IDENTIFYING TALENTED HANDBALL PLAYERS – THE POSSIBILITIES OF EXAMINING THE PLAYERS BY MEANS OF SPEED-FORCE AND COORDINATION TESTS

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Abstract. The main aim of this thesis was to assess the usefulness of the chosen tests of motor skills (focused mainly on the work of the lower and upper limbs) and the computerized motor skills tests in identifying the talented handball players. To examine them, the players' results from two junior teams were compared. The first test was performed before the players started high school, that is, at the age of sixteen. The results were compared with the sport level examined during the second test, performed when the players reached the senior age (nineteen years old). The Spearman's rank correlation coefficient among the ranking results (sport level), somatic features and motor skills, was used in the analysis, with the level of statistical significance being $p < 0,05$. Significant statistical correlations were discovered between the level of anaerobic force of the examined handball players when they are sixteen, and their sport level when they are nineteen years old. The significant statistical correlations may be one reason to use the tests of speed-force skills to identify the talented handball players described in this thesis. Among the coordination skills, only the multitasking ability proved to have significant statistical correlations with the players' sport level.

Key words: handball, identifying the talented players, motor tests, coordination tests, somatic features

Introduction

Nowadays, when more and more challenging records are being established, it is impossible to achieve sport championship without performing the appropriate selection process of the players for the discipline. Generally speaking, the recruitment and selection process can be defined as a system of various actions that are aimed at finding individuals who have optimal somatic, psychological and motor features to acquire good results in a given sport discipline in the future (Ważny 1981).

The selection is not restricted to the recruitment of players, it is carried out during the whole training process. There are a few stages of selection and their exact amount depends on the system of children's and adolescents'

sport training and the sport discipline (Sozański and Zaporożanow 1993; Sozański 1999; Bompa 1999; Wołkow 2002; Perič 2006; Ozimek 2007).

As sport games require specific and complex skills, there are exact age limits for each training stage (Naglak 2001, 2005, 2010; Spieszny and Walczyk 2001). Naglak (2010) distinguishes them as follows:

- the initial stage of training: 13–15-year-olds,
- the basic stage of training: 16–19-year-olds,
- the special stage of training: 20–24-year-olds,
- the professionalization stage: from the age of 25.

In sport games training, the age of sixteen is a very important moment because the young players choose high school, which has an enormous influence on their future careers. At this stage, many players resign from training in order to study.

At this point, it is therefore important to select the most talented players, and persuade them to continue training the discipline they have chosen. Moreover, this period is believed by many specialists to be the most appropriate one to perform the correct selection of handball players. It is confirmed by the results of research performed by Fernández et al. (2004) and Mohamed et al. (2009).

The scientists who specialize in identifying sport talents mostly agree that recognizing the potential of the young players should be focused on three groups of factors: motor fitness, psychological features and social features (Fisher and Borms 1990; Brown 2001; Duran-Bush and Salmela 2001; Bompa and Haff 2010; Naglak 2010 and others).

The success in sport also depends on the level of technical-tactical skills and their adequate use during the game. The player is required not only to foresee the moves of their teammates, but also of the players of the opposite team. Those specific psychosomatic reactions are the reason why anticipation is one of the crucial factors that determine the quality of the game. Nevertheless, it must be concluded that the players rarely perform simple reactions during the game, as they perform reactions of their choice much more often. In this case, a player is able to react to their opponent's move in various ways. The above-mentioned examples lead to a conclusion that the game technique must be taught together with all the motor reactions (Czajkowski 2004), including the factors that condition the teaching process.

All the scientific research performed to date has demonstrated that the level of motor coordination is a decisive factor in acquiring new motor skills. This notion is mentioned often in the reference books (Zimmermann 1983; Szczepanik and Szopa 1993; Ljach et al. 2001, Raczek et al. 2002; Starosta 2003; Raczek 2010 and others). According to Starosta (2006), a higher level of motor coordination facilitates mastering difficult motor tasks, and the coordination skills constitute a "genetic" basis for learning sport technique. Therefore, coordination skills can be treated as predispositions to motor skills.

It is therefore surprising that the assessment of the coordination skills do not take place at each stage of selection of sport games training. However, it must be admitted that the measurement of the coordination skills is very difficult.

Furthermore, the tests assessing motor skills of the players are used by the coaches as a selection tool very often. It is mostly caused by their facility and high availability. The physical fitness tests that are aimed at finding talented players and controlling the training effects of children and adolescents are reflected upon in the reference books (Brown 2001; Schorer and Willimski 2002; Bompa i Haff 2010; Spieszny 2011b).

The results of research by many scientists specializing in identifying the talented players demonstrate that the most diagnostic are the motor fitness tests that are performed in accordance with the specificity of the sport discipline trained. For instance, while examining Israeli handball players aged 12–13, Lidor et al. (2005) discovered that the test of special motor fitness was a more reliable means of assessing the prospects of sport development than tests of general fitness. They successfully predicted in 50% cases whether a player will join the junior league after 2–3 years period. The general fitness tests were successful in recognizing a sport talent only in 23% of the players. Furthermore, Pienaar et al. (1998) predicted with an 88% accuracy, on the basis of physical fitness tests and anthropomorphic measurements, which of the examined 10-year-old boys will qualify for the regional primary school rugby teams in the Republic of South Africa.

However, Reilly et al. (2000) and Reilly and Gilbourne (2003) demonstrated that the tests of motor fitness have low efficiency in selecting football players. According to these authors, none of the methods commonly used can successfully assess the potential of athletic development of a player. Therefore, the assessment of the motor skills should be used in order to monitor the young players, not to select them.

Hence, it is not easy to choose a proper test that evaluates the level of the motor skills of an energetic basis in order to identify a talented player. It is therefore crucial to perform further research to clarify the contentious issues.

The aim of the research

The main aim of the research is an attempt to assess the diagnostic value of the motor effects tests and the computerized coordination skills test used for sixteen-year-old players (first grade in high school).

1. Is it justified to select the players for the specialized training by means of the tests of speed-force skills and coordination skills?

2. Are the proposed tests of speed-force skills and coordination skills useful in the process of identifying the talented handball players?

The characteristics of the examined group of players

The material of the research is constituted of the competitors' test results representing two schools: the Sport Championship School of the Polish Handball Association in Gdańsk (17 players) and the sport class specializing in handball from the Comprehensive and Vocational Complex of Schools nr 8 in Chełmek (9 players).

The examinations were performed at the beginning of August 2010, during the preparatory training camp before the season.

The scope of the research:

1. Somatic features: body height, body height while sitting and body mass.
2. Motor tests:
   - Sitting up from a lying position – performed according to the instructions of "Eurofit" (1991), the test used to evaluate the force of the abdomen muscles.
   - Throwing a medicine ball (1 kg) while kneeling down (Spieszny 2011a) – this test assesses the power of the shoulder muscles and the uprail. The subject kneels down on a mattress and throws the medicine ball

forward with two arms, from behind their head. Two thirds of the mattress are positioned before the line that indicates the starting point of the measured length of the throw. The second line is drawn on a mattress and the subject kneels down behind it to throw. The subject is allowed to fall on the mattress after throwing the ball. The measurements were made to an accuracy of ten centimetres. The subject repeats the test three times and the best result is written down.

– The pendular run 10 × 3 m (Spieszny 2011a) – it is the test of the lower limbs' force. The subject runs a 3-meter distance ten times. The distance is defined by lines (for example, the attack line and the middle line of a volleyball court). The player is supposed to touch the ground behind the line with their hand and their foot every time they change the direction. It was vital that the touching was interchangeable: once with the right foot and the right hand, next time with the left foot and the left hand. The subject starts from a high position from behind one of the lines and the stopwatch is switched on after the subject touches the ground for the first time. During the performance, the person taking the measurement is counting each cycle of the run loudly. The player runs forward. The test is repeated twice with at least a five-minute break. The better result is used to count the maximal anaerobic power (MMA) that was acquired by the subject during the pendulum running test. The calculations are performed according to the formula:

$$MMA = \frac{36{,}000\ m}{t^3},$$

where:

m – body mass (kg),
t – time of performing the test (s).

– Tapping with a medicine ball (2 kg) (Spieszny 2011a) is a test evaluating the upper limbs' force. The player is seated in a straddle position on a mattress by the wall and supports their back on a second mattress placed against the wall. The subject is holding the ball in front of them with two hands. They decide when to start, hit the mattress between their legs with a ball and then the mattress above their heads. The task is to perform ten cycles "down-up", hitting the mattresses with the ball. The stopwatch is switched on when the subject hits the mattress between their legs for the first time and then when they hit the mattress between their legs for the eleventh time (ten full cycles). The task is measured twice, the subject performs the test twice with at least a five-minute break. The better result is used to calculate the maximal anaerobic power of the upper limbs. The calculations are performed according to the formula:

$$MMA = \frac{20 \cdot (2 + 0{,}1 \cdot m) \cdot g \cdot h_s}{t},$$

where:

m – body mass (kg),
g – acceleration of free fall (9,81 m/s^2),
h_s – body height while sitting (m),
t – time of performing the task (s).

3. The computerized tests of coordination skills (Klocek et al. 2002) that determine:
- time of a simple reaction to a visual stimulus,
- time of complex reactions to visual stimuli,
- visual-motor coordination – a modified test on the Piórkowski's device,
- spatial imagination- on a cross visual-motor testing device,
- multitasking skills,
- sense of direction – perception (a part of the sense of direction).

4. The assessment of the examined players' sport level at the end of the season 2012/2013 games. Each player was ascribed a rank according to the following criteria:
- basic player of Polish junior national team,
- player invited to the Polish junior national team,
- player involved in the centralized training (a Sport Championship School – SMS),
- player who is a member of the second senior league,
- player who competes only in junior league matches.

5. In order to picture the differences between the compared groups, the average results of the SMS players were normalized into an average and a standard deviation of the handball players from Chełmek. The values of the normalized indices were calculated by means of the formula:

$$WU = \frac{\overline{X}_{SMS} - \overline{X}_{UKS\ Chełmek}}{SD_{UKS\ Chełmek}}$$

If the value of a normalized index calculated in this way is negative, it means that the handball players from the Sport Championship School in Gdańsk are characterized by a lower level of the analysed parameter from the players from Chełmek. Therefore, when calculating the normalized indices, the value was changed from the negative to the positive and the other way round in the case of the tests where the time was the most important measure (shorter time – better result). It happened in the case of the following tests: pendular run, tapping with a medicine ball, simple and complex reaction, visual-motor coordination and spatial imagination.

6. Calculation of the Spearman's rank correlation coefficient between the ranking results (sport level) and the somatic features was performed with the use of the Statistica program.

Results

The development profiles of the analyzed somatic features and motor skills unanimously indicate that the SMS players are definitely taller and heavier than their peers from Chełmek. Considerable differences can be observed in the body height parameter, as they reach almost two standard deviations. Body height is, at the same time, the feature that differentiates the two examined groups of players the most. The Gdańsk players are characterized by a higher level of speed-force skills. Those differences are the most visible in the maximal anaerobic power value of the upper and lower limbs (1 SD). The results of the coordination skills tests are not so explicit and they are in favor of the handball players from Chełmek. The players from both schools achieved similar results in the tests of simple and complex reaction time and sense of direction-perception. The players from Chełmek have a higher level of spatial imagination and visual-motor coordination, but are considerably weaker than the SMS Gdańsk players

in terms of multitasking skills. The differences in the results of those three tests fluctuate around one standard deviation.

Table 1. Numerical characteristics of the analyzed elements of the players from the Sport Championship School in Gdańsk (SMS) and from the Youth Sport Club "Siódemka" from Chełmek

Somatic features, motor tests	SMS Gdańsk N = 17		UKS "Siódemka" Chełmek N = 9	
	$\bar{X}$	SD	$\bar{X}$	SD
Body height (cm)	187.90	4.90	178.90	4.81
Body height while sitting (cm)	97.30	3.07	93.50	2.73
Body mass (kg)	78.40	8.08	74.50	6.14
Sitting up from lying (amount of repetition)	35.60	4.48	37.00	3.59
Medicine ball throw (m)	13.60	1.30	13.80	2.41
Pendular run 10 × 3m (s)	10.400	0.662	10.800	0.752
MMA of pendular run 10 × 3 (W)	2543.70	464.34	2182.20	406.12
Medicine ball tapping (s)	5.620	0.401	6.030	0.672
MMA of medicine ball tapping (W)	335.00	49.09	292.10	48.10
Time of simple reaction (s)	0.233	0.0194	0.238	0.035
Time of complex reaction (s)	0.4060	0.0438	0.4330	0.1404
Piórkowski's test (s)	75.070	6.031	70.320	5.152
Spatial imagination (s)	92.060	11.258	86.000	8.403
Multitasking skills (rate of focus)	77.00	12.20	68.30	9.87
Sense of direction (%)	56.10	9.93	53.30	7.87

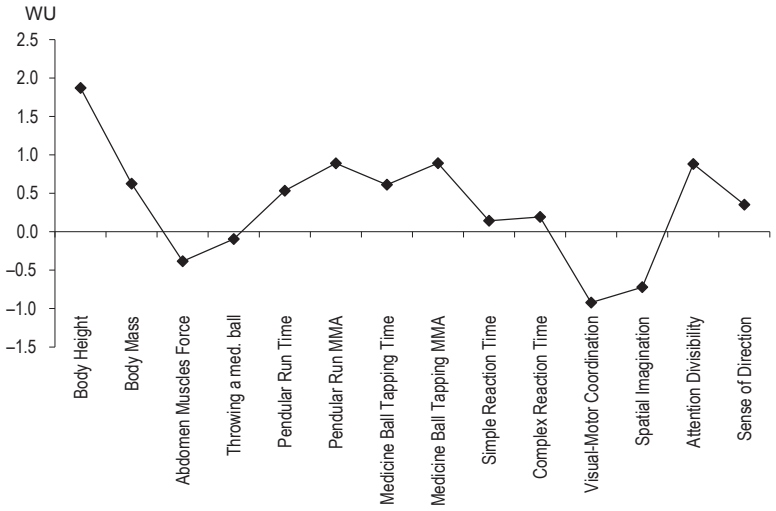

Figure 1. The profiles of the analyzed somatic features and motor skills of the handball players from the Sport Championship School in Gdańsk (SMS) normalizing into an average and standard deviation of the results of the players from the Youth Sport Club "Siódemka" from Chełmek

Table 2. Table representing Spearman rank correlation coefficients and their statistical significance

	N (Significant)	R (Spearman)	p
Sport Level – Body Height	26	–0.338475	0.090770
Sport Level – Body Mass	26	–0.478093	0.013497
Sport Level – Abdomen Muscles Force	26	–0.001462	0.994848
Sport Level – Throwing a med.ball kneeling down	26	–0.436601	0.042199
Sport Level – Pendular Run 10 × 3 m	26	0.392497	0.070791
Sport Level – Pendular Run 10 × 3 m MMA	26	–0.537866	0.009825
Sport Level – Medicine Ball Tapping (2 kg)	26	0.599260	0.003206
Sport Level – Medicine Ball Tapping (2kg) MMA	26	–0.426804	0.047595
Sport Level – Simple Reaction Time	26	–0.083589	0.684763
Sport Level – Complex Reaction Time	26	0.294401	0.144315
Sport Level – "Piórkowski's"	26	–0.107814	0.600110
Sport Level – "Cross VisualMotor"	26	–0.190613	0.350960
Sport Level – Attention Divisibility	26	–0.437241	0.025506
Sport Level – Sense Of Direction	26	0.016588	0.935897

Among the somatic features, solely the body height shows some significant statistical relations to the sport level achieved by players at the age of nineteen. Among the motor effects test, the ones that resulted to be significant are: the medicine ball throw while kneeling down, tapping with a medicine ball, the pendular run and tapping with a medicine ball if used to calculate the maximal anaerobic power. Among the coordination skills, only the multitasking skills proved to be related to the level of the game. It is worth mentioning that the rest of the coordination skills are not related to the sport level achieved by the players. The highest correlation coefficient was achieved in the results of the tapping with the medicine ball and the maximal anaerobic power of the 10 × 3 m run.

Discussion

As expected, the somatic features of players from the SMS Gdańsk exceed the somatic features of the players from Chełmek (in case of the body height especially). It can result from the fact that in the process of selection of the candidates for the school in Gdańsk the physical conditions of the candidates are very important. It is obvious that an appropriate body height and body mass are crucial for handball players. This belief is supported by the results of this research that demonstrate that those features have a high correlation with the sport level achieved at the age of nineteen. Nevertheless, the somatic features cannot be the only criterion while selecting the players for the sport schools. They are treated as not the main factor in selecting the talented handball players (Lidor et al. 2005; Spieszny 2011b). Moreover, due to the strong hormonal activity, the body height can change considerably during the adolescence. In consequence, it would be more appropriate during the selection process to estimate body height when the individual is an adult, in order to lessen the risk of eliminating the players who mature later (Pearson et al. 2006).

The next analysed issue were the speed-force skills of the young players. Many experts claim them to be decisive in the effectiveness of the players' actions during the game (Zglinicki 2004; Norkowski 2001; Rannou et al. 2001). It stems from the structure of a handball match that contains a lot of starts, sprints, throws, jumps, etc. It could be therefore expected that the players from the Gdańsk school, as it is one of the best in the country, would have

a much higher level of speed-force skills than the players from Chełmek. However, the results of the research proved it not to be true. The SMS players are definitely better in terms of the values of the maximal anaerobic force of the pendular run and the tapping with a medicine ball. Nevertheless, the difference was not higher than one standard deviation. The advantage over the Chełmek players in terms of the time of performing those tests fluctuated only around 0,5 standard deviation. The players from Chełmek achieved slightly better results in abdominal muscles test and the throw of the medicine ball from behind the head. It can be caused by the fact that while selecting the players for the Gdańsk school, no tests measuring speed- force skills are performed. This research demonstrates that the good results of the tests that assess those skills correlate highly with the sport level that the players reach after they graduate from high school (especially the distance of the medicine ball throw from behind the head, maximal anaerobic power of the pendular run and the time and the maximal anaerobic power of the tapping with a medicine ball). Therefore, in order to make the selection process for the Sport Championship School in Gdańsk more efficient, those tests should be included.

Most surprisingly, the results of the coordination skills test are ambiguous and they do not correlate with the sport level achieved when the players reach adulthood. Many theses have proven that coordination skills are a crucial factor that determines a high sport level of a sport game player (Żak and Spieszny 2002; Szczepanik and Szopa 1993; Raczek et al. 1998). The structure of a handball game is the reason why the players perform simple reactions rarely during the match (a known and expected stimulus causes a reaction in form of a stereotypical movement). The reactions that require a choice are more common (a sensory-motor reaction with a choice). The potential of a player in this field is determined by the level of the motor coordination. Moreover, one of the most important factors that condition a high sport level of a sport game player are the technical-tactical abilities. Szczepanik and Szopa (1993) have demonstrated that the level of the coordination skills positively influences the level of those abilities and the speed of acquiring them.

The lack of correlation between the majority of the coordination skills with the sport level achieved when a player becomes an adult may stem from the small sample size and the high level of those skills in case of all the subjects (the subjects from Gdańsk were one of the best in their age group, and Chełmek club are the bronze medalists of the Polish Junior Championships). Multitasking skills, which were the only ones to prove statistically significant, may be the key skill in assessing a player's aptitude to train handball. However, it cannot be argued that it can be proven only with further research that may confirm or deny this statement. Nevertheless, taking into consideration the fact that the majority of the experts claim that these skills are significant in sport games and that they are highly genetic, it can be assumed that the evaluation of these skills should be taken into consideration in the recruitment and the selection process for the sport classes.

Conclusions

1. Significant statistical relations have been established between the level of anaerobic power of the examined handball players when they are sixteen years old and their sport level when they are nineteen years old. It is the reason to perform the tests of speed-force skills, which are described in this thesis, in order to identify the talented handball players.

2. The examined handball players are characterized by a high level of the analysed coordination skills. Solely the multitasking skills have proven to have a significant statistical relation with the sport level of the examined players.

3. Among the somatic features, the body height has demonstrated to have a high correlation level with the sport level.

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