

# PSYCHOLOGICAL CHARACTERISTICS OF SLOVENE HANDBALL GOALKEEPERS

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## Abstract:

Handball is a fast, dynamic sport and the role of the goalkeeper is especially exposed. However, little attention is paid in science to the development of the goalkeeper. This research is focused on the psychological characteristics of handball goalkeepers, specifically with regard to aggression, anxiety, reaction times, fluid intelligence and concentration. More and less successful goalkeepers were compared in these characteristics. Forty-six participants were included – 23 of them were more successful and 23 less successful, according to an expert evaluation. The more successful goalkeepers were also significantly older. The data was collected in 2010 and 2011. The instruments used were Buss-Durkee *Aggression Questionnaire*, Spielberger's *Anxiety Inventory* (STAIX – 1 and 2), the *Test of Series* for measuring fluid intelligence, the *Test of Attention* for measuring concentration, and the *CRD Series* for measuring reaction times. One-way analysis of variance (ANOVA) was used to compare both groups. Several significant differences between both groups were found – the less successful goalkeepers had a faster simple reaction time and made fewer mistakes when reacting to simple stimuli. They were also quicker in response times to simple visual orientation stimuli and seemed to lose less time when reacting to different stimuli. It thus seems that neither reaction times, fluid intelligence nor concentration, anxiety or aggression has influence on the quality of handball goalkeepers. The obtained result is easily explained with the age of the participants since the investigated abilities gradually decrease over time.

**Key words:** team handball, goalkeepers, aggression, anxiety, reaction times, fluid intelligence, attention

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## Introduction

Literature shows sparse information on what makes a good handball player from a psychological perspective (Rogulj, Nazor, Srhoj, & Božin, 2006). Different positions of players have been investigated also in basketball (Erčulj, Blas, Čoh, & Bračić, 2009). The current research focuses on the psychological characteristics which are presupposed to be important in the tasks the handball goalkeepers have to perform during a game. As regards their physical fitness, in literature some findings can be found, although few and often contradicting – it was found that handball goalkeepers are slower runners than other handball players (Sporiš, Vuleta, Vuleta Jr., & Milanović, 2010), whereas Chaouachi, Brughelli, Levin, Boudhina, Cronin and Chamari (2009) found no differences in the same trait. Some research was focused on the morphological traits and found goalkeepers to be taller, heavier and to have longer limbs (Srhoj, Marinović, & Rogulj, 2002; Šentija, Matković, Vuleta, Tomljanović, & Džaja, 1997; Gorostiaga, Granados, Ibanez, &

Izquierdo, 2005; Hasan, Rahaman, Cable, & Reilly, 2007; Massuça & Fragoso 2011). Some studies found goalkeepers to have a higher percentage of body fat (Srhoj, et al., 2002; Sporiš, et al., 2010; Šibila & Pori, 2009).

Fluid intelligence (as part of the g-factor) has a positive influence on perceptual abilities and the coordination of movement (Brochard, Dufour, & Despres, 2004; Hughes & Franz, 2007). Higher fluid intelligence is manifested in shorter complex reaction times in both children and adults (Carmeli, Bar-Yossef, Ariav, Levy, & Liebermann, 2008; Choudhury & Kathleen, 1999; Sonke, Van Boxtel, Geert, Griesel, & Poortinga, 2008), and it can also help control aggression (Richetin & Richardson, 2008). Fluid intelligence has never been researched in handball players, but it has frequently been a part of research in musicians, where it was shown that high-level classical musicians have high fluid intelligence (Jakobson, Lewicky, Kilgour, & Stoesz, 2008). It has been shown that information processing and thinking about a game can influence

the learning process (Marques Pereira, Ribeiro Mesquita, & Braga Graça, 2010). As it has been already demonstrated that fluid intelligence is important in processing information, it is supposed to be important to team sport performance as well since athletes in team sports need to process large amounts of information.

Anxiety can have a high impact on performance in sport – low levels of anxiety enable athletes to stay positive, calm and relaxed, and also enable the use of other psychological skills, for example, imagery, positive thinking, good focus, etc. (Dale, 2000; Hardy, Jones, & Gould, 1996; Sosa & Oliver, 2011). Higher levels of anxiety and neuroticism affect selective reaction times and visual orientation tasks performance in a way to prolong them (Bunce, Handley, & Gaines, 2008; Stelton & Ferraro, 2008; Rivilla, Lorenzo, Ferro, & Sampetro, 2011). Several studies show a lower level of anxiety (both state and trait) with experienced and/or successful athletes or have in those who learned to recognize their anxiety as helpful rather than disturbing (Mellalieu, Neil, & Hanton, 2006; Rokka, Mavridis, Bebetos, & Mavridis, 2009; Spieler, Czech, Barry Joyner, Munkasy, Gentner, & Long, 2007).

Top-level athletes demonstrate a high level of psychoticism, which basically shows higher levels of aggression (Eysenck, 1981). It can be reflected in faster simple reaction times, but also in a lower precision in response (Vigil-Colet & Codorniu-Raga, 2004). Research from different sports shows that more experienced athletes are more aggressive (Bebetos, Christoforidis, & Mantis, 2008; Christoforidis, Kalivas, Matsouka, Bebetos, & Kambas, 2010; Konstantoulas, Bebetos, & Michailideu, 2006) and the same was found for handball players (Christoforidis, et al., 2010). In research on aggression, however, we should pay attention to different kinds of aggression and should always differentiate between the positive, instrumental, and the reactive, destructive, forms of aggression (Tušak & Tušak, 2003).

Perceptive abilities are important in team sports (Zwierko, 2007). Better and more experienced athletes are better in predicting the opponents' reactions. They anticipate better than non-athletes or less experienced athletes (Cañal-Bruland & Schmidt, 2009; Roca, Ford, McRobert, & Mark Williams, 2011); have shorter selective reaction times (Mori, Ohtani, & Imanaka, 2002; Venter & Ferreira, 2004; Zwierko, 2007; Zwierko, Osinski,

Lubinski, Czepita, & Florkiewicz; 2010) and shorter simple reaction times (Zwierko, et al., 2010). Similarly, visual attention and concentration are extremely important in top-level sport since they enable the development of specific visual search strategies necessary for each sport and for better prediction and anticipation (Morgan & Patterson, 2009). In many areas of life – professional, scientific and athletic alike, people who were very skilled scored better in attention tests than those who were beginners, which means that attention can be well trained (Allen, McGeorge, Pearson, & Milne, 2004; Green & Bavelier, 2003).

Psychological traits of male handball keepers have so far never been specifically investigated. Therefore, the purpose of this research is to estimate those traits in a group of successful handball goalkeepers in comparison with their less successful colleagues.

## Methods

### Participants

Forty-six Slovene handball goalkeepers participated in the research. They were divided into groups of successful, better, and less successful goalkeepers according to the expert estimation of their quality. The groups were equal in size, both comprising 23 goalkeepers who all play in the first Slovene handball league. An informed consent from each participant was obtained.

The average age of the entire sample was 23.13 years (SD=4.37). However, the group of better goalkeepers was older and more experienced, as can be seen from Table 1.

### Instruments

*Test of Series* (*Test nizov*, TN-10-A – Pogačnik, 1983) was used for measuring fluid intelligence. It consists of 30 series of tasks with progression in difficulty. The participant is given a task to select one out of five suggested characters to continue the series of characters correctly. The time for the test accomplishment is ten minutes, meaning that mental speed affects the scores.

Attention was measured using the *Attention Test* (*Test pozornosti*, TP – Đurić, Bele-Potočnik, & Hruševar-Bobek, 1985). It measures the participants' ability to select, visually follow and detect the appropriate answer among a number of distrac-

Table 1. Comparison of age and career duration of successful and less successful goalkeepers

	Successful goalkeepers		Less successful goalkeepers		F	sig (F)
	M	SD	M	SD		
Age	24.30	4.55	21.96	4.25	3.27	.08
Career duration	14.57	4.28	10.96	4.42	7.91	.01

ting elements. It consists of forty rows of symbols, and in each row the participant must count the number of predetermined symbols. The time of test accomplishment is limited to five minutes.

**The Aggression Questionnaire** (Buss & Durkee, 1961) measures physical, verbal, indirect aggression, irritability, negativity, suspicion, hostility and the presence of feelings of guilt. The Slovene version of the questionnaire was used (Tušak, 1992).

**The State-Trait Anxiety Inventory (STAI-X-1 and STAI-X-2)** (Spielberger, Gorsuch, Lushene, Vagg, & Jacobson, 1983) questionnaires were used to measure the state and trait anxiety, respectively. The first one measures the amount of anxiety experienced in a stressful situation (i.e. at a competition) and the second the predisposition of a person to react with increased stress. The Slovene version of the questionnaire was used (Tušak & Tušak, 2003).

Reaction times were measured using the **Complex Reactionmeter Drenovac (CRD)** (Drenovac, 1994). Simple reaction time is the time between the appearance of the light signal and the participant's pressing the switch. Complex reaction time is the time between the appearance of a combination of light signals and the coordinated response of the participant's hands and feet. We also measured the simple visual orientation or simple selective response (the participant should find, following the instructions, the correct light amongst many possibilities) and complex visual orientation reaction times (two correct lights should be found following the given instructions).

## Procedure

The measurements were conducted in small groups for the tests of fluid intelligence, aggression,

anxiety and concentration. The measurement of reaction times was conducted individually. All the measurements were conducted in laboratories at the Faculty of Sport in Ljubljana in 2010. The quality (successful – less successful) of handball goalkeepers was estimated on the basis of an expert opinion. The experts evaluating the quality of the goalkeepers were three professors of handball with the Faculty of Sport, University of Ljubljana. They evaluated the quality of the goalkeepers on the basis of the statistical data kept by the Slovene Handball Federation and according their knowledge about the players. Namely, all three experts are actively involved in sport as coaches. The agreement between them was reached via discussion. Data was analysed using analysis of variance (ANOVA), calculated by the PASW statistical programme.

## Results

Some differences between more and less successful handball goalkeepers in their psychological traits were obtained. The shaded variables (Table 2) differ on the level of statistical significance of  $p < .05$ . The differences occurred in the area of reaction times and all were in favour of the less successful goalkeepers. When they made a mistake, they thought about it longer, which indicates they were aware that something was not quite right. They lost less time in deciding upon the correct answer in simple selective tasks and lost less time in complex tasks that required visual orientation.

They seemed to respond better in the mentioned tests of reaction.

A more intelligible presentation of comparison results can be found in Figure 1.

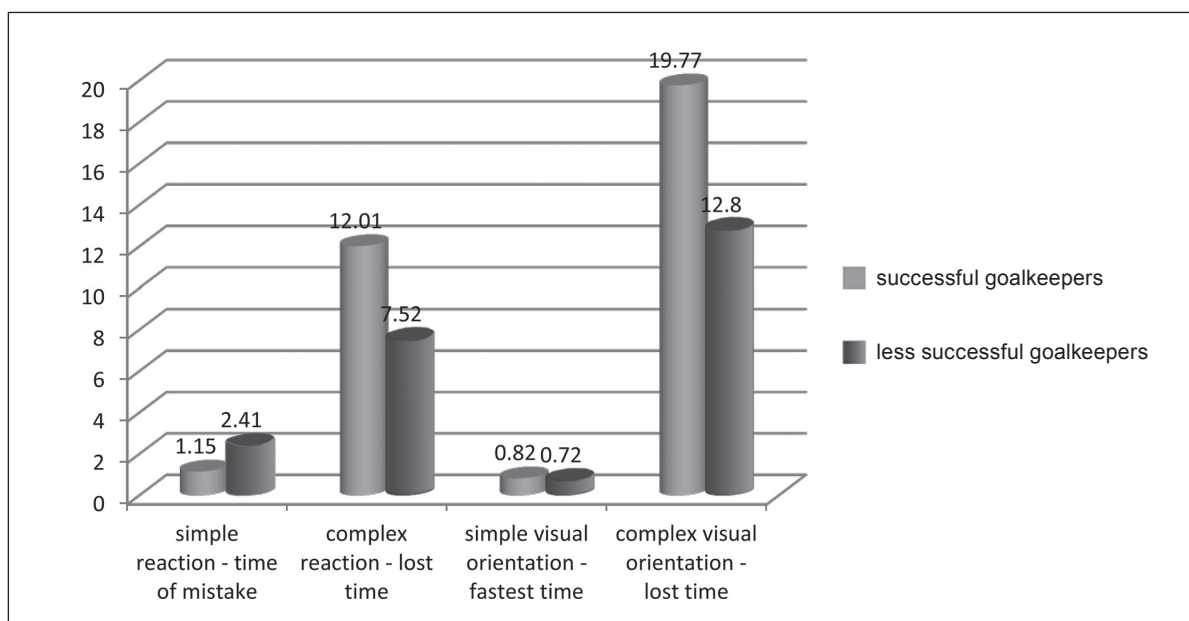


Figure 1. A graphical comparison of differences between successful and less successful goalkeepers.

Table 2. Comparison of psychological traits of successful and less successful goalkeepers

		<i>Successful goalkeepers</i>		<i>Less successful goalkeepers</i>		<i>F</i>	<i>sig (F)</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
<b>Aggression</b>	Physical aggression	3.57	1.85	4.00	2.26	.51	.48
	Indirect aggression	4.26	1.81	4.48	2.48	.11	.74
	Irritability	4.35	2.39	4.65	2.39	.19	.67
	Verbal aggression	7.09	1.50	6.43	1.97	1.59	.21
	Negativity	2.26	1.18	2.22	1.09	.02	.90
	Hostility	2.30	1.33	2.09	1.50	.27	.61
	Suspicion	3.52	1.88	3.39	1.95	.05	.82
	Guilt	5.17	1.77	5.00	1.68	.12	.73
	Trait anxiety	33.57	5.07	34.43	6.47	.26	.61
	State anxiety	35.61	6.54	35.61	7.10	.00	1.00
	Attention – correct answers	25.35	7.64	23.96	7.93	.37	.55
	Attention – mistakes	5.17	6.67	3.96	5.10	.48	.49
	Fluid intelligence – correct answers	21.83	3.60	22.52	3.37	.46	.50
	Fluid intelligence – mistakes	4.78	3.09	5.48	3.00	.60	.44
<b>Reaction times</b>	Simple reaction – total time	8.42	2.63	9.05	2.09	.79	.38
	Simple reaction – mistakes	1.00	1.38	0.86	0.89	.15	.70
	Simple reaction – time of mistake	1.15	1.21	2.41	2.43	4.89	.03
	Complex reaction – total time	29.89	5.40	27.94	7.19	1.08	.30
	Complex reaction – mistakes	10.71	4.31	9.95	9.58	.11	.74
	Complex reaction – lost time	12.01	7.78	7.52	7.28	4.08	.05
	Simple visual orientation – total time	41.79	7.70	40.68	7.38	.25	.62
	Simple visual orientation – fastest time	.82	.23	.72	.10	3.75	.06
	Simple visual orientation – mistakes	1.87	1.69	1.96	1.36	.04	.85
	Complex visual orientation – total time	67.04	10.97	66.70	7.94	.01	.90
	Complex visual orientation – mistakes	5.40	7.35	5.48	5.19	.00	.97
	Complex visual orientation – lost time	19.77	13.91	12.80	11.68	3.39	.07

## Discussion and conclusions

Less successful goalkeepers were faster in synchronizing arm and leg movement, that is, they spent their time more economically. This could probably be explained with the individual characteristics of the investigated athletes (for example, health status, body temperature, age, myelination of neurons, alertness, etc.), which can affect the speed of response of an athlete (Jeromen, Barić, & Kajtna, 2010). Less successful athletes were significantly younger than their more successful (better) colleagues. Numerous studies have shown that younger participants have faster simple reaction times (Salthouse, 2000), as well as faster complex reaction times (Horn & Masunaga, 2006). The

other possible explanation for the obtained results would be that the better, but also older players with longer careers, have probably sustained more injuries to the locomotor system than their younger and less successful colleagues. We could assume therefore that an injured muscle could also affect the functioning of the nervous system and the speed of the neuromuscular reaction, but such an assumption should, be further explored. However, some authors have found that health status and the myelination of neurons can affect the speed of response (Jeromen, et al., 2010).

Also, we can suppose that the better goalkeepers were less motivated for the measurements and thus scored lower than their less successful colleagues.

Younger and less successful goalkeepers, on the other hand, might try to prove themselves more in the social, handball in particular, environment. They, therefore, fulfilled eagerly the tasks which simulated the game conditions, that is, responded to appearing visual stimuli. Motivation, agility and attention increase the speed of reaction (Jeromen, et al., 2010) and preparatory attention plays an important role since it increases the level of activation and enables a faster response (Korošec, 2002). Better goalkeepers, here older and more experienced subjects, are supposed to be more experienced in handball tactics. Tactical knowledge and experience have a great influence on performance, equally to response times (Lipkova, Štulrajter, Norovskyjev, & Miklanek, 1997). In the case presented here it seems that, perhaps, the specific knowledge and tactical experience outweighed the reaction times, since not only were the groups equal, but even the less successful goalkeepers scored better.

Both groups were equally efficient in the selection tasks and distraction avoidance tasks, which they faced in the test of attention. A similar finding was reported by Memmert, Simons and Grimme (2009).

No differences were found also in the tests of anxiety, aggression and fluid intelligence.

It is very interesting that no differences were found in the area of aggression since use of positive aggression has often been found to be significant for good performance in athletes (Bebetsos, et al., 2008). Aggression in sport is often a force which helps athletes achieve their goals and in high confrontation sports, such as handball (Pori & Šibila, 2006), control of aggression is an imperative. Poor control of aggression can lead to injuries and to the exclusion of players. It is in the interest of both players and coaches to help athletes control their aggression. By using Buss and Durkee's (1961) categories of aggression, the following types can be manifested by handball players: physical and verbal aggression in direct contact with the opponent, hostility toward the opponent and, indirectly, towards equipment, for instance, throwing the ball harder than needed.

As far as the playing position of the goalkeeper in handball is regarded, the perspective of aggression is somewhat different – a goalkeeper usually has no direct contact with the opponent, so hostility as well as physical and verbal aggression can be rarely manifested. He/she can, however, express indirect aggression and perhaps kick or hit the goal post, but often he or she is unable to do that, since he/she need to keep his/her focus on the game. Also, goalkeepers spend more time in a game physically less active than their team-mates in the field, but they are, by all means, deeply involved in what is going on in the field (Šibila, Bon, & Pori, 2006). Thus the build-up of energy also appears in goalkeepers, but since

they are unable to express it in motion or release it with words, the tension and the aggressive drive need to be released in other ways. What remains of the types of aggression are suspicion and guilt. And it is exactly those two types of aggression that are most destructive for personality development (Ule, 2000). Goalkeepers thus take on a great amount of guilt not just because it is ultimately their “defence wall” which collapses when the ball passes into their goal, but also because they have much time to build up aggression. Unfortunately, assuming guilt is the only means through which goalkeepers can release aggression. However, all goalkeepers are in the position of taking on responsibility, not just the better ones. Therefore, no differences were found between the two groups of our subjects. Of course, to further verify this claim, we should test other handball players on different playing positions and compare them to the goalkeepers. Also, the goalkeepers' results should be compared to the results of the general population.

A similar claim could be made for anxiety – it is also frequently seen as a build-up of unreleased energy (Tušak, Misja, & Vičič, 2003). Due to the fact that handball goalkeepers on all levels of involvement have more spare time during a match and training sessions and are physically less active than their team-mates, no differences were understandably found in this field as well. This carries an important implication for coaches – they need to help their goalkeepers get more involved in a game and keep them active. Coaches need to ensure practice which will focus exactly on goalkeepers' needs and they need to help them focus throughout the entire game – goalkeepers often focus well when the opposing team is on attack, but are far less focused when their own team is on attack and the game is “away” from their own goal (Pori & Šibila, 2006).

Perhaps one of the reasons for few identified differences is the sample characteristics. Despite the fact that the sample was fairly large with respect to the entire population of Slovene handball goalkeepers, the very best ones were not available for testing since they were playing abroad. That means that the goalkeepers participating in this research were not really that different in quality, which, of course, would explain the lack of differences. The expert evaluation of handball keepers' quality must be questioned as well – the assessment was predominantly subjective due to the lack of useful statistical data on which to base the division into better, successful or less successful goalkeepers. Due to these characteristics of our sample, we believe that the results obtained cannot be generalized. The hypothesis of the paper that better goalkeepers should be those who are faster, whose response times are shorter, who score better on attention, problem solving and so on, was not

confirmed. These are some issues that future research in the field should address – results also from the best goalkeepers should be obtained and some statistical data should be collected to help in dividing the goalkeepers into two quality groups. Also, goalkeepers' scores should be compared with those of other handball players (playing positions). Some attention in handball training should be

directed towards developing specific practice for handball goalkeepers that would enable them to stay focused throughout the game and in which they would be actively involved to overcome a frequently reported finding (Šibila, et al., 2006; Šibila, Vuleta, & Pori, 2004) that goalkeepers are far less active in practice and matches than other team handball players.

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## PSIHOLOŠKE KARAKTERISTIKE SLOVENSКИH RUKOMETNIH VRATARA

Rukomet je brz, dinamičan sport i uloga vratara je osobito istaknuta, ali se vrlo malo pozornosti poklanja njihovom razvoju. Autori su se odlučili usmjeriti svoje istraživanje na psihološke karakteristike rukometnih vratara, posebno na agresivnost, anksioznost, vrijeme reakcije, fluidnu inteligenciju i koncentraciju. Usporedili smo uspješne i manje uspješne vratare u navedenim karakteristikama. U istraživanje je bilo uključeno 46 ispitanika koji su, prema ekspertnoj procjeni, podijeljeni u 23 uspješnija (kvalitetnija) i 23 manje uspješna vratara. Uspješniji vratari bili su značajno stariji od svojih manje uspješnih kolega. Podaci su prikupljeni tijekom 2010. i 2011. godine. Korišteni su Buss-Durkeeov upitnik agresivnosti, Spielbergerov upitnik anksioznosti (STAIX – 1 i 2), test nizova (serija) za mjerenje fluidne inteligencije, test pažnje za mjerenje koncentracije te CRD test nizova za mjerenje vremena reakcije.

Za uspoređivanje grupa korištena je jednosmjerna univarijatna analiza varijance (ANOVA). Utvrđene su značajne razlike između grupa: manje uspješni vratari su postigli kraće vrijeme jednostavne reakcije i činili su manje pogrešaka reagirajući na jednostavne podražaje. Bili su također brži u reakcijama na jednostavan podražaj vizualne orijentacije, a čini se da su također gubili manje vremena u reagiranju na različite podražaje. Stoga se čini kako ni vremena reakcije, ni fluidna inteligencija pa ni koncentracija, anksioznost ni agresija ne utječu na kvalitetu rukometnih vratara. Dobiveni rezultati se jednostavno mogu objasniti razlikama u dobi ispitanika budući da navedene sposobnosti postupno opadaju tijekom vremena.

**Ključne riječi:** rukomet, vratari, agresija, anksioznost, vrijeme reakcije, fluidna inteligencija, pažnja