maturation evaluation (Matthys et al., 2013; Till et al., 2017a), Sit and Reach (Gonaus & Müller, 2012), Medicine Ball overhead throws (Till et al., 2017a), Long Jump (Matthys et al., 2013), Counter Movement Jumps (Gonaus & Müller, 2012), Running speed as a 20 m (Leyhr et al., 2018), and 30 m (Matthys et al., 2013), Slalom (Leyhr et al., 2018) and 505 Agility (Till et al., 2017a) tests, VO_2max estimation using Multi-Stage Fitness Shuttles test have also been used (Dugdale et al., 2021; Gonaus & Müller, 2012; Matthys et al., 2013; Till et al., 2017a). Two studies measured maturation (Matthys et al., 2013; Till et al., 2017a) by using the Mirwald equation (Mirwald, G. Baxter-Jones, Bailey, & Beunen, 2002).

Risk of Bias within Studies

Participants in most studies were open cohorts. Adolescents were enrolled at different ages and could drop out at different ages. In addition, they may have failed some tests at different ages. The dropout rate on the tests was 45-58% (Matthys et al., 2013). This problem has been addressed in some studies by appropriate statistical means, but there may still be unknown confounding factors that affect the data. The risk of bias is therefore high in some of the studies. A summary of the risk of bias assessments is provided in the Appendix.

Risk of bias across studies

It is difficult to assess the risk of publication bias in this type of study because the number of studies is small and funnel plots are difficult to use. If there is bias, the results would likely be in the direction of "no effect," as has been shown for other types of studies (see Appendix). Negative studies are more likely to be left on the desk or rejected by scientific journals. However, no other longitudinal studies of physical performance in ball sports such as soccer, rugby, or handball were found in Clinical Trials Gov (https://clinicaltrials.Gov).

Results of Individual Studies

For most outcomes, sprint, and aerobic capacity were better in elite, selected, or professional athletes than in non-elite, armature, or non-selected athletes. There were some differences among the included studies. For example, in the study by Roescher et al. (2010), it was found that there was no difference between nonprofessional and professional athletes at ages 14 to 15 years. However, from the age of 15, the professional athlete group showed a faster development and linear progression of aerobic capacity compared to the non-professional group. Another study by Dugdale and colleagues (2021) showed that in 8- to 14-year-olds, the sprint test was better in unsuccessful players than in successful players. However, from the age of 15, successful players performed better on sprint tests. Because of the heterogeneity of the study design and the lack of data for longitudinal assessment of physical performance, meta-analysis was not considered a safe option.

Progression in Physical Performance

The included studies involve three categories of team ball sports; Soccer (four studies) (Dugdale et al., 2021; Gonaus & Müller, 2012; Leyhr et al., 2018; Roescher et al., 2010), Handball (one study) (Matthys et al., 2013), and Rugby (one study) (Till et al., 2017a) as shown in Table 1. Two of the soccer studies found that there was no difference between successful and unsuccessful athletes at the beginning. However, over time, successful athletes show better physical performance than unsuccessful athletes (Dugdale et al., 2021; Roescher et al., 2010). In two other studies, it was found that athletes who showed better physical performance at the beginning of the study continued to do so in later years (Gonaus & Müller, 2012; Leyhr et al., 2018). Layher et al.(2018) reported that athletes' motor development has the highest rate before the age of peak height velocity (Leyhr et al., 2018). The handball study found that during the three years of study, those who later became elite players did not improve their physical performance more rapidly than the future non-elites (Matthys et al., 2013). The study conducted on rugby players showed that the development of anthropometric data, maturation, and physical fitness in adolescent rugby league players contributes to career outcomes in adulthood. However, age, maturity, and size advantages at a given age may not be sensitive to changes at later developmental stages to correctly determine future athletic success.

Maturity and Growth

Biological maturation is significantly related to youthful growth and physical performance (Giudicelli et al., 2021; Luna-Villouta et al., 2021). Of the six studies included in this systematic review, two studies attempt to show the relationship between maturity and physical performance. In this context, Matthys et al. 2013 pointed out that maturity affects anthropometric profile and physical performance (strength and speed) (Matthys et al., 2013). Also, Till et al. 2017 claimed that physical performance has changed during the peak height velocity domain (Till et al., 2017a).

Discussion

In summary, the extracted articles state that the discussion of athlete identification is as follows: Among these studies, findings are heterogeneous and inconclusive, in that childhood/adolescent development of potential physical talent indicators (anthropometric, physical growth, and physical abilities) was sometimes positively associated with later performance level, sometimes not associated, and sometimes negatively associated with later performance level. That is, although talent/giftedness/expertise theory asserts talents have greater physical progress at a young age, respective empirical evidence is poor and inconclusive. Also, regarding biological maturation for prospective prediction purposes, the issue is not the adolescent performance advantage of early biological maturation, but the issue is that this advantage diminishes by adulthood, and participation patterns, social environment (opportunities, coach and coaching, peers, parental support, demands outside sports, especially academics), psychosocial maturation, health, and wellbeing may all differ individually between athletes, change over time intra- individually, and the intra-individual change over time may differ between athletes in terms of occurrence, magnitude, timing and speed of changes. In addition, the relative age effect (RAE) on early talent indicators and on long-term adult performance which has been shown to be reversed in several studies should also be considered. Many previous authors have concluded that the identification of talent cannot fully and accurately comment on whether or not the talent process exists (Elferink-Gemser, Visscher, Lemmink, & Mulder, 2007; Leyhr et al., 2018; Till et al., 2017b; Vandorpe et al., 2012). In examining the research literature in the area of talent identification in sports, most of the data presented come from cross-sectional studies (Abarghoueinejad et al., 2021; Dodd & Newans, 2018; Mohamed et al., 2009; Rowat, 2017; Trecroci, Longo, Perri, Iaia, & Alberti, 2019; Viero, Triossi, Bianchi, Campagna, & Melchiorri, 2020). In addition to the general physical battery test, the specific battery test should also be performed (R Lidor & Lavyan, 2002; Roescher et al., 2010). Moreover, the results of this review show that the discussion on the identification of top athletes is not related to a single-stage or prognostic analysis, but to a prediction of age, since talent indicators change with different intensity, speed, and time during the growth period. On the other hand, the included studies were conducted in soccer, rugby, and handball (Gonaus & Müller, 2012; Philippaerts et al., 2006; Roescher et al., 2010; Till et al., 2013a; Kevin Till, Stephen Cobley, John O'Hara, Chris Chapman, & Carlton Cooke, 2013b; Vaeyens et al., 2006). There are many research gaps in various team and individual sports when it comes to identifying talent. It should be noted that longitudinal studies on talent identification are limited to boys in all selected studies (Dugdale et al., 2021; Leyhr et al., 2018; Matthys et al., 2013; Till et al., 2017a).

Physical Performance Aspects of Soccer

Researchers suggest that the ages between 12 and 14 years old are the most important age for the rapid development of physical performance, and the explanations they have produced include biological and maturation changes in children at these ages (Farrow, 2013; Fransen et al., 2017; Leyhr et al., 2018). One study mentioned that the early teens are a "Window of accelerated adaptation to motor coordination", however for endurance capacity they mentioned the age 12 years old onward and call it a “Window of accelerated adaptation to aerobic training” (Gonaus & Müller, 2012).

Physical Performance Aspects of Handball

The study stated that skill tests are more sensitive in identifying elite athletes (Matthys et al., 2013). One of the reasons and suggestions that these researchers point out is that a sport such as a handball is an open skill and has a high cognitive skill requirement. The researchers also proposed that elite ball athletes have a better understanding of playing games and solving problems. Based on the data, specific skill performance battery tests should be generated to be able to distinguish between elite and non-elite athletes (Matthys et al., 2013).

Physical Performance Aspects of Rugby

Researchers declared that late maturity could be one of the hallmarks of high potential for professional career attainment. They also stated that high VO2 max capacity; specifically achieving high aerobic capacity at a young age can play a major role in achieving future career attainment (Till et al., 2017a).

Multidisciplinary Approach to the Selection of Young Players

A most important question for childhood/adolescents is whether there is a sensitive period for the training program at the different physical fitness components. As a team sport, players from the same team can differ considerably in anthropometric and physical performance due to their individual pace of development. The issue of physical growth and physical maturity is considered here, which will drive changes in indicators of developmental factors (Deprez et al., 2015). Some researchers have shown that physical growth and physical fitness characteristics change as a child grows and as a result aerobic, anaerobic, strength, endurance, speed, agility, and flexibility change reciprocally (Gonaus & Müller, 2012; Leyhr et al., 2018; Till et al., 2017a). Therefore, children are often grouped into several categories in terms of maturity and growth. Some children enter puberty early, some reach puberty at the expected time, and finally, children have late puberty. Thus, their growth tempo has a distinctive rhythm, time, and intensity and varies in all and affects the level of performance (Marshall & Tanner, 1969). Consequently, late-maturing boys appear to be systematically excluded from many team sports. For team sports, children with the same age categories, but with different biological ages should have specific training implemented at a particular maturational stage that is, before, during, or after peak height velocity. Generally, Maximal factors such as muscular strength and power occur, after closer to peak weight velocity (Deprez et al., 2015; Fragoso et al., 2015). Identifying children as talent-trainable during adolescence is complex and should be noted. Physical performance improvement continued after peak height velocity, probably reflecting differential timing of growth in muscle mass and performance perhaps the influence of training. Information with regard to the maturity status of children suggests that early maturation correlates positively with physical performance (Heilmann, Memmert, Weinberg, & Lautenbach, 2022; Malina et al., 2000). Hence, children with advanced maturity are structurally and functionally more advanced. Therefore, for talent identification and development, trainers and coaches should be aware of the characteristics of the adolescent growth spurt and recognize that changes in growth and performance at this time are highly individualized. On the other hand, some studies had declared that the general battery tests are not enough sensitive to indicate between good and very good athletes (Ronnie Lidor, Falk, Arnon, & Cohen, 2005; Williams & Reilly, 2000). Therefore, the authors of this particular study proposed that a new specific, open-skill test should be conducted to recognize elite athletes (Ronnie Lidor et al., 2005). Some sports such as soccer, handball, and rugby are not closed-skill sports; instead, they are open-skill sports that in each second of the game the players should determine the best choice for success. Therefore, the talent identification battery test should have this quality to distinguish children's competence and capability (Ronnie Lidor et al., 2005; Roescher et al., 2010). In total, the studies mentioned that the general physical performance battery test couldn't distinguish between elite and non-elite athletes. It has been suggested that a specific skill test should be conducted on the recognition between athletes because general tests are not sensitive and corrective enough (Ronnie Lidor et al., 2005; Roescher et al., 2010). Therefore, concerning the abovementioned information, there is a huge gap between the physical fitness test and what the researchers looking for. Due to this, the researchers need to have longitudinal predictive studies to establish a new physical fitness test related to the demands of each specific sport.

Conclusions

There are few studies on the relationship between physical performance in adolescence and later success as an elite adult athlete. The published studies included only ball sports and none included women. The risk of bias in this type of study with open cohorts is substantial. It cannot be said that physical fitness tests may or may not identify indicators of later performance differences or success in elite sports in children/adolescents.

Strength and limitations

One of the strengths of the present study was the longitudinal examination of physical performance factors in adolescent athletes. To date, no article has published a longitudinal study of all ball sports. Although this systematic review without meta-analysis is the first comprehensive synthesis of existing work on predictors of talent in sports, it is not without limitations. One of the major weaknesses is the inclusion and exclusion of ball sports items that were listed in the Table and Appendix (questionnaire assessment, mental ability). Moreover, the present qualitative synthesis primarily lacks a sufficient number of studies and similar results.

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The Authors declare no conflict of interest

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