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Talent Identification in Sports Using the Adaptive Method of Core Indicators in Professional Athletes

Fatemeh. Sajjadipour[1], Hossein. Peymanizad[2*], Javad. Mohammadkhani[3], Meysam. Rezaei[4]

1 PhD Student, Department of Sport Management, Faculty of Sport Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran
2 Associate Professor, Department of Sport Management, Faculty of Sport Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran
3 Assistant Professor, Department of Sport Management, Faculty of Sport Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran
4 Assistant Professor, Department of Physical Education and Sport Sciences, Faculty of Sport Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran

Corresponding author email address: peymanizad0353@mahdiau.ac.ir

ABSTRACT

The present study was conducted with the aim of identifying athletic talent using the adaptive method of core indicators in professional athletes. This research is applied in terms of purpose and descriptive-analytical in terms of nature and method, utilizing a mixed-methods approach (qualitative-quantitative). The statistical population in the qualitative section included selected scientific articles from domestic and international databases, as well as academic experts and elite athletes. Sampling was conducted purposively, and data were collected through semi-structured interviews and analyzed using thematic analysis. In the quantitative section, the statistical population consisted of 36 professional and elite athletes selected using purposive sampling. Data were collected using a researcher-made questionnaire and analyzed using a one-sample t-test. The results indicated that athletic talent identification through the adaptive method of core indicators includes seven main dimensions (genetic, physiological, anthropometric, psychological, biological, living environment, and lifestyle) and 53 indicators. Of these, 46 indicators were in a favorable condition, while 7 indicators (having athlete parents, sitting height, lower limb length, pelvic width, thoracic circumference, abdominal circumference, and the use of university-educated professionals in talent identification centers) were in an unfavorable condition. The highest means were related to the indicators of intrinsic interest in competitive sports (4.47), physical health (4.42), and mental toughness (4.39). Athletic talent identification is a complex and multidimensional process that requires attention to a range of genetic, physiological, anthropometric, psychological, biological, and environmental indicators. To succeed in this process, a comprehensive and scientific talent identification system must be designed and implemented with the participation of academic experts and by considering all these indicators. Furthermore, special attention should be given to the indicators that are in an unfavorable condition, and appropriate plans should be developed to improve them.

Keywords: athletic talent identification, adaptability, core indicators, professional athletes, thematic analysis

Introduction

Talent identification is one of the fundamental concepts in sports science and physical education, playing a pivotal role in the development of elite sports. Sports development research encompasses all participants and sporting disciplines, addressing the policies, processes, and practices designed to facilitate participation from grassroots to elite levels (de Oliveira Abrahão et al., 2022). In the talent identification process, numerous factors such as age, physical fitness, cognitive, perceptual, and motor skills play critical roles (Seifert et al., 2018). Accordingly, many countries have adopted and expanded systematic programs for talent identification and development to achieve international success (Wang & Pervaiz, 2016).

In recent years, the strategy of prioritizing talent identification camps and talent development has been integrated into the annual sports calendars of national federations. The development of national talent identification initiatives is a key factor in the growth of sports federations and, consequently, the advancement of national sports. Such programs provide the groundwork for transforming potential athletic talent into actual performance (Abrefam et al., 2022). However, the talent identification system in the country's elite sports faces several challenges, including the inefficient perception of school sports by administrators as the foundation of elite sports, weak performance of elite training centers and talent identification institutions, limited involvement of the private sector, political influences on organizational operations, lack of comprehensive support systems for elite athletes and coaches, and the absence of a structured and integrated talent identification model (Ribeiro et al., 2021).

Developing elite sports requires coordination among various sectors to properly allocate available financial resources in the sports domain. Currently, multiple sporting competitions are organized by diverse bodies such as sports federations, the Ministry of Education, higher education institutions, armed forces, the Ministry of Labor, and the Basij, each incurring significant costs. Yet, it seems the outcomes of such events have not yielded a substantial impact on the advancement of elite sports in the country (Haidar Eissa et al., 2023).

Athletic talent identification is the process of recognizing the potential of human attributes influenced by various genetic, physical, and behavioral factors. This approach emphasizes the importance of understanding capabilities and conducting comprehensive assessments, determining the impact and contribution of different influencing elements in order to predict outcomes accurately and guide athletes toward safe and optimal skill execution (Kalani et al., 2020). Adaptability refers to the characteristic of a system or model that defines its capacity to adjust and perform effectively under changing conditions. In the context of athletic talent identification, adaptability pertains to the ability to align talent identification indicators with different cultural, ethnic, geographical, and individual contexts (Eskandari Fard et al., 2020). Talent identification with an adaptive approach involves discovering athletes' potential capabilities and assessing the compatibility of these capabilities with essential and influential indicators across various sports disciplines (Siyahi & Asghari Pour Dasht Bozorg, 2020).

Core indicators in athletic talent identification encompass various elements. Athletic performance includes sport-specific skills, competition style, sportsmanship, and competitiveness—each acting as crucial tools in building an athlete's brand image and fan loyalty (Pourzarnegar, 2021). Physiological and anthropometric characteristics consist of bodily, physical, and physiological features that influence athletic performance. These characteristics play a significant role in identifying, discovering, and supporting talent, as well as determining the appropriate playing position based on individual differences (Shahi, 2018). Another factor is heredity and genetics. Physical activity is a complex phenotype influenced by millions of environmental and genetic variables. It has long been recognized that the variation in physical performance and athletic ability has strong genetic components (Siyahi & Asghari Pour Dasht Bozorg, 2020). Marketable lifestyle refers to attributes that can be presented both in the marketplace and outside the playing field, reflecting the athlete's values and personality (Dadgar, 2021). Psychological factors include motivational characteristics, self-confidence, goal-setting, and emotional control, all of which significantly influence sports success (Hajilo & Anbaryan, 2023).

Since talent identification and the recognition of elite individuals are integral to advanced and modern sports principles, selective studies for detecting capable individuals are essential (Hajinabi et al., 2013). Given the wide

diversity in the physical, physiological, psychological, body type, personality, and biological and hereditary requirements of different sports, employing precise and scientific data to match individuals with the sports most suited to their abilities is considered indispensable (Hosseini, 2013).

Effective talent identification has been a primary contributor to the dominance of Eastern European countries in elite sports over the past two decades (Eftekhari et al., 2019). Today, the increased emphasis by governments and ruling systems on social, political, and economic aspects to achieve international prestige has magnified the role of talent identification in sports (Talebzadeh et al., 2023).

In Iran, the use of scientific talent identification methods began in 2000. Before that, there was no systematic approach to identifying athletic talent nationally. In the 2000s, several federations adopted diverse approaches to talent identification, mainly through the creation of regional hubs, public calls for applicants, and the organization of competitions. However, these talent identification activities across various institutions followed separate paths and lacked a strategic plan or comprehensive system to serve as a foundation for operational planning in this field (Asadi & Moradi, 2018).

Despite the significance of talent identification in developing elite sports, no precise implementation model exists for elite sports talent identification in the country (Barron, 2011). According to the findings of Alavi and Khosrpour (2020), under current conditions where multiple organizations are responsible for talent identification, each with separate and non-scientific programs, there is a pressing need to establish a cohesive structure involving all relevant organizations, particularly universities and the Ministry of Education, to centralize and unify talent identification efforts (Alavi & Khosrpour, 2020).

Contemporary models of talent development emphasize the integration of specialized training with broader athletic enrichment. This integrated process enhances self-regulation in perception and action, emotional control, and social interactions—all of which underpin elite and sub-elite athletic performance (Ribeiro et al., 2021).

Athletic talent identification using the adaptive method of core indicators in professional athletes, considering cultural, ethnic, and geographical differences, can assist the Ministry of Sports and Youth Affairs and provincial departments in integrating these factors into their planning. Based on the aforementioned issues, the present study aims to answer the following question: Can adaptive talent identification using core indicators in professional athletes contribute to the future development of professional sports in the country?

Methods and Materials

The present study was conducted with the aim of identifying athletic talent using the adaptive method of core indicators in professional athletes. This research is applied in nature and descriptive-analytical in terms of methodology, utilizing a mixed-methods approach (qualitative-quantitative). The study was implemented in two main phases: the qualitative phase for identifying talent identification indicators and the quantitative phase for evaluating the current status of these indicators.

In the qualitative phase, the statistical population included two groups: (a) selected academic articles from domestic databases (Magiran, Civilica, Noor Journals) and international databases (Elsevier, Emerald), chosen using a systematic review method, and (b) academic experts (faculty members in sport management) and elite athletes. Purposeful sampling was employed, and theoretical saturation was achieved with approximately 20 experts. Qualitative data were collected through semi-structured interviews with experts and analyzed using thematic analysis.

Following the identification of preliminary indicators through literature review, expert interviews were conducted to refine and contextualize the indicators. Through content analysis of the interview data, additional influential elements shaping the sports talent identification model were identified. To determine the content validity of the extracted indicators, expert opinions were used, and the Content Validity Ratio (CVR) was calculated for each indicator. Indicators with CVR values below the threshold—based on the number of evaluating experts—were excluded from the model.

In the quantitative phase, data were collected using a researcher-developed questionnaire based on the indicators identified in the qualitative phase. The questionnaire's validity was confirmed using convergent and discriminant validity assessments, and its reliability was verified using Cronbach's alpha and composite reliability coefficients. The statistical population in this phase included 36 professional and elite athletes from various sports disciplines, selected via purposive sampling. The talent identification model was developed as a second-order hierarchical factor model. Estimates related to the model—including validity indices, reliability measures, and core parameters (factor loadings, subcategories, and indicators)—were calculated. One-sample t-tests were employed to analyze quantitative data and assess the current status of talent identification indicators. Data analysis was conducted using SPSS and Smart PLS software.

Findings and Results

This section presents the research findings in two main parts: the first pertains to the identification of talent indicators using the adaptive method, and the second addresses the evaluation of these indicators' current status among professional athletes. For identifying the adaptive indicators for sports talent identification, a systematic review of relevant domestic and international research articles was conducted. Subsequently, thematic analysis was applied to extract initial indicators. To further refine and contextualize these indicators, expert interviews were carried out, and additional influential elements were identified through content analysis.

Table 1 illustrates the synthesis of expert opinions and findings from the reviewed literature on adaptive indicators for sports talent identification.

Table 1. Integration of Expert Opinions and Literature Findings on Adaptive Indicators for Sports Talent Identification

Axial Code	Open Code	Article Codes	Expert Codes
Genetic	Athlete parents	A1-A8	All experts
	Genetic codes	A2-A21-A26	2-6-8-9-10-11-12-13-17
	Muscle fiber type	A12-A25	4-10-14-16-18-19
	Lung capacity volume	A10-A17-A26	All experts
	Bone density	A7-A14	6-8-11-14-15-19
Physiological	Physical condition	A13-A16	2-5-8-12-13-15-20
	Lactic acid system	A4-A17	4-7-8-15-17-19-20
	Heart rate	A8-A14-A18-A20	All experts
	Maximum oxygen uptake (VO2max)	A7-A12-A25-A27	2-3-5-9-10-13-19
	Physical endurance	A9-A13	6-8-12-14-16
	Muscular endurance	A14-A16	1-4-10-15-18-20
	Fatigue resistance	A2-A16	3-6-11-15-17
Anthropometric	Height	A1-A2-A3-A5-A8-A10...	1-5-8-9-10-16-20
	Arm length	A1-A2-A5-A10-A11...	All experts
	Leg length	A2-A3-A5-A8-A13-A24	11-12-13-16-17-19
	Sitting height	A1-A2-A3-A11-A13-A19	5-9-14
	Upper limb length	A2-A10-A11-A13-A15	2-8-14
	Lower limb length	A1-A3-A8-A13-A15-A19	1-11-15-19
	Pelvic width	A1-A2-A3-A5-A8-A10...	6-8-9-13-16-20
	Chest circumference	A1-A2-A3-A5-A15-A19	11-12-14-17-20
	Abdominal circumference	A1-A2-A10-A11-A13-A19	3-7-8-15-18
	Body mass	A1-A5-A8-A10...	All experts
	Body fat percentage	A2-A13-A21	1-3-9-14-20
	Reaction time	A2-A3-A15-A22	8-10-12-13
	Agility	A2-A16	All experts
Psychological	Intrinsic interest in elite sports	A9-A10	5-9-10-16-20
	General intelligence and logical reasoning	A7-A22	2-8-14-18
	Psychological flexibility	A12-A19	6-7-12-20
	Learning ability and visual memory	A1-A2-A22	–
	Anticipation of object motion	A1-A14-A18	6-10-14-20
	Spatial perception skill	A9-A11-A12-A15...	6-9-11-15
	Stress response	A7-A8-A26	All experts
	Mental toughness	A1-A2-A22	3-5-7-12-17-19
	Resilience	A13-A14-A27	All experts
	Self-esteem	A21-A28	2-8-9-16

	Competitiveness	A8-A10-A26	3-9-10-13-17-20
	Confidence	A7-A8-A26	10-11-12-15-18
Biological	Morphological age	A2-A21-A22	1-8-9-10-14-19
	Physical health	A7-A12-A16	–
	Cardiovascular endurance	A1-A8	All experts
	Aerobic endurance	A2-A21-A26	2-6-8-9-10-11...
	Anaerobic endurance	A12-A25	4-10-14-16-18-19
	Muscular strength	A10-A17	All experts
Living Env.	Presence of goal-oriented coaches and managers	A9-A13	6-8-12-14-16
	Economic status	A14-A16	1-4-10-15-18-20
	Family support	A2-A16	3-6-11-15-17
Lifestyle	Nutrition aligned with activity level	A4-A5-A21	1-5-8-9-10-16-20
	Adequate sleep	A25-A26	11-12-13-16-17-19
	No use of tobacco/alcohol	A1-A21	5-9-14
	No use of performance-enhancing drugs	A7-A14	–
	Psychological well-being	A14-A16	1-11-15-19
	Sportsmanship	A8-A12	6-8-9-13-16-20

As shown in Table 1, a total of 53 indicators were identified across seven axial codes. These axial codes include: genetic, physiological, anthropometric, psychological, biological, living environment, and lifestyle. In the genetic dimension, indicators such as athlete parents, genetic codes, muscle fiber types, lung capacity volume, and bone density were identified. In the physiological dimension, indicators such as physical condition, lactic acid system, heart rate, maximum oxygen uptake (VO2max), physical endurance, muscular endurance, and fatigue resistance were identified. In the anthropometric dimension, indicators such as height, arm length, leg length, sitting height, upper limb length, lower limb length, pelvic width, chest circumference, abdominal circumference, body mass, body fat percentage, reaction time, and agility were identified.

Furthermore, in the psychological dimension, indicators such as intrinsic interest in elite sports, general intelligence and logical reasoning, psychological flexibility, learning ability and short-term visual memory, anticipation of object motion, spatial perception skill, stress response, mental toughness, resilience, self-esteem, competitiveness, and confidence level were identified. In the biological dimension, indicators such as morphological age, physical health, cardiovascular endurance, aerobic endurance, anaerobic endurance, and muscular strength were identified. In the living environment dimension, indicators such as the presence of goal-oriented coaches and managers, economic status, and family support were identified. Finally, in the lifestyle dimension, indicators such as nutrition aligned with activity level, adequate sleep, no use of tobacco and alcohol, no use of performance-enhancing drugs, psychological well-being, and sportsmanship were identified.

After identifying the indicators, to ensure the validity and reliability of the measurement tool, indices including convergent validity, discriminant validity, Cronbach's alpha, and composite reliability were calculated. The results of these evaluations are presented in Table 2.

Table 2. Reliability of Subcategories and Indicators of Talent Identification Components

Axial Codes	Convergent Validity	Cronbach's Alpha	Composite Reliability
Genetic	0.7588	0.7054	0.7820
Physiological	0.7713	0.8310	0.7936
Anthropometric	0.7352	0.8406	0.8208
Psychological	0.7008	0.8940	0.8655
Biological	0.7405	0.8706	0.7658
Living Environment	0.8776	0.8847	0.8324
Lifestyle	0.7975	0.9223	0.8834

The results in Table 2 indicate that all axial codes demonstrate acceptable levels of convergent validity (above 0.7). Additionally, the values of Cronbach's alpha for all dimensions exceed 0.7, indicating satisfactory internal consistency. Composite reliability values are also above 0.7 for all dimensions, confirming the instrument's composite reliability. The highest convergent validity pertains to the 'living environment' dimension (0.8776), and the highest Cronbach's alpha corresponds to the 'lifestyle' dimension (0.9223), suggesting the importance of these dimensions in athletic talent identification.

To identify the current status of athletic talent identification indicators, interviews were conducted with 36 elite athletes. The demographic characteristics of these individuals are presented in Tables 3 and 4.

Table 3. Names of Interviewed Elite Athletes (Sample)

Work Experience (Years)	Blood Type	Championship Level	Sport	Education Level	Gender	Interviewee Name	Code
Over 15	B+	Asia	Taekwondo	M.A.	Male	Masoud Khoshniyat	In1
5–10	O+	Asia	Taekwondo	High School	Male	Mohammad Amin Karsaz	In2
5–10	A+	Asia	Taekwondo	M.A.	Male	Sajjad Mardani	In3
5–10	O–	Asia	Taekwondo	Associate Degree	Male	Rahmat Nazari	In4
5–10	B+	Asia	Wrestling	M.A.	Male	Heydar Alizayi Yousef-Abadi	In5

Table 4. Descriptive Findings of Professional Athletes

Component	Category	Frequency	Percentage
Gender	Male	33	91.7%
	Female	3	8.3%
Work Experience	Less than 5 years	2	5.6%
	5–10 years	9	25%
	10–15 years	8	22.2%
	Over 15 years	17	47.2%
Education	High school/Associate	5	13.9%
	Bachelor's degree	17	47.2%
	Master's degree	9	25%
	Ph.D.	5	13.9%
Blood Type	B+	12	33.3%
	B–	1	2.8%
	A+	9	25%
	O+	8	22.2%
	AB+	5	13.9%
	O–	1	2.8%

As shown in Table 4, 91.7% of the sample were male and 8.3% were female. In terms of work experience, the highest proportion belonged to individuals with over 15 years of experience (47.2%), indicating high experience levels among participants. Regarding education, most participants held a bachelor's degree (47.2%). For blood type distribution, the highest frequency belonged to B+ (33.3%), followed by A+ (25%) and O+ (22.2%).

To examine the current status of athletic talent identification indicators, a one-sample t-test was employed. The results of this test are presented in Table 5.

Table 5. Results of the One-Sample t-Test for the Current Status of Talent Identification Indicators

ID	Factor	Mean	SD	t-value	Sig.	Result
R1	Athlete parents	3.39	1.27	1.84	0.075	Unfavorable
R2	Genetic codes	3.94	1.04	5.45	0.0001	Favorable
R3	Muscle fiber type	3.67	1.04	3.84	0.0001	Favorable
R4	Lung capacity volume	3.89	0.95	5.62	0.0001	Favorable
R5	Bone density	3.56	0.88	3.80	0.001	Favorable
R6	Physical condition	4.00	0.83	7.25	0.0001	Favorable
R7	Lactic acid system	3.61	0.90	4.06	0.0001	Favorable
R8	Heart rate	3.75	0.97	4.65	0.0001	Favorable
R9	Maximum oxygen uptake (VO2max)	3.69	0.95	4.38	0.0001	Favorable
R10	Physical endurance	4.17	0.85	8.28	0.0001	Favorable
R11	Muscular endurance	4.25	0.81	9.30	0.0001	Favorable
R12	Fatigue resistance	4.31	0.71	11.03	0.0001	Favorable
R13	Height	3.36	0.93	2.33	0.026	Favorable
R14	Arm length	3.56	1.18	2.82	0.008	Favorable
R15	Leg length	3.44	1.00	2.67	0.001	Favorable
R16	Sitting height	3.25	0.97	1.55	0.130	Unfavorable
R17	Upper limb length	3.36	1.05	2.07	0.006	Favorable
R18	Lower limb length	3.22	0.99	1.35	0.186	Unfavorable
R19	Pelvic width	3.03	1.06	0.16	0.875	Unfavorable
R20	Chest circumference	3.03	1.08	0.15	0.878	Unfavorable
R21	Abdominal circumference	3.08	1.05	0.48	0.638	Unfavorable
R22	Body mass	3.39	0.99	2.35	0.001	Favorable
R23	Body fat percentage	3.39	1.15	2.02	0.001	Favorable
R24	Reaction time	4.19	1.04	6.91	0.0001	Favorable

R25	Agility	4.25	0.87	8.58	0.0001	Favorable
R26	Intrinsic interest in elite sports	4.47	0.74	12.00	0.0001	Favorable
R27	General intelligence and logical reasoning	4.22	0.68	10.77	0.0001	Favorable
R28	Psychological flexibility	4.28	0.91	8.39	0.0001	Favorable
R29	Learning ability and short-term visual memory	4.19	0.71	10.10	0.0001	Favorable
R30	Anticipation of object motion	3.97	0.88	6.65	0.0001	Favorable
R31	Spatial perception skill	3.86	0.87	5.96	0.0001	Favorable
R32	Stress response	4.06	0.98	6.44	0.0001	Favorable
R33	Mental toughness	4.39	0.64	12.92	0.0001	Favorable
R34	Resilience	4.22	0.80	9.20	0.0001	Favorable
R35	Self-esteem	4.31	0.79	9.96	0.0001	Favorable
R36	Competitiveness	4.25	0.91	8.28	0.0001	Favorable
R37	Confidence level	4.25	0.87	8.58	0.0001	Favorable
R38	Morphological age	3.56	0.91	3.67	0.001	Favorable
R39	Physical health	4.42	0.69	12.29	0.0001	Favorable
R40	Cardiovascular endurance	4.17	0.85	8.28	0.0001	Favorable
R41	Aerobic endurance	4.00	0.83	7.25	0.0001	Favorable
R42	Anaerobic endurance	4.08	0.69	9.40	0.0001	Favorable
R43	Muscular strength	4.14	0.76	8.97	0.0001	Favorable
R44	Use of university-trained professionals in talent centers	2.58	1.34	−1.87	0.070	Unfavorable
R45	Presence of goal-oriented coaches and managers	3.58	1.32	2.66	0.012	Favorable
R46	Economic status	3.50	1.18	2.54	0.016	Favorable
R47	Family support	3.97	1.08	5.39	0.0001	Favorable
R48	Nutrition aligned with activity level	3.94	1.15	4.95	0.0001	Favorable
R49	Adequate sleep	4.28	0.94	8.12	0.0001	Favorable
R50	No use of tobacco and alcohol	3.94	1.19	4.75	0.0001	Favorable
R51	No use of performance-enhancing drugs	3.72	1.43	3.04	0.004	Favorable
R52	Psychological well-being	4.11	0.92	7.26	0.0001	Favorable
R53	Sportsmanship	4.28	0.85	9.03	0.0001	Favorable

The results of the one-sample t-test in Table 5 show that out of 53 identified indicators, 46 are in a favorable condition (mean score above the theoretical mean of 3 with a significance level of less than 0.05), while 7 indicators are in an unfavorable condition (significance level above 0.05).

The unfavorable indicators include:

- Athlete parents (Mean = 3.39, t = 1.84, p = 0.075)
- Sitting height (Mean = 3.25, t = 1.55, p = 0.130)
- Lower limb length (Mean = 3.22, t = 1.35, p = 0.186)
- Pelvic width (Mean = 3.03, t = 0.16, p = 0.875)
- Chest circumference (Mean = 3.03, t = 0.15, p = 0.878)
- Abdominal circumference (Mean = 3.08, t = 0.48, p = 0.638)
- Use of university-trained professionals in talent centers (Mean = 2.58, t = −1.87, p = 0.070)

Among the favorable indicators, the highest mean scores were observed for:

- Intrinsic interest in elite sports (Mean = 4.47)
- Physical health (Mean = 4.42)
- Mental toughness (Mean = 4.39)
- Fatigue resistance (Mean = 4.31)
- Self-esteem (Mean = 4.31)

Discussion and Conclusion

The present study aimed to identify athletic talent through the adaptive method of core indicators in professional athletes. The findings indicated that talent identification through this method encompasses seven main dimensions—genetic, physiological, anthropometric, psychological, biological, living environment, and lifestyle—comprising a total of 53 indicators. Among these, 46 indicators were evaluated as being in a favorable condition, while 7 were deemed unfavorable. In the genetic dimension, the results revealed that all indicators except for “athlete parents” were satisfactory, including genetic codes, muscle fiber type, lung capacity, and bone density. These findings align with the

studies of Siyahi and colleagues (2020) and Pourzarnegar (2021), who emphasized the strong genetic components influencing physical performance and athletic potential and advocated for the genetic assessment of populations to identify athletic aptitude (Pourzarnegar, 2021; Siyahi & Asghari Pour Dasht Bozorg, 2020).

The unfavorable condition of the "athlete parents" indicator suggests insufficient attention to familial and hereditary backgrounds in the national talent identification process. Previous research has underscored the significance of parental genetic traits in shaping athletic ability. For example, Dadgar (2021) argued that genetics plays a critical role in individual physical abilities and that tailored athletic pathways based on genetic predispositions yield better outcomes and faster progress (Dadgar, 2021).

Recent advancements in sports genetics have enabled researchers to identify performance-related genes such as ACTN3, linked with power and speed-based activities, and ACE, associated with endurance performance. Thus, including genetic and familial information in talent identification programs is recommended to enhance predictive precision.

In the physiological dimension, all indicators—including physical condition, lactic acid system, heart rate, VO2max, physical endurance, muscular endurance, and fatigue resistance—were found to be favorable. These results are consistent with findings by Hajilo et al. (2023), who demonstrated significant differences in physiological variables between elite and non-elite athletes, underscoring the critical role of physiological endurance and fitness in sports performance (Hajilo & Anbaryan, 2023).

The favorable status of all physiological indicators in this study indicates that this aspect receives sufficient attention in the national talent identification process. Key physiological metrics like cardiovascular endurance, muscular endurance, and lactic acid resistance are essential for sports success. For instance, high aerobic capacity is vital in endurance sports like marathon running, cycling, and long-distance swimming, whereas anaerobic power is crucial in explosive events like sprints and weightlifting.

Indicators such as heart rate, VO2max, and lactic acid tolerance also significantly affect athletic performance. Athletes with higher VO2max values tend to perform better in endurance sports, while efficient lactic acid metabolism is essential for success in high-intensity, short-duration events. Therefore, attention to these physiological metrics is crucial and appears to be well-integrated into existing programs.

In the anthropometric dimension, the study found that 6 out of 13 indicators—sitting height, lower limb length, pelvic width, thoracic circumference, and abdominal circumference—were in an unfavorable state. This somewhat contrasts with the findings of Hajilo et al. (2023), who highlighted the importance of anthropometric variables in talent identification (Hajilo & Anbaryan, 2023). The discrepancy might be due to insufficient focus on specific anthropometric metrics in current national programs.

Anthropometric traits such as height, limb length, pelvic structure, and body girths are significant for athletic performance. For example, greater height and arm span benefit sports like basketball and volleyball, while shorter stature and a low center of gravity are advantageous in gymnastics and wrestling. Specific structural traits like pelvic width may affect sprinting and swimming performance.

Neglecting such traits can result in overlooking potentially talented individuals. For instance, failure to consider lower limb length in sprinting could lead to missing ideal candidates. Hence, talent identification programs must account for sport-specific anthropometric indicators. Shahi (2018) emphasized the role of these traits in not only identifying and nurturing talent but also in selecting appropriate positions within sports teams (Shahi, 2018).

In the psychological dimension, all 12 examined indicators—including intrinsic interest in elite sports, general intelligence, psychological flexibility, learning ability, visual memory, spatial perception, response to stress, mental toughness, resilience, self-esteem, competitiveness, and confidence—were rated as favorable. These findings align with Talebzadeh et al. (2023), who highlighted emotional control, focus recovery, and self-talk as key performance determinants (Talebzadeh et al., 2023).

This favorable assessment suggests effective integration of psychological variables in current talent identification practices. Mental resilience, confidence, motivation, and stress management are often decisive factors in elite sports

performance. For instance, high mental toughness allows athletes to maintain focus and motivation under pressure, while self-esteem is linked to better competitive confidence and reduced vulnerability to failure.

Tektaei (2023) further noted that elite shooter performance relies on a multidimensional set of psychological and physiological variables. Among the psychological indicators, intrinsic motivation had the highest mean score (4.47), highlighting its central role in athletic success. Internally motivated athletes show greater commitment, persistence, and goal-directed behavior. Similarly, high mental toughness (mean 4.39) and self-esteem (mean 4.31) correlated with better coping mechanisms and athletic perseverance.

In the biological dimension, all six indicators—morphological age, physical health, cardiovascular endurance, aerobic endurance, anaerobic endurance, and muscular strength—were in favorable condition. These findings support earlier findings by Dadgar (2021), which emphasized the importance of biological factors in talent identification and sports success (Dadgar, 2021).

Biological attributes such as maturity status, physical health, and endurance capacity are fundamental for athletic readiness. For example, morphological age helps determine the optimal timing for specialized training, while robust physical health forms the foundation of performance and injury prevention. Among these indicators, physical health scored the highest mean (4.42), reinforcing its critical role in consistent training, recovery, and progress. High endurance and muscular strength also support sustained and intensive athletic activity.

In the living environment dimension, three out of four indicators—presence of goal-oriented coaches and managers, economic status, and family support—were favorable, while "use of university-educated professionals in talent identification centers" was rated unfavorably. This supports findings by Alavi and Khosrpour (2020), who stressed the need for structured collaboration between universities and talent centers (Alavi & Khosrpour, 2020).

The poor rating of this indicator points to a gap between academia and applied talent identification. While sports science graduates could provide valuable expertise in physiology, biomechanics, sports psychology, and injury prevention, this knowledge appears underutilized. Alavi and Khosrpour (2020) emphasized the necessity of creating an integrated framework with university involvement to strengthen national talent systems (Alavi & Khosrpour, 2020).

The favorable ratings of economic status, family support, and professional coaching reflect effective attention to external developmental conditions. Coaches and program managers contribute significantly by implementing structured training plans and progress monitoring. Additionally, financial and emotional support from families can reduce stress and foster focus and commitment in athletes.

In the lifestyle dimension, all six indicators—appropriate nutrition, sufficient sleep, abstinence from tobacco and alcohol, avoidance of performance-enhancing drugs, psychological well-being, and sportsmanship—were rated favorably. These findings align with prior studies underscoring the role of a healthy lifestyle in elite sports success.

Athletes with healthy lifestyles tend to perform better, recover faster, and maintain longer careers. Nutrition ensures energy supply, recovery, and immune function. Sleep supports physical and mental restoration. Among lifestyle indicators, adequate sleep and sportsmanship had the highest mean score (4.28), indicating their prominent influence on performance, image, and athlete-brand loyalty. Dadgar (2021) noted that an athlete's lifestyle shapes public and fan perception, influencing personal branding (Dadgar, 2021).

An interesting additional finding was the blood type distribution among elite athletes in the study. Blood type B+ was the most prevalent (33.3%), followed by A+ (25%) and O+ (22.2%). While some researchers suggest that blood type may influence athletic predisposition, there is currently insufficient empirical evidence to support this claim. However, this finding may serve as a basis for future research in the genetic correlates of sports performance (Haidar Eissa et al., 2023; Pourzarnegar, 2021).

In conclusion, the study confirmed that adaptive talent identification in professional athletes involves seven key dimensions—genetic, physiological, anthropometric, psychological, biological, living environment, and lifestyle—comprising 53 indicators. Of these, 46 were in favorable condition, while seven were not: athlete parents, sitting height, lower limb length, pelvic width, thoracic circumference, abdominal circumference, and the use of university-educated professionals.

Talent identification is a complex, multidimensional process requiring an integrated approach to all relevant indicators. A scientific and comprehensive talent identification system must be developed and implemented with the participation of academic experts and relevant institutions. Special attention should be given to underperforming indicators to ensure effective improvement strategies.

One of the most significant findings was the unfavorable condition of using academically trained professionals in talent centers, highlighting a disconnect between universities and practice. Strengthening this linkage could greatly enhance the quality of talent identification.

Another concern is the underattention to anthropometric features in certain sports, which could result in overlooking ideal candidates. Programs must ensure all sport-specific anthropometric indicators are included.

Finally, the undervaluation of parental athletic background and hereditary factors warrants attention. Given the growing role of genetics in performance prediction, programs should incorporate family history and genetic profiles into their assessments.

Ultimately, a comprehensive and scientifically grounded national talent identification system should be implemented, involving the Ministry of Sports and Youth, the National Olympic Committee, sports federations, the Ministry of Education, universities, and research centers. Sport-specific identification criteria must also be developed and tailored for each athletic discipline.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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