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INDICADORES MULTIDIMENSIONAIS PARA IDENTIFICAÇÃO E SELEÇÃO DE JOVENS FUTEBOLISTAS. Projeto INEX.

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Dissertação apresentada com vista à obtenção do 2º ciclo em Treino Desportivo, especialização em Treino de Jovens, da Faculdade de Desporto da Universidade do Porto, ao abrigo do Decreto-Lei nº 74/2006, de 24 de março, na redação dada pelo Decreto-Lei nº 65/2018 de 16 de agosto.

Orientador: Professor Doutor Daniel Barreira

Coorientador: Mestre Rafael Toshio Bagatin

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Palavras-chave: MATURAÇÃO BIOLÓGICA; DESEMPENHO TÁTICO; DESEMPENHO TÉCNICO; DESEMPENHO FÍSICO; FUTEBOL.

FINANCIAMENTO

Este trabalho realizou-se no Centro de Investigação, Formação, Inovação e Investigação em Desporto (CIFI^{2}D) da Faculdade de Desporto da Universidade do Porto, Portugal, estando inserido no âmbito do Projeto INEX - Em busca da excelência no desporto: Um estudo longitudinal-misto em jovens atletas, com o apoio do Instituto Português do Desporto e Juventude I.P. (IPDJ) e o Comité Olímpico de Portugal (COP).

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Sobre o percurso acadêmico que vem a findar, sobre os percalços que nos fortalecem e fazem valorizar todo o processo digo:

“Valeu a pena? Tudo vale a pena, se a alma não é pequena [...]” (Fernando Pessoa).

Certamente vale. A busca desde criança por respostas, as constantes indagações, as pesquisas variadas que iam desde Antigas Civilizações até Ídolos do Futebol, FUTEBOL... DESPORTO... PAIXÃO.... Buscar conhecimento constante, atualizar-se, ler, pesquisar, divertir-se, estressar-se, uma vasta coletânea de verbos... Para constatar, a alma não é pequena e continua sedenta por conhecimento.

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“A família não nasce pronta; constrói-se aos poucos e é o melhor laboratório do amor. Em casa, entre pais e filhos, pode-se aprender a amar, ter respeito, fé solidariedade, companheirismo e outros sentimentos.” (Luís Fernando Veríssimo).

Aos meus amigos, as pessoas próximas e amadas, que participaram direta ou indiretamente deste ciclo de estudos, que me acompanharam e estenderam a mão, que me acolheram, me abraçaram e beijaram, cobraram e incentivaram posso dizer:

"Benditos sejam os amigos que acreditam na tua verdade ou te apontam a realidade. Porque amigo é a direção. Amigo é a base quando falta o chão!" (Machado de Assis).

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RESUMO

A presente dissertação verificou os processos de identificação e seleção futebolistas, bem como os efeitos da maturação biológica sobre a antropometria, desempenho físico e técnico, e no conhecimento tático processual. Primeiramente, 53 estudos científicos relacionados com processos de identificação e seleção de futebolistas foram contabilizados e classificados de acordo com autores, amostra, objetivos, dimensão e resultados. Consideraram-se apenas os estudos empíricos, obtendo-se que a concentração das publicações se dá e no continente europeu, tendo como variáveis mais exploradas a maturação, antropometria, aptidão física, idade relativa e idade cronológica. Entretanto, estudos envolvendo variáveis táticas foram escassos. Seguidamente, dados antropométricos, maturacionais, físicos, técnicos e táticos foram recolhidos de 84 jovens futebolistas portugueses. Os jogadores foram divididos em três grupos maturacionais (Pré-PVA, PVA, Pós-PVA) e, posteriormente, averiguaram-se as diferenças entre os grupos, a correlação entre variáveis e quais são as características que melhor explicam o desempenho no Índice de Performance Tático em Jogo. Os resultados demonstram que os atletas Pós-PVA eram mais altos, pesados, com melhor desempenho físico e técnico em relação aos Pré-PVA e PVA, entretanto sem relação com variáveis táticas. Já as correlações foram fortes-moderadas entre maturação, antropometria, salto horizontal, passe 35 metros e condução de bola, mas sem associação com as variáveis táticas. Utilizou-se a regressão logística linear, que evidenciou que o IPT ofensivo e o % de acerto são as variáveis que melhor explicam um alto desempenho no IPT Jogo. Conclui-se que as variáveis táticas sofreram pouca ou nenhuma influência do estado maturacional. Em contrapartida, a maturação influi positivamente na antropometria, aptidão física e variáveis técnicas de jovens futebolistas. Sugere-se que nas ações práticas observe-se as características individuais de desenvolvimento humano e crie-se, sobretudo, estratégias de verificação do desempenho tático.

Palavras-chave: MATURAÇÃO BIOLÓGICA; DESEMPENHO TÁTICO; DESEMPENHO TÉCNICO; DESEMPENHO FÍSICO; FUTEBOL.

ABSTRACT

This dissertation verified the processes of identification and selection of soccer's, as well as the effects of biological maturation on anthropometry, physical and technical performance, and on procedural tactical knowledge. First, 53 scientific studies related to the identification and selection of soccer's were recorded and classified according to authors, sample, objectives, dimension, and results**.** Only empirical studies were considered, obtaining that the concentration of publications occurs and in the European continent, with the most explored variables being maturation, anthropometry, physical fitness, relative age, and chronological age. However, studies involving tactical variables were scarce. Then, anthropometric, maturational, physical, technical skills and tactical data were collected from 84 young Portuguese soccer players. The players were divided into three maturation groups (Pre-PHV, PHV, Post-PHV) and, later, verified the differences between the groups, the correlation between the variables and which characteristics better explain the performance in the Game Tactical Performance Index. The results demonstrate that Post-PHV athletes were taller, heavier, with better physical and technical performance in relation to Pre-PHV and PHV, however unrelated to tactical variables. The correlations were strong-moderate between maturation, anthropometry, horizontal jump, pass 35 meters and ball driving, but without association with tactical variables. Linear logistic regression was used, which showed that the offensive TPI and the % accuracy are the variables that best explain a high performance in the TPI Game. It is concluded that the tactical variables suffered little or no influence from the maturational state. On the other hand, maturation has a positive influence on anthropometry, physical fitness, and technical variables of young soccer's. It is suggested that in practical actions, the individual characteristics of human development are observed and strategies to verify tactical performance are created.

Keywords: BIOLOGICAL MATURATION; TACTICAL PERFORMANCE; TECHNICAL PERFORMANCE; PHYSICAL PERFORMANCE; SOCCER.

LISTA DE ABREVIATURAS

Abreviatura	Nome
Cm	Centímetros
CMJ	*Counter Movement Jump*
FUT-SAT	Sistema de Avaliação Tática no Futebol
GPS	Sistema de Posicionamento Global
IMC	Índice de Massa Corporal
INEX	*In Search of Excellence in Sport*
IPT	Índice de Performance Tática
Kg	Quilogramas
KTK	*Körperkoordination Test für Kinder*
M	Metros
Pré-PVA	Estado maturacional atrasado
PVA	Pico de Velocidade da Altura
Pós-PVA	Estado maturacional avançado
S	Segundos
SJ	*Squat Jump*
T20	*Sprint* 20 metros
35m	Passe para 35 metros
% acerto	Percentual de Acerto

Capítulo I – Introdução Geral

1. Introdução Geral

1.1 Identificação e seleção de talentos desportivos.

A definição de talento assume-se complexa. A literatura refere que talento reflete um melhor desempenho em pré-requisitos para inclusão de um atleta em determinado desporto, que apresenta melhor capacidade de execução de tarefas específicas, com certa predisposição genética e alta performance em uma prática intensiva (Matthys et al., 2011; Mohamed et al., 2009; Sieghartsleitner, Zuber, Zibung, & Conzelmann, 2019; Till, Cobley, O'Hara, Cooke, & Chapman, 2014).

Böhme (1994) ressalta as situações ambientais e os estímulos gerados junto ao indivíduo. Nesse caso, as influências sociais e situacionais proporcionam um processo de encorajamento para ações motoras mais desenvolvidas. Como consequência, o processo desportivo deve ser analisado e respeitado considerando-se o indivíduo na sua totalidade (visão holística), as condições internas próprias (indiretas ou indiretas) ao desempenho desportivo e se associando às condições pessoais e sociais do indivíduo (Araújo & Davids, 2011; Davids & Araújo, 2019; Till & Baker, 2020; Williams & Reilly, 2000). Para além disso, ressaltam-se as condições e a qualidade do processo de formação e treino, devendo ser condizentes aos indivíduos ali inseridos (Till & Baker, 2020).

Identificar talentos refere-se, segundo Mohamed et al. (2009) e Till e Baker (2020), à descoberta de indivíduos que possam apresentar potencial de desempenho, sendo que em vezes não apresentam envolvimento com um desporto específico. É também o processo de reconhecer nos desportistas já praticantes aqueles que possam chegar ao nível de elite.

A busca por futuros desportistas de elite envolve grandes recursos financeiros e, geralmente, aspetos que possam descrever qualidades fisiológicas, morfológicas, sociológicas, psicológicas, técnicas e táticas (Höner, Votteler, Schmid, Schultz, & Roth, 2015; Vaeyens, Philippaerts, & Malina, 2005; Vaeyens et al., 2006; Wilson et al., 2016; Williams & Reilly, 2000).

Os programas de identificação e desenvolvimento de talentos têm como objetivo perceber variáveis fundamentais para distinguir atletas de elite e sub-elite fornecendo modelos contínuos de avaliação objetiva dos processos de treino e competição (Reilly, Williams, Nevill, & Franks, 2000; Vaeyens et al., 2006;). Geralmente, estes programas ocorrem em um período denominado por adolescência, que é marcado por alterações a nível maturacional e de crescimento, e em que prevalecem processos de especialização desportiva (Coutinho, Mesquita, & Fonseca, 2016). Mesmo sendo um processo de amplo interesse (Pankhurst & Collins, 2013) e com possíveis lucros financeiros, existe uma certa restrição para o uso de abordagens científicas e de protocolos quantitativos específicos para a avaliação de jovens atletas (Vaeyens et al., 2006; Vaeyens, Gülich, Warr, & Philippaerts, 2009; Wilson et al., 2016).

Torna-se importante evidenciar que muitos indivíduos são excluídos dos processos de desenvolvimento de talentos e não são claros os motivos. Algumas possibilidades estão relacionadas, por exemplo, com lesões, o estado maturacional e fatores psicológicos (Steidl-Müller, Hildebrandt, Raschner, & Müller, 2019; Till & Baker, 2020). Deste modo, uma abordagem multivariada do processo de identificação de talentos pode ser uma opção mais condizente com a atual conjuntura do desporto (Coutinho et al., 2016; Sieghartsleitner et al., 2019; Tribolet, Bennett, Watsford, & Fransen, 2018; Vandendriessche et al., 2012). Esta análise, que se associa a uma funcionalidade individual, parece contribuir para um desenvolvimento condizente e justo junto do jovem atleta, aparentando um potencial futuro atlético mais bem-sucedido (Davids, & Araújo, 2019; Wormhoudt, Savelsbergh, Teunissen, & Davids, 2017).

A combinação de avaliações objetivas e de diferentes variáveis apresenta ser um caminho interessante. Um processo de identificação, seleção e desenvolvimento de talentos que passe por uma busca integrada multidimensional faz com que se percebam características combinadas de aptidão física, técnica e percetivo-cognitiva nos possíveis futuros atletas de elite (Deprez et al., 2015a, 2016b; Matthys et al., 2011; Till & Baker, 2020; Tribolet et al., 2018). Assim o sucesso do desenvolvimento de jovens atletas passa por proporcionar comportamentos adaptativos que serão utilizados em uma vasta

variedade de contextos de treino e competição (Araújo & Davids, 2011; Wormhoudt et al., 2017).

É percetível a evolução de estudos científicos e programas de identificação e desenvolvimento de talentos com base nos múltiplos fatores do desporto (Reilly et al., 2000). Precisamente no futebol, as avaliações buscam respostas que possam melhor nortear as equipas para as variáveis antropométricas (Malina, Reyes, Eisenmann, Horta, Rodrigues, & Miller, 2000), maturacionais (Malina et al., 2012), físicas (Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004), técnicas (Malina et al., 2005) e táticas (Borges et al., 2018; Reis & Almeida, 2020).

1.2 Variáveis, instrumentos e suas relações com os processos de identificação e seleção de talentos.

Ao longo dos anos a literatura específica vem referindo a eminente relação entre capacidades físicas, dados antropométricos e desempenho técnico nos desportos em geral (Malina et al., 1988). Mais recentemente, a inclusão do aspeto tático, ganha relevância e vem fazendo parte dos processos de análise de jovens atletas (Borges et al., 2018; Reis & Almeida, 2020).

No âmbito da ciência humana e do desporto os cientistas vêm observando o processo de variação do crescimento e maturação, com atenção por exemplo para as atividades enzimáticas e de regulação neuro endócrina. Essas relações podem ser expressas mediante curvas gráficas e que se originam de procedimentos matemáticos ou por observação direta com os envolvidos nas pesquisas (Granados, Gebremariam, & Lee, 2015; Malina, Bouchard, & Beunen, 1988; Round, Jones, Honour, & Nevill, 1999; Valente-dos-Santos et al., 2012).

Outra perspetiva que vem ocupando uma das lacunas do treino desportivo são as relações envolvendo crescimento, maturação e programas de identificação e desenvolvimento de jovens talentos (Myburgh et al., 2016; Pankhurst & Collins, 2013). Procedimentos de estimativa corporal baseados em modelos adultos vêm sendo discutidos e substituídos desde as últimas décadas do Século XX e se estendendo com atualizações constantes para os anos 2000

(Kozieł & Malina, 2017; Malina & Kozieł, 2014; Malina et al., 1988; Mirwald, Baxter-Jones, Bailey, & Beunen, 2002; Round et al., 1999).

É importante salientar as considerações sobre as diferenças individuais para a maturação e sua influência durante o percurso do jovem atleta no contexto do treino desportivo (Baxter-Jones & Maffulli, 2002; Murtagh et al., 2018). A maturação é particular a cada indivíduo, sendo que estes amadurecem de maneiras distintas, mas todos os indivíduos alcançam o estado maturacional completo. A maturação refere-se ao progresso biológico individual (Baxter-Jones & Maffulli, 2002; Corso, 2018).

Os estudos acerca deste tema, por vezes, controlam o efeito da maturação para as características físicas, antropométricas e desempenho técnico/tático com a finalidade de identificar diferenças na performance desportiva (Asadi, Ramirez-Campillo, Arazi, & Villarreal, 2018; Borges et al., 2018; Buchheit & Mendez-Villanueva; 2013; Carvalho, Lekue, Gil, & Bidaurrazaga-Letona, 2017; Cripps, Joyce, Woods, & Hopper, 2017; Deprez et al., 2015a; Malina et al., 2005; Müller et al. 2017; Reis & Almeida, 2020; Round et al., 1999; Rubajczyk, Świerzko, & Rokita, 2017).

Durante a transição da infância para adolescência, principalmente quando relacionado ao desporto e atividades competitivas, as características individuais podem ser potenciais fatores para seleção dos indivíduos e, consequentemente, seu desenvolvimento e nível competitivo em que se enquadrarão (Cripps, Hopper, Joyce, & Veale, 2015; Deprez et al., 2015a; Malina et al., 2005; Myburgh et al., 2016; Pankhurst & Collins, 2013; te Wierike, Elferink-Gemser, Tromp, Vaeyens, & Visscher, 2015). Por exemplo, ao considerar a maturação biológica, os indivíduos avançados (Pós-PVA) ou dentro do previsto (PVA) apresentam vantagens corporais, de aptidão física, incluindo potência aeróbia, força muscular, potência geral, resistência e velocidade quando comparado com aqueles com maturação tardia (Pré-PVA) (Asadi et al., 2018; Borges et al., 2018; Cripps et al., 2017; Deprez et al., 2015a; Gastin & Bennett, 2014; Malina et al., 2005, 2006; Meyers et al., 2015; te Wierike, 2015; Till, Cobley, O'Hara, Chapman, & Cooke, 2013).

A maturação biológica pode ser classificada por diferentes termos. De acordo com Malina et al. (2005, 2006), o estado maturacional refere-se ao processo maturacional individual com base num ponto do tempo, podendo ser: idade esquelética, relação da percentagem da altura adulta e idade cronológica, período anterior e posterior a menarca nas mulheres e estágios pré-puberal, puberal e pós-puberal (com base na idade do pico de velocidade da altura, PVA) em jovens de mesma idade cronológica. A puberdade é um período que envolve rápidas mudanças em vários aspetos individuais, sendo eles hormonais psicológicos e físicos (Malina et al., 1988; Erlandson et al., 2011; John et al., 2019; Khairullah et al., 2013; Sherar et al., 2009).

Nos desportos de invasão o contacto físico é constante e faz-se necessário, além claro da aptidão física geral, para vencer duelos individuais e coletivos. Isso ocorre muito em desportos como o basquetebol, futebol, futebol australiano, andebol, hóquei, esqui, judo e rúgbi (Cripps et al., 2017; Fukuda et al., 2018; Gastin & Bennett, 2014; Giudicelli, 2016; Kobal et al., 2016; Malina & Kozieł, 2014; Matthys et al., 2011; Sherar et al., 2007; Till et al., 2014; Vernillo et al., 2012). A força é intimamente relacionada ao ganho dos duelos, sendo que está ligada aos hormônios sexuais, particularmente a testosterona, e que tem seu desenvolvimento acentuado no período pubertário (Jorquera, Rodríguez, Torrealba, & Barrazaga, 2012; Deprez et al., 2015a; Granados et al., 2015; Khairullah et al., 2013; Malina et al., 1988; Meyers et al., 2016).

Mediante o estado maturacional podem guiar-se os jovens atletas e ajustar as cargas de treino individuais para reduzir risco de lesões e ampliar a performance desportiva (Jorquera et al., 2012; Corso, 2018; DiStefano et al., 2015; Ford et al., 2010; John et al., 2019; Myer et al., 2009; Read et al., 2018; Schmitz et al., 2009). Porém, é comum nos processos de seleção de talentos, a exclusão dos atletas Pré-PVA. Isto ocorre pelos indivíduos apresentarem desvantagens físicas que, numa avaliação preliminar, são fatores de inclusão (Borges et al., 2018; Carvalho, Lekue, Gil, & Bidaurrazaga-Letona, 2017; Coelho-e-Silva et al, 2012; Cripps et al., 2017; Gastin & Bennett, 2014; Malina et al., 2012; Pena-González et al., 2018; Rubajczyk et al., 2017; Sherar et al., 2007; Till & Jones, 2015; Vandendriessche et al., 2012).

Entretanto, Ostojic et al. (2014) concluiu de maneira divergente em relação ao estado maturacional e critérios de seleção. A análise foi de que à medida que o nível de desempenho competitivo aumentava os meninos classificados como Pré-PVA eram favorecidos em relação aos PVA e Pós-PVA.

Em um contexto competitivo não é só a aptidão física que atua para um melhor desempenho (Romann et al., 2017). As dimensões tático-técnicas e psicológicas também assumem um papel importante e, coincidentemente, não sofrem influência do estado maturacional no qual o indivíduo está inserido. A maturação precoce, a princípio, não é capaz de determinar um melhor desempenho tático em jogo (Borges et al., 2018; Reis & Almeida, 2020). Contudo, mesmo sabendo-se da importância tática para o desporto, poucos são os estudos envolvendo isto e os métodos de treino, crescimento corporal dos indivíduos e as possíveis vantagens/desvantagens associadas (Borges et al., 2018; Reis & Almeida, 2020).

Deste modo torna-se importante considerar que o desporto deve estar voltado, inicialmente, para a literacia motora (Coutinho et al., 2016; Savelsbergh, & Wormhoudt, 2018). Foca-se assim no indivíduo, nas suas necessidades e, consequentemente, os processos de seleção estariam alinhados nessas sugestões de prática. Habilidades motoras gerais e específicas, enquadradas com o desenvolvimento motor e cognitivo do indivíduo, são implementadas de forma a dar um suporte motor e cognitivo a ele, contribuindo assim para um atleta criativo e adaptativo a multi cenários, tarefas e ambientes (Davids, & Araújo, 2019; Savelsbergh, & Wormhoudt, 2018).

Uma das consequências da falta de atenção para o efeito da maturação é que os atletas selecionados por meio disto possuem, geralmente, melhores treinamentos, instrução por parte de técnicos com melhor qualificação e, consequentemente, preenchem as equipas de elite (Lloyd et al., 2014; 2015; Lovell et al., 2015; Müller et al., 2015). Torna-se importante considerar que os programas de identificação de talentos e predição para desenvolvimento contínuo em atletas é parte fulcral no desporto de alta performance (Cripps et al., 2015; Pacharoni et al., 2014; Simmons & Paul, 2001; Till & Baker, 2020). O contraste para tudo que foi exposto passa por um processo de identificação,

seleção e desenvolvimento de talentos com viés multidisciplinar (Carvalho et al., 2017; Coutinho et al., 2016; Kramer et al., 2017; Savelsbergh, & Wormhoudt, 2018; Till & Baker, 2020).

2. Objetivos

Tem-se como hipótese que a maturação biológica influencie as características antropométricas de jovens futebolistas e impacte no desempenho tático, técnico e físico**.**

2.1 Objetivo Geral

Investigar os efeitos da maturação biológica sobre a antropometria, desempenho físico, técnico e no conhecimento tático processual em jovens futebolistas.

2.2 Objetivos Específicos

I) Verificar, e II) comparar a antropometria, desempenho físico, técnico e tático de jovens futebolistas com diferentes estatutos maturacionais; III) Estimar as contribuições das variáveis antropométricas, maturacional, físicas, técnicas e táticas no Índice de Performance Tática em Jogo (IPT Jogo).

3. Estrutura da Dissertação

A presente dissertação baseia-se na teoria dedutiva, enquadrando-se no paradigma positivista. Caracteriza-se por uma pesquisa básica, de natureza experimental, com uma abordagem quantitativa analítica. Quanto aos objetivos, apresenta um cunho explicativo, com procedimento técnico laboratorial, e, em relação ao desenvolvimento no tempo, assume-se como transversal (Fontelles et al., 2009; Nedel & Silveira, 2016; Viveiros et al., 2015).

A tese encontra-se dividida em:

I) **Introdução geral**: apresentação do tema em estudo baseado numa revisão da literatura, definição do problema de estudo e respetivos objetivos, e apresentação da estrutura do trabalho.

II) **Estudos de Investigação**:

1. Estudo 1: Os métodos de identificação e seleção de futebolistas: uma revisão sistemática.
2. Estudo 2: Seleção de jovens futebolistas mediante uma abordagem multivariada. Projeto INEX.

III) **Discussão Geral**: Apresentação e discussão dos dois estudos realizados com o conhecimento emergente na literatura científica.

IV) **Conclusões**: Apresentação das principais conclusões dos trabalhos desenvolvidos, bem como as possíveis aplicações práticas, limitações e proposta de linhas de investigação.

V) **Referências**: Lista das obras utilizadas no decorrer da elaboração da dissertação.

Capítulo II – Estudos de Investigação

1. Estudo 1

Submetido

Journal: Research Quarterly for Exercise and Sport.

Title: Talent identification and selection in soccer: A systematic review.

Running Title: Review about methods to identify soccer talents.

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ABSTRACT

The methods used to identify and select talented soccer players have been widely studied in the scientific community as it depends on a set of factors whose interaction influences a particular individual to achieve high performances. Conduct a systematic review of published articles with meta-analysis guidelines (PRISMA). The search was performed on the SPORTDiscus and PubMed database using the keywords: “talent identification in sports”, associated with the terms “soccer”, “maturity”, “effect of relative age” and “peak speed in height”. 53 articles were classified according to the sample, objectives, dimension, procedures, and results. The results showed that mainly focused researches originated in Europe (87%), with emphasis on Spain (19%). There has been an increase of 77% in publications in the last decade since 2015. Most participants were young soccer players, whose goals and dimensions were related to the topics of maturation (38%) and the effect of relative age (32%). Anthropometry (53%) and physical tests (49%) have been widely explored, in contrast to the cognition (11%) and tactic (4%) domains. It concludes that there is a momentary physical advantage for athletes born in the first months of the year and in an advanced maturational state. It is suggested that these aspects are better mediated, since this sporting advantage is still a major factor in the criteria for selection and sports success and, therefore, an integrated and varied approach that considers the multiple aspects of this sport is important.

Keywords: Talent identification in Soccer; Maturation; Relative Age Effect; Peak height velocity.

Introduction

The identification and selection of talents seems a transversal assignment in different sports, with more relevance in the recent years (Costa et al., 2009; Deprez et al., 2015a; Vandendriessche et al., 2012). The continuous emergence of novel scientific knowledge, as well as the investment of sports organizations confirms the great importance of this topic.

The complexity of the definition of talent in sport results from the convergence of several variables, namely the best performance in sports' prerequisites and the ability to perform specific tasks in relation to a certain genetic predisposition and high response in an intensive practice (McCunn, Weston, Hill, Johnston, & Gibson, 2017; Mohamed et al., 2009; Sieghartsleitner, Zuber, Zibung, & Conzelmann, 2019; Till, Kevin, & Jones, 2014).

In soccer, the processes of identifying talents involves recognizing and setting expectations on the talented players, to provide earlier better contexts for players' development, consequently increasing the likelihood of achieving better performances in the future (Fenner, Iga, & Unnithan, 2016; Höner, & Votteler, 2016; Murtagh et al., 2018; Rommers et al., 2019). These processes are applied to all ages, youth, and senior players, including the ones that are already experienced practitioners and can still reach the elite level (Müller, Gehmaier, Gonaus, Raschner, & Müller, 2018).

Nevertheless, most studies about talent identification in soccer have been performed in youth players, as it is a period of human life marked by acute hormonal and physiological transitions that, in turn, determine morphological maturation (Malina, Coelho-e-Silva, Figueiredo, Carling, & Beunen, 2012; Menegassi et al., 2017; Murtagh et al., 2018; Vandendriessche et al., 2012). The processes of identification and selection is mostly based on the maturational state of the players (Cumming et al., 2018; Romann, Lüdin, & Born, 2020). Thus, processes regarding talent identification and selection programs during adolescence include remarkable variables, such as biological maturation and physical growth that are considered the main confounders for predicting future performances (Vandendriessche et al., 2012). Considering the prominent

transitory aspects of adolescence, scientific studies highlight the variables related to maturation and the relative age effect (RAE) (Gil et al., 2014; Malina et al., 2012), the both factors that have presented implications for sports performance at the physical, technical, tactical, cognitive, and psychological levels (Carvalho, Lekue, Gil, & Bidaurrazaga-Letona, 2017; Höner, & Feichtinger, 2016; Romann, Javet, & Fuchslocher, 2017).

Maturation is understood as the individual process of hormonal and physiological changes that stimulate muscle growth and strength of the players (Deprez et al., 2015a; Malina et al., 2012; Menegassi et al., 2017). Through the emergence of puberty and the peak of growth, the stimuli that players receive are varied and can manifest themselves at different times in the natural process of human growth and development (Buchheit & Mendez-Villanueva, 2014; Malina et al., 2012). Individuals who have advanced maturation for their age group have increases in speed, resistance and power compared to those who are in a late or normal stage. So, maturation impacts the processes of talent identification, thus favouring those who have an advanced maturational status (Cumming et al., 2017; Malina et al., 2019; Till & Baker, 2020). These processes become complex due to the performance and future sporting success being determined by multidimensional variables (Bidaurrazaga-Letona, Lekue, Amado, Santos-Concejero, & Gil, 2015; Höner & Feichtinger, 2016; Romann & Fuchslocher, 2016). Regarding the methods most frequently used to assess the maturational state of the players, specific literature categorizes them as invasive and non-invasive. Both seek to establish relationships with programs for the identification and selection of talented athletes (Malina et al., 2012). The most used indicators to measure the players' maturational state are: i) skeletal age, ii) secondary sexual characteristics, and iii) calculation of peak height velocity (PHV). The PHV is calculated by recording the current age, height, sitting height, estimated leg size, weight, and interaction of these variables (Mirwald et al., 2002).

The variable relative age effect is also considered influential in the process of identification and selection of young soccer players. Generally, youth competitions in collective sports are organized through staggering in age groups, depending on the players' date of birth, making within each age category a great

diversity of chronological ages (Brustio et al., 2018; Buchheit & Mendez-Villanueva, 2014; Gil et al., 2014; Lovell et al., 2015). The understanding of relative age involves the clarity of the quartile of birth, i.e., players born longer are distinct even within the same chronological year and confer advantages for those who are born in the early quartiles regarding the natural process of growth and human development (Brustio et al., 2018; Mann & van Ginneken, 2017). The relative age effect also increases the possibility of selection by players born in the first months of the year (Mann & van Ginneken, 2017; Peña-Gonzalez, Fernández-Fernández, Moya-Ramón, & Cervelló, 2018).

It is understood that the effect of maturational status and relative age is present in various sports and at the highest competitive levels (Brustio et al., 2018; Müller et al., 2018). Individuals with an advanced maturational status and/or born in the first months of the year (relative age effect) have advantages in the selection processes for talent development programs (Cumming et al., 2017; Malina et al., 2019; Till & Baker, 2020). It is consensual that talent identification systems generally admit these confounding variables and, consequently, favour players born in the initial quartiles of the year and with an advanced maturational state (Cumming et al., 2017; Malina et al., 2019; Till & Baker, 2020).

However, recently emerged a new proposal for the escalation of athletes, in addition to chronological age, named as bio-banding. This is applied to youth players (11 to 15 years-old), that are grouped based on the maturational indicator percentage of the expected adult height at the time of observation (Malina et al., 2019). Studies showed that athletes with late maturation participate more, and more actively, in this type of escalation than in the conventional. Some showed that bio-banding can be a more coherent way of organizing training levels, since technical, tactical, and psychological skills are emphasized (Abbott, Williams, Brickley, & Smeeton, 2019; Cumming et al., 2018; Romann et al., 2020), but in some cases the effect of biological maturation remains noticeable (Giudicelli et al., 2020).

Considering the items and subjects above introduced, it was perceived the need to review published articles over the last decade, to identify, organize and integrate the emerging patterns of recent works focusing on the methods used to identify and select young talented soccer players. For this, the present systematic review aimed to (i) compile data about the processes of identification and selection of soccer players; (ii) identify which samples, objectives, dimensions, and procedures were most applied; and to (iii) organize the knowledge promoted by the analysed researches over 2009-2019.

Methods

Search strategies

PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-analyses) (Moher et al., 2000) were followed.

The search was conducted in May 2020, and the following databases were consulted: SPORTDiscus and PubMed, as in Sarmento et al. (2014; 2018). To search for documents that corresponded to the subject under study, the following research equations were used: talent identification in sports AND soccer; talent identification in sports AND maturity; talent identification in sports AND relative age effect; and talent identification in sports AND peak height velocity. The terms were combined through the Boolean operator "and".

Eligibility criteria

Studies fulfilling the following criteria were included: (a) empirical and original articles indexed in SPORTDiscus and PubMed with peer review; (b) publications between 2009 and 2019; (c) papers written in Portuguese, English or Spanish; (d) texts published in full; (e) studies on the following topics: maturation, relative age effect, young athletes and/or talent identification/selection programs; (f) focused on soccer; (g) included soccer's and/or sports professionals directly linked to talent identification and selection processes.

The studies with the following conditions were excluded: (a) critical articles/opinion, abstracts, reviews, theoretical essays, monographs, dissertations, theses, chapters or books (with no peer review); (b) research including other sports than soccer; (c) absence of any of the terms above referred in the title or abstract; (d) articles that did not fit the objective of this study.

Data extraction

Considering the first search 759 papers were found, which according to the keywords and predefined combinations, were listed as follows: 429 (talent identification in sports); 192 (talent identification in sports AND maturity); 93 (talent identification in sports AND relative age effect); and 45 (talent identification in sports AND peak height velocity). After a preliminary analysis, 71 studies were selected, and excluding the duplicates and applying the exclusion criteria, 53 articles were considered for this study (Figure 1).

Afterwards reading the full 53 articles included, all selected studies were tabulated and quantified through tables constructed in MS Word and MS Excel (Microsoft Office, 2010). For this, each study was initially subdivided into 3 categories: (i) author(s) and year; (ii) sample country; and (iii) methods used, and the 53 researches were subsequently subdivided into 7 categories: (i) author(s); (ii) profile and sample number; (iii) objectives; (iv) dimension; (v) instruments; (vi) procedures; and (vii) results.

Reliability

We sought to identify the agreement of the searches and selections of the studies using the PRISMA methodology, in addition to the framing of the classifications generated through the tables developed in MS Word and MS Excel (Microsoft Office, 2010).

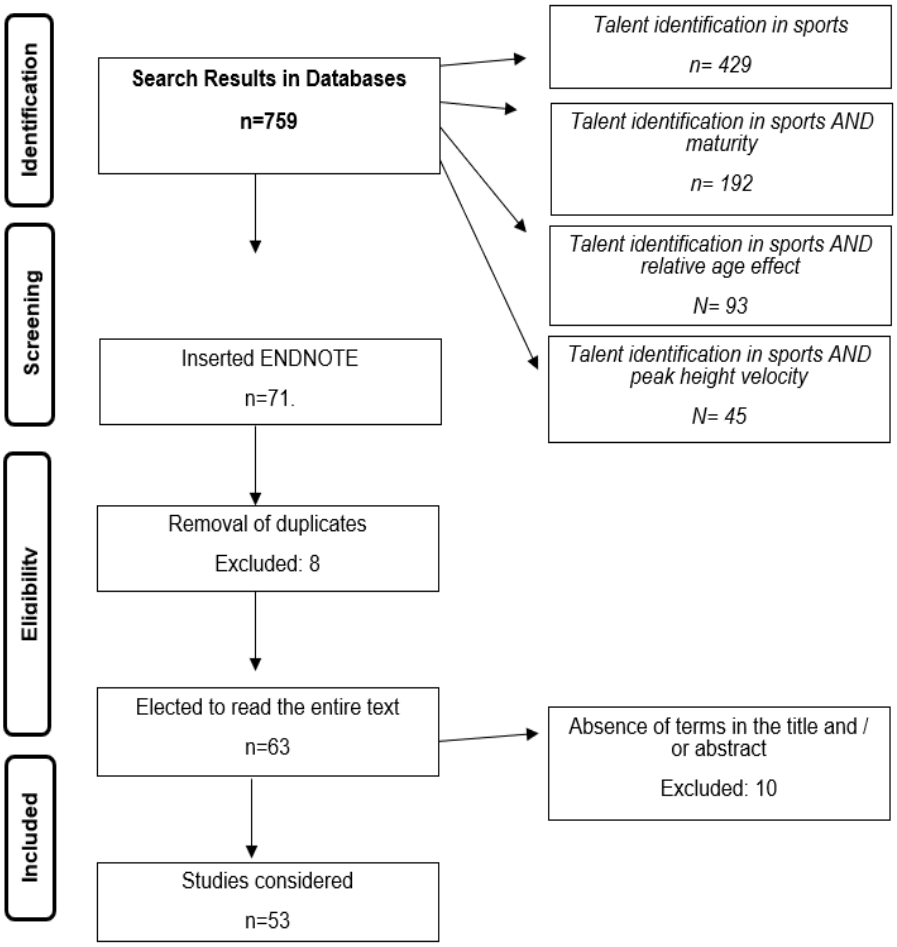


Figure 1. Flowchart with the included studies using the PRISMA method.

Results

Next, the studies considered among this systematic review will be presented in their characteristics and results and taking in consideration the variables: a) year of publication; b) country of origin of the sample; c) characteristics of the sample; d) objectives and dimensions; e) variables and procedures; and f) results (consult Table 1 in the end of the results section).

a) Year of publication

There is an increase in the number of studies from 2015 (77%) (Figure 2). In particular, the years 2017, 2018 and 2019 show the highest number of

published studies (9 in each year). Before 2015 only 12 studies were considered, performing a total of 23% of all publications in the period 2009-2019.

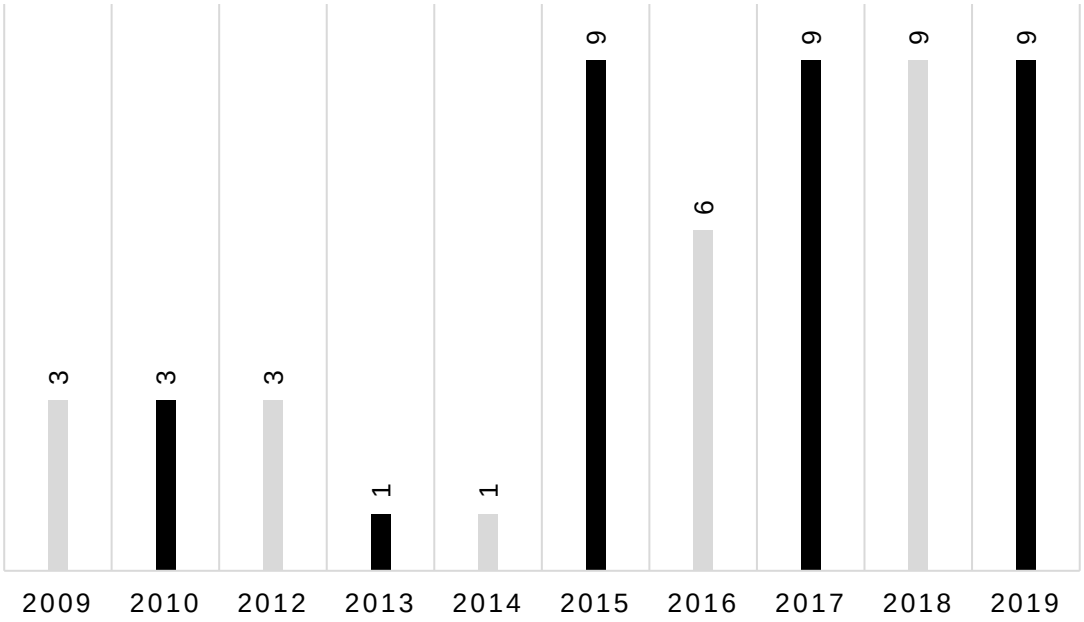


Figure 2. Studies considered and stratified according to their year of publication.

b) Country of origin of the sample

In regards of the 53 selected publications, Spain stands out for the number of publications (10), representing 19% of the total. United Kingdom (8) and Germany (5) are next. With the same number of publications, Belgium (4) and Switzerland (4). Then, Croatia (3), Portugal (3), Brazil (2), Greece (2), Netherlands (2) and Italy (2). With only one publication, appear Argentina, Austria, Australia, Finland, Iran, Poland, Qatar, and Czech Republic, which together (8).

Apparently, there is a geographical discrepancy in relation to publications. When publications by continents are considered, there is a greater concentration of studies for Europe (n = 47, 87%). Next is America (n = 3, 6%) and Asia (n = 2, 4%). Oceania represents 3% of publications, however Africa does not present studies on the subject linked to this systematic review (Figure 3).

Institutions, researchers, and science promotion are more concentrated in the countries of Europe (Figure 3). Public policies and financial incentives act

directly in this proportionality. In our opinion, this issue is of global interest, therefore, a more equal investment of incentives and research is recommended for all continents.

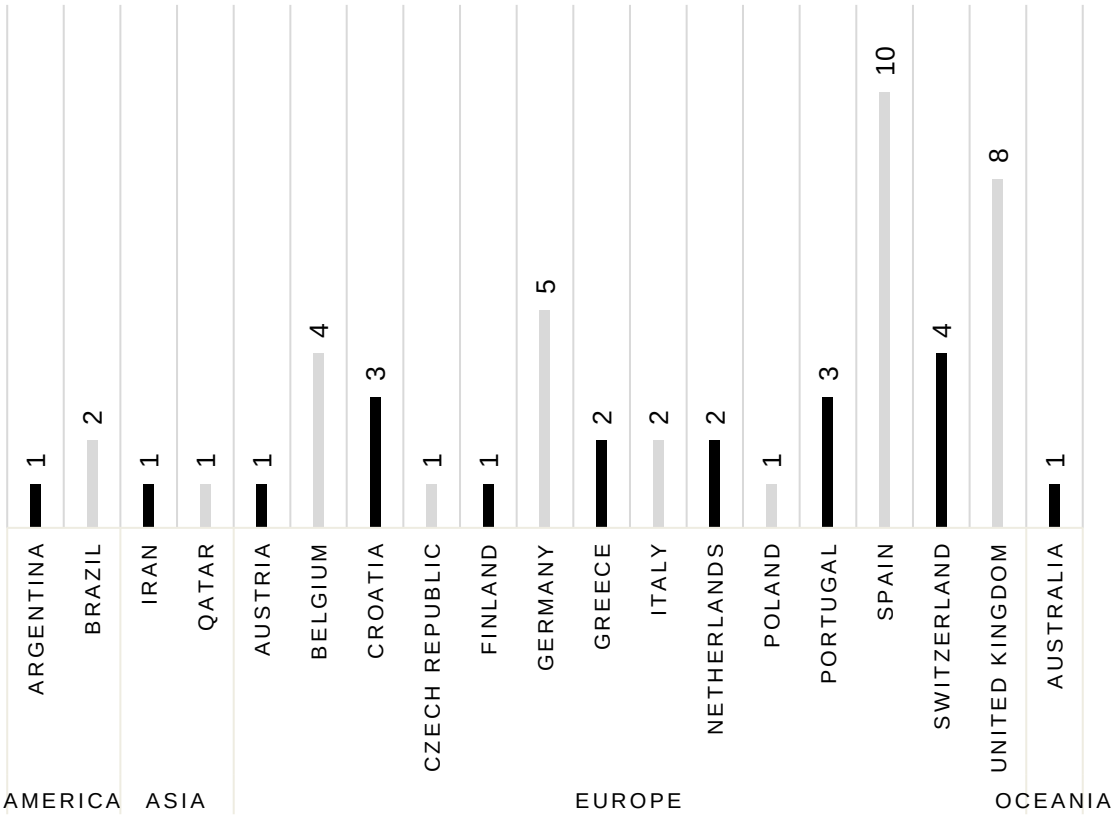


Figure 3. Total publications related to the topic of identification and selection of soccer players by country and continent.

c) Sample characteristics

Here we categorized the studies according to their sample size:

(i) 7 studies surpassed 2000 athletes analysed: Höner and Votteler (2016) with 22843; Höner, Leyhr, and Kelava (2017) including 14178; Mujika et al. (2009) with 13519; Del Campo, Vicedo, Villora, and Jordan (2010) with 4193; Gonzalez Bertomeu (2018) analyzing 2985; Höner and Feichtinger (2016) containing 2677; and Brustio et al. (2018) with 2064 participants.

(ii) 5 studies analysed between 1000 and 2000 athletes, namely Lovell et al. (2015): 1212; Leyhr et al. (2018): 1134; Doyle and Bottomley

(2018): 1112; Práxedes, Moreno, García-González, Pizarro, and Del Villar (2017): 1098; and Costa et al. (2009): 1022 athletes.

(iii) 37 research with more than 30 and less than 1000 athletes included in the sample: González-Víllora et al. (2015): 841; Camões and Clemente (2017): 680; Rommers et al. (2019): 619; Peña-González et al. (2018): 564; Nikolaïdis (2012): 561; Deprez et al. (2015)(b): 356; Rodríguez-Lorenzo and Martin-Acero (2019): 334; Murtagh et al. (2018): 326; McCunn et al. (2017): 306; Costa et al. (2010): 300; Rubajczyk and Rokita (2018): 264; Müller et al. (2018): 222; Valente-dos-Santos et al. (2012): 135; Zuber, Zibung and Conzelmann (2015): 134; O'Connor, Larkin and Williams (2016): 127; Rađa et al. (2019): 119; Sieghartsleitner et al. (2019): 117; Castillo et al. (2019): 111; Francioni et al. (2016): 103; Bidaurrazaga-Letona et al. (2019): 94; Baláková, Boschek and Skalíková (2015): 91; Huijgen et al. (2015): 88; Buchheit and Mendez-Villanueva (2013): 80; Vandendriessche et al. (2012): 78; Gil et al. (2014): 64; Hendry et al. (2019): 63; Romann and Fuchslocher (2016): 63; Asadi et al. (2018): 60; James, Thake and Birch (2017): 60; Bidaurrazaga-Letona et al. (2015): 55; Cunha et al. (2017): 46; Hicheur et al. (2017): 46; Deprez et al. (2015)(a): 42; Sporiš et al. (2017): 37; Vänttinen, Blomqvist and Häkkinen (2010): 36; Goto, Morris, and Nevill, (2015): 34; Katis and Kellis (2009): 34 athletes.

(i) 4 studies have a sample of less than 30 individuals: Fenner, Iga and Unnithan (2016): 16; Mann and van Ginneken (2017): 25; Jukic et al. (2019): 23; and Scharfen and Memmert (2019): 15 athletes.

Regarding the type of sample, the studies gathered present distinctions regarding the level of competition (training up to seniors) and age, however, all participants are male soccer players. Therefore, 42 studies considered only young athletes. Studies involving young people and/or adults were 7. In addition to young people, 4 studies had the evaluation (direct or indirect) of soccer coaches and, according to their authors, were included in the sample.

d) Objectives and dimensions

The most presented objectives in the analysed studies were to analyse, evaluate, compare, determine, examine, and investigate aspects related to the identification and selection of young sports talents. Based on Sieghartsleitner et al. (2019) the studies were stratified by dimensions (Table 1). The most reported objectives were general motor performance (53%, n=28) and anthropometric (49%, n=26). Biological maturation was considered in 38% of studies (=20), relative age in 32% (n=17) and technical skills in 30% (n=16). The following areas represented 22% (n=12): cognitive with 11% (n=6), psychological with 7% (n=4), and tactics with 4% (n=2).

e) Variables and procedures

The variables, as well as the procedures, are closely and directly linked to the objectives and dimensions of the studies. Through them it is known which resources were used and how they were applied.

The variables were later grouped into dimensions and are associated with numerals (Table 1). The most used variables were chronological age (year), relative age (month), height, weight, body mass, PVA equation (Mirwald et al., 2002), psychological questionnaires, among others. These, in turn, are linked to field procedures (natural, synthetic grass or game context) or in lab (actions in a laboratory environment).

The tests, when studying underage athletes, were approved by the respective ethics committees, with the signing of the Declaration of Helsinki. They varied in several protocols, being carried out in a controlled environment (laboratory) and open environment (natural and / or synthetic grass fields).

f) Results

Studies have revealed which factors tend to influence the process of identifying and selecting athletes (Table 1).

The effects of maturation and / or relative age on the athletes' general performance, as well as the criteria for defining the selection and greater opportunities for young soccer's were listed in most articles (e.g. Costa et al. 2009; Mujika et al., 2009). Regarding maturation, studies have largely shown that it is strongly associated with the relative age effect (e.g. Asadi et al., 2018; Práxedes et al., 2017). Individuals born in the first months of the year seem to have an advanced maturation state and, consequently, physical advantages in relation to the others.

The relative age effect was present in a large part of the echelons and levels of soccer, thus showing that athletes categorized in quartiles 1 and 2 are favoured regarding the selection opportunities for talent development programs. Maturation was measured mainly by the non-invasive method proposed by Mirwald et al. (2002). Other proposals were presented, such as radiography of the left wrist and blood collection (checking hormone levels) (e.g. Romann and Fuchloscher, 2016; Vänttinen, Blomqvist, & Häkkinen, 2010). Invasive methods are more reliable but expose individuals (such as radiation). They can also generate ethical constraints and their high financial value prevents large-scale application.

Other aspects were studied and explored, such as the technical skills. Numerous variations of field and laboratory tests, battery of tests of general and specific motor coordination were applied to young soccer players (e.g. O'Connor, Larkin, & Williams, 2016; Leyhr et al., 2018). Together with these, but with less incidence, the tactical, cognitive, and psychological dimensions were also studied. Technical skills, tactics, and cognition little or almost nothing, were influenced by the maturational state.

In relation to cognition and tactical behaviours, small-sides games and simulated tests for decision making, response and memory related to the task were used (e.g. Katis & Kellis, 2009; Hicheur et al., 2017). In this case, it was shown that these are reliable and interesting tools to identify and select soccer's.

Also, but in a minority way, psychological dimensions were explored. Questionnaires sought to identify motivational profiles, socioenvironmental aspects that may affect athletes and the relationship between this and practice

over the years (e.g. Hendry et al., 2019; Zuber et al., 2015). Studies have shown that as the individual ages, the motivation has fallen, but athletes with greater social support and with intrinsic motivation are prone to sports success.

It was noticed that the anthropometric dimensions and general motor performance were widely valued and, in turn, are factors that can determine with greater incidence the possibility of success in the selection processes (e.g. Baláková, Boschek & Skalíková, 2015; Jukic et al., 2019). These dimensions were closely related to the maturation state and the relative age effect. However, such factors have not been able to greatly influence technical skills, tactics, and cognition.

The studies presented suggestions and solutions to sports professionals regarding a more coherent and fairer sports intervention. Statistical analysis with predictive power were in great demand and confirmed that certain batteries of physical tests, motors and technicians can assist coaches and scouts (e.g. Sieghartsleitner et al., 2019).

Table 1. Organization of the empirical studies between 2009-2019 considered in the systematic review, ordered by the year of publication.

AUTHORS	SAMPLE	AIM	DIMENSION	VARIABLES	RESULTS
Costa, Simim, Noce, Costa, Samulski, and Moraes (2009)	1022 adult players	Analyse and compare the existence of differences between semesters and data from the birth quarter.	Age.	Chronological age (years). Relative age (month).	Prevalence of athletes born at the beginning of the year in clubs.
Katis and Kellis (2009)	34 youth players	Examine the actions performed in small-sides games; examine such effects on physical-technical tests.	**1)** Coach assessment. **2)** General motor performance. **3)** Technical skills.	**1)** Small-sides games (3x3; 6x6). **2)** Yo-Yo Test; Horizontal jump; Agility; Sprint. **3)** Technical actions analysed by videos: Dribble; Launch.	The 3x3 games provide greater physical stimulation and technical improvement than 6x6.
Mujika, Vaeyens, Matthys, Santisteban, Goiriena, and Philippaerts, (2009)	13519 youth players and adults	Compare birth date distributions; identify whether the relative age effect is influenced by age or skill level.	Age.	Chronological age (years). Relative age (month).	The relative age effect has been recorded and represents a significant loss of potential talent.
Costa, Garganta, Greco, Mesquita, and Afonso (2010)	300 youth players	Analyse tactical behaviours at different levels.	Tactical behaviours.	Analysis of tactical actions by video.	Greater participation in the game by the athletes as the age group increases, performing more game actions.
Del Campo, Vicedo, González-Víllora, and Jordan (2010)	4193 youth players	Identify the existence of the relative age effect of the youth layers.	Age.	Chronological age (years). Relative age (month).	There was a reduction in the effect of the relative age of the 2005-2006 season to 2008-2009. Position in the field, years of practice and rank did not influence the relative age effect.

Vänttinen, Blomqvist, and Häkkinen (2010)	36 youth players	Examine the development of specific soccer skills; examine body composition, hormonal profile, physical fitness, motor skills of different levels.	**1)** Anthropometry. **2)** Cognitive. **3)** General motor performance. **4)** Biological maturation. **5)** Technical skills.	**1)** Height; Body mass. **2)** Motor perception skills (peripheral vision); In-lab test of anticipation, reception, dribbling, feint, pass; Video technical-cognitive analysis; **3)** 10m; Agility; CMJ. **4)** Testosterone concentration. **5)** Pass; dribble (technical score).	In-ball performance was superior in older athletes.
Nikolaïdis (2012)	561 youth players	To investigate the anaerobic components of strength and speed in adolescence.	**1)** Anthropometry. **2)** General motor performance.	**1)** Height; Weight; Skin folds. **2)** Maximum anaerobic power. (4 sprints; Exercise cycle on bicycle.	Maximum anaerobic power was lower in athletes in the early stages of adolescence compared to older ones.
Valente-dos-Santos, Coelho-e-Silva, Severino, Duarte, Martins, Figueiredo, Seabra, Philippaerts, Cmuming, Elferink-Gemser, and Malina (2012)	135 youth players	To evaluate the performance changes in speed test in youth soccer players with different maturation status.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Body mass; Skin folds. **2)** Sprint 34.2m; Aerobic resistance (20m continuous test); CMJ. **3)** Bone age (delayed, expected; advanced).	Body size and muscle mass can be attributed to variation in maturation status.
Vandendriessche, Vaeyens, Vandorpe, Lenoir, Lefevre, and Philippaerts (2012)	78 youth players	Compare maturation, morphology, physical capacity, and motor coordination between two groups of the same age.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation. **4)** Technical skills.	**1)** Height; Weight. **2)** Eurofit (dynamometry; explosive strength of lower limbs, agility, 30m sprint). **3)** Age of the peak height velocity (PHV equation). **4)** KPK.	Maturation affects morphology and physical fitness more than motor coordination.

Buchheit, and Mendez-Villanueva (2013)	80 youth players	Assess the short-term reliability of anthropometric measurements and physical performance; examine the long-term stability of the same measures over a 4-year training / competition period.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Body Mass; 7 skin folds. **2)** CMJ; Sprint 10m; Speed test. **3)** Age of the peak height velocity (PHV equation).	In the short term, anthropometry and physical performance are not affected by maturation, but when observed in the long run, they are.
Gil, Zabala-Lili, Bidaurrazaga-Letona, Aduna, Lekue, Santos-Concejero, and Granados (2014)	64 youth players	Analyse the characteristics of youth soccer's; check which features are most relevant.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Weight; Body mass; 6 skin folds; Arm, thigh, and leg circumferences. **2)** Agility test; Sprint 15m and 30m; Yo-Yo Test; CMJ; Dynamometry. **3)** Age of the peak height velocity (PVA equation); Hormonal collection by mouth.	Speed and agility proved to be important. Line players have better anthropometric and physical values than goalkeepers.
Baláková, Boschek, and Skalíková (2015)	91 youth players and soccer coaches	Determine the relationship between the talent and achievement variables in the Vienna Test System; Identify the distinct cognitive characteristics among soccer's.	**1)** Psychological characteristics. **2)** Cognitive. **3)** Technical skills.	Multidimensional questionnaire "TALENT Questionnaire" (movement, technical skills, psychological characteristics); Computerized VTS version.	Differences between the 2 groups, but objective tests for motor skills and cognitive perceptions can be unsuccessful in predicting the future performance of athletes.
Bidaurrazaga-Letona, Lekue, Amado, Santos-Concejero, and Gil (2015)	55 youth players	Provide the profile of youth soccer's.	**1)** Anthropometry. **2)** Age. **3)** General motor performance. **4)** Biological maturation.	**1)** Height, body mass, skin folds. **2)** Chronological age (years), Relative age (month). **3)** Barrow Test; CMJ; Yo-Yo Test; Sprint 15m. **4)** Age of the peak height velocity (PHV equation).	Athletes were classified by specific anthropometric characteristics at the expense of performance.

Deprez, Buchheit, Fransen, Pion, Lenoir, Philippaerts, and Vaeyens (2015) (a)	42 youth players	Investigate the evolution and stability of anthropometry and specific resistance characteristics of soccer.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Weight; Body mass. **2)** Test yo-yo. **3)** Age of the peak height velocity (PHV equation).	Maturational status influences the variables surveyed, but as individuals grow and advance in maturation, they can partially recover their performance in relation to the others.
Deprez, Valente-dos-Santos, Coelho-e-Silva, Lenoir, Philippaerts, and Vaeyens (2015) (b)	356 youth players	Model changes in explosive power development.	**1)** Anthropometry. **2)** Age. **3)** General motor performance. **4)** Biological maturation.	**1)** Height; Body mass; Sit and reach; SBJ and CMJ. **2)** Chronological age (years). **3)** Eurofit; KPK; SBJ; CMJ. **4)** Age of the peak height velocity (PHV equation).	Performance in the CMJ can be beneficial for athletes in delayed maturation status.
González-Víllora, Pastor-Vicedo, and Cordente (2015)	841 youth players and adults	Examine birth dates and relative age effect.	Age.	Relative age (month).	The relative age effect was not evident in the senior teams, but it was evident in the training levels.
Goto, Morris, and Nevill (2015)	34 youth players	Investigate game performance; Examine the difference in game performance between athletes of different levels.	**1)** General motor performance. **2)** Biological maturation.	**1)** Sprint 5m; Yo-Yo Test; Use of GPS in games (sprints, low and medium speed, running, walking). **2)** Age of the peak height velocity (PHV equation).	The U10 class tends to travel a longer distance at moderate speed and sprint compared to U9.
Huijgen, Leemhuis, Kok, Verburgh, Oosterlaan, Elferink-Gemser, and Visscher (2015)	88 youth players	To investigate the relationship between cognitive functions and performance level in soccer players.	Cognitive.	Visual-perceptual ability (Trail Making Test); Inhibitory control (Stop-Signal Task); Visual memory (Backward Visual Memory Span); Memory, inhibitory control, cognitive flexibility (D-Kefs Design Fluency Test).	Elite athletes have better inhibitory control, cognitive adaptation and metacognition compared to sub-elite athletes.

Lovell, Towlson, Parkin, Portas, Vaeyens, and Cobley (2015)	1212 youth players	Examine the relative age effect; to verify the relationship between the relative age effect, maturation status, anthropometry, and physical performance.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Weight; Body mass. **2)** Aerobic test; MVJ; Sprint 20m. **3)** Age of the peak height velocity (PHV equation).	Coaches should consider motor assessment and maturation status to avoid premature abandonment of youth soccer's.
Zuber, Zibung, and Conzelmann (2015)	134 youth	Describe patterns of psychological motivation variables; examine the stability of these patterns.	Psychological characteristics.	Motivation (Achievement Motives Scale-Sport); Achievement goals (Sport Orientation Questionnaire); Self-determination (Sport Motivation Scale).	Importance of favourable standards for motivating youth athletes.
Fenner, Iga, and Unnithan (2016)	16 youth players	Evaluate physiological and technical attributes in prepubertal athletes through small side games; determine whether small-sides games can act as a tool for identifying talent.	**1)** Anthropometry. **2)** General motor performance. **3)** Technical skills.	**1)** Height; Body mass. **2)** Total distance covered; Maximum speed reached; CMJ; Sprint 10m, 30m. **3)** JR in a field of natural grass, with goals and 6x6 (18.3mX23m); Individual assessment by questionnaire (0-3 = result of the game; 0-5 = decision making).	Great agreement between top ranked athletes and success in small-sides games. The small game can be used to identify talents.
Francioni, Figueiredo, Terribili, and Tessitore (2016)	103 youth players	Observe the stability of the results of anthropometric, technical, and functional tests of soccer's.	**1)** Anthropometry. **2)** General motor performance. **3)** Technical skills.	**1)** Body mass; Height. **2)** CMJ; CMJFH; Sprint 15m. **3)** Driving; driving with head; pass, shoot, dribble.	Anthropometry, functional and technical tests varied substantially throughout the season, influenced by growth and training sessions.

Höner, and Feichtinger (2016)	2677 youth players	Examine the relationship of momentary and future psychological characteristics of soccer's.	**1)** Psychological characteristics. **2)** Technical skills.	**1)** Motivation (Achievement Motives Scale-Sport; Sport Orientation Questionnaire; Task and Ego Orientation in Sport Questionnaire); Task and ego relationship (Volitional Components in Sport); Cognitive self-reference (Physical Self-Concept Scales). **2)** Sprint 20m, agility (with / without ball), dribbling, driving, shooting (technical score).	There is no clear relationship between psychological aspects and physical-technical performance. Performance may be linked to aspects not related to the research.
Höner, and Votteler (2016)	22843 youth players	Investigate the relevance of adolescent performance prognosis to identify expected levels in the short and long term.	Technical skills.	Sprint, agility, dribbling, driving, shooting (technical score).	Performance prediction value was obtained for all tests, thus providing coaches and clubs with additional knowledge to identify and develop talent.
O'Connor, Larkin, and Williams (2016)	127 youth players	To identify the perceptual-cognitive skills and variables of the practice history for the selection of soccer players.	**1)** Training history. **2)** Cognitive.	**1)** Information from the last 8 seasons (Participation History Questionnaire). **2)** Decision making, situational probability and recognition pattern (response after viewing video clips).	Selected athletes recorded superior performance in the combined tests of perceptual-cognitive skills compared to the others.
Romann, and Fuchslocher (2016)	63 youth players	Assess the reliability of skeletal age assessments and validate DXA.	**1)** Anthropometry. **2)** Age. **3)** Biological maturation.	**1)** Height; Weight. **2)** Chronological age (years). **3)** DXA of the left wrist.	The results of the DXA method are similar in precision to that of the X-ray to identify skeletal age.
Camões, and Clemente (2017)	680 youth players	Characterize the anaerobic profile and analyse the variability relative to each position and age group of athletes.	**1)** Anthropometry. **2)** General motor performance.	**1)** Height; Weight; Body mass; 10 skin folds. **2)** Ergometer cycle.	Age influences, regardless of the position of the game, the power. But there was no effect of age on fatigue.

Cunha, Cumming, Valente-dos-Santos, Duarte, Silva, Dourado, Leites, Gaya, Reischak-Oliveira, and Coelho-e-Silva (2017)	46 youth players	Examine power through jumping and running in athletes with different pubertal status.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Body mass. **2)** CMJ; SJ; Sprint 10m and 30m. **3)** Tanner scales.	Biological maturation has a broad effect on power in sprints, but not in jumps.
Hicheur, Chauvin, Chassot, Chenevière, and Taube (2017)	46 youth players and soccer coaches	To investigate the effects of age and practice on cognitive-motor performance.	**1)** Cognitive. **2)** Technical skills.	**1)** Visual stimuli by video (number of fixations and location). **2)** Pass (error, speed).	COGNIFOOT presents clear reference values that can help to reduce the variation of coaches' judgments.
Höner, Leyhr, and Kelava (2017)	14178 youth players	Predictive validity of the German talent identification and development program tests.	**1)** Anthropometry. **2)** Age. **3)** Technical skills.	**1)** Height; Weight. **2)** Relative age (month). **3)** Sprint, agility, dribbling, driving, shooting (technical score).	Prognostic validity of motor tests over a period of 9 years, even controlling characteristics related to maturation.
James, Thake, and Birch (2017)	60 youth players	Determine whether the removals of the relative age effect changed the relationship between physical performance and anthropometry.	**1)** Anthropometry. **2)** Age. **3)** General motor performance.	**1)** Height; Body mass; Skin folds. **2)** Relative age (month). **3)** CMJ; Hand grip; Sprint 30m; T-test.	There was no significant relationship between agility, age, and any other measures.
Mann, and van Ginneken (2017)	25 youth players	Determine whether the relative age effect can be reduced when the selectors receive prior information from the athletes.	**1)** Age. **2)** General motor performance.	**1)** Relative age (month). **2)** Small-sides games (4x4) with randomized teams; 2nd: small-sides games (5x5) but without randomized teams.	The relative age effect was recorded, but it was eliminated when technical observers had access to relative age.
McCunn, Weston, Hill, Johnston, and Gibson (2017)	306 youth players	To investigate the influence of relative age on maturation and running speed at different competitive levels.	**1)** Anthropometry. **2)** Age. **3)** General motor performance. **4)** Biological maturation.	**1)** Height; Weight. **2)** Relative age (month). **3)** Sprint 15m. **4)** Age of the peak height velocity (PHV equation).	Through the results, making decisions about who to select based on the ability to race at lower echelons is not the most appropriate.

Práxedes, Moreno, García-González, Pizzarro, and Del Villar (2017)	1098 youth player	To analyse the relative age effect on youth soccer's.	Age.	Relative age (month).	Athletes born in the early months of the year tend to be more selected and this is due to their maturation status.
Sporiš, Dujic, Trajkovic, Milanovic, and Madic (2017)	37 youth players	Examine the relationship between body morphology and game performance.	**1)** Anthropometry. **2)** General motor performance.	**1)** Height; Weight; Skin folds. **2)** Walk; run; medium and high running intensity; sprint (in play).	There are no significant relationships between morphology and game performance. Need to verify in the selection processes of soccer's psychological aspects and specific skills of the sport.
Asadi, Ramirez-Campillo, Arazi, and Villarreal (2018)	60 youth players	Investigate the effects of maturation on power and sprint performance.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; body mass. **2)** CMJ.	All maturation groups showed increases in vertical jump, so the plyometric training showed positive effects for power and vertical jump.
Brustio, Lupo, Ungureanu, Frati, Rainoldi, and Boccia (2018)	2064 youth player	Investigate the relative age effect.	Age.	Relative age (month).	Prevalence for Quartile 1 in all categories, but with a reduction in effect size as age increased.
Doyle, and Bottomley (2018)	1112 youth players	Investigate the RAE and its relationship to the market value of the 1000 athletes with the highest market value.	Age.	Relative age (month).	Countries and clubs are not immune to the effects of relative age. Athletes with higher market values were born in the initial months of the year.
Gonzalez Bertomeu (2018)	2985 youth players	Check if a soccer's birth date affects his outlook on sport.	Age.	Relative age (month).	The effect of the relative age for players born in Argentina is very strong and explains the greater possibilities of becoming a professional athlete.
Leyhr, Kelava, Raabe, and Höner (2018)	1134 youth players	Investigate the relevance of adolescent performance prognosis to identify expected long-term levels.	**1)** General motor performance. **2)** Technical skills.	**1)** Sprint 20m; agility. **2)** Dribbling, driving, finishing (technical score).	The tests predict future performance, as elite athletes were already better when U12 and U15.

Müller, Gehmaier, Gonaus, Raschner, and Müller (2018)	222 youth players	Evaluate the relative age effect and investigate the influence of maturation on relative age.	**1)** Anthropometry. **2)** Age. **3)** Biological maturation.	**1)** Relative age (month). **2)** Height; Weight. **3)** Age of the peak height velocity (PHV equation).	Association of maturation with relative age. There is a greater chance on the part of new athletes if they have advanced maturation.
Murtagh, Brownlee, O'Boyle, Morgans, Drust, and Erskine (2018)	326 youth players and adults	Compare acceleration, speed, vertical and horizontal power in different pubertal periods.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Weight. **2)** CMJ; Sprint 10m, 20m. **3)** Age of the peak height velocity (PHV equation).	The physical assessments used to identify and select talent need to be dynamic and specific in relation to maturity status.
Peña-González, Fernández-Fernández, Moya-Ramón, and Cervelló (2018)	564 youth players and soccer coaches	Test the existence of the relative age effect, the possible influence of physical and anthropometric performance and the effectiveness of the coaches' analysis.	**1)** Anthropometry. **2)** Age. **3)** General motor performance. **4)** Biological maturation.	**1)** Height; Body mass. **2)** Relative age (month). **3)** CMJ; Speed 30m; Agility; Yo-Yo Test. **4)** PVA equation. Age of peak height velocity (PHV equation).	Anthropometric and physical performance measures were not affected by the birth quartile.
Rubajczyk, and Rokita (2018)	264 youth players	Determine the magnitude of the relative age effect and the reasons for this phenomenon.	Age.	Relative age (month).	There is the relative age effect and it is estimated that it occurs at levels lower than U17-U21.
Bidaurrazaga-Letona, Lekue, Amado, and Gil (2019)	94 youth players	Identify the important factors in the process of identifying and selecting youth soccer players.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Body mass; skin folds. **2)** Barrow Test; CMJ; Yo-Yo Test; Sprint 15m. **3)** Age of the peak height velocity (PHV equation).	The talent identification program was actually a selection one, as the athletes were identified posteriori and not a priori.
Castillo, Pérez-González, Raya-González, Fernández-Luna, Burillo, and Lago-Rodríguez (2019)	111 youth players	Analyse the relative age effect in the selection and promotion of youth soccer's.	**1)** Anthropometry. **2)** Age. **3)** General motor performance.	**1)** Height; Body mass; 6 skin folds. **2)** Relative age (month). **3)** CMJ; Sprint 10m, 30m; Sit and reach.	Prevalence for Quartile 1 in the U14-U16 categories, but this did not indicate greater chances of selection. Selected U14 athletes had better anthropometric values.

Hendry, Crocker, Williams, and Hodges (2019)	63 youth players	Determine whether the self-determined motivation in youth soccer's changes over time and age.	**1)** Training history. **2)** Psychological characteristics.	**1)** Time of practice (Participation History Questionnaire); Accumulated hours of training. **2)** Motivation (Behavioral Regulation in Sport Questionnaire).	In the elite group, motivation was reduced in the passage of steps. Non-elite group-maintained motivation rates, but compared to the elite group, they were less motivated.
Jukic, Prnjak, Zoellner, Tufano, Sekulic, and Salaj (2019)	23 youth players	Examine differences in fundamental motor skills and specific conditioning skills; examine the most important qualities.	**1)** Anthropometry. **2)** Age. **3)** General motor performance. **4)** Technical skills.	**1)** Height; Body mass. **2)** Relative age (month). **3)** Sprint 5m, 10m, 20m, 40m (maximum O2 capacity). **4)** Run; Trot; Jump; Jump; Jump and slide; Hitting; Dribble; Catch; Shot; Dribble; Driving (technical score).	It is suggested that the development of athletes should be focused first on basic motor skills and technical skills and then on conditioning capabilities.
Rađa, Kuvačić, De Giorgio, Sellami, Ardigò, Bragazzi, and Padulo (2019)	119 youth players	Investigate shooting variables and their relevance to youth sports success.	**1)** Anthropometry. **2)** Technical skills.	**1)** Height; Weight. **2)** Pass and kick in different situations (anticipating the touch to the ground; preferred and not preferred feet).	In each age group, athletes considered to be starting points obtained higher averages than the substitutes.
Rodríguez-Lorenzo, and Martin-Acero (2019)	334 youth players and adults	Analyse the relative age effect on all categories of a professional club.	**1)** Age. **2)** Training history.	**1)** Relative age (month). **2)** Sum of the minutes played by the soccer during the competitive season.	Relative age effect was present in all levels. No differences were found between minutes played and semester of birth.
Rommers, Mostaert, Goossens, Vaeyens, Witvrouw, Lenoir, and D'Hondt (2019)	619 youth players	Investigate the general and specific motor coordination differences of soccer, as well as speed and agility according to maturation.	**1)** Anthropometry. **2)** General motor performance. **3)** Biological maturation.	**1)** Height; Weight. **2)** KPK (general motor coordination); Dribbling and ball driving circuit (football-specific coordination); Sprint 30m; T-test. **3)** Age of the peak height velocity (PHV equation).	Pubertal period is a critical period for the acquisition of skills and physical development in young athletes.

Scharfen, and Memmert (2019)	15 youth players	Examine the relationship between basic cognitive functions and specific motor skills in soccer.	**1)** Cognitive. **2)** General motor performance. **3)** Technical skills.	**1)** Attention task; Memory; Percentage load; Speed and number of fixations (visual stimuli by computational projections). **2)** Sprint 10m; Acceleration 20m; change of direction. **3)** dribbling; driving; touches.	Some cognitive functions are partially associated with technical skills.
Sieghartsleitner, Zuber, Zibung, and Conzelmann (2019)	117 youth players and soccer coaches	Examine whether coach assessments, motor performance tests, or multidimensional data show a higher talent selection rate.	**1)** Coach assessment. **2)** General motor performance. **3)** Technical skills. **4)** Biological maturation. **5)** Psychological characteristics.	**1)** Game performance (score). **2)** Yo-Yo Test; CMJ; Agility test. **3)** Dribble, pass, touches. **4)** Age of the peak height velocity (PHV equation). **5)** Motivation (Achievement Motives Scale-Sport); Achievement goals (Sport Orientation Questionnaire); Self-determination (Sport Motivation Scale).	Combining the coach's subjective gaze with scientific data can lessen the weaknesses of both selection technical skills.

Discussion

The purpose of this paper was to categorize the published articles, identify, organize, and integrate the emerging patterns of works between 2009 and 2019, focusing on the methods used to identify and select young talented soccer players. This review was structured, particularly as to the dimensions, objectives, procedures, and results of the included works.

Based on defined criteria, 53 studies were considered. It was found that the objectives in which the studies most focused were about the influence of relative age and maturational status on the physical, technical, tactical, cognitive and psychological performance of young soccer players, in addition to the impacts generated in the processes of identification and selection of talented soccer players.

The studied players were predominantly young and always categorized into levels. The most studied dimensions concerning this type of participants were maturation, relative age effect, anthropometric and physical data. Most of the interventions were in the way relative age affects the selection conditions of youth (Castillo et al., 2019; Mann & van Ginneken, 2017; Müller et al., 2018) and participation in play (Costa et al., 2010; Del Campo et al., 2010). Regarding the maturational status, research sought to perceive how individuals in different pubertal stages (Pre-PHV, PHV, Post-PHV) behave before physical tests (Asadi et al., 2018; Buchheit & Mendez-Villanueva, 2013; Cunha et al., 2017), technical skills (Fenner et al., 2016; Höner et al., 2017; Vänttinen et al., 2010, i.e.), cognitive (Vänttinen et al., 2010) and psychological (Sieghartsleitner et al., 2019). However, all the studies using mixed samples (young and adult athletes) sought to investigate the relative age effect for ascent to senior stage (Gonzalez Bertomeu, 2018) or in a specific competition (Brustio et al., 2018; Costa et al., 2009).

Influence of the relative age effect and maturational status.

A latent concern for the relative age effect and maturational status on athletic performance is demonstrated. The effects of relative age were always considered based on dates of birth and the year subdivided into quartiles. These

studies showed the prevalence of players born in quartiles 1 and 2 (Brustio et al., 2018; Costa et al., 2009; 2010; Rubajczyk & Rokita, 2018). Apparently, there is a clear association between the effect of relative age and maturation status. Studies show that athletes are selected, in large part, based on a single criterion (physical advantage). On average the relative age effect is presented in the youth players and this affects the process of talent exclusion (Mujika et al., 2009; Rodríguez-Lorenzo, 2019), but, as one observes age groups closer to that of seniors this tends to be reduced (Brustio et al., 2018; González-Víllora et al., 2015).

The procedures used to ascertain the maturational state and relative age effect were varied. With emphasis on the Peak Height Velocity equation proposed by Mirwald et al. (2002), in which through anthropometric data it is possible to estimate the PHV of the individual. With this, McCunn et al. (2017), Müller et al. (2018) and Rommers et al. (2019) performed studies that applied the referred non-invasive procedure. To identify the relative age effect, it is necessary to identify the dates of birth of the sample, in addition to its categorization by quartiles. Thus, starting from this procedure, Brustio et al. (2018), Doyle and Bottomley (2018), González-Víllora et al. (2015), Gonzalez Bertomeu (2018) and Rubajczyk and Rokita (2018) completed researches in order to understand how the date of birth influenced the composition of the formation levels and competitions.

It is consensual in literature the existence of momentary advantages to athletes considered PHV and Post-PHV in relation to Pre-PHV in the physical dimension, consequently inducing superior performances in training and game contexts (Cumming et al., 2017; Malina et al., 2019; Till & Baker, 2020). In this setting, athletes born in quartiles 1 and 2 and/or associated with an advanced maturational status presented better values in vertical jump (Asadi et al., 2018), sprint (Cunha et al., 2017; McCunn et al., 2017) and overall, in-game performance (Camões & Clemente, 2017; Costa et al., 2010; Gil et al., 2014; Goto et al., 2015), for example.

In contrast, RAE and maturation status do not influence motor coordination, such as technical skills (Vandendriessche et al., 2012). This is an

indicator that when considering only one characteristic of soccer, it is shifting from the conception of ideal performance in soccer, since it is a highly complex sport. By neglecting fundamental aspects of human development to gain a momentary advantage, the identification and selection process can generate a false impression that is positive in the short term, but generating future failures (failure to sports success, for example) (Sieghartsleitner et al, 2019).

Selection processes that disregard the effect of relative age and maturation status tend not to understand the numerous forms of performance associated with soccer and can lead to the early abandonment of potential successful athletes (Lovell et al., 2015). Sports professionals need to understand and consider that soccer performance does not occur only through physical bias, but rather through a complex set of factors, such as technical skills and tactics (Till & Baker, 2020).

Physical, technical, and tactical performance.

Studies that addressed the cognitive and technical topics, tactics and physics through small-sides games are less frequent. Cognitive tests in simulated format (computational projections) and various constraints were verified by Huijgen et al. (2015) and Vänttinen et al. (2010). The small-sided games were applied on natural turf, in formats of 3x3 and 6x6 and only by Katis and Kellis (2009), Mann and van Ginneken (2017), and O'Connor et al. (2016). This game format proved to be efficient for evaluating players and the authors suggested it as a reliable possibility to evaluate soccer players in an ecological context.

Studies involving the tactical, cognitive, and psychological dimensions, but not directly associated with the relative age effect and maturational status, were also explored using young players. Baláková et al. (2015), Hicheur et al. (2016), Huijgen et al. (2015) and Scharfen and Memmert (2019) identified the cognitive characteristics (attention task, memory, percentage load, speed, and number of fixations) that distinguish young talents. To understand psychological aspects, Hendry et al. (2019), Sieghartsleitner et al. (2019) and Zuber et al. (2015) investigated how motivation influenced the performance of athletes. Elite athletes have higher motivational indices than non-elites. It is clearly a psychological

factor that configures a successful soccer player and needs to be considered, but for that it is necessary specific knowledge, qualified professionals and able to contextualize the tests to the soccer environment. A disassociated analysis may not portray the real psychological profile of the assessed athlete.

However, the tactical dimension was little explored, with only two studies. The data reveal that athletes belonging to higher and selected age groups present a greater number of participations in the game and tactical actions, as well as superior tactical-cognitive performance. Studies involving tactical performance did not involve RAE and maturation status. This limits an understanding of whether there is an influence of the month of birth and PHV on the ability to manage the playing space (Costa et al., 2010; O'Connor et al., 2016).

In particular, the studies sought to apply protocols, batteries, and tests to understand how the relative age effect and maturation influence the overall performance of young soccer players. Findings that collected height, weight, body mass and skinfolds, through specific protocols such as ISAK, were widely employed (Bidaurrazaga-Letona et al., 2015; 2019; Buchheit, & Mendez-Villanueva, 2013; Camões, & Clemente, 2017). Physical tests (i.e. sprint, CMJ, SJ, Yo-Yo Test) were applied in a good number of studies, such as Castillo et al. (2019), Cunha et al. (2017), Goto et al. (2015) and Peña-González et al. (2018). Technical protocols were used to understand the profile of each athlete and allow comparisons between levels and age groups, e.g. Höner and Votteler (2016), Höner et al. (2017), Jukic et al. (2019) and Leyhr et al. (2018).

It becomes noticeable that the processes of identification and selection of young soccer players are more exclusionary than inclusive (Bidaurrazaga-Letona et al. 2019; Lovell et al., 2015; Mujika et al., 2009; Práxedes et al., 2017), considering in an independent way the physical aspect. This inequality is assumed as occurring in soccer (Romann et al., 2020). One possible solution would be the focus on individual development, respecting the growth and maturational characteristics of the players (Abbott et al., 2019; Malina et al., 2019), e.g., concentrating on motor literacy and holistic training bias (Till & Baker, 2020; Wormhoudt et al., 2017). Such suggestions can provide a more coherent, inclusive, and developing sporting environment with all the potential inherent of

sports. This new look at soccer contexts provides athletes the capacity to respond to the needs of the game and more adaptability to different contexts of practice (Coutinho et al., 2016; Wormhoudt et al., 2017).

Conclusions

The variables related to the maturational status of soccer players, the relative age effect and their relationship with physical fitness, motor coordination and technical performance in soccer, were the most studied. Thus, there is evident scarce literature regarding the relationship between the processes of identification and selection of soccer players considering the tactical-cognitive aspects of the performance.

Considering that soccer performance is associated with different variables and that environmental interactions occur, it is important to study as much as possible the contextual details that can influence the performance of soccer's, as well as the practical solutions of intervention together with them. A favourable formative context, aligned with a dynamic curriculum of contents, based on the needs, initially, of the athlete and, later, of the team can promote and expand the motor and cognitive repertoire of the practitioners. Thus, a richer, more complete practice that achieves the formative objectives as a citizen and athlete.

A contemporary concept that emerges as a possible way to organize competitive levels is bio-banding. Thus, individualized human development is based on stratifying levels. There is, apparently, a reduction in the effects of relative age and maturational state, providing a fairer practice that can stimulate long-term sporting success.

It is concluded that the maturation of soccer players and the relative age effect impact on the performance of young athletes, and that coaches and sports institutions should be sensitive and attentive to these aspects in order to create opportunities for the development of athletes to be carried out according to their potential, consequently allowing the application of more reliable processes of identification and selection of talents in soccer.

Limitations and future investigations

Studies discoursed particularly on the dimensions of age, general motor performance and technical skills, without considering the environmental situations inherent to training and game. The dimensions associated with cognition and tactical performance are more recent in the international literature and the conclusions regarding these dimensions need further scientific extending.

The processes of selection and identification of talents need to consider ecological situations that represent the real situations of training and game. For that, it is necessary to apply, or even create instruments of observation and analysis capable of extracting data from these contexts.

Thus, it is suggested the stimulus for empirical research that considers the effects of relative age and maturational state, but which are associated, mainly with tactical-technical and cognitive aspects. This is due to the gap in these dimensions and that can impact for a better understanding of the processes of identification and selection of young soccer players.

These insights encourage sports professionals to conduct longitudinal studies, as one can see the trends of players' transformation over the years. At the same time, these studies can relate more than one aspect of training, covering multiple aspects of soccer to allow a more robust and dynamic view of the sport in consideration. This way, the scientific community and the professionals involved in this domain can be provided with more coherent knowledge about methods to better identify and select soccer talented players.

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2. Estudo 2

A submeter

Target Journal: To define.

Title: Identifying and selecting young soccer players through a multivariate approach. INEX project.

Running Title: Identifying and selecting young soccer players.

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ABSTRACT

The present study aimed to compare anthropometric, maturational, physical, technical, and tactical variables of 84 young Portuguese soccer players, in addition to estimating the contributions of the same variables to a better Game Tactical Performance Index (Game TPI). The athletes were submitted to an anthropometric, physical, technical, and tactical test protocol and, subsequently, categorized according to their maturational statutes Pre-PHV (M= 12,81; SD= 0,50), PHV (M= 13,95; SD= 0,78) and Post-PHV (M= 14,67; SD= 0,63). For statistical analysis, ANOVA with Tukey's post-test was used to find out the differences between groups, Pearson's correlation for correlation between variables and Linear Logistic Regression to predict the best performance in the Game IPT for a significance level of p <0.05. The results demonstrate that Post-PHV athletes were taller, heavier, with better physical and technical performance compared to Pre-PHV and PHV, but the same did not happen for the tactical variables. Regarding the correlations, they were strong-moderate between maturation, anthropometry, horizontal jump, pass 35 meters and dribbling, but without associations of the others with tactical factors. Linear Logistic Regression shows that players with high values of Offensive TPI, percentage of correct were prone to a high performance in the Game TPI. It was noticed that the tactical variables suffer little, if any, influence from maturational aspects. It is also noticeable that a high Game TPI cannot be predicted by the maturational status. It is concluded that the advanced maturation status has a positive influence on most of the variables used, except the tactics and that the 5x5 in situ performance cannot be predicted by decontextualized technical and physical tests of the game.

Keywords: Maturation; Tactical; Technical; Physical; Talent identification; Youth; Soccer.

Introduction

Exploring the potential of young athletes for sports excellence in adulthood or developing talents for superior performance can be defined as a process of identifying and developing talent (Böhme, 1994; Höner, Votteler, Schmid, Schultz, & Roth, 2015; Till & Baker, 2020; Vaeyens et al., 2016; Williams & Reilly, 2000).

Talents, in turn, depend on a combination of factors and complex interaction. Böhme, (1994) presents talent as an individual with inherited body constitution, high motor, cognitive and affective dispositions, as well as favorable social and environmental conditions.

However, in sports, athletes are often divided by age groups and framed in systematic training and competition programs with this assumption (Cumming, Lloyd, Oliver, Eisenmann, & Malina, 2017; Malina et al., 2019). But one factor and its associations can influence the performance of young athletes, maturation (Goto, Morris, & Nevill, 2016; Lovell et al., 2015; Peña-González, Fernández-Fernández, Moya-Ramón & Cervelló, 2018).

Maturation is characterized by a natural and individual process of the human species, considering cellular, enzymatic, and neuro-endocrine regulation changes (Cumming et al., 2017; Khairullah et al., 2013; Malina, Bouchard, & Beunen, 1988).

The processes of identification and development of talents commonly occur in a period defined by puberty (Sherar, Baxter-Jones, Faulkner, & Russell, 2007; Vaeyens et al., 2016). It is precisely at this moment that the influence of maturation (Borges et al., 2018) becomes more apparent and with momentary advantages, but that will not necessarily be transported to long-term adult success (Bidaurrazaga-Letona, Lekue, Amado, Santos-Concejero, & Gil, 2014; Towlson, Cobley, Parkin, & Lovell, 2018; Till & Baker, 2020).).

These processes, in turn, consider many aspects related to general athletic performance, thus seeking attributes of strength, power, speed and cardiorespiratory capacity, for example (Bidaurrazaga-Letona et al., 2015; Goto et al., 2016; Williams & Reilly, 2000).

Maturation influences, in general terms, anthropometric variables and neuromuscular abilities, causing an advantage in athletic performance (Cumming et al., 2017; Malina et al., 2019). Thus, the athletes already matured, that is, who are beyond the peak speed of height (Post-PHV) have advantages over the others (those who are Pre-PHV or PHV) (Borges et al., 2018; Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004; Malina, Rogol, Cumming, Coelho e Silva, & Figueiredo, 2015).

Studies seek to explore the theme of maturation and which variables, associated with the development of young soccer players, suffer interference from it (Deprez et al. 2015; McCunn, Weston, Hill, Johnston, & Gibson, 2017). Authors highlight the relationships between maturational status and anthropometric variables (Malina et al., 2000; 2004), physical (Murtagh et al., 2018; Malina et al., 2004; Valente-dos-Santos et al., 2012), techniques (Bidaurrazaga-Letona et al., 2015; Höner et al., 2015; Malina et al., 2015) and tactics (Borges et al., 2018; Reis & Almeida, 2020).

Considering the points listed, mainly anthropometric, physiological, physical, coordination and cognitive alterations linked to the maturational process, as well as their direct and indirect relationships in selection criteria of soccer talents and, consequently, development of these athletes, the present study aims to (I) compare anthropometric, physical, technical skills and tactical data of young soccer's in different maturational statuses and (II) to estimate the contributions of maturational variables , anthropometric, physical, technical and tactical in the Game Tactical Performance Index (Game TPI).

Methods

The present study originates from the mixed longitudinal project called INEX (In search of excellence. A longitudinal-mixed study in young sportsmen). The clubs were selected and, together with the coordinators and parents of the players, a meeting was held to explain the participants' objectives, procedures, and consent for data collection.

Sample

The sample included 84 Portuguese soccer's aged between 13 and 15 years. They were stratified into three groups based on the maturational offset (Mirwald et al, 2002), as follows: Pre-Peak Height Speed (Pre-PHV) (values < -0.5), Peak Height Speed (PHV) (values between -0.5 and 0.5) and Post-Peak Height Speed (Post-PHV) (values > 0.5) (Reis & Almeida, 2020).

Thus, 16 players (M= 12.81; SD= 0.50) classified as Pre-PHV, 22 (M= 13.95; SD= 0.78) as PHV and 46 (M= 14.67; SD= 0.63) for Post-PHV. These athletes participated in competitions at regional and national level in Portugal. The inclusion criteria for this study are that individuals (I) were enrolled in systematic sports training programs with at least three weekly training sessions and at least one official match each week; and (II) absent from injury at the time of data collection or have been in the states for less than three months.

Instrument and Procedures

(I) Anthropometry

For anthropometric factors, height (cm), sitting height (cm) and leg height were considered, measured with a stadiometer with accuracy of 0.1 cm. Leg size was defined by subtracting height (cm) by sitting height (cm) (seated height-height) (Bidaurrazaga-Letona et al., 2015; Borges et al., 2018; Guimarães et al., 2017).

Body mass was measured with a bioimpedance scale (Tanita BC-418MA, Tanita Corp., Japan) with an accuracy of 100 g. This equipment allows fractionation of fat mass and fat-free mass (MIG) (Guimarães et al., 2017).

(II) Biological Maturation

Biological maturation was determined using the technique described by Mirwald et al., 2002. This is a noninvasive technique for predicting maturational status and that considers interactions between leg length, age, anthropometric measurements, and body composition (Borges et al., 2018). It is a specific equation that estimates the maturational offset of boys, where you have:

Maturational offset = -9.236 + 0.0002708 (leg length X seated height) - 0.001663 (age X leg length) + 0.007216 (age X seated height) + 0.02292 (weight: height).

The product of the equation (offset) seeks to estimate the age that the individual reaches his peak height velocity (PHV). Being this positive represents that it is advanced in relation to the PHV and negative that there are a few years to reach the PHV (Guimarães et al., 2017).

(III) Tactical Performance

The proficiency of the game was analyzed through procedural tactical knowledge, which in this case occurs based on the Football Tactical Evaluation System (FUT-SAT) (Costa, Garganta, Greco, Mesquita, & Maia, 2011). It is possible with the respective system to evaluate the tactical actions, with and without ball, made by each of the players (except goalkeeper).

The test consists of evaluating the athletes in a GK+4x4+GK game situation, in a field of 48 meters long by 36 meters wide. The duration time is two times of 10 minutes with an interval of five minutes.

Based on the ten tactical principles suggested by Costa et al., 2011, five offensive (penetration, offensive coverage, space, mobility, and offensive unit) and five defensives (containment, defensive coverage, balance, concentration, and defensive unit). Through these is determined the offensive TPI, defensive TPI and the game TPI.

TPI= Σ tactical actions (realization of the principle x quality of action x location of the action x result of the action) / number of tactical actions (Costa et al., 2011).

(IV) Motor Performance - Soccer-Specific Technical Skills

The technical skills were analyzed using the Battery of Technical Tests based on the Football Skills Assessment Protocol of the University of Queensland (Wilson et al., 2016). These are eight exercises that include actions with dominant and non-dominant foot, as well as dribbling and control of ball, passes and submissions with distance variation.

Based on Rampinini, Impellizzeri, Castagna, Coutts, & Wisløff (2009) where they showed that successful teams are those with the greatest involvement with the ball through short passes, these being successful and Wilson et al., (2016), who ponders the dribbling of the ball as a motor skill specific to soccer's', but especially linked to those who attack, since, seek to break spaces in the opposing defense. Thus, three tests were considered:

(A) Short pass 20 m (Pass 20): Consists of a table, with a score of 2-10 values, fixed to 20 meters from the performer. There are 14 attempts (7 with each foot), and the total score divided by 14. This gives an average of the hits.

(B) Long pass 35 m (Total 35): A circular target with rings is positioned at 35 meters, where the central zone is worth 20 points and each adjacent ring is 2 points less. The athlete makes the pass and seeks to score the maximum points by hitting the scoring zones.

(C) Ball/dribble speed (Dribbling): The ball is driven straight and between obstacles, and the course has a total of 61.2 m. The interval between sets is 2 minutes and 30 seconds. For each failed cone it is added 1 second in total time, for two cones in a row are another 2 seconds and 0.5 seconds for tipped cone. Three sets are performed, the attempt with shorter time is considered.

(V) Physical Performance

To evaluate physical performance, the 84 young athletes were submitted to a battery of physical tests. The tests considered were:

(A) Speed 20 meters (T20): The sprint 20-meter test was used to assess the speed of young athletes (Höner et al., 2015; Murtagh et al., 2018; Vandendriessche et al., 2012). Players depart 30 cm before the starting line. The test was repeated three times and was considered the best of the two attempts. Photoelectric cells were used. Murtagh et al. (2018) show that speed and acceleration are important physical valences, preponderant and determinant for high performance in soccer. Athletes considered elite have high performance for acceleration, speed, and power.

(B) T Test (Agility): The T test was used (Jakovljevic et al., 2016; Vandendriessche et al., 2012) to assess the agility of soccer players. Standing

and situated 30 cm before the starting line, the athletes perform a course with five accelerations (10m-5m-10m-5m-10m), with a change of direction, in a "T" shape, playing with the foot at each end. The test is repeated three times. The first attempt is framed as recognition and the following two are considered valid, with the registration for the best performance. The recovery time between series is three minutes.

(C) Repetitions of sit-ups: The individual has as initial position the dorsal decubitus, knees to form an angle less than 90º, with the feet on the ground and the heels away from the buttocks. The movement begins with the hands behind the nape, fingers intertwined and elbows on the ground. An oral sign of the evaluator is said for the preparation and beginning of the test, as well as for termination. The test is performed once and has the repetitions considered in 60 seconds. The movements in which the athlete released his fingers behind the nape, which brought his elbows forward without first touching the ground or returning to the starting position without touching the knees were not counted.

(D) Horizontal Jump: Typical test to evaluate the strength of the lower limbs (Rodrigues, & Marins, 2011). The player puts himself with his feet together and with their tips at ground zero of the measuring tape. It has the possibility to move the upper limbs to achieve the heel as far as possible and, moving towards a foot stabilization. The distance is accounted for by the heel of the foot closest to the heel principle. The test was repeated twice, and the best performance (recorded in centimeters) was considered.

(E) Squat Jump (SJ): The SJ test was also used to ascertain the strength of the lower limbs. It is a vertical jump that starts from a static squat position, at 90º of flexion and with an extension of the lower limbs in sequence. Sports professionals use this type of test to determine the physical capacity of the evaluated, considering explosive force. Lower limb strength is considered an important parameter for soccer because it is a modality with intermittent series and with distinct physiological demands (Rodrigues, & Marins, 2011). The evaluation was applied on a force platform. Two attempts were made but considering only the best record.

Statistical analysis

Descriptive data were analyzed using means and standard deviations. An exploratory analysis of the data was carried out and to analyze their normality, the Kolmogorov-Smirnov test was used (n = 84).

First, to examine the differences between the three maturational groups (Pre-PHV, PHV and Post-PHV) and anthropometric, maturational, tactical, technical, and physical variables, an ANOVA with Tukey post-test ($p< 0.05$) was used.

Pearson's Correlation test was applied to verify the associations between anthropometric, maturational, physical, tactical, and technical variables. The magnitude of association between the variables considered was low (.10, .30), moderate (.30, .50) or elevated (.50, 1) (Cohen et al., 2013). Added to this, through a Linear Logistic Regression (stepwise method), we analyzed which variables predict the best performance in the Tactical Performance Index of the game.

All statistical tests were conducted using the statistical software SPSS version 26.0 (SPSS Inc., Chicago, II), and the significance level of 5% was adopted.

Results

When we check the data in Table 2, we can see the average values of each variable for higher variance values in the groups that Intra groups for each of the three maturational groups from ANOVA.

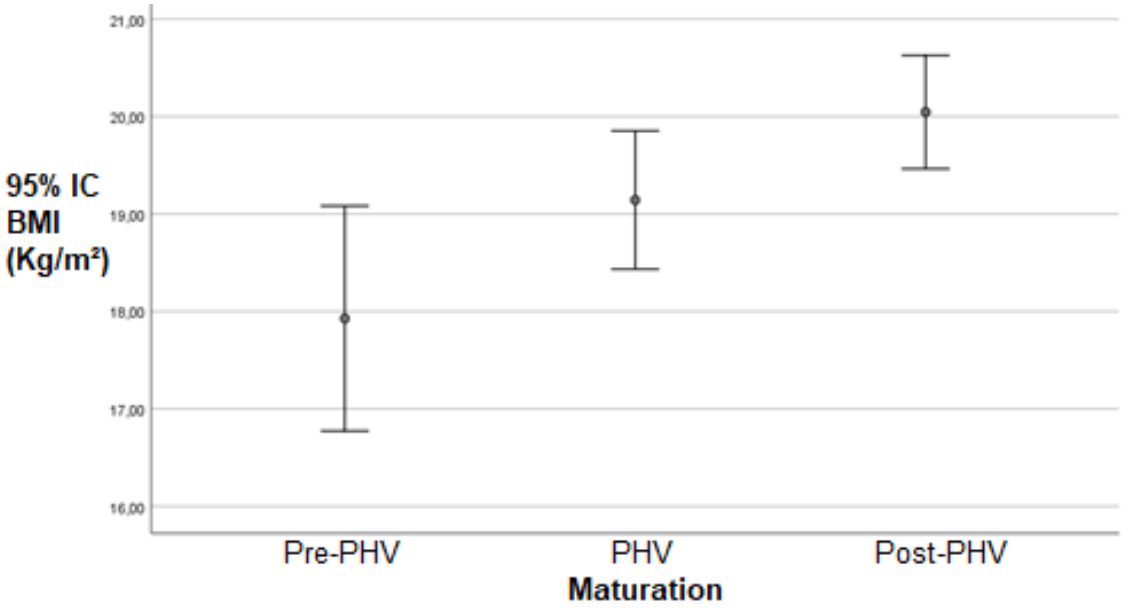
On average, the athletes belonging to the Post-PHV group are heavier, taller and with higher BMI (Figure 4) than the Pre-PHV and PHV. Those classified as PHV are heavier and higher, also having higher BMI than Pre-PHV.

Table 2. Sample characterization based on Peak Height Velocity.

Variables	***Pre-PHV (n=16)***	***PHV (n=22)***	***Post-PHV (n= 46)***	**F**	***P***
Weight (kg)	41.55 ± 7.83	51.2 ± 6.2	57.38 ± 7.84	27.441	<.01
Height (cm)	151.61 ± 7.41	163.35 ± 6.34	169.01 ± 6.87	38.627	<.01
BMI (kg/m^2)	17.93 ± 2.17	19.14 ± 1.60	20.04 ± 1.96	7.550	.001
T20 (s)	4.10 ± 0.26	3.82 ± 0.55	3.62 ± 0.38	7.986	.001
Horizontal Jump (cm)	162.62 ± 10.96	181.45 ± 72.75	199.83 ± 49.22	3.164	.048
T35	1.66 ± 1.23	2.42 ± 1.53	4.00 ± 1.72	15.937	<.01
Dribbling	2.36 ± 0.17	2.49 ± 0.18	2.54 ± 0.16	6.407	.003

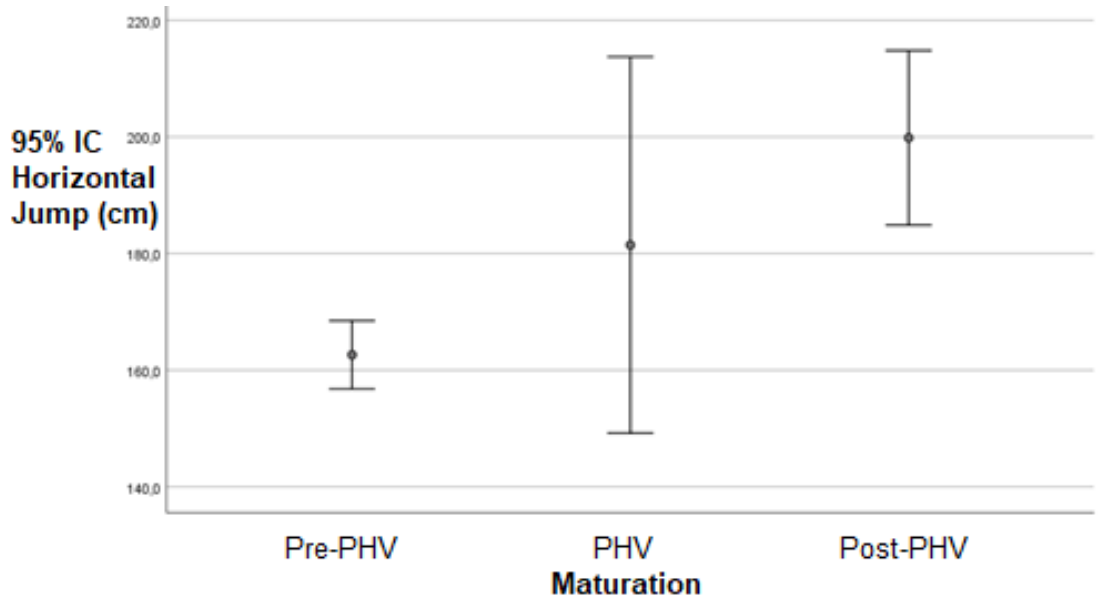
Means and standard deviations (±) of the ANOVA independent variables.

Figure 4. Difference between groups. Independent variable: Body mass index.



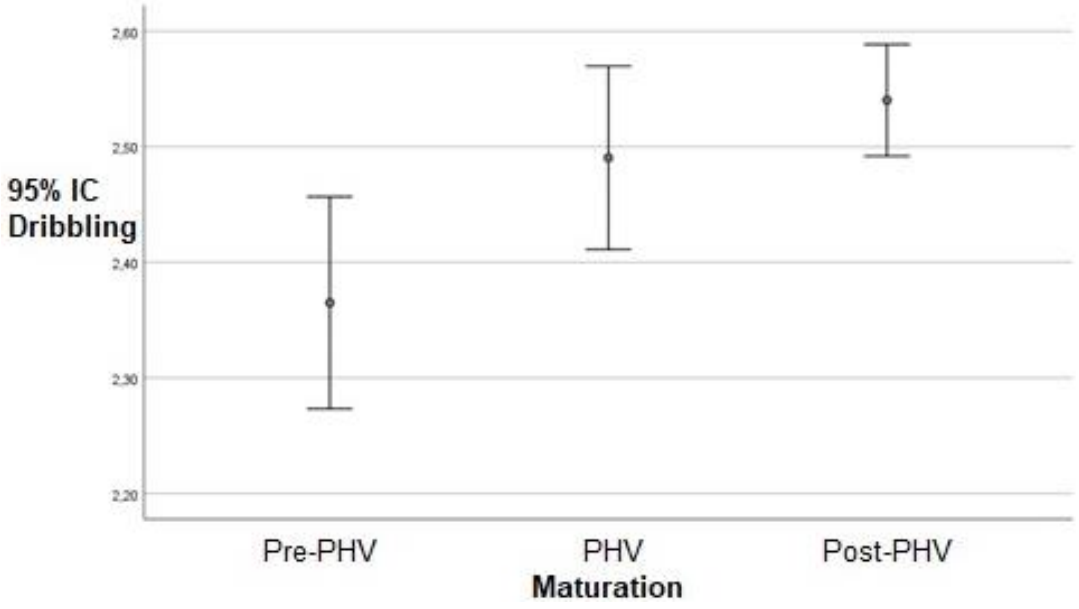
Considering the physical tests, some variables present a statistically significant difference between the groups. Thus, athletes in the Post-PHV group are faster in the 20-meter speed test than the Pre-PHV. When considering the horizontal jump, the same happens, but for a higher performance than those of the PHV group in relation to the Pre-PHV (Figure 5).

Figure 5. Difference between groups. Independent variable: Horizontal Jump.



Considering technical tests, the performance is superior for the 35-meter pass to the Post-PHV in relation to the Pre-PHV and PHV. In the test involving dribbling (Figure 6) the difference is imminent between the Post-PHV and Pre-PHV group, being favorable to the Post.

Figure 6. Difference between groups. Independent variable: Dribbling.



By observing the data from Table 3, it is possible to verify the statistically significant associations between dependent variables (maturational groups) and independent variables. Thus, there is a strong positive correlation involving maturation and the variables weight, height, BMI, horizontal jump, pass 35 meters and dribbling.

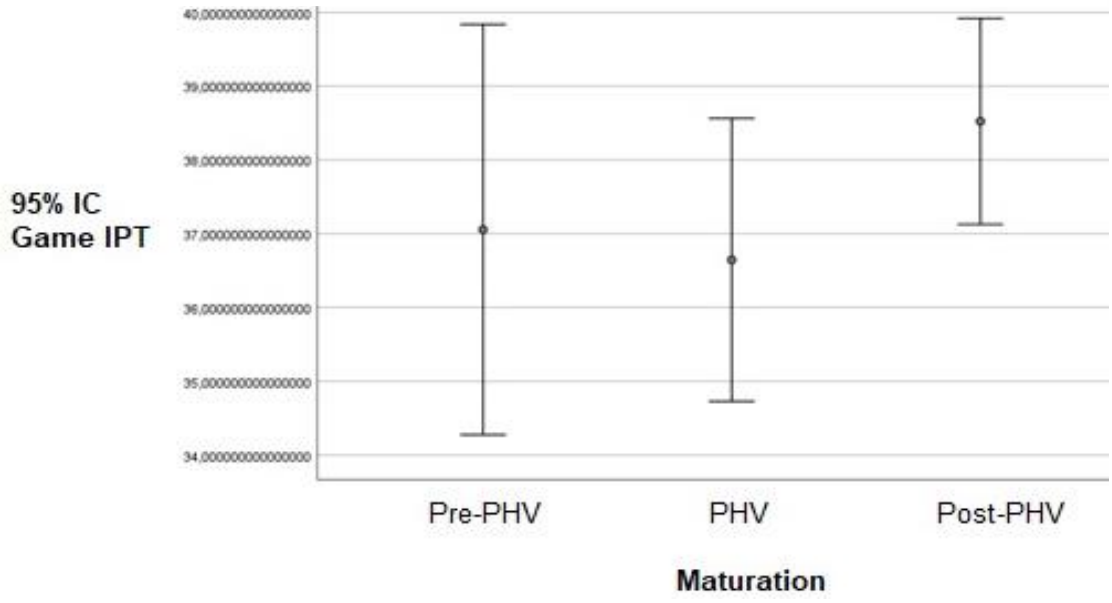
Table 3. Associations between Maturational Groups and anthropometric, physical, technical skills, and tactical variables.

Independent variables	*r*	*p*
Weight (kg)	0.631**	<.01
Height (cm)	0.685**	<.01
BMI (kg/m^2)	0.395**	<.01
T20 (s)	-0.406**	<.01
Horizontal Jump (cm)	0.272*	0.013
T35	0.523**	<.01
Dribbling	0.359**	0.001

** The correlation is significant at the 0.01 level (2 ends).
* The correlation is significant at the 0.05 level (2 ends).

Also, with strong but negative correlation for maturational status and speed test 20 meters. No statistically significant correlations were found between maturational status and any variable of tactical bias (Figure 7). Other anthropometric, physical, and technical variables also did not present correlations with maturational status.

Figure 7. Difference between groups. Independent variable: Game Tactical Performance Index.



The Linear Logistic Regression test was validated according to the data presented in Table 4 and 5. The dependent variable was the Game Tactical Performance Index.

Table 4. Multiple Linear Regression of maturation, tactical, technical skills, physical, and anthropometric indicators.

	Odds Ratio (95% IC)	Z	p
Model 1			
Offensive TPI	0.337 (.250-.406)	73.912	<.01[b]
Model 2			
Offensive TPI	0.316 (.255-.367)	105.385	<.01[c]
% Accuracy	0.195 (.154-.245)		

a. Dependent Variable: Game TPI.
b. Predictors: (Constant), Offensive TPI.
c. Predictors: (Constant), Offensive TPI, % Accuracy.

Through the results expressed the independent variables that best explain the Offensive Tactical Performance Index (45%) and Percentage of Correct Answers (24%). Anthropometric, physical, technical, and maturational variables were not able to explain a superior performance for the Game TPI.

Table 5. Association between Game Tactical Performance Index and independent variables.

	B	S.E. B	β
Model 1	22.027	1.865	
Offensive TPI	0.337	0.039	0.695
Model 2	9.788	1.987	
Offensive TPI	0.316	0.029	0.653
% Accuracy	0.195	0.023	0.498

Δ R2= 0.45 for Model 1; Δ R2= 0.24 for Model 2.
*p= 0.05.
Dependent Variable= Game TPI.

Discussion

The present study aimed to compare and verify the relationships between tactical, technical, physical, and anthropometric data between three maturational groups (Pre-PHV, PHV, Post-PHV). It was also examined how in situ performance in reduced soccer games can be predicted by the Offensive Tactical Performance Index, tactical accuracy percentage, anthropometric variables, physical tests, and soccer-specific technical skills.

Thus, the data are explained by four blocks (anthropometry, physical, technical skills, and tactical tests), based on the objectives and statistical tests applied, considering as dependent variables the maturational status and Game TPI.

When comparing each of the three maturational groups, statistically significant differences were perceived for three of the four anthropometric variables. Post-PHV soccer players were taller, heavier and with higher BMI value compared to the others (Pre-PHV and PHV). The group classified as PHV also presented higher mean values for the same variables in relation to Pre-PHV soccer players.

The data associated with anthropometric variables are in line with other studies. Towlson et al. (2018) identified that the advance in maturational status causes increases in height and body mass of young soccer players. Borges et al. (2018) investigated the relationship between tactical performance, maturational status, anthropometry, and functional characteristics of young soccer players.

When using a sample of school sportsmen, Wickel & Eisenmann (2007) also identified significant differences in anthropometric characteristics for boys who reached maturation earlier. The same happens with young English soccer players, where Murtgah et al. (2018) realized that Post-PHV athletes have greater height and body mass than athletes in the Pre-PHV and PHV groups.

The data presented in Table 3 (Pearson Correlation) show statistically significant associations between maturational groups and independent variables. The strong positive correlations involve the maturational status and the variables: weight, height, BMI, horizontal jump, pass 35 meters and dribbling. With strong but negative correlation, there is the 20-meter speed test.

Among the physical tests considered and applied together the sample (speed 30 meters, agility, repetitions of abdominals, horizontal jump and squat jump), only the 20-meter speed test and horizontal jump showed statistically significant differences between the groups (Table 2). Post-PHV athletes have superior performance compared to Pre-PHV in the speed test, while PHV athletes jump higher than Pre-PHV. These increments are associated with the natural increase of testosterone in individuals who have already undergone PHV and, thus, obtain better performance for actions directly linked to some property of strength (Jorquera et al., 2012; Deprez et al., 2015; Granados, Gebremariam, & Lee, 2015; Malina, Coelho-e-Silva, Figueiredo, Carling, & Beunen, 2012).

The international literature presents explanations for the variations in performance between physical capacities and maturational status. Malina et al. (2004) with a sample of young Portuguese soccer players concluded that maturational status directly influences functional abilities. Similar results are provided by Valente-dos-Santos et al. (2012), where it was observed that higher anthropometric means and performance in the speed of young soccer players are associated with maturational status.

When considering physical tests, McCunn et al. (2017) and Rommers et al. (2019) identified that the highest performance in speed, for example, tends to be tied to players who mature previously (Post-PHV). On the other hand, when athletes are inserted in a high-development program, anthropometric and physical variables do not seem to suffer short-term effects of maturational status (Buchheit, & Mendez-Villanueva, 2013).

For the technical tests specific to soccer, part of the battery suggested by (Wilson et al., 2016) was used. Thus, the performance data for the pass 20 and 35 meters plus the dribbling were counted with the sample of eighty-four young soccer's. Once again, an advantage can be perceived for athletes with consolidated or advanced maturational status (Table 2). The athletes with advanced maturational status (Post-PHV) obtained higher rates in the pass 35 meters in relation to the Pre-PHV and PHV. For dribbling, the difference is between Post-PHV and Pre-PHV, being favorable to those with advanced maturation.

Malina et al. (2005) realized, when analyzing a sample of 69 young soccer players, that maturational status contributed significantly to the performance of certain soccer-specific skills tests.

On the other hand, Rommers et al. (2019) and Vandendriessche et al. (2012) presented data in which they concluded that the specific motor coordination of soccer does not seem to be influenced by maturational status.

When looking at the tactical variables, there were no statistically significant differences between any of the three maturational groups. The best tactical performance, quantified by the variables Offensive TPI, Defensive, Game, % accuracy and % error, was not linked to the Post-PHV and PHV groups (Table 2; Figure 7), as most of the other variables presented in this study.

Using Pearson's correlation, no statistically significant values were found between maturational status and any variable of tactical bias (Table 3). The results are like those of Borges et al. (2018), where they show that there is a low correlation between tactical performance and maturational status of young soccer's. The same is true of tactical effectiveness. The study by Reis & Almeida (2020) shows that the maturational status does not affect the offensive, defensive and in-game tactical performance.

Also, through the Linear Logistic Regression test, it was noticed that the variables that best explain a better performance for the Offensive Tactical Performance Index (Table 4; Table 5). Thus, a better performance in the tactical issue (Offensive TPI and % accuracy) implies increases in the Game Tactical Performance Index.

Despite the maturational differences there is no statistically significant differences for the tactical variables. We can infer that players belonging to the Pre-PHV group use other cognitive resources to solve the same problems inherent to the soccer game (Borges et al., 2017). Other anthropometric, physical, and technical variables also did not present correlations with maturation. These variables were also not able to predict a superior performance for the Game TPI through Linear Logistic Regression.

Post-PHV players present superior performance than Pre-PHV and PHV regarding soccer-specific skills (Borges et al., 2018) and physical capacity

(Valente-dos-Santos et al., 2012), but the same is not true for tactical performance (Borges et al., 2017, 2018; Reis & Almeida, 2020).

In general, the selectors and coaches use the anthropometric, physical, and technical advantages, momentary, that athletes included in advanced maturational statutes have (Bidaurrazaga-Letona et al., 2015; Till & Baker, 2020; Vandendriessche et al., 2012). However, by increasing the level of soccer performance, these programs tend to exclude athletes with advanced maturation to the detriment of those with late maturation (Ostojic et al., 2014). This is probably due to the stabilization of the biological growth of individuals, the high level and quality of the training and competition process, besides being more likely to develop space management skills in the field of play (tactics) (Malina et al., 2015).

Conclusions

It was concluded that maturational status does not affect tactical performance. However, Post-PHV athletes have higher anthropometric values when compared to Pre-PHV and PHV. The performance is superior in two physical tests (T20, horizontal jump) and technical skills (Pass 35m, dribbling) for Post-PHV. Apparently the PHV and PHV Post-PHV athletes because they have a lower physical capacity (relative to pre-PHV), create adaptations in their style of play to solve the game problems. Such solutions may be associated with the management of the game space, which consequently are indicated by the values of the Game TPI and Offesinve TPI.

The central idea is to provide young soccer’s with a fairer context during the identification and selection processes. Considering the individual's maturational status, as well as the consequences linked to it, appears to be a viable and interesting path to be followed. But it is necessary, above everything, the definition of the characteristics will be sought in athletes. The domain of this theme, as well as the direct and indirect relations to it, are recommended to professionals who deal with the processes of identification and selection of talents.

In this case, it is realized that maturational status can be a confounding variable in the processes of identification and selection of young soccer's. However, it is emphasized that if the objective of the selection is the eligibility of the highest, heaviest, strongest and with certain physical indices is an interesting criterion.

Also decontextualized testing training and game are apparently less effective than those that occur in ecological context. Tests that consider the real game context and that are combined with data analysis and observation instruments capable of quantifying these actions may present greater assertiveness.

Limitations and future investigations

The limitations of the study go through the application and collection of data (all tests occurred on a single day) and the heterogeneity of the sample (athletes belonging to teams, training levels and different competition).

Further research on the theme of the identification and selection of young soccer's is suggested, but considering, for example, the time of practice.

Declaration of conflicting interests

The Author(s) declare(s) that there is no conflict of interest.

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Capítulo III – Discussão Geral

1. Discussão Geral

Nesta dissertação os objetivos foram verificar os efeitos da maturação biológica sobre a antropometria, desempenho físico e técnico e no conhecimento tático processual de jovens futebolistas. Para isso, desenvolveram-se dois estudos: uma revisão sistemática e um estudo exploratório.

Consideraram-se na revisão sistemática (Estudo 1) 53 estudos sendo, maioritariamente, de origem europeia e concentrados em Espanha. Esta temática é explorada há muitos anos, porém nem sempre com o viés científico condizente. Desde a proposta não invasiva de Mirwald et al. (2002) verifica-se um crescimento de publicações relativas aos efeitos da maturação sobre o desempenho físico e técnico de futebolistas, embora os aumentos dessas publicações tenham acontecido a partir de 2015.

A proposta de Mirwald et al. (2002) possibilita aos avaliadores estimarem o Pico de Velocidade da Altura, e classificarem os atletas em atrasados, previstos e avançados maturacionalmente, sem expor ou constranger os avaliados como tende a acontecer nos testes com carácter invasivo. Com a equação matemática de Mirwald et al. (2002) os profissionais interessados em analisar a maturação biológica em humanos têm à disposição um método com baixo investimento financeiro, mas amparado cientificamente. Provavelmente, esse advento possibilitou um aumento nas pesquisas relacionadas com o tema da identificação e seleção de talentos, uma vez que a maioria das pesquisas consideradas para a presente revisão sistemática serviram-se deste método não invasivo.

Os estudos incluídos na revisão incluíram apenas futebolistas do género masculino e, em grande parte, apresentaram amostras superiores a 30 jogadores. Os objetivos direcionaram-se em perceber a influência da idade relativa e do estado maturacional sobre o desempenho físico, técnico, tático, cognitivo e psicológico de jovens futebolistas e, sobretudo, os impactos dessas variáveis nos processos de identificação e seleção de jovens futebolistas. Os

sujeitos, por sua vez, eram maioritariamente jovens atletas e classificados por escalões etários.

As intervenções junto dos futebolistas passaram pela verificação dos efeitos da idade relativa sobre a seleção de atletas (Castillo et al., 2019) e participação em jogo (Del Campo et al., 2010), sobre a influência do estado maturacional no desempenho físico (Asadi et al., 2018), técnico (Fenner et al., 2016), cognitivo (Vänttinen et al., 2010) e psicológico (Sieghartsleitner et al., 2019). Os estudos confirmaram os efeitos da idade relativa no futebol de formação, o que possivelmente afeta a exclusão de jovens talentos (Mujika et al., 2009; Rodríguez-Lorenzo, 2019). Não obstante, nos escalões mais próximos dos seniores verifica-se uma diminuição desse efeito (Brustio et al., 2018; González-Víllora et al., 2015). O estudo de Ostojic e colaboradores (2014) apresenta a mesma ideia, ou seja, à medida que escalões etários avançam, e consequentemente verifica-se uma estabilização do crescimento corporal, os atletas elegidos para compor as equipas e jogarem competições não apresentam grandes diferenças em relação ao mês de nascimento.

Ao considerarmos os procedimentos dos estudos, verifica-se que os protocolos, baterias e testes tiveram como finalidade verificar como o efeito da idade relativa e estado maturacional dos jovens influem no desempenho atlético geral de futebolistas. Para isso, a recolha de dados de diversa ordem foi realizada em diversos estudos: dados antropométricos (Bidaurrazaga-Letona et al., 2015; 2019; Buchheit, & Mendez-Villanueva, 2013), dados físicos (Castillo et al., 2019; Cunha et al., 2017) e dados técnicos (Jukic et al., 2019; Leyhr et al., 2018).

Com uma quantidade menor de estudos, as temáticas cognitivas e técnicas, táticas e físicas, através de jogos reduzidos, foram verificados (Huijgen et al., 2015; Katis, & Kellis, 2009, i.e.). Os procedimentos utilizados para verificar o efeito da idade relativa e o estado maturacional foram variados, com destaque para a equação do PVA (Mirwald et al., 2002) e categorização dos quartis (Doyle, & Bottomley, 2018; Rubajczyk, & Rokita, 2018). É percetível, por meio dos 53 estudos, que os processos de identificação e seleção de jovens futebolistas são

mais excludentes que inclusivos (Bidaurrazaga-Letona et al., 2019; Mujika et al., 2009), principalmente ao nível físico. O futebol é um campo de prática que, a princípio, valoriza muito os aspetos físicos e, paralelamente, está associado ao mês de nascimento (quartil) e, consequentemente, ao estado maturacional, gerando uma desigualdade entre os futebolistas (Romann et al., 2020). Um desenvolvimento mais individualizado e com respeito às características de crescimento e maturação pode ser uma solução para amortizar essa recorrente desigualdade (Abbott et al., 2019; Malina et al., 2019). Um olhar para a literacia motora, em um primeiro momento, somado a um ambiente desportivo favorável para o amplo desenvolvimento atlético, talvez seja mais coerente e benéfico aos futebolistas, potencializando-os a chegarem ao topo do futebol (Coutinho et al., 2016; Till & Baker, 2020).

Relativamente ao estudo exploratório realizado (Estudo 2), compararam-se dados antropométricos, físicos, técnicos e táticos de 84 jovens em diferentes estados maturacionais (Pré-PVA, PVA, Pós-PVA), e estimaram-se as contribuições das variáveis maturacionais, antropométricas, físicas, técnicas e táticas no Índice de Performance Tática em Jogo (IPT Jogo). Os 84 jovens futebolistas portugueses encontravam-se a serem analisados por meio do Projeto INEX. Observou-se que os atletas Pós-PVA eram mais altos, mais pesados e com maior valor de IMC em relação aos outros dois grupos (Pré-PVA e PVA). Os atletas PVA evidenciaram valores médios superiores para as variáveis altura, peso e IMC em relação aos Pré-PVA. As variáveis físicas apresentaram diferenças estatisticamente significativas para o teste de velocidade 20 metros e salto horizontal. Assim, os atletas Pós-PVA foram mais rápidos (T20) que os Pré-PVA. Já para o salto horizontal o desempenho foi superior do grupo PVA em relação aos Pré-PVA.

Considerando-se os testes técnicos, o desempenho dos atletas Pós-PVA foi superior no teste de 35 metros e de condução de bola em relação aos Pré-PVA e PVA. Entretanto, nenhuma das variáveis táticas apresentou diferenças estatisticamente significativas considerando os grupos maturacionais.

No que diz respeito às correlações, obtiveram-se valores estatisticamente significativos entre os grupos maturacionais e as variáveis peso, altura, IMC, salto horizontal, passe 35 metros e condução, mas sem associação com as variáveis táticas (Quadro 3).

Os indicadores que melhor explicaram um desempenho superior no Índice de Performance Tática (IPT) em jogo foram os valores do IPT ofensivo e percentagem de acerto (% acerto). Nenhuma das variáveis antropométricas, físicas e técnicas puderam explicar valores superiores no IPT Jogo. Scherer (2019) identificou igualmente que o desempenho elevado no IPT Jogo é explicado pelo IPT Ofensivo e eficácia no % acerto. Diferentemente da presente dissertação, apresenta também que a idade (atletas mais jovens) e impulsão horizontal influem para melhores índices no IPT Jogo.

As relações entre estado maturacional, variáveis antropométricas e desempenho físico são aspetos dinâmicos e divergentes, podendo apresentar ambiguidade no momento de avaliar jovens futebolistas (Towlson et al., 2018). Esta ideia é corroborada na presente dissertação na medida em que se encontrou que os atletas pertencentes aos grupos PVA e Pós-PVA apresentaram valores superiores na antropometria e desempenho físico.

Outros estudos (e.g. Buchheit & Mendez-Villanueva, 2013; Deprez et al., 2015; Malina et al., 2000; Vandendriessche et al., 2012) confirmam os resultados pois apresentam que o estado maturacional afeta a antropometria, como por exemplo o peso e a altura. Os resultados apresentados no Estudo 2 corroboram que haja influência direta da maturação em variáveis antropométricas e físicas, possibilitando vantagens a atletas classificados por PVA e/ou Pós-PVA, pois, em geral, são mais altos e mais pesados que indivíduos da mesma idade cronológica, mas classificados como Pré-PVA.

Percebeu-se que o desempenho físico também é influenciado pelo estado maturacional, pois os atletas PVA e Pós-PVA são mais rápidos e saltam mais que os Pré-PVA. Esta relação é conhecida e apoiada pela literatura internacional, que aponta que o estado maturacional tem relação direta com melhores índices de força e, consequentemente, com o melhor desempenho em testes físicos

específicos (McCunn et al., 2017; Murtagh et al., 2018; Towlson et al., 2018; Valente-dos-Santos et al., 2012).

O estado maturacional contribui na variação de desempenho para o salto (Malina et al., 2004; Murtagh et al., 2018) e pode influenciar no desempenho em jogo. Atletas Pós-PVA podem saltar mais que indivíduos da mesma idade e escalão etário obtendo assim vantagens claras durante sessões de treino e competição. Transportando este facto para situações de treino e competição, atletas com idade cronológica semelhante e, assim sendo, pertencentes ao mesmo escalão competitivo, mas classificados diferentemente pelo estado maturacional, possuem um desempenho também distinto (favorável aos Pós-PVA). Por exemplo, atletas Pós-PVA correm mais, possuem desempenho superior no sprint e jogam mais minutos em relação aos PVA e Pré-PVA (Goto et al., 2016). Isso pode apresentar uma tendência de maiores oportunidades para atletas Pós-PVA, em relação aos demais, por apresentarem melhores índices físicos.

A maturação está associada com uma maior composição corporal (peso, altura e IMC, por exemplo), valores de força e desempenho físico geral superiores, deste modo, atletas Pós-PVA possuem vantagens eminentes e podem dominar o cenário do desporto infantojuvenil (Cumming et al., 2017; Malina et al., 2000, 2019; Murtagh et al., 2018).

Ao considerarmos a dimensão técnica, a literatura apresenta a baixa associação desta com o estado maturacional dos futebolistas. Malina et al. (2005), ao analisarem a relação de diferentes variáveis, entre elas o estado maturacional e variáveis técnicas, concluíram que a maturação influi, mas explica pouco, para índices superiores do controle de bola, drible em velocidade com passe e precisão do remate em futebolistas portugueses.

Rommers et al. (2019) apresentam que a coordenação específica do futebol, aparentemente, não é influenciada pelo estado maturacional. O mesmo acontece no estudo de Vandendriessche et al. (2012), em que os resultados referentes a testes de coordenação motora geral e específica do futebol, com 78

jovens atletas belgas, não demonstraram relação entre estado maturacional avançado e melhor desempenho para os respetivos testes.

Estes resultados permitem uma reflexão relativa aos processos de seleção, uma vez que a opção por selecionar atletas classificados como Pós-PVA pode apresentar vantagens a curto prazo, na questão antropométrica e física, mas não para o aspeto técnico. Os critérios estabelecidos anteriormente aos processos de seleção e desenvolvimento de talentos ajuda neste aspeto. A valorização e busca por vantagem em duelos físicos, aparentemente, favorece os Pós-PVA. Entretanto, ao considerar-se o aspeto técnico, o estado maturacional avançado não se torna preponderante para um melhor desempenho.

Ao versar o olhar para as variáveis táticas percebe-se que um melhor desempenho nessas variáveis não é necessariamente explicado, ou associado, pelo estado maturacional. Estudos apontam (Borges et al., 2018; Reis & Almeida, 2020) que não há uma relação eminente disso com o desempenho tático. Deste modo, não é possível predizer que atletas PVA e Pós-PVA apresentam índices superiores para esta variável em relação aos Pré-PVA.

Os resultados demonstram que os fatores que melhor explicam IPT Jogo, neste caso, não são variáveis antropométricas, maturacionais ou físicas, mas sim o desempenho superior no IPT Ofensivo e % de acerto. Presume-se que o desempenho na variável tática esteja intimamente relacionado por uma melhor gestão do espaço, fator que sofre pouca influência da antropometria e/ou capacidades físicas. O atleta, independentemente do seu estado maturacional e relações com a altura e capacidade atlética, por exemplo, pode ter um bom desempenho técnico e tático. Apresentar um estado maturacional avançado (Reis & Almeida, 2020) e índices físicos superiores (Borges et al., 2017) pode influenciar positivamente em determinadas ações táticas ofensivas e defensivas, entretanto não influencia a efetividade tática no jogo (Reis & Almeida, 2020).

Provavelmente a falta de associação direta entre estado maturacional e variáveis táticas esteja atrelado a outros fatores, tais quais a cognição e o contexto ambiental, socio-parental, econômico entre outros (Borges et al., 2017).

Atletas com melhores índices táticos, provavelmente, possuem os aspetos cognitivos atrelados a tomada de decisão mais bem desenvolvidos e, quando inseridos a um contexto formativo de qualidade, podem apresentar melhores soluções para as demandas de variabilidade, imprevisibilidade e aleatoriedade inerentes ao futebol (Borges et al., 2017).

No âmbito geral, os programas de identificação e desenvolvimento de jovens futebolistas necessitam considerar as diversas influências da maturação, particularmente na faixa etária entre 13 e 14 anos (Cumming et al., 2017; Malina et al., 2019; McCunn et al., 2017). Levando em conta o máximo de aspetos relacionados ao jogo de futebol, em detrimento de critérios unilaterais (desempenho físico, por exemplo) (Reilly et al., 2000; Williams & Reilly, 2000). Um olhar amplo e a passar por aspetos técnicos, táticos e psicológicos necessita ser considerado com prevalência (Borges et al., 2018; Vandendriessche et al., 2018; Reilly et al., 2000; Williams & Reilly, 2000).

Isto devido ao fato de que o desempenho desportivo a nível de formação não é determinante para o sucesso na elite sênior (Carvalho et al., 2017; Ostojic et al., 2014). O processo de formação desportiva passa por um currículo sólido, adaptável e coerente com as demandas dos atletas em questão (Cumming et al., 2017; Lloyd et al., 2014; Malina et al., 2019). Desta maneira, as vantagens associadas ao estado maturacional no desporto infantojuvenil são momentâneas e não predizem o desempenho adulto.

Capítulo IV – Conclusões

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1. Conclusões

Conclui-se que a população infantojuvenil amadurece distintamente, ao modo que, indivíduos competindo no mesmo escalão etário podem apresentar diferenças nos fatores maturacional e físico mesmo com idade cronológica semelhante. Os estudos considerados indicam que esses fatores são presentes e influentes junto aos processos de identificação e seleção de talentos. Esses fenômenos, aparentemente, favorecem a exclusão prematura de possíveis atletas de sucesso, pois estão associados ao desempenho superior, mas momentâneo, em determinadas capacidades físicas, como por exemplo a força (fator primordial para vencer os duelos individuais no contexto do futebol).

As pesquisas relacionadas a temática de identificação e seleção de futebolistas talentosos e associadas, por exemplo, ao efeito da idade relativa, estado maturacional, aspetos antropométricos, entre outros, estão em desenvolvimento constante, com as publicações concentradas na Europa e nos anos de 2015, 2017, 2018 e 2019. Mesmo com uma literatura consolidada internacionalmente, esses fatores ainda são recorrentes e comprovados através dos resultados. Em contrapartida, quando os objetivos da equipa e dos profissionais desportivos estão atrelados às questões meramente físicas e de desempenho imediato, apresenta-se como um interessante critério de seleção.

Sugere-se uma atenção para que indivíduos maturados tardiamente não sejam excluídos do processo de identificação e seleção de jovens atletas, mesmo caso apresentem desempenho físico inferior quando comparado aos com estatuto maturacional intermedio e/ou avançado. Os indivíduos enquadrados como atrasados maturacionalmente parecem resolver os problemas inerentes ao futebol de forma distinta aos demais, partindo por uma melhor gestão e ocupação do espaço de jogo. Para isso faz-se necessário uma avaliação criteriosa sobre todas as possíveis variáveis relacionadas ao crescimento, desenvolvimento, maturação e treinamento desportivo.

As características de desempenho físico necessitam ter uma ênfase diferente no período infantojuvenil, uma vez que, o estado maturacional age de forma distinta no desempenho. Entretanto, a coordenação motora genérica e

específica são primordiais e imprescindíveis nos anos iniciais da prática desportiva, especialmente na faixa etária que compreende a primeira infância. Desta maneira, ao considerar-se esses aspetos, haveria maior chance de igualar o processo de identificação e seleção de jovens talentos.

Os profissionais do desporto devem considerar como fatores importantes no processo de identificação e seleção de talentos o bom desempenho em habilidades técnicas específicas ao futebol e a aptidão física, mas não só. Aspetos táticos são fatores que interferem diretamente no desempenho desportivo, porém sofrem pouca ou nenhuma interferência do estado maturacional. Os estudos compilados mostram que os aspetos táticos, e cognitivos, ainda não são usados de forma recorrente em avaliações junto a jovens futebolistas, mesmo sendo parte importante para o desempenho em treino e jogo. Aconselha-se, também, que os testes sejam contextualizados ao ambiente de prática, considerando a análise do máximo de componentes associados ao jogo de futebol, tais quais as técnicas, táticas, fatores cognitivos e psicológicos, dentro de uma visão holística.

Em um âmbito geral o processo de identificação de talentos precisa ter em conta inúmeros fatores, considerando a visão holística, ambiental e situacional aqui reforçada. Realmente perceber que tais processos possuem um trajeto não linear, sendo dinâmico e complexo.

Estimula-se que continuem a realizar-se pesquisas envolvendo a temática de identificação e seleção de talentos, mas que passem a considerar mais o desempenho tático como variável e com análises longitudinais. Passa-se, assim, pela finalidade de perceber a evolução, ou não, dos jovens futebolistas e como essas variáveis influem para o alcance de estágios superiores de desempenho.

Capítulo V – Referências

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