ATHLETIC TALENT AS A SCIENTIFIC PROBLEM AND CHALLENGE FOR PRACTICE

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Abstract:

Aim. A narrative review of the research results of the multi-aspectual phenomenon of sports talent by researchers from various research centers around the world.

Basic procedures. Analysis and synthesis in a narrative review of various methodological concepts regarding research on sports talent, with particular notice of selected American (USA), Canadian, Dutch, German (DDR) and Soviet (USSR) stances.

Results. The commonly accepted approach presupposes the division of long-term preparation into a number of stages, at which various age and sport-specific tasks are solved, and young athletes overcome appropriate phases of their giftedness and talent evaluation. The objective difficulties in Talent Identification (TI) are associated with variations in the rate of maturation and unevenness of biological and sport-specific development of young prospects. Serious restrictions regarding early evaluation of giftedness and talent are associated with the lack of psychological measures and insufficient attention paid to personality traits that, to a great extent, determine the achievement of exceptional performance. Talent Identification (TI) in team sports requires more sensitive tests for prediction of successful game activity; such an item as fatigue tolerance was not taken into account by training experts and analysts.

Main findings. 1. Athletic Talent is a complex, multifaceted phenomenon that is widely considered from methodological, biological, philosophical and social positions; 2. The methodological foundation can be considered the basic background for general comprehension of the problem and fulfillment of various scientific and practical projects directed towards the recognition, identification and promotion of talented individuals.

Introduction

Athletic Talent is a complex, multifaceted phenomenon that is widely considered from methodological, biological, philosophical and social positions. The available literature embraces a large body of findings and evidence that can be clustered into three basic branches: methodological foundation, hereditary and biological premises, data and evidence from sport psychology. The methodological foundation can be considered the basic background of general comprehension of the problem and fulfillment of various scientific and practical projects directed toward recognition, identification and promotion of talented individuals. Therefore, the present review aims to consider basic methodological premises as the major contributors of athletic talent.

1. Basic positions and concepts in the theory of Athletic Talent

The problem of Athletic Talent is closely associated with the phenomenon and concept of athletic giftedness that can be characterized as a predisposition for and a higher learning rate/trainability for a given activity. In sports, properly developed giftedness implies attaining sports excellence and, therefore, achievement of Ath-
letic Talent. The earlier this giftedness is identified, the more effectively the individual’s athletic preparation can be managed and the greater is the probability of developing an elite athlete. Thus, a gifted child is potentially a talented athlete and, therefore, identification of gifted or potentially talented youngsters is very important and desirable. For further clarification, the following definition can be offered: Athletic Talent is a special extraordinary ability that allows an athlete to reach excellence in his/her sport activity.

The current literature introduces a number of popular concepts related to Talent Identification or Selection (TI and TS respectively) and Talent Development (TDV). Lidor with associates specify: “Talent selection involves the ongoing process of identifying athletes/players at various stages of the training program” [1]. The authors continued clarifying the long-term preparation process: “Talent development implies that the athletes/players are being provided with the appropriate learning/practice conditions to promote and realize their potential in a specific sport”. Further investigation and practical interpretation of the TI and TDV problem has led to elaboration of a number of programs for earlier discovery of potentially talented athletes and their rational, efficient and scientifically based preparation [2-4]. The attempts focused on practical needs of high-performance sport will be reviewed below.

2. Earlier studies of Athletic Talent

For many years, sport analysts and scholars have focused much of their attention on Athletic Talent. Traditionally, identification of athletic giftedness and talent for a given sport was associated with the optimal combination of anthropometric variables, high learnability and trainability, high motivation, persistence, and competitiveness [5,6]. Despite the high importance and actuality of the problem of Athletic Talent, systematic studies of this phenomenon have a relatively short history. Further description of available materials highlights the concepts and evidence received from an earlier stage of investigations as well as those from the latest decades.

The studies devoted to the discovery of potentially talented young athletes primarily strived to find individuals who would be able to reach a level of outstanding mastery and earn the highest athletic rewards. These desires were firmly associated with social and political expectations, which were much more pronounced in former communist countries. This circumstance partly explains the appearance of prospective research programs in the early 1970’s in East Germany and the USSR. These research projects were subordinated by appropriate authorities and oriented, first and foremost, to sports with a higher representation in the Olympic program.

2.1. Evidence from East Germany

It should be noted that athletes from the former GDR (East Germany) attained very impressive achievements in international, high-performance sport, particularly in Olympic disciplines. From 1972 to 1988, GDR athletes earned 2nd place in the unofficial team medal rankings of Winter Olympic Games with one exception: in 1984 the GDR team earned 1st place. A similar situation also occurred in the Summer Olympic program where the GDR athletes earned 2nd place twice in the unofficial team medal rankings (in 1976 and 1988) outperforming teams from the USA, Great Britain, Australia, etc. Although consideration of these magnificent successes was frequently associated with usage of non-legal pharmacological substances, contribution of scientific and methodological sources cannot be ruled out. The rational system of TI and TDV was definitely one of the most influential factors.

The studies of TI and TDV in the early 1970’s were strictly oriented to earlier examination of young prospects, aiming their selection to regional centers of athlete preparation in various sports [7]. There were elaborate, complex evaluation programs that included anthropometric, physiological, psychological and sport-specific measures with appropriate norms and methods allowing for prediction of future achievements in given sports. The methodological demands for general evaluation of potentially talented young stars influenced differential examination of the following components: (1) available level of athletic performance; (2) improvement rate of performances; (3) stability of progression of relevant athletic abilities [8]. These components required detailed characterization relating to techno-tactical, functional status, adaptability to training workloads, and psychological prerequisites.

The programs for complex evaluation of athletes contained general and event-specific tests that were executed in regional preparation centers using certified instruments and standardized protocols. Interestingly, several original tests broadened the borders of traditionally used approaches. Following anecdotal reports, the athletes of ball games were tested with regard to their intellectual abilities, aiming for the prediction of attainment of perfect tactical meaning and mastery. Such talent identification programs have been elaborated and implemented in artistic gymnastics, swimming, rowing, diving, figure skating, and several team sports.

To date, in accordance with the GDR rules of secrecy, descriptions and outcomes of these studies, where Athletic Talent was examined, have not been published in the available literature. From this position, a retrospective review of Kozel [9] raises distinct interest. The author introduced a hierarchical system of TI and TDV in the GDR describing five layers:
1. The primary sport organizations such as school sport collectives, sport associations, and some sport clubs.

2. Sport schools with full time coaches who were responsible for talent scouting. These training centers were firmly directed toward high-performance preparation; their quantity approached 2000 and the number of hosted athletes was about 70,000.

3. Youth sport schools specialized exclusively in selecting athletic disciplines where all activities were determined by training demands. These 20 specialized training centers hosted about 9000 selected athletes.

4. Sport centers of Army and Police had exclusive, independent status and had the privilege to recruit athletes from other training centers in the GDR.

5. The competitions of Spartakiades were organized periodically where medal winners received honored status like that of national team members.

Importantly, the preparation process of selected athletes was fulfilled following the training programs developed and controlled by the experts from National Sport Institute (DHfK Leipzig); the specific performance standards, norms and demands for competition and education were thoroughly prescribed. In these conditions, recognition of gifted and talented athletes was part of the whole preparation process. Interestingly, identification of talented youngsters was substantially based on their ability quickly acquire new technical skills following precise instruction. That means that GDR experts emphasized the role of learnability in TI and TDV. Besides this, the author of review emphasized the role and importance of highly qualified coaches who had been involved in evaluation of athletes at each stage of their long-term preparation. The last but not the least contributor of the successful TI and TDV system was efficient sport medicine assistance and valuable financial support of superior athletes.

2.2. Evidence and study outcomes from the USSR

The studies of athletic giftedness and talent in the USSR were executed in accordance to a prospective centralized plan of research. One of the earliest methodological interventions into the area of TI and TDV was fulfilled by Zatsiorsky with associates [10]. The authors focused on the complex evaluation of Athletic Talent and proposed three modes of athlete selection: 1) primary sport orientation, aimed to determine suitableness of the individual for a given sport; 2) selection of appropriate candidates for a certain team or squad, taking into account their compatibility and correspondence to team-specific demands; 3) selection of athletes for participation in the highest level competitions.

The authors specified that the selection problem requires solving four research tasks: the formation of a model of the “ideal athlete;” prediction of decisive athletic abilities; classification the athletes following their results and sport history; and organization of entire evaluation and decision making process. The central link of the considered problem is the prediction of adult sport abilities (definitive variables) based on data from these athletes in earlier stages of their preparation (juvenile performances). Based on findings from long-term studies, the authors claimed that the most predictive values are those of improvement rate of relevant abilities during the initial 1.5 years of preparation. Special attention was given to hereditary factors where the authors reviewed four study approaches: investigation of sport dynasties, where family members have shown outstanding performances (1); determination of relationships between athletic abilities of parents and children (2); investigation of identical and non-identical twins (3); and dependence of several motor abilities on certain genetic markers (4). Concluding an extensive review, the authors stressed that selection of athletes to the National Olympic team should be fulfilled by taking into account their age, sport history and the remaining time span before forthcoming Olympic events.

The concept of the “ideal athlete” became popular among soviet scholars and a number of research groups initiated and conducted studies directed toward the elaboration of appropriate models for elite athletes such as runners, throwers, swimmers, etc. Correspondingly, several projects were full filled with the aim to find earlier predictors of definitive models for identification of gifted individuals having a predisposition to a given sport and specific athletic disciplines. Such research has been realized using three different approaches: cross sectional studies, where most prospective candidates were chosen based on evaluation of body build and motor abilities in a large group of youngsters; retrospective analyses of athletic biographies of outstanding athletes; and longitudinal studies of young athletes during their long-term preparation. These three approaches can be illustrated by data of appropriate studies.

A large group of young soccer players, ages 9-10 years, was examined by qualified experts using anthropometric and physiological measures, general and sport-specific fitness tests, technical preparedness evaluations, as well as mental and willpower tests [11]. The authors found a relatively low impact of anthropometric and general fitness variables on sport-specific skills and technical status. They emphasized the usefulness of expert evaluation of technical preparedness, and especially for the mental/willpower component, which are decisive for future progression.

The second example relates to investigation of sport biographies of elite athletes. The long-term trend of
athletic performances of 37 of the world’s best sprint runners (average group result 10.06 s for 100 m) was analyzed from the age of 13 years until retirement [12]. It was found that all elite athletes had a very high level of initial results. The time duration to obtain a personal best result varied between 8.2 and 9.3 years depending on the age when the athletes started their purposeful preparation. The highest improvement rate was marked during the initial 4-5 years of preparation. The authors concluded that these revealed characteristics of the world best athletes can be utilized for elaboration of model characteristics of annual performance trends for long-term preparation of young sprint runners.

The third example refers to the findings from longitudinal monitoring of the preparation of 31 swimmers for 6 years – from age 11 to 16 years [13]. The study design included periodical examination of anthropometric and physiological variables, maximum strength and flexibility, and swim-specific performances in the 50 m, 100 m, 200 m, 400 m, and 800 m distances and an intermittent test of 4×50 m. Stability of individual trends of various estimates was evaluated by means of correlations between juvenile and definitive performances. It was established that body size, ankle flexibility and swim performances in the 400 m and 800 m are the most predictive; these measures at age 11-12 give valuable information for prognosis of definitive status. Characteristics of strength and swim performances in the 50 m, 100 m and 200 m were less predictive. The study’s conclusion claimed that real prognosis of definitive status can be done at ages 13-14.

The monograph of Bril has summarized extensive data on the predisposition of young athletes to successful preparation and high athletic performance in team and dual sports [14]. Analyzing the impact of various factors, the author distinguishes conservative prerequisites that cannot be compensated for during further preparation as the most predictive and decisive. These variables are body size and learnability. Furthermore, the author specified conservative prerequisites that can be compensated for during serious, purposeful preparation. This group of variables includes sensory motor responses such as space orientation, kinaesthetic differentiation, audio-visual reactions, body balance and voluntary relaxation. One more group contains labile variables, which can be largely improved during long-term training such as motor fitness estimates, techno-tactical skills and sport-specific mental abilities. Several indicators having high stability trends during long-term preparation are considered to be the most predictive and valuable for prospective prognosis. They are running tests of 20 m and 60 m, a shuttle run, agility tests with and without dribbling, and jump performances. Similar to other analysts, the author specified different stages of athletes’ selection: 1) initial selection aimed toward evaluation of the general predisposition of youngsters to a given sport; this stage duration is about 2 years; 2) prospective evaluation of potentially talented candidates; this stage duration is also about 2 years; 3) selection and formation of a concrete team; 4) selection to National team for high prestige tournament like the Olympic Games.

The author emphasized the importance of expert evaluation of sport-specific game activities in each stage of athlete selection.

A number of well-controlled, prospective studies were conducted by Soviet and Bulgarian researchers in track and field during the period of 1970-80. An essential part of these findings was summarized in the collective monograph entitled “Selection and prognosis of predisposition to track and field” [15]. The published materials embrace data from systematic studies in five disciplines of track and field: sprint running, long- and medium-distance running, long jump, throwing, and decathlon. The five appropriate chapters contain characteristics of age, when world-leading athletes attained their best performances, characteristics of body build of elite athletes, modeled trends, and improvement rates of sport-specific fitness variables. The authors specified the probability of prognosis of definitive results to be about of 30-35% based on the initial evaluation of fitness components. Prognosis based on data obtained after 1.5 years of preparation reaches a probability of 75-80%. In conclusion, the authors postulated an organizational bases for selection procedures. They specified that the initial stage should include evaluation of children aged 9-11 years; the second stage includes evaluation of children at ages 11-12. Importantly, the variety of individual biological estimates and rates of maturity substantially complicate the objective evaluation of candidates; correspondingly, this factor should be thoroughly taken into account both on the 1st and 2nd stage of evaluation and selection. Although the studies of Siris with associates were conducted more than three decades ago, the published model characteristics of talented children may the raise interest of contemporary readers and will be considered in appropriate sections of this book (11.1.1 and 11.1.2) [15].

2.3. Evidence and findings of studies conducted in different countries

A valuable methodological contribution to the problem of TI and TDV has been carried out by Bar-Or, who proposed an original approach to identification of sport talented individuals. The author’s proposed format was a five-step examination of potentially talented candidates, namely:

1) evaluation of morphological, physiological and psychological status of children and their performance estimates;
2) determination of maturity level;
3) evaluation of reaction to training following a relatively short-term program;
4) evaluation of athletic history of the family;
5) prediction of future performance using an appropriate multiple regression statistical model [16].

A serious review of Athletic Talent investigation was published by Gimbel who claimed that three decisive factors should be analyzed: morphological and physiological characteristics; trainability, and motivation [17]. The author stressed the necessity to evaluate 8-9-year-old candidates before their growth maturity spurt. He reasonably highlighted that achievement of top-level performances usually occurs at ages 18-20 when athletes have a training experience of about 8-10 years. According to the author’s analysis, accuracy of earlier prognosis of Athletic Talent is very low and many youngsters evaluated as gifted and prospective do not reach a level of pure excellence. The author explained this failure of such prognoses by insufficient sensitivity and validity of tests (1), the inability to take into account biological age and maturity level (2), the impact of psychological factors, which were usually not assessed during earlier evaluations (3).

One of the most memorable publications devoted to Athletic Talent was conducted by Bloom and still remains a valuable contribution to the methodology of TI and TDV [18]. Based on structured interviews of top-level swimmers, tennis players, and highly successful sculptors, concert pianists, neurosurgeons, and mathematicians, the author developed a model of talent detection and promotion. The model proposes a realization of three stages of long-term professional preparation (Table 1).

It is worth noting that unlike previous versions this model, Bloom highlights the importance and interaction between all participants of the TI and TDV process, i.e. the athlete, coach, and parents. The relevant characteristics of their activities over each stage allows for a better understanding of this multifaceted process.

An original study of long-term preparation of elite athletes was conducted by Skanlan, Ravizza, and Stein [19]. The researchers interviewed 26 former top-level US figure skaters aiming to reveal their time expenses for training during different phases of preparation, chrono-

Table 1. Stages of long-term preparation of talented individuals according to model of Bloom (1985) [18]

<table>
<thead>
<tr>
<th>Stages</th>
<th>Relevant characteristics of activities</th>
</tr>
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<tbody>
<tr>
<td>Performer</td>
<td>Mentor</td>
</tr>
<tr>
<td>Initiation</td>
<td>Enjoyment</td>
</tr>
<tr>
<td></td>
<td>Playfulness</td>
</tr>
<tr>
<td></td>
<td>Excitation</td>
</tr>
<tr>
<td></td>
<td>Fan orientation</td>
</tr>
<tr>
<td>Development</td>
<td>Commitment to training</td>
</tr>
<tr>
<td></td>
<td>Potential self-estimation</td>
</tr>
<tr>
<td></td>
<td>More serious attitude</td>
</tr>
<tr>
<td></td>
<td>Task/achievement orientation</td>
</tr>
<tr>
<td>Perfection</td>
<td>Priority of sport values</td>
</tr>
<tr>
<td></td>
<td>Psychological stability</td>
</tr>
<tr>
<td></td>
<td>Personal responsibility</td>
</tr>
<tr>
<td></td>
<td>Full dedication</td>
</tr>
<tr>
<td></td>
<td>Willingness to meet highest standards</td>
</tr>
</tbody>
</table>

Table 2. Characteristics of long-term athletic preparation of 26 top-level US figure skaters [19].

<table>
<thead>
<tr>
<th>Phases</th>
<th>Duration (years)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation</td>
<td>2-4</td>
<td>One group lesson per week in Figure Skating, acquisition of technical skills, involvement in other non-skating activities</td>
</tr>
<tr>
<td>Development</td>
<td>3-5</td>
<td>2-3 Figure Skating sessions per week, practicing private lessons, participation in competitions of lower/intermediate level; decreased amount of non-skating physical activities</td>
</tr>
<tr>
<td>Perfection</td>
<td>4-12</td>
<td>Highly dedicated preparation about 4-7 hours/day, 5-7 days/week, 45-52 weeks/year; professional competitive practice; minimal level of non-skating physical activities</td>
</tr>
</tbody>
</table>
logical terms for these phases’ completion, sources of enjoyment that emerged from various circumstances, familial support, etc. The stages of preparation were specified according to Bloom [18]; their relevant characteristics are presented in Table 2.

The authors specified that the age when respondents started their athletic preparation varied between 4 and 14 (with an average of 8.7 years). Correspondingly, the duration of the initial phase was longer in younger athletes and shorter in adult novices. The preparation in figure skating was associated with substantial financial expenses and all respondents marked that they received sufficient familial support. The athletes noted that they received enjoyment associated with their activities and every-day life. Specifically, they marked enjoyment from the act of skating, from perceived competence, social recognition, and from life opportunities associated with their exclusive status.

It can be suggested that the general situation of talent promotion in US figure skating a few decades ago was rather typical for North American sport and very different as compared with TI and TDV in former Eastern European socialist countries. The gifted athletes were recruited to local sport clubs following their self-initiative and parental support. Their initial preparation was not supported by a local or centralized organization and financial resources and identification of their giftedness was the responsibility of local coaches and sport managers. Apparently, this situation has changed drastically during subsequent decades.

3. Contemporary projects of athletic talent investigation

Since the early 1990’s the importance of Athletic Talent identification and nurturing has become widely recognized and the number of methodological publications all over the world has increased dramatically. Among the factors that were affected by this increased scientific and practical interest were great social and political changes in human society, which resulted in disintegration of the bloc of Eastern European communist countries and unification of Germany. These historical perturbations opened a new stage of liberalization of all forms of cooperation between the athletes, coaches, managers, and researchers. Many coaches and scientists from former communist states moved to Western countries with short-term projects and for long-term employment. Besides this, the sport organizations in Western countries become affected by political and social pressure associated with stronger demands to obtain leading positions in world sport [20]. At that time, the interest and attention to the problem of talent search was shared in various areas and in 1992, the International organization of Centers for Talented Youth was founded [21]. Thus, since the early 90’s, the number of research studies and analytical projects devoted to Athletic Talent increased dramatically.

3.1. Framework of prospective and innovative projects

During the latest decades, a number of extensive review-papers and reports of prospective projects have been published aiming to highlight contemporary approaches for solving the problem of TI and TDV in different countries. A summary of these recent publications is given in Table 3.

The first publication listed in Table 2.3 introduces the Australian prospective project “Talent Search”. The authors reasonably supposed that the amount of accurately measured information could be the crucial factor in TI with respect to a particular sport and successfullness of long-term preparation of youngsters. Such factors as physiques, physiological, psychological, and sociological were taken into account. About 2000 Australian high schools were involved in the evaluation process and 1% of the initially tested children joined the national TDV program. The application of this program resulted in substantial enhancement of Australian athletes in the junior World championships.

One of the serious review-papers devoted to long-term nurturing of young gifted athletes was published by [23]. Based on available findings of Eastern and Western sport-science literature the author presented an original model of long-term preparation that embraces four meaningful stages (Table 4).

According to Balyi’s model, the 1st stage is devoted to the development of general physical abilities and basic movement skills such as running, jumping, throwing, agility, speed and balance. Strength exercises can be used with body weight and medicine balls. The author emphasized that “FUN” is an important component of this stage. The 2nd stage is directed toward the acquisition of physical and mental skills for a specific sport. The athletes should acquire basic technical/tactical skills, basic techniques such as warming up, cooling down, stretching, etc. The competitive practice becomes part of preparation, although its contribution remains relatively small. The 3rd stage includes a sport-specific, highly individualized program with a high contribution from competition and the utilization of high-intensity exercises. The training components such as fitness, tactics, recovery programs, and psychological preparation are firmly directed to competitive demands. The 4th stage is the final in the framework of long-term preparation; it is directed to attainment of the highest athletic rewards and includes the most efficient and advanced means and
The above-presented model of Balyi provides reasonable content and sequencing of preparation stages although it largely contradicts the reality of several Olympic sports and experiences of numerous outstanding athletes. Such sports as figure skating, artistic and rhythmic gymnastics and swimming give many examples of magnificent performances of 15-16-year-old athletes. On the other hand, the duration of fundamental preparation (4 years) seems unreasonably excessive for talented youngsters. Nevertheless, as a general scheme, it has distinct value.
The paper published by Côté introduced the outcomes of an in-depth study of families of elite rowers and elite tennis players with a focus on appropriate “stages of sport participation” [24]. The first stage was named “Sampling Years,” where age varied between 6 and 13. It was characterized by the involvement in diversified, pleasurable activities that can be qualified as an intentional or deliberate type of play. Thus, the term “deliberate play” is actively used by analysts and experts in TI and TDV. The author found that during this stage, the parents recognized the giftedness of their children and gave financial support for their activities. The second stage labeled “Specialized Years” corresponds to ages 13-15 and is characterized by increased sport-specific activity and decreased contribution of extra-curricular activities, focusing on the development and perfection of specialized skills. The author noted that fun and excitement still play an important role in earlier experiences of studied elite athletes. However, the study revealed that at this stage the parents develop an increasing interest in preparation and achievements of their gifted children. The next stage termed “Investment Years” started at age 15 and was characterized by much more pronounced training and competitive activities. Any kind of play activity was replaced with a tremendous amount of athletic practice. The role of parents at this stage changes as well. Although they are not immediately involved in the training process, they have shown increased activities to facilitate athletic preparation of children. In addition, they actively participate in the consideration of future plans, giving advice regarding continuation of the athletic career.

The study of Williams and Reilly was devoted to TI in soccer [25]. Nevertheless, they produced valuable, methodological input for talent evaluation and nurturing in any sport. They stated that Athletic Talent is characterized by an optimal combination of anthropological, physiological, psychological, and social prerequisites. These authors described a general framework that introduces the three most important processes related to Athletic Talent, namely: talent identification, talent development, and talent selection (Table 5).

The extensive review of Durand-Bush and Salmela summarizes findings of traditional and updated approaches related to TDV in sport [26]. The authors reasonably claimed that although hereditary prerequisites have a strong impact and cannot be changed, the possible manipulations with environmental factors including competent coaching can largely determine the quality of athletes’ preparation and achievement of exceptional performance.

The German researchers Hohmann and Seidel examined scientific aspects of TI and TDV focusing on available knowledge and prospective approaches to further efforts [2]. They emphasized that early TI is extremely desirable for advanced preparation of young athletes and an important condition for their successful realization of athletic potential. Moreover, early TI is particularly important in cases of early specialization, which is very typical in contemporary sport. The authors reasonably outlined four integrative criteria for early diagnostics of Athletic Talent, namely: juvenile performance, where prediction accuracy varies between 20 and 65% and more reliable prognosis can be usually done after puberty (1);

**Table 4. Stages of long-term athletic preparation according to Balyi [23]**

<table>
<thead>
<tr>
<th>Stages, Age, years</th>
<th>Fundamental</th>
<th>Training to Train</th>
<th>Training to Compete</th>
<th>Training to Win</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males – 6-10</td>
<td>Males – 10-14</td>
<td>Males – 14-18</td>
<td>Males – 18+</td>
<td></td>
</tr>
<tr>
<td>Females – 6-10</td>
<td>Females – 10-14</td>
<td>Females – 14-17</td>
<td>Females – 17+</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5. Characterization of Athletic Talent identification, development and selection [25]**

<table>
<thead>
<tr>
<th>Process</th>
<th>Definition</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Talent identification</td>
<td>Recognition of athletic candidates’ potential to attain exceptional performance and excellence in given sport</td>
<td>This process presupposes evaluation of relevant estimates and monitoring training over the timespan</td>
</tr>
<tr>
<td>Talent development</td>
<td>Provision of optimal conditions for realization of available potential and attainment of exceptional performance</td>
<td>This embraces subsequent stages of the long-term athletic preparation</td>
</tr>
<tr>
<td>Talent selection</td>
<td>Inclusion of talented individuals into appropriate preparation structures, teams and squads</td>
<td>This includes a number of selection procedures with gradually increasing demands</td>
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improvement rate of performances that should be analyzed taking into account the natural enhancement trend associated with the phases of long-term preparation and the maturation process; utilization of performance-specific conditions such as movement technique, coordinative and appropriate morphological prerequisites; and load tolerance, meaning favorable adaptation and low incidence of injuries.

The serious restrictions of traditional approaches and more advanced framework for understanding TDV perspectives were considered in publication of Vaeyens with associates [27]. Deficiencies of current approaches to TI were considered focusing on the widely used method of cross-sectional studies. They highlighted that cross-sectional studies are based on the assumption that extra-ordinary abilities of elite athletes can be extrapolated to earlier stages of preparation; in fact, as the authors claimed, many athletic qualities may not be apparent until late adolescence. The maturation process seriously confounds the possibility of TI at earlier stages of preparation; as a result, the later developers may be underestimated as compared with their early-matured peers. In addition, the authors outlined the necessity of multidimensional evaluation of youngsters, contrary to the popular one-dimensional approach. The valuable theoretical input of this review is associated with the application of the Differential Model of Giftedness and Talent as the framework for TI and TDV interpretation. The model proposes that natural abilities embrace four broad domains: intellectual, creative, socio-affective, and senso-motor. Of course, the physical component is dominant in athletes. However, the multidimensional nature forms the basis for both sport talent and sport gift. Giftedness is considered the possession of a high level of natural abilities; among the top 10% of same age peers.

Valuable methodological input has been provided by Lidor, Côté and Hackfort who introduced principal positions related to multi-component testing for TI and TDV [1]. Based on an extensive review of relevant publications, the authors emphasized the main benefits and typical restrictions of current approaches to talent detection and promotion. Comparing the Eastern and Western approaches to TI and TDV the authors claimed that in first case, the major efforts were directed to recognition of the most talented prospects, whereas the Western practice was mostly oriented to talent development. In both cases the tests’ batteries included evaluation of physical, physiological, motor and skill components. Considering the benefits of complex evaluation, the authors noted that physical skills tests combined with anthropometric measures have a distinct value in the prediction of future successes both in individual and team sports. However, such factors as cross-sectional study design and insufficient attention to the maturation process substantially reduces the persuasiveness of studies’ outcomes. Typical limitations of TI and TDV of young prospects were pointed out:

1) The personality traits that are very important for prognosis are usually not tested and not included in evaluation models. Such indicators as willpower and ability to cope with competitive stress are extremely important but are not taken into account.

2) The cognitive skills i.e. anticipation, decision making, game understanding, etc. are extremely important for team sports, but are usually not evaluated during available TDV programs.

3) The team sports testing batteries should contain not only individual tasks but also modeling of “real-world” situations with gradual evaluation of task results.

4) Physical skills tests performed in a rested state do not provide sufficient information for prediction. Fatigue tolerance should be taken into account as well.

The perspectives and applicability of talent detection programs were thoroughly considered in a review from Anshel and Lidor [4]. A number of prospective TI programs for various sports, which included testing of motor abilities, physical skills and anthropometric measurements were reviewed. Their implementation resulted in an increased number of gifted youngsters involved in serious preparation, enhanced quality of domestic competitions, and even an increased number of international-level athletes. A special aspect of TI programs is their valuable assistance in the choice of an appropriate sport in the early stage of athletic preparation. The deficiency of these programs is the lack of psychological measures that substantially contribute to the accuracy of future success prediction. The paper includes an extensive summary of psychological characteristics indicated by different researchers for distinguishing between more and less successful athletes. Importantly, the most widely indicated characteristics that discriminated skill level were self-motivation and self-confidence. Nevertheless, the authors noticed that the accuracy of talent prediction is markedly decreased due to the limitations of research methods, self-reports, and anecdotal reports. The deficiency of these programs is the lack of psychological measures that substantially contribute to the accuracy of future success prediction.

The valuable experience of the Swiss Federal Institute of Sport Magglingen has been described in the publication of Fuchslocher et al. [28]. Unlike the theory of deliberate practice, the authors developed a “deliberate programming” approach that has been realized in follow-up practice with the Swiss elite and sub-elite athletes. The authors introduced the assessment criteria for evaluation and success prediction of young athletes. The scale of prognosis validity presupposes gradual evalua-
tion of various criteria in terms of their predictability for achievement of superior performance. The highest rank was given to five estimates: performance at late junior age, testing of sport-specific performance, outcomes of competitive performance, achievement motivation, and resilience. Average but still significant impact was given to environmental factors and body build. The other estimates were qualified as less affecting on elite sport success. Nevertheless, such basic integrative characteristics as biological development and maturation level are thoroughly examined and taken into account during the final consideration of athletic status of candidates.

The current situation with TI and TDV in the Netherlands was analyzed and commented on in the publication of Efferink-Gemser [29]. The framework of the National Olympic Committee embraces 90 national sports federations, which fulfill regular athletes’ preparation within more than 27,000 sports clubs. The district and national youth selection teams are formed as a result of TI by the sports clubs. Long-term experience shows that about 3% of youngsters are qualified as potentially talented; they join district selection teams for further systematic preparation. Ultimately, less than 0.5% teenagers are invited to national youth selection groups. Of course, this final selection is performed based on improvement rate, learnability, attitude to training, while at the same time taking into account the ideal profile of a talented athlete specific to the sport. The research group for Talent Identification and Development in Sports from the national HAN University of Applied Sciences is focused on further investigation of three principal research themes such as ‘smart choice of sports,’ ‘talent identification,’ and ‘talent development.’

The recent publication of Burk contains valuable information concerned TI and TDV in China [30]. A hierarchical system of multi-stage evaluation of young prospects has been adopted following purposeful regulation of the central State Sport Authority and has a long-term history of successful implementation. The 1st stage is directed toward initial evaluation and reasonable choice of the most suitable sport for the examined athletes. This stage is executed on the school level by physical education teachers and coaches. The 2nd stage presupposes regular preparation of selected candidates in regional youth sport schools. The 3rd stage embraces advanced preparation of the most prospective candidates within the boarding-school system, where the athletes train 4-5 hours a day 5-6 days a week. The 4th stage includes professional preparation in national athletic centers, where the volume of training routines subsequently increases. The top-level of hierarchy is preparation within the system of national teams, where daily time expenses for training reaches the level of 10 hours. The author noticed that after the 2008 Beijing Olympic Games, new tendencies in top-level athletes’ preparation have occurred. There are some trends in decentralization, liberalization, and commercialization.

Concluding this section, it is worth noting that reviewed papers largely contributed to the methodological foundation of Athletic Talent detection and promotion. To note, serious research projects have been realized in countries with deep athletic traditions and successful representation in the International Olympic program. On one hand, the high Olympic ambitions and expectations presuppose elaboration of serious multifaceted programs for searching and promotion of young talents. On the other hand, realization of such projects leads to an increased number of highly qualified athletes and ultimately to achievement of exceptional athletic performances.

3.2. Evidence from studies that evaluated giftedness in young athletes

The purpose of this section is to display and consider examples of practically oriented studies where young athletic prospects were evaluated and the most gifted individuals were identified. For a long time, the attention of researchers and coaches was on determining the relevant predictors of Athletic Talent. Such reasonable predictions can be made based on the most favorable combinations of anthropometric, physiological, and fitness estimates for different ages. Such age-related models can be created through longitudinal study of a large group of athletes, where one sub-group attains the elite level. Data for the athletes recorded in the different periods can be used as model characteristics for corresponding age categories. It is obvious that such a study, which would take a number of years, appears difficult and has organizational problems, but such long-term research projects have been conducted (see Table 2.5). Much more common are so-called cross-sectional studies that compare less successful and more successful youngsters. The results are used to reveal some specifics about hypothetically gifted athletes. Let’s consider a number of studies that represent the findings of cross-sectional and longitudinal investigations (Table 6).

The overview of the above presented research findings shows a variety of study outcomes that display different tendencies in Athletic Talent prediction and identification. Employment of a complex test battery in novices and low-level athletes allowed for recognition of more prospective candidates in rugby [32] and in handball [35]. These data definitely have practical value for further athletic preparation of prospective candidates. Importantly, the inclusion of sport-specific motor tests has particular value due to their higher sensitivity to targeted abilities. The apparent perspective is also to evalu-
athletes in groups of different competence, which allows one to find the most discriminating indicators that can be used for potential talent identification. Such studies were successfully conducted in tennis [31], soccer [33], and volleyball [37]. Particular interest is raised from the data of the longitudinal study where test results at early phases of athletic development were matched with successfultness of athletes after long-term purposeful preparation. The research project with young judo prospects led to unexpected results; the fitness monitoring during two years did not reveal predictive potential in either general or sport-specific variables as compared with athletic ranking of these trainees eight years after completion of a follow up program [36]. The reasons of such “prediction failure” could be associated with low homogeneity of the group (initial age varied between 12 and 15) and relatively low sensitivity of the test battery to highly specific judo athletic abilities. In any case, each single study listed in Table 2.5 gives certain information that can assist the coach in more reasonably selecting tests and indicators of giftedness and more consciously evaluating sport-specific potential of athletes.

## Conclusions

Athletic Talent is definitely one of the most intriguing and widely discussed issues in sport science and practice. Although there has been interest in this problem since many decades ago, when high-performance sport became a reality of social, cultural, and political life, the systematic studies of Athletic Talent have a relatively short history. In fact, the serious investigations of Athletic Talent were only been initiated in the early 1970’s in Eastern European countries. One of the most efficient, hierarchical systems for talent identification and development was elaborated on and fulfilled in East Germany (former GDR). The serious, methodological input to theoretical and evaluation background of TI and TDV was done in the USSR. A number of prospective studies were also conducted in Western European countries and in the USA. Since the early 1990’s, experience from former communist countries became available for the community of international training experts and analysts. As a result, a number of “talent search” projects were successfully realized in Australia, Canada, Great Britain, the USA, the Netherlands, Belgium,

### Table 6. Summary of studies where giftedness and Athletic Talent were evaluated

<table>
<thead>
<tr>
<th>Sample</th>
<th>Study’s description</th>
<th>Study’s outcomes</th>
</tr>
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<tbody>
<tr>
<td>The USA tennis National team members (age 15.4 yrs.), sub-elite players (age 13.6 yrs.) and 250 young players</td>
<td>CSS*. Test battery included speed, agility, strength, flexibility and injury risk data. Testing was fulfilled during special training camp</td>
<td>The tests results yielded an accurateness of prediction for proper group of competence: 85.7% for National team, 91.3% for sub-elite and 95.5% for the rest of the players [31].</td>
</tr>
<tr>
<td>173 candidates for rugby club without previous training. Age of athletes - 10 yrs.</td>
<td>CSS*. 14 motor tests (speed, agility, strength, flexibility) and 14 anthropometric data were measured</td>
<td>Using evaluation profile from 45 top-level players all candidates were classified in according to their predisposition with accurateness 93.8% [32].</td>
</tr>
<tr>
<td>16 elite and 15 sub-elite soccer players aged 16.4 yrs.</td>
<td>CSS*. Test program included soccer-specific skills, fitness, anthropometric, physiological and psychological data</td>
<td>The most discriminating variables were speed, agility, anticipation skill, aerobic power, fatigue tolerance, and ego orientation [33].</td>
</tr>
<tr>
<td>24 elite water-polo players aged 14-15 yrs.</td>
<td>LS*. Test battery included 6 swim trials, dribbling, shooting, “jump” from water, and game intelligence. Follow up during 2 yrs.</td>
<td>The selected roster had initial superiority in swim tasks, dribbling and game intelligence. Prediction for 67% of players was in agreement with final selection [34].</td>
</tr>
<tr>
<td>405 novices handball players aged 12-13 yrs.</td>
<td>LS*. Test battery included height, weight, speed, explosive power and a slalom dribbling. 2 yrs. follow up program</td>
<td>Comparisons between selected to National team and other players have shown that only slalom dribbling served as good predictor of giftedness [35].</td>
</tr>
<tr>
<td>10 judo athletes aged 12-15 yrs.</td>
<td>LS*. The general abilities tests and judo specific set (10 skill tasks stations) were conducted 3 times during 2 years</td>
<td>The athletes’ ranking 8 yrs. after the testing did not meet agreement with the results of judo specific test, which is not sensitive enough to predict talent of athletes [36].</td>
</tr>
<tr>
<td>15 adolescent elite volleyball players aged 16 yrs. divided to starters (S) and non-starters (NS)</td>
<td>LS*. The battery included speed, agility, explosive power, endurance tests and 2 skill tasks. 15-months follow up program</td>
<td>Only one test – vertical jump with approach-revealed difference between S and NS groups. The other tests did not reveal impact of athletic competence [37].</td>
</tr>
</tbody>
</table>

Abbreviations: CSS – cross-sectional study; LS – longitudinal study
Germany, and Switzerland. The tremendous progression of Chinese Olympic athletes was, to a great extent, conditioned by the application of a strictly structured system of talent search and nurturing from the school level until national Olympic centers and national teams.

During the latest decades, a large number of studies have been conducted to verify batteries of relevant estimates for evaluation of giftedness of athletes in different sports. Employment of various tests such as motor fitness, physical skills, body build, physiological, and psychological abilities in different combinations allowed recognition of more prospective candidates with an accuracy that varies between 67-95%. However, this accuracy drastically decreases in attempts to predict talent from a long-term perspective.

Summarizing the evidence from prospective, long-lasting projects and practically oriented studies conducted for the needs of certain sports, a number of relevant issues can be highlighted, namely:

- The commonly accepted approach presupposes the division of long-term preparation into a number of stages where various age and sport-specific tasks be solved and young athletes overcome appropriate phases of their giftedness and talent evaluation;
- The objective difficulties in TI are associated with differences in the rate of maturation and unevenness of biological and sport-specific development of young prospects;
- Serious restrictions of early evaluation of giftedness and talent are associated with the lack of psychological measures and insufficient attention to personality traits that, to a great extent, determine the achievement of exceptional performance;
- The TI in team sports needs more sensitive tests for prediction of successful game activity; such an item as fatigue tolerance was not taken into account by training experts and analysts.

References:

Athletic talent as a scientific problem...


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