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DEPENDECIES BETWEEN THE METHODS USED IN IDENTIFYING PLAYER TALENT IN THE GAME OF HANDBALL

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ABSTRACT
Purpose. One of the basic operational goals of early physical education is the early recognition of athletic potential in children. When examining the presence of talent, it is necessary to consider the specific nature of a given sport, especially if it is a team sport, and the fact that skill in playing a sport is determined not only by featuring a high level of applicable motor abilities. Within this context, the aim of this study was to determine what dependencies existed between the methods frequently used to assess talented children in the game of handball, specifically targeted sports and motor tests. The popularity of these diagnostic methods is based on the theory that achievement in sports is accompanied by a high level of physical ability. Therefore, the practical aim of the study was to improve the accuracy of recognizing and examining sports talent. **Methods.** A group of 21 twelve-year-old boys were recruited, all of whom were involved in a sports program that specialized in handball. Talent was identified by the observation, analysis, and interpretation of the participants' (1) general physical ability – assessed by the Eurofit test battery, (2) targeted physical ability – measured by specific hardball skills such as moving with the ball, catching and passing the ball, and throwing the ball from a distance, and (3) innate in-game behavior – based on a ranking of thirteen behavioral categories exhibited during the course of a game. **Results and conclusion.** The correlation coefficients adopted in this study indicated a high dependency between the three methods used to identify potential talent in handball. This indicates that young athletes who score relatively well in one test are likely to attain positive results in the other two methods.

Key words: initial stage, diagnosis, talent in handball

Introduction

No country is rich and powerful enough to ignore supporting its most talented and gifted individuals. This has been even formally recognized by the European Parliament in legislation on the social well-being and education of talented children and youth in the European Union.

Nonetheless, schools and teachers are faced with a number of difficulties in recognizing overall talent, identifying gifted students, or discovering promising athletes. There exist a number of controversies on the methods used to distinguish talented children and on what course of action is best suited in further developing their capabilities within a public school system, such as enrolling them in alternative classes with an extended specialized learning program. Unfortunately, schools, as formal institutions that teach and bring up children, do not have the means to effectively identify and develop a child's potential at an early age. In terms of physical abilities, previous observations have found that rarely is the athletic talent of students truly utilized; the vast majority of individuals remain undiscovered and never have their talents appreciated enough to develop their potential.

Furthermore, many studies have attempted to identify the archetype of a talented child within specific disciplines of sport as well as develop early-detection methods that can discover future potential [1–5]. Despite the fact that there exist numerous varieties of 'sports potential', it has been almost universally recognized that the most primary factor is having an individual exhibit a high level of overall motor skills and abilities. A practical approach would therefore be based on searching for those individuals who already at a young age feature higher than average levels of these properties. It should be noted that such a traditional approach places larger emphasis on what is more common among various types of sports abilities than on what is more specific. However, the usefulness of testing methods that study only certain isolated skills is not being called into question, as they are an important link in the selection and screening of potential athletes within a specific sport.

Nonetheless, Naglak presented a slightly different outlook on identifying sports talent in youth [6]. In building a prototype model of a juvenile handball player, the author sought to find what skills and abilities a candidate athlete ought to have in order to best fulfill their future sporting objectives. According to Naglak, in order to understand the essence of what qualities are needed in team sports, it is necessary to remember that an athlete continually needs to make difficult choices during a game and that talent in sport is not only based on physical prowess. Naglak [6] believed that one of the

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most important prognostic factors is the so-called 'makings of an athlete', which are specific behaviors an athlete innately reveals when playing a sport. Here, sports talent is recognized primarily as the attitude an athlete holds when faced with a dilemma that emerges during the course of a game (i.e., what choices they can make) and is not dependent on "[…] when they were born or how high they measure on various scales testing various aptitudes and capabilities, it depends, above all, on how they behave during the game" [6, p. 78]. When identifying talent, Naglak took into account, among other factors, the innovation and precision an athlete exhibits when solving problems that emerge during a game. In this case of youth, every child carries inside of them a great deal of spontaneous activity that is still quite independent of the influences of learning and teaching; this allows a young athlete to express (even though they may still be quite clumsy and ineffective) their base motivations when making certain choices. Since children do not present full technical competency, they ought to be observed and evaluated by performing tasks in selected environmental situations, which would consequently "[…] teach the game to those best predisposed, and not just anyone" [6, p. 85]. A characteristic of having such predispositions can be attributed to not only those individuals who make the right decisions and effectively implement them but also those with an efficient decision-making process albeit with sometimes limited effectiveness when carrying out a certain task.

To further analyze these ideas, the main objective of this study was to determine the relationship between the methods used to assess children's abilities when learning to play handball still at an early stage of training and determine if (and what kind) of correlations exist between these various methods.

An important goal of the authors was to also demonstrate the significance of the recruitment and selection process used by sports organizations (e.g. sports clubs, extended curriculum classes) and show the suitability as well as limitations of the standard diagnostic methods currently employed.

Material and methods

The study analyzed 21 twelve-year-old boys who were involved in a comprehensive and intensive handball program. The participants were a select group of young athletes who were sponsored by the WKS Śląsk football team from Wrocław, Poland and the regional Interschool Sports Club.

The study was guided in part by pure observation, which is considered essential in the work of educators. The participants were analyzed by three methods commonly used to measure athletic talent:

(1) general physical ability – assessed by the European Tests of Physical Fitness (Eurofit) [7], which measure overall balance, hand movement speed, trunk flexibility and strength, functional strength, jump ability, hand static strength, and agility;
(2) targeted physical ability – determined by tests specific for the participants' age group by the Handball Methodological-Training Association in Poland [8], which measured three specific motor skills (movement with the ball when changing direction, catching and passing the ball, and throwing the ball from a distance);
(3) and in-game behavioral characteristics – with the expert-assessed ordinal scale developed by Naglak [6].

This last method has been used as a tool to suggest which sports disciplines an individual is best-suited for and also as a criterion for calculating the intensity of player behavior based on a scale with 13 behavioral categories. The assayed criteria, such as "playing without hesitation", can be graded from 1 to 5, with 5 points meaning that the athlete is very good in this category, 4 points – good, 3 points – average, 2 points – poor, or 1 point – the athlete does not exhibit this characteristic. This ordinal scale was used in the study to create a register that can determine the intensity of specific player behavior and to collect primarily qualitative data.

All of the physical fitness tests were conducted in June 2011 during the participants' training sessions; player behavior was assessed during eight games the boys played in during the Wrocław Junior Olympics. The collected data were then analyzed with the following mathematical methods and statistical tests:

– measures of central tendency, arithmetic mean and median;
– measures of dispersion and coefficient of variation;
– Spearman's rank correlation method
– Wilcoxon signed-rank test;

with a significance level (p) of 0.05.

Analysis was performed with Statistica v. 9.0 statistical analysis software (StatSoft, Poland).

Results

The participants' somatic characteristics were first assessed by measuring body height and weight. A benchmark on the somatic development of children practicing handball was used, based on the results of a national Polish survey by Stupnicki et al., stating that the "[…] percentile data herein creates a comparative background that is valid for Polish youth for at least the first decade of the 21st century [7, p. 11].

The arithmetic means of the participants' somatic features found that they were very close to the 50th-percentile of the nationwide population, being only slightly taller and weighing somewhat less than the average. This indicates that the boys had a slightly slimmer figure in relation to the rest of the population. The mean values of both somatic features were between the 25th

Table 1. Somatic characteristics of the participants

Somatic characteristic	Mean	Median	SD	V%	Somatic norms of the 12-year-old male sample [2]	
					50th percentile	25–75th percentile
Body height (cm)	148.38	149	5.43	3.7	146.8	141–151
Body mass (kg)	36.14	36.2	4.74	13.1	37.6	32–41

and 75th percentiles, which indicates that they are within the limits of development norms (Tab. 1).

As the study aimed at examining the relationships between the methods used to assess talent in handball, one of the first conclusions that was reached was that the boys were rather mediocrely chosen to play handball, as they featured only slightly better physical traits than the general population. The importance of body build and, consequently, the need for carefully selected players in team sports and predicting such factors as their final body height is an aspect that has been emphasized by many authors [9–11]. Milanese et al. [12] analyzed the body build of handball players (N = 43, including 7 goalkeepers, 14 points guards, 18 wingmen, and four pivots) and found that the players varied in terms of height, weight, and BMI depending on what position they played, with the largest differentiation found in those specializing as wingmen and goalkeepers. Other authors, notably Czerwinski [13] and Mohamed et al. [14], have also advised the use of anthropometric measurements when recruiting individuals to play handball.

(1) Analysis and evaluation of the participants' general physical fitness development

General physical ability describes the current level of movement possibilities an individual can exhibit or the body's maximum capacity for physical activity. However, this term is more frequently understood as the current ability to perform motor action with the use of one's motor abilities. Nonetheless, how physical ability can be accurately measured is still a relatively unsolved problem, particularly in the case of testing beginner athletes. One of the reasons behind choosing the European Physical Fitness Test (Eurofit) was that this is the latest and most comprehensive physical fitness test that measures all basic motor skills.

The rate of motor skill development is different for individuals, as it is determined by the development of the passive and active musculoskeletal systems, the morphological development of the nervous system, and psychomotor predispositions. The use of a coefficient of variation (V) allowed for the comparison of the dispersion characteristics, as the size of variation is expressed in relation to the size of the variable being measured (relative variability). When analyzing the participants' general physical fitness, it was found that the variable with the largest maximum dispersion around its mean was for shoulder strength endurance, i.e., bent arm hang time (67%), and, what is more surprising, for the balance test, which was measured by the maximum time one could stand on one leg (55%). The mean results of the physical fitness tests, similar to the boys' somatic characteristics, fit within the range of mean values between the 25th and 75th percentile norms of Polish youth [7]. Only body balance and flexibility were found to favorably differ for the boys when compared with the population norms, which is rather difficult to rationally justify (Tab. 2). It can be, therefore, assumed that the participants were also poorly chosen in terms of their overall physical fitness. This is especially so if one considers that between the 25th and 75th percentiles lies 50% of the observed groupings. Young athletes ought to attain far higher values, preferably those who are in the top 10%.

Table 2. Statistical characteristics of participants' general physical fitness

Motor skill	Mean	Median	SD	V%	Functional norms of the 12-year-old male sample [2]	
					50th percentile	25–75th percentile
Overall balance (s)	11.2	9	6.19	55	5	2–8.8
Hand movement speed (s)	138.9	136	19.99	14	148	132–163
Trunk flexibility (cm)	20.4	22	7.29	36	17	12.2–19.2
Trunk strength (total sit-ups)	21.7	21	4.39	20	21.5	18.2–24.5
Functional strength (s)	105.8	87	70.98	67	140	55–220
Jump ability (cm)	167.9	166	25.71	15	145	133–161
Hand static strength (kg)	17.6	18	3.38	19	17	13–30
Agility (s)	213	214	13.48	6	215	204–232

(2) Analysis and evaluation of the participants' targeted physical fitness development

Targeted physical ability (also known as technique) refers to the ability to perform specific motor actions that fulfill the goals and conditions of a specific environment. Generally speaking, it is the readiness one has towards performing meaningful action through the use of particular tasks that can adapted to variable conditions that emerge during a situation. These specific abilities are what constitute technical expertise, which, without physical activity that includes an element of "good hands-on experience", cannot be executed.

After verifying their coefficients of variation, it was found that among the three components of targeted physical fitness test the largest amount of dispersion around the mean was in the ability to catch and pass the ball (18.5%) and then the ability to throw the ball from a distance (15.3%) and the ability to move with the ball while changing directions (4.3%) (Tab. 3). One of the causes that could have influenced such a large dispersion around catching and passing a ball could have been that not all of the boys were able to throw the ball from a distance with the necessary force and angle to have the ball bounce back into their hands. What often happened was that the ball bounced once more off of the floor, which could have had an impact on the relatively low number of passes and catches that were completed within one minute. Unfortunately, this test, developed by the Polish Association of Handball [8] and recommended by school sports organizations, provides no frame of reference nor is there any available data for comparison, such as point-scales.

(3) Analysis and evaluation of participants' in-game behavior that could specify athletic potential

This diagnostic method was performed by an observer examining the boys' behavior throughout the course of a handball game, who rated their playing abilities in specific categories. This method is slightly different from the other diagnostic approaches, as it stresses the importance of a natural research environment that features free, often spontaneous, physical activity. Data collected from this method can be analyzed to assess a child's athletic ability by examining the correctness of certain in-game behaviors within a suitable context.

The overall average for the point scores grading the observed in-game behaviors were found to oscillate between 2.2 to 3.8 points, with an average of 3 (*SD* = 1.09). The highest average point value was found for the fourth graded criterion, 'Rapid play with and without the ball' ($\bar{x}$ = 3.8), while the lowest value was for the seventh criterion, 'Being in a position to score a point' ($\bar{x}$ = 2.2). Of the 13 analyzed behaviors, eight had point scores that slightly exceeded the overall average. The relatively large coefficients of variation, ranging between 49 and 29 with an average of 33.6%, indicate a significant variation of the results. The largest amount of dispersion was found in the mean value of the sixth behavioral category, 'scores points' (49%), while the least dispersion was in the thirteenth category, 'outnumbered in defense' (29%) (Tab. 4). It should be noted that two behavioral descriptors, 'scores points' and 'intercepting the ball',

Table 3. Statistical characteristics of participants' targeted physical fitness

Expressions of targeted physical skills	Mean	Median	SD	V%
Ability to move with the ball while changing directions (s)	17.64	17.40	0.76	4.3
Ability to pass and throw the ball (total)	33.85	32.00	6.27	18.5
Ability to throw the ball from a distance (cm)	14.56	14.60	2.22	15.3

Table 4. Statistical characteristics of participants' in-game behavior identifying athletic disposition

Type of behavior	Mean	Median	SD	V%
1. Plays without hesitation	3.1	3	1.52	49
2. Unafraid to take risks	3.1	3	1.38	44
3. Player is active	3.4	3	1.28	38
4. Rapid play with and without the ball	3.8	4	1.17	31
5. Made the right choice when passing the ball	2.8	3	0.81	29
6. Scores points	2.8	3	1.36	49
7. Being in a position to score a point	2.2	2	0.99	45
8. Outnumbered during offense	2.5	2	0.92	38
9. Is active during defense	3.3	3	1.00	31
10. Intercepting the ball	2.7	3	0.90	33
11. Blocking attacks	3.3	3	0.96	29
12. Impedes the opposing team	3.1	3	1.04	34
13. Outnumbered during defense	3.3	3	0.96	29
Total	3	2.9	1.09	33.6

grade specific motor actions. They have, according to Naglak [6], the biggest impact on the progression and level of the game, that they are some of the most difficult abilities to teach, and that these two categories are also able to decisively differentiate players in terms of their abilities.

Relationships between participants' rankings based on the tests identifying talent in handball

After analyzing the mean values, an attempt was made to assess what relationships existed among the methods used to identify the physical abilities of children playing handball. For this purpose, the boys were ranked (from best to worst) by their results in each of the test methods, with Spearman's rank correlation coefficient used to rank their results and create a final ranking (Tab. 5).

The results found a very strong positive correlation among the analyzed rankings. Based on the correlation coefficients that were adopted, it could be concluded that an athlete who scored well in one of the methods identifying talent would also present satisfactory results in the other two. The lowest agreement was found between the rankings of targeted physical ability and general physical ability ($r = 0.53$), while the largest agreement was between targeted physical ability and the in-game behaviors that identify athletic potential ($r = 0.77$) (Tab. 5). Subsequently, it was decided to test the significance of the dependencies between the obtained rankings with the use of the nonparametric Wilcoxon signed-rank test, on the basis that the variables were measured on a scale allowing observations to be ranked for each method and that each of the variables in one method are comparable with the variables from another method. This test is a nonparametric alternative to the *t*-test for dependent samples, the advantages of which are that it does not require data on the variables' distribution and that it can be used when the studied characteristics are calculated with the use of ordinal scales. The results are presented in Table 6.

The results found no statistically significant differences between the analyzed evaluation methods (general physical fitness, targeted physical fitness, and in-game behavior). In addition, the boys did not differ significantly when comparing the ranked lists of the methods identifying talent in handball.

Table 6. Level of probability of the Wilcoxon signed-rank test comparing the ranked lists of the methods identifying talent in handball

Paired rankings	Wilcoxon signed-rank test		
	N sample size	*T*	*p*
OSF ranking and ZG ranking	20	101.00	0.884
OSF ranking and ST ranking	20	96.00	0.743
ZG ranking and ST ranking	18	76.5	0.691

OSF – general physical fitness; ZG – in-game behavior; ST – targeted physical fitness (technique)
* significant at $p < 0.05$

Discussion

In many sports, especially those with set movement patterns (figure skating, track and field), the recruitment process of identifying potential athletes, as well as how to do so, is relatively well proceduralized and can provide objective data with the use of a standardized system of measurement. This, however, is not the same with team sports, whose movement patterns are entirely varied in nature [2, 5]. These are dynamic varied movement patterns that have a low predictability of subsequent sequences, which to a certain degree underlines the individual creativity in accomplishing team goals [15, 16]. Therefore, within them lay the specific mechanisms that regulate an athlete's functioning. The nature of this mechanism is the feedback interaction of a number of factors, such as individual player potential, the possible behaviors of other team players, and the possible reactions of opponents. Player efficiency should, therefore, be considered within the context of a set task or given situation and not only in terms of individual dispositions. However, the problem of identifying the most talented children in team sports is one includes a social dimension that is, unfortunately, not yet fully understood.

In this study, we described athletic skill by using three basic methods indicative of a young athletes motor ability potential. The first was calculated by meas-

Table 5. Relationship between participants' rankings based on the tests identifying talent in handball

Ranking	Spearman's rank correlation			
	General physical abilities	Targeted physical abilities	In-game behavior	Final ranking
General physical abilities	X	0.53*	0.55*	0.74*
Targeted physical abilities	0.53*	X	0.77*	0.87*
In-game behavior	0.55*	0.77*	X	0.91*

* Correlation coefficient significant at $p \leq 0.05$

uring general physical fitness, since it appears that the level of motor ability determines, above all, how an individual stands in an overall sports hierarchy. Physical fitness can be explained in a variety of ways, partly due to the fact that it is possible to distinguish certain motor skill configurations that lead ultimately to the creation of certain valued fitness characteristics. These, in turn, can be associated with describing what motor skills are desired in specific sports. It is worth noting that handball is a game of speed dominated by speed-strength motor skills. Hence, this is one of the reasons why Lidor et al. [17], when recruiting participants for their study, subjected young males (N = 405, aged 12–13 years) who were suggested by their coaches to take part in the study to a specific set of trials. The participants were tested by a 20 m sprint from a standing and running start, a 4 × 10 m run and also had their explosive power measured by a medicine ball throw and standing long jump. The tests found a number of overlapping results by the young players who were specifically recruited and those who were randomly chosen, which, according to Lidor et al. clearly indicated that they were not the best variables that could identify talent [17]. Mohamed et al. also analyzed general physical ability as a multi-faceted subject [14]. This research group verified if the general fitness levels of young handball players aged 14 and 16 years (N = 34, N = 47, respectively) differed from the physical fitness of non-training youth of the same age (N = 430, N = 570, respectively). Discriminant analysis found that the athletes obtained far better results in tests of strength, speed, and agility but not balance and upper limb speed. The present study assessed the participants' physical fitness by the Eurofit test, where establishing a so-called base level is quite important. It appeared that only the participants' body balance and flexibility favorably differed from the physical development norms of Polish children and youth.

The second method dealt with targeted physical ability and, as was already mentioned, how it determines the effectiveness of executing particular tasks. In this regard, Lidor et al. suggested that a good indicator may be evaluating the ability to move with the ball (dribbling). Schorer et al. introduced an interesting way at evaluating specific abilities, where boys aged 13–15 years had to throw ten balls towards the two upper corners of a goal as accurately and as quickly as possible [18]. The task was for the boys to pick up a ball placed 12 m from the goal, take three steps forward and then throw the ball from around 9 m towards the goal. Interestingly, the task was assessed not only by the duration of the task and throw accuracy but by the speed at which they threw the ball (measured by a Speed-Track system). They were also scored by two judges who graded the run towards the ball and the initial and final throwing position. In the present study, the efficiency of targeted physical ability was based on the performance of executing technical elements that are typical in the game of handball. Although the participants performed the tasks without an opponent, they were under a time constraint, which for this age group was enough to replicate a form of in-game stress.

Finally, the third method was based on observing in-game behavior. Here, analysis took into account a number of different abilities that could be graded on an ordinal scale. Individual activity is one of the most important factors in the development of personality, as it is, in effect, the autocreation of one's own individuality. Generally speaking, an assessment of a child's individual activity is related to the adequate reactions they present during changes in their environment, the ease of transition they have from one task to another, and how often they are active in highly stimulating conditions. In psychological terms, this dimension corresponds to emotional resilience and self-control. It is worth noting that such forms of behavior in this age category has not yet been discussed in literature on the subject. This is unfortunate, as this was found to be correlated with both general and targeted physical fitness. Studies have shown that general and targeted physical ability and in-game behavior are three dynamic units that exist in a mutually conditioning relationship, and they are particularly important in structuring the abilities needed to play handball when still learning how to play the game.

Therefore, the results found that the abilities of young handball players can be explained by three specific criteria: general physical ability, targeted physical ability, and in-game behavior. General physical ability can be considered to provide players with effective functioning, something that could be understood through the motto "Citius Altius Fortius". Targeted physical ability determines effective player action in a team sport with clearly defined parameters; these are specific abilities that cannot be measured by general motor skills. In-game behavior can be considered as those dispositions that provide 'style' and are based on generativity and originality. The studied criteria were found to all interact with one another, while still maintaining their own standard set of values. As a result, depending on how well or how strong a player exhibits the criteria analyzed in the present study, individual configurations for each athlete can be created providing different ability potential. Naturally, only athletes with high results in all three assessment methods can be considered to have a high probability of featuring sporting success.

In conclusion, it was found that the recruited group of boys were not well selected in terms of their somatic characteristics or their general physical ability levels, they were, in other words, not physically fit nor developed enough to be 'model' handball players. This, in effect, points to a poor recruitment process used in selecting potential handball players.

Conclusions

The correlation coefficients adopted in this study indicated a high dependency between the three methods that can identify potential player talent in handball. The results found that the participants who scored relatively well in one test also attained good results in the other two methods.

The authors of the present study wish to postulate on the creation of a personality profile for future candidates in handball. Such a profile would be based on what characteristics a player presents and prevent one from concentrating too much on only a narrow group of selection criteria.

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