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SOME PSYCHOLOGICAL CHARACTERISTICS OF ELITE HANDBALL PLAYERS IN CORRELATION WITH PLAYERS' MOTOR ABILITIES

NEKATERE PSIHOLOŠKE ZNAČILNOSTI V POVEZAVI S MOTORIČNIMI SPOSOBNOSTMI PRI VRHUNSKIH IGRALKAH ROKOMETA

ABSTRACT

Personality characteristics, problem-solving, movement speed, explosive leg power and correlations between them are essential topics in elite handball, although studies in these fields are relatively rare. The correlations between psychological characteristics, problem-solving abilities, and some motor abilities in two different age categories were researched. The sample included 41 female handball players, 24 of which were members of the senior national team, with an average age of 24.79 years (SD = 4.84 years), and 17 girls from the Slovenian youth national team, whose average age was 16.35 (SD = 0.70 years). The differences in age between groups were statistically significant (t = 8.42, p (t) = 0.00). Players' psychological characteristics were examined with the Wartegg test, while the Runs Test (different sprints and vertical jumps) was used to assess players' motor abilities. Identity has a significant negative (-0.61) correlation to CMJ - youth players with a lower identity score jumped higher. Furthermore, rational-emotional integrity is also negatively correlated to CMJ (0.58). Results do not conclusively describe the correlation between problem-solving and movement speed among female handball players. No any statistically significant differences between youth and senior players were discovered. The test results are an essential contribution to a better understanding of the correlation between specific psychological characteristics and problem-solving in relation to movement speed and explosive leg power of youth and senior female elite handball players despite the fact that the correlations were not statistically significant. However, this was the first use of the Wartegg test in female handball.

Key words: female handball, Wartegg test, motor abilities

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IZVLEČEK

Osebne značilnosti, reševanje problemov, hitrost gibanja, eksplozivna moč nog, in povezave med temi dejavniki so ključna področja v vrhunskem ženskem rokometu. Čeprav pa so študije relativno redke. Povezave med psihološkimi dejavniki, reševanjem problemov in z nekaterimi motoričnimi sposobnostmi so bile raziskovane. Vzorec obsega 41 vrhunskih rokometašic, 24 članic članske reprezentance, v starosti 24.79 let v povprečju (SD = 4.84 let), in 17 igralk kadetske reprezentance Slovenije, s povprečno starostjo 16.35 let (SD = 0.70 let). Razlike v letih so statistično značilno pomembne (t = 8.42, p (t) = 0.00). Psihološke značilnosti igralk so bile merjene s Warteg testom in testom nizov: Motorične sposobnosti (različni sprinti in skoki) so bile izmerjene preko standardnih testov za oceno motoričnih sposobnosti. Ugotovljena je bila statistično značilna negativna korelacija (-0.61) s CMJ – kadetinje z nižjo vrednostjo v testu identitete so imele boljše rezultate v skokih. Nadalje, rezultat v testu racionalno-čustveno integritete je tudi negativno povezan s rezultati v CMJ (0.58). Rezultati ne opisujejo korelacijo med reševanjem problemov in hitrostjo gibanja igralk. Poleg tega ni bila ugotovljena nobena statistično pomembna korelacija med rezultati kadetinj in članic. Izsledki študije so pomemben prispevek k boljšemu razumevanju povezav med rezultati nekaterih specifičnih psiholoških karakteristik, sposobnostjo reševanja problemov in povezave s motoričnimi testi (moč nog, hitrost) pri članskih in kadetskih reprezentantkah, glede na to, da korelacije niso statistično značilne. Poleg tega je prvič uporabljen Warteg test v ženskem rokometu.

Ključne besede: ženski rokomet, Warteg test, motorične sposobnosti

INTRODUCTION

Personality can be defined as a basic pattern of our mental, behavioural and physical characteristics, according to which an individual differs from other people (Musek, 2010).

Several works explore personality effects on athletic success and population-based differences, as well as how sport participation can contribute to personality development. Allen, Greenlees, and Jones (2011) outlined the role of athletic interactions and group processes in the development of personality.

One of the personality tests is the projective drawing test developed by the Austrian-German psychologist Ehrig Wartegg. The test consists of eight squares of 4 x 4 cm in two rows, with each square containing the beginning of a drawing. The role of the participant is to complete the drawing and include the given stimulus in his/her product. At the bottom of the test sheet, they must explain their drawings. There is no time limit. The test assumes that the content and quality of the drawing reflects the personality of the individual who completes the test (Roivainen, 2009). The squares are evaluated by comparing the pictures. The maximum number of points for the box is eight. Negative points are allowed. Each square represents different areas: identity, affectivity, motivation, tension, problem-solving, combining emotional and rational aspects of the situation, sensitivity to detail, and social relations (Kajtna, 2016).

Soilevuo Grønnerød and Grønnerød (2012) found in their meta-analysis of the test that it is difficult to reach a conclusion regarding the validity and reliability of the Wartegg test.

A comparison of the competition levels showed that athletes competing at a national or international level possess a lower level of neuroticism, and a higher level of meticulousness and palatability than athletes competing at a regional level (Allen et al., 2011). On average, professional athletes are more sociable, energetic, active and confident, and less prone to negative emotions, anxiety, depression, and melancholy. They respond better in stressful situations (Allen et al., 2013; Egloff & Gruhn, 1996). According to extensive researches in this field, it is necessary to emphasise that personality traits are significant predictors of long-term success or differences between athletes. Personality is associated with factors that have a long-term impact on athletes' results, for example meticulousness, which successfully predicts the quality of athletes' preparations (Woodman, Zourbanos, Hardy, Beattie, & McQuillan, 2010).

In addition to indirect effects, some studies also confirm the effects of moderator variables between personality and sport variables. The first among them is the presence of an audience that moderates the influence of extraversion on the results (Graydon and Murphy, 1995). Many studies confirm that athletes who are involved in organised forms of sports activity, possess certain personality traits. They are characterised by a higher level of extraversion (Paunonen, 2003), emotional stability (Egan & Stelmack, 2003; McKelvie, Lemieux, & Stout, 2003) and openness to new experiences (Kajtna, Tušak, Barić, & Burnik, 2004). Rhodes and Smith (2006) confirmed in their meta-analysis that sports activity in non-competitive athletes is positively related to extraversion, conscientiousness, and negatively to neuroticism. Furthermore, research suggests that team athletes are on average more extroverted and less conscientious than individual athletes (Nia & Besharat, 2010; Eagleton, McKelvie, & DeMan, 2007). Athletes, therefore, show common personality traits. It is possible that these traits are already expressed before getting involved in sport, and are further developed through engagement in the chosen discipline (Allen et al., 2013).

Along with other basic psychological characteristics in sport, fluid intelligence is a meaningful concept and is positively related to relevant variables, especially in competitive sports. Some researchers (Carmeli, Bar-Yossef, Ariav, Levy, & Liebermann, 2008) find that fluid intelligence is associated with shorter reaction times, better perception and coordination of movement (Brochard, Dufour, & Despres, 2004). In their study, Kajtna, Vuleta, Dolenc, Justin, & Pori (2012) carried out one of the few types of research that addressed fluid intelligence in handball. Their research did not confirm statistically significant differences in fluid intelligence between more and less successful goalkeepers. Badr and Radwan (2010) define sports intelligence as the ability of an individual to use their body intelligently, employing accurate and focused movement of their body in competitive situations. According to Kaur and Sharma (2015), sports intelligence, divided into team and individual sports intelligence, is a dividing line between elite, average and beginner athletes.

Handball is a complex, high-intensity sport, with frequent physical contact between players; physical demands are characterised by intermittent sprinting, different speed levels, high-speed (forward, backward, sideways) running, cutting movements, jumping, landing, turning, and repeated acceleration and deceleration (Bon, Pori, & Šibila, 2015; Wagner, Finkenzeller, Würth, and von Duvillard, 2014).

In the sanple of different team athletes Gorostiaga, Granados, Ibáñez, & Izquierdo (2005) did not detect significant differences in sprint between professional and amateur athletes; differences were significant only in sprinting with a change of direction. The most common activities are fast accelerations (0-3 m) with rapid stops and changes of direction (Povoas et al., 2012) as well as agility (Wagner et al., 2014).

Apart from physical and cognitive factors, researchers are increasingly focusing on personality characteristics of handball players, which also have a significant influence on their success (e.g. Rogulj, Nazor, Srhoj, and Božin (2006). Geukes, Vorberg, and Zwitserlood (2019) showed that high self-esteem and self-focus, particularly in high-stress conditions (presence of an audience, competitive matches etc.), are essential factors for success. In low-stress conditions, however, this feature does not have a significant impact on the success of handball players. Rogulj, Srhoj, Nazor, Srhoj, and Čavala (2005) found differences in basic motor abilities and psychological factors of handball players (especially in terms of playing positions). König-Görögh et al. (2017) found that personality characteristics of handball players differ considerably according to their gender, playing position and age.

The main problem this study explores is the correlation between problem-solving, selected psychological characteristics and individual motor abilities of female national team handball players and the differences between youth and senior female national team handball players.

METHODS

More information is needed on Wartegg test - please, explain why it has been chosen (are the traits defined with the test relevant to team and/or femalesport, etc.), what are its metric characteristics (validity and reliability; however poor they may be) and whether it has been used in other team sports.

Sample

Our sample included 41 female handball players, 24 of which were members of the senior national team, with an average age of 24.79 years (SD = 4.84 years), and 17 girls from the Slovenian youth team, whose average age was 16.35 (SD = 0.70 years). The differences in players' age between groups were statistically significant (t = 8, 42, p (t) = 0.00).

WARTEGG test

The Wartegg test has been used by psychologists to analyse personality from a person's drawing. According to Roivainen (2009), the Wartegg test has eight boxes that contain an unfinished sketch. The subjects should complete the drawings as they wish. After they have finished, they are asked to name the drawings and write down the order in which the drawings were made. The test shows some basic views on personality and was tried out on a sample of athletes in Slovenia in one study (Kajtna, 2016).

The Wartegg test (Kostelić-Martić and Jokić-Begić, 2003) is a projective test in which drawings are supplemented in eight white squares. The test itself has no time limit.

Individual squares or pictures, in the order from the first to the eighth, represent the following areas (Kostelić-Martić and Jokić-Begić, 2003):

Identity - a high score means that an individual has a good understanding of their knowledge, excellent evaluating skills; they know how to insert themselves in the heart of events and stand up for themselves if necessary.

Affectivity - a high score means that the emotions are stable, connected with the situation; there are no frequent excessive or inappropriate emotional reactions that would disrupt performance.

Motivation - an individual with a high score creates clear and high goals that do not go beyond realistic abilities; they have a good insight into themselves and are aware that progress comes through perseverance and effort.

Tackling the tension - for a person with a high score, a situation in which increased tension occurs (for example, competition, demanding training, testing) poses a challenge and is well-suited to them.

Problem-solving - a high score means functional problem solving; in a new situation, such an individual reviews the characteristics of the situation and quickly and effectively finds a suitable solution.

Combining emotional and rational aspects of the situation - in situations where it is necessary to reconcile the logical and emotional aspects, the individual with a high score can correctly identify what is more important at a given moment.

Sensitivity to detail - a high score means that an individual is well aware of details; they detect them quickly and use them well in solving the task.

Social relations - a high score means that an individual gets along with others; they rarely get into conflicts because they can adequately resolve possible disagreements.

Literature shows a metastudy of reliability, which was 0,79 on the average of 12 samples and of internal consistency 0,74, which was calculated on the basis of results of three studies (Soilevuo Grønnerød & Grønnerød, 2011).

RUNS TEST

The Runs test is intended for measuring fluid intelligence (Pogačnik, 2006), i.e. testing of the general neurophysiological capacity of the central nervous system for information processing. It is non-verbal and culture-free. In discussed study, the 10-minute format, version A, TN-10-A was used. It consists of runs, of 30 individual tasks that heighten in complexity and increase in difficulty. In each task, there are 14 signs on the left side, and 5 suggested answers on the right. The task of the participant is to circle the one which continues the sequence correctly. The number of correct results is evaluated. The test has satisfactory measurement characteristics and is thus appropriate for application on the selected sample. Pogačnik (1995) determines a high correlation of this test with other tests for the assessment of intelligence.

MOTOR TESTING

The players also performed a series of tests for speed measurement. To assess the speed of movement 5-, 10- and 20-meter sprints with a standing start (S5 S10 S20) and the same test with a flying start (F5, F10, F20) were used. As a measurement of sprinting endurance, an 8 x 40m polygon was set up with a change of direction. The sprinters had a 20-second pause between each repetition. The time of each repetition was measured, and as the final result, all repetitions were summed up, and average result was used. For a better understanding and more accurate matching, two jumps that measure the explosiveness and elasticity of the leg muscles: the squat jump (SJ) and the countermovement jump (CMJ) were used. In the CMJ, the movement begins downward (the eccentric phase), followed by the concentric phase (phase of the discharge) (Pereira et al., 2019).

TEST SJ and CMJ

For the SJ, athletes were required to remain in a static position with a 90° knee flexion angle for 2s before jumping, without any preparatory movement. During the CMJ, athletes were instructed to execute a downward movement to a self-selected height followed by a full extension. The SJ and CMJ were executed with the hands on the hips. All jumps were performed on a contact mat (Smart Jump; Fusion Sport, Coopers Plains, Brisbane, Australia), which allows the calculation of the jump height based on the flight time (from take-off to landing). A total of five valid attempts (i.e. executed with a proper jump technique) were allowed for each jump, interspersed by 15s intervals, and the highest jumps (SJ and CMJ) were used for further analysis. The intraclass coefficient of correlation (ICC) values were ≥ 0.96 for the SJ and CMJ in both groups of players.

PROTOCOL

The testing took place during the training camp for the national teams in May 2016. The measurement was done in small groups in order to provide a clear explanation of the test procedure, if necessary. The participants were informed that they could refuse participation and withdraw from the study at any time, for any reason, and their consent was obtained.

Data were analysed using the IBM SPSS Statistics statistical program (Version 20; IBM, Armonk, NY, USA), graphs and tables were made with Microsoft Office Excel (version 2013; Microsoft, Redmond, WA, USA). Variability among groups was analysed using t-test and analysis of vari-

ance. Correlations were analysed with Pearson's correlation coefficient. The distribution of the data was normal, skewness and kurtosis parameters were all within the range of normal distribution, and Kolmogorov-Smirnov tests were .16 or more in significance. Statistical significance was used at the .05 level. The participants provided informed consent for participation in the study.

RESULTS

The significant correlations between the Wartegg dimensions and fluid intelligence were find (Table 1). The results, on other hand, did not present statistically significant differences in fluid intelligence and aspects of functioning measured in the Wartegg test, between senior and youth players.

Table 1. Correlations between functioning and fluid intelligence in the whole sample of elite handball players, Pearsons' coefficient of correlation

	SENSIBILITY	CORRECT	MISTAKES	SCORE
Number of correct answers	- 0.32*			
Number of mistakes		- 0.45**		
Total score		0.87**	- 0.57**	
Fluid intelligence	- 0.35*	0.97**	- 0.53**	0.87**

Legend. ** - a two-directional correlation is characteristic at the level of 0.01; * - a two-directional correlation is characteristic at the level of 0.05

As shown in Table 1, sensitivity and fluid intelligence are negatively linked. Handball players who achieved better results in fluid intelligence showed lower sensitivity in the Wartegg test.

In addition, the youth and senior player results in the selected motor tests were compared (Table 2).

Table 2. Comparison of the senior and youth results in the selected motor tests

	seniors		Youth		*t*	*p(t)*
	M	*SD*	*M*	*SD*		
S5	1.15	0.07	1.18	0.06	- 1.07	0.30
S10	1.95	0.11	2.00	0.10	- 1.11	0.28
S20	3.33	0.16	3.42	0.17	- 1.20	0.24
F5	0.71	0.03	0.73	0.04	- 1.15	0.26
F10	1.38	0.06	1.42	0.08	- 1.30	0.21
F20	2.68	0.12	2.77	0.18	- 1.24	0.23
8x40	71.72	1.93	75.08	4.54	- 1.99	0.06
SJ	28.37	4.23	25.47	3.66	1.71	0.10
CMJ	31.47	4.20	26.86	3.20	2.95	0.01

Statistics show that senior and youth players significantly differed only in one motor skill – CMJ, with seniors achieving significantly better results. Other motor criteria, 5- 10- and 20-meter

sprints with a standing and flying start, did not differ significantly between senior and youth players.

Further it has been looked for differences between motor tests and psychological aspects and found no statistically significant correlations. The decision to look at these correlations separately in senior and youth players was chosen.

Table 3. Correlation between the psychological and motor aspects of functioning in senior players shown by Pearsons' coefficient of correlation

	Sum	SJ
Identity	- 0.77	0.79*

Legend. ** - a two-directional correlation is characteristic at the level of 0.01; * - a two-directional correlation is characteristic at the level of 0.05

Table 3 shows a correlation between identity and SJ - senior identity and SJ are statistically significantly correlated (0.79) (Table 3)

Table 4. Correlation between psychological and motoric aspects of the activity in youth players, represented by Pearsons' coefficient of correlation

	S5	S10	CMJ
Identity			- 0.61*
Rational -emotional integrity	0.56*	0.55*	- 0.58*

Legend. ** – a two-directional correlation is characteristic at the level of 0.01; * – a two-directional correlation is characteristic at the level of 0.05

Table 4 shows two aspects of the psychological activity of youth players, which are significantly correlated to some motor characteristics. Identity is significantly negatively correlated to the CMJ (0.61) - the youth players that have a lower score in identity jumped higher. Furthermore, rational-emotional integration is also negatively related to CMJ. The youth players who achieved lower values on this psychological criterion achieved better results in the jump. Conversely, a higher score in rational-emotional integration means lower results in short sprint (S5).

DISCUSSION

The sample of youth and senior handball players did not exhibit statistically significant properties of correlation between problem-solving and the selected motor tests (speed, explosive power). The exception is the CMJ test, where senior players achieved significantly better results. It seems that, the speed of female handball players is independent of their ability to cope with new problems, assess the circumstances and find suitable solutions. The reason might be related to the nature of the motor tests. These are specific tests, in which the participants did not have the opportunity, nor the need, to assess the circumstances and find new solutions. The property of problem-solving cannot be expressed in the framework of motor speed tests, and this also reflects in the absence of correlation between these variables. Furthermore, decision for research focus was oriented on the link between psychological properties and movement speed only, and although the selected motor tests somehow a priori suggested no correlations would have been established,

out study try to confirm this remark. Our study also confirm the statement, that maybe it would have been better to use certain agility, accuracy, and/or Beep tests.

The psychological properties of the study were measured using the Wartegg and Runs test. It was assumed that there was no statistically significant correlation between the selected psychological characteristics and the movement speed of handball players. The correlation was analysed on the whole sample, and on the two sub-samples (senior and youth players) separately. Most of the psychological properties in the sample are not significantly related to the movement speed. For some properties, however, a statistically significant link has been confirmed; senior players, in particular, exhibited positive correlation between identity on Wartegg test and SJ test. Senior players who reached higher identity values, as well as senior players who can evaluate and trust in their capabilities, jumped higher in the SJ test. The parallel with these results can be found in the research of the differences between professional and recreational athletes - professional athletes are more likely to be extroverted and emotionally stable, more sociable, energetic and confident (Allen et al., 2013).

A negative correlation between identity and CMJ test is particularly impressive. Youth players who achieved a higher score in identity had lower CMJ and SJ results. These results are not in line with the results of the senior players, where the SJ result is positively related and statistically significant to the results in identity. It is also not following the past research that supports a definite link between trusting yourself and the height of the jump, as confirmed in the case of senior players.

Several factors can be responsible for such contradictory results. First of all, the projective nature of the Wartegg test and its metric characteristics was taken into account. According to the Soilevuo Grønnerød and Grønnerød meta-analyses (2012), the validity and reliability of the Wartegg test cannot be confirmed (Kajtna, 2016). A correlation between psychological characteristics and motor skills was checked on small sub-samples (but including the whole national team selection), 24 senior and 17 youth players. Given the fact that these are national team players, selected by national team coaches, a larger sample is almost impossible to obtain.

Personality traits can be used to predict short term results, but are mainly used to evaluate long term efficiency in sport (Allen et al., 2013). In our case, these are the short-term results of participants, which could be more influenced by factors other than personality traits, such as feelings, circumstances, motivation for cooperation. The short-term nature of the measurements could have influenced the strength of the correlation.

Furthermore, three important correlations between motor abilities and psychological properties were confirmed by the rational-emotional integration of the psychological variable. This includes the ability to combine the emotional and rational aspects of the situation. Individuals with highly expressed rational-emotional integration know when to reconcile emotional and logical aspects, to adequately recognise what is most important at a given moment (Kostelić-Martić & Jokić-Begić, 2003). Therefore, players can make rational decision when needed, and rely less upon the emotions in such situations. Conversely, they can integrate emotions into life when and as much as needed. The described property is significantly positively related to the 5- and 10-meter sprints. Individuals who achieved a higher result in rational-emotional integration had a comparatively worse result in sprints. The correlations between rational-emotional integration and CMJ is similar; the correlation is significant and has a negative statistical correlation. The more the rational-emotional integration is expressed, the lower the result in the CMJ. Rational-

emotional integration in youth players is therefore associated with worse results in some matches and worse CMJ performance. Such results are again not in line with expectations since the rational-emotional integration characteristic of the description is very similar to emotional stability, which in the research of athletes consistently positively and significantly relates to achieving good sports results (Allen et al., 2013).

The same applies to emotional intelligence, which covers concepts similar to rational-emotional integration, and is consistent with success in sport (Laborde, Dosseville, & Allen, 2015). Fluid intelligence, measured by the Runs test, was significantly positively related to sensitivity to attention both throughout the whole sample as well as in senior players. Participants who pay more attention to detail and detect them faster therefore achieved a higher score in the test and demonstrated higher fluid intelligence. Kajtna (2016) reported the exact reverse link in his study, where fluid intelligence and sensitivity to detail, based on its pattern, were significantly interconnected. This result was based on the explanation that the distracted participants may get lost in detail and consequently achieve worse results in the test of fluid intelligence.

In youth players, there was a slightly different correlation between the Wartegg test and fluid intelligence than in senior players. The number of correct answers in the Runs test is significantly negatively correlated to the motivation in the Wartegg test. More motivated youth players thus achieved a lower number of correct answers. A negative link can be explained by the fact that fluid intelligence is independent of experience, learning and cultural environment (Musek, 2010). Meanwhile, motivation defines individuals who are willing to learn and invest their energy into the task. This provides no insight into how well they perform in a test where abilities are measured independently form previous experience. Intelligence does not allow such rapid acquisition of knowledge and needs motivation for further learning and gaining experience. This would also explain the negative link between motivation and fluid intelligence.

Based on the results, the conclusion was taken, that among the senior and youth players in discussed sample, there are no significant differences in problem-solving, psychological characteristics and speed. However, previous research yielded somewhat different findings. König-Görögh et al. (2017) found that younger handball players i.e. under 15 years old, are significantly more extroverted, palatable, open and also significantly less emotionally stable. However, it cannot conclude for sure that that this comparison is good for this sample, as there were both male and female handball players, while only female players were included in discussed sample.

CONCLUSIONS

In elite female handball, personality represents a relatively consistent and unique sum of psychological, cognitive and physical characteristics of an athlete, and is correlated with other personal capacities, which can influence sports success. The results of discussed study have not shown statistically significant differences between youth and senior players. In conclusion, it can be said that the test results are a significant contribution to a better understanding of the correlation between certain psychological characteristics, problem-solving, movement speed and explosive leg power of youth and senior female elite handball players, although the correlations were not statistically significant and metric characteristics of the Wartegg test were not defined. It is necessary to underline that the Wartegg test has not yet proven to be a reliable and valid way to measure personality traits, and further studies are needed in this field. It can also be assumed

that personality traits are most likely to have a significant impact on long-term sports results and less on short-term results. However, this was the first use of the Wartegg test in female handball. It needs to be highlighted that the sample in this study, from the methodological point of view, can be described as small, but on the other hand it included all national team players in youth and senior categories in Slovenia. Lastly, the motor tests used in this study were simple (cyclic activities). Further studies should therefore include more sophisticated and elaborate tests, which will even more precisely reflect the poly-structured nature of handball, and will be able to expand knowledge on psychological characteristics and fluid intelligence in elite female handball.

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