Psychometric properties of a Serbian version of the State-Trait Anxiety Inventory X-2

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Abstract

Given that anxiety is a significant individual disposition that affects sports performance, this study aimed to verify the latent variables obtained by the State – Trait Anxiety Inventory X-2, and to compare the obtained factor solutions with the proposed model of latent variables. The second aim refers to the presentation of the results of the questionnaire State - Trait Anxiety Inventory X-2 answered by Serbian male and female handball players. The research was conducted on a sample of 170 respondents, 99 male and 71 female handball players, aged 14 to 39 years (average age = 21.9) with an average handball playing career of 9.39 years. Towards the end of 2019, the respondents filled in the above-mentioned questionnaire used to assess anxiety as a personality trait. Exploratory factor analysis with certain modifications of the algorithm was applied to determine accurately latent space. The overall analysis was performed using the R statistical package. Four factors were selected based on the conducted factor analysis of the latent space of the questionnaire. Ten, five, three and two items are projected on the first, second, third and fo-urth factor respectively. Since internal reliability of the fourth factor was 0.394 it was excluded from further consideration and interpretation. The achieved scores on four separate factors show that Serbian male and female handball players achieve average results on the first (Presence of Trait anxiety) and the third factor (Absence of proactivity), while they achieve scores above the average on the second factor (Positive affect). In order to examine the sex differences between the examined variables, a one-way analysis of variance was performed. The findings show that there is no statistically significant difference on all three factors between the scores achieved by male and female handball players. A statistically significant difference between handball players of different competitive ranks appeared only on the Positive affect factor between the top athletes and the athletes in the second league (p = .04).

Keywords anxiety • handball players • STAI questionnaire • gender differences.

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Introduction

Modern sport has raised the bar of physical achievement and top athletes differ minimally in motor and morphological characteristics. When athletes are equal in all physical dispositions, individual psychological dispositions decide the winner. The psychology of sport has aimed at identifying the individual dispositions of top athletes that affect sports performance and results for the last thirty years (Lavallee et al., 2004). One of the most frequently examined dispositions is emotional regulation, which proved to be important for achieving top results in sport (Lava-

llee et al., 2004). More specifically, research has largely focused on understanding how athletes' levels of anxiety affect their results (Woodman & Hardy, 2003). Anxiety is an unpleasant emotion accompanied by a vague experience of insecurity, uneasiness and fear without a real stimulus, as well as a high degree of activation of the autonomic nervous system (Petrović & Trbojević, 2020). Martens et al. (1990) assume that anxiety is not a one-dimensional construct, but a multidimensional one, and that anxiety consists of cognitive and somatic anxiety. Cognitive anxiety refers to the assessment of the situation and oneself, primarily to the negative interpretation of the situation and one's own abilities in certain situations. It is characterized by a high degree of concern about performance and results. Somatic anxiety refers to physical symptoms of uneasiness, bodily reaction such as heart palpitations, loss of breath, shortness of breath, sweating, blurred vision, etc. (Petrović & Trbojević, 2020). The complexity of anxiety is also reflected in its duration - it can be momentary (State anxiety) or a personality trait (Trait anxiety) (Spielberger, Gorsuch, & Lushene, 1970). State anxiety refers to a temporary emotional state characterized by subjective feelings of tension that can be of varying intensity. Trait anxiety refers to a relatively consistent tendency to respond to stress with anxiety and a tendency to perceive environmental situations as threatening (Behzadi, Hamzei, Nori, & Salehian, 2011). Trait anxiety can therefore have a far longer and stronger negative impact on the athlete's results, as it has been confirmed with the research in sports psychology (e.g., Rice et al., 2019; Patsiaouras, Papanikolaou, Haritonidis, Nikolaidis, & Keramidas, 2008; Wilson, Wood, & Vine, 2009). Anxiety rates in the general population are between 10 and 12 percent (Somers et al., 2006), while the incidence rate in athletes is estimated to be about 8% (Schaal et al., 2011). Gender differences in the degree of anxiety between male and female athletes were also recorded, in favor of female athletes (Rice et al., 2019), as well as differences in the degree of anxiety in relation to the rank of the competition and the type of sport. Athletes playing in higher-rank competitions, as well as those involved in team sports, experience a lower degree of anxiety (Correia & Rosado, 2019).

Before theoretical advances encouraged the development of new measuring instruments for assessing Trait anxiety, anxiety in sport was often assessed using the Sport Competition Anxiety Test (SCAT; Martens, 1977). SCAT is a one-dimensional questionnaire, meaning that it does not differentiate the above types of anxiety, but primarily assesses somatic anxiety (Smith, Smoll, & Passer, 2002). It has proven to be reliable, but limited in assessing the cognitive aspects of anxiety (Giacobbi & Weinberg, 2000; Johnson, Ekengren, & Andersen, 2005). As a result, a need arose to construct a questionnaire that would assess a particular type of anxiety.

The State-Trait Anxiety Inventory is the most commonly used questionnaire for self-assessment of anxiety throughout research in different countries (Lonner & Ibrahim, 1989), primarily in clinical studies (Keedwell & Snaith, 1996). The questionnaire was developed by Spielberger, Gorsuch, and Lushene (1970) to allow the assessment of two different components of anxiety: current status and personality traits. For this reason, the STAI questionnaire consists of two different scales: one referring to State anxiety (STAI-S), and the other referring to Trait anxiety (STAI-T). Although the STAI questionnaire is widely used, confirmation of its latent structure in athletes is not widely recognized. In fact, most of the research that dealt with the validation of the questionnaire was conducted on a sample of college students and high school students (e.g., Bee Seok et al., 2018). The situation is similar when it comes to the verification of the questionnaire on the Serbian sample, where it was validated in the general and clinical population. Although the STAI is used as a global score of State or Trait anxiety, the authors of the questionnaire eventually noticed certain psychometric limitations of the questionnaire and thus proposed a four-factor solution to the whole questionnaire (both State and Trait forms of questionnaire): presence of Trait anxiety, presence of State anxiety, absence of Trait anxiety and absence of State of anxiety (Spielberger et al., 1980), which some studies have confirmed in their own cultures (Bee Seok et al., 2018).

Although researchers are increasingly investigating the effects of anxiety on athletic outcomes, research is more focused on linking State anxiety to athletic performance, than on athletes' Trait anxiety. The researchers primarily focus on pre-competition anxiety, as opposed to Trait anxiety.

Bearing in mind that anxiety represents a significant individual disposition that affects sports performance, this research aims at checking the latent dimensions obtained by the State - Trait Anxiety Inventory X-2 questionnaire, and comparing the obtained factor solutions with the proposed model of latent dimensions. Another aim is to display the differences in the score values obtained from the

sample of Serbian handball players on the State - Trait Anxiety Inventory X-2 questionnaire.

Method

The sample consisted of 170 handball players i.e., male (N = 99) and female handball players (N = 71), who have been playing handball for an average of 9.39 years; aged 14 to 39 (Mean = 21.9). At the end of 2019, respondents filled out the Trait anxiety STAI questionnaire.

Table 1. Structure of sample of participants

	Male handball players		Female handball players	
	Frequency	Valid Percent	Frequency	Valid Percent
Highest rank	47	47.5	46	64.8
First league	22	37.4	11	15.5
Second league	29	14.1	14	19.7
Total	99	100.0	71	100.0

The State-Trait Anxiety Inventory, form X-2 (Spielberger, Gorsuch & Lushene, 1970) was used to assess Trait anxiety. It consisted of a total of 20 statements (items) with the Likert scale answers as follows: "Not at all" (1), "Somewhat" (2), "Moderately so" (3), to "Very much so "(4). Thirteen statements were anxiety present, while seven were anxiety absent questions. The questionnaire was translated by the author.

Exploratory factor analysis with certain modifications of the algorithm was applied to determine accurately latent space. Firstly, the Spearman rank correlation matrix was calculated because of the ordinal nature of the variables. The mentioned matrix was loaded as the initial one for factor analysis instead of raw data. Then, the main components were calculated and presented, and the number of significant factors was determined on the basis of four criteria: Kaiser-Guttman's, parallel analysis (scree), optimal coordinates and acceleration factor. The obtained significant solutions were retained, and were subsequently rotated by an oblique promax process into a more favorable parsimonious model. Finally, the factor defining was conducted.

That was followed by determining the differences between male and female handball players in previously defined factors. The results of the items that define the factors formed a summary variable, and for each variable thus obtained, the median, interquartile range and significance of deviations from the normal distribution were calculated using the Kolmogorov-Smirnov (KS) test. The Mann-Whitney (MW) U-test was used to determine statistically significant differences between male and female handball players. Furthermore, differences in the obtained aggregate variables formed by the factors, and between the competition ranks, were determined using the Kruskal-Wallis H-test, while the MW U-test was used in the post hoc analysis.

The overall analysis was performed using the R statistical package.

Results

The verification of the latent dimensions obtained by the State-Trait Anxiety Inventory, form X-2 is starting with correlation martix shown in Table 2.

Table 1. Spearman's intercorrelation matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Item1		.002	.464	.423	.198	.001	.116	.005	.328	.000	.021	.001	.000	.001	.000	.000	.214	.013	.000	.866
Item2	-.231		.258	.002	.000	.000	.498	.000	.000	.017	.011	.001	.037	.041	.008	.005	.000	.000	.001	.005
Item3	-.057	.087		.008	.052	.685	.403	.001	.006	.063	.000	.000	.001	.648	.000	.009	.000	.019	.002	.000
Item4	-.062	.239	.203		.000	.156	.500	.001	.092	.020	.077	.002	.037	.389	.006	.116	.001	.050	.228	.060
Item5	-.099	.457	.149	.275		.000	.081	.000	.000	.002	.031	.000	.038	.002	.005	.000	.000	.000	.000	.001
Item6	.264	-.279	-.031	-.110	-.302		.002	.032	.042	.000	.003	.039	.004	.248	.028	.002	.000	.010	.000	.019
Item7	.121	-.052	-.065	-.052	-.134	.241		.037	.243	.006	.248	.000	.006	.005	.006	.000	.191	.020	.005	.255
Item8	-.216	.323	.256	.250	.449	-.165	-.160		.001	.003	.000	.000	.000	.102	.000	.001	.000	.000	.000	.000
Item9	-.075	.295	.210	.130	.293	-.157	-.090	.255		.061	.000	.000	.004	.029	.000	.000	.000	.000	.000	.000
Item10	.528	-.183	-.143	-.179	-.235	.335	.212	-.229	-.144		.018	.000	.000	.010	.000	.000	.002	.000	.000	.050
Item11	-.177	.194	.348	.137	.166	-.225	-.089	.324	.403	-.182		.000	.000	.246	.000	.003	.000	.000	.000	.000
Item12	-.251	.263	.270	.232	.401	-.159	-.273	.502	.366	-.278	.432		.000	.022	.000	.000	.000	.000	.000	.000
Item13	.269	-.160	-.256	-.161	-.159	.222	.211	-.339	-.221	.267	-.318	-.399		.017	.000	.000	.005	.001	.000	.009
Item14	.251	-.158	-.035	-.067	-.242	.089	.213	-.126	-.168	.197	.090	-.177	.183		.116	.010	.695	.000	.327	.595
Item15	-.281	.201	.330	.210	.212	-.169	-.209	.357	.319	-.499	.266	.415	-.344	-.121		.000	.000	.000	.000	.000
Item16	.399	-.216	-.201	-.121	-.358	.241	.347	-.248	-.270	.557	-.223	-.440	.363	.198	-.542		.001	.000	.000	.000
Item17	-.096	.275	.279	.257	.435	-.292	-.101	.434	.469	-.236	.415	.376	-.214	-.030	.373	-.257		.000	.000	.000
Item18	-.191	.269	.180	.152	.363	-.197	-.179	.401	.492	-.304	.351	.455	-.247	-.290	.379	-.361	.483		.000	.000
Item19	.400	-.247	-.233	-.093	-.344	.331	.213	-.367	-.299	.422	-.448	-.457	.426	.076	-.397	.537	-.321	-.373		.000
Item20	-.013	.216	.271	.145	.264	-.180	-.088	.337	.357	-.150	.274	.332	-.201	-.041	.302	-.303	.444	.389	-.308	

Lower triangle – ρ coefficient; upper triangle – significance
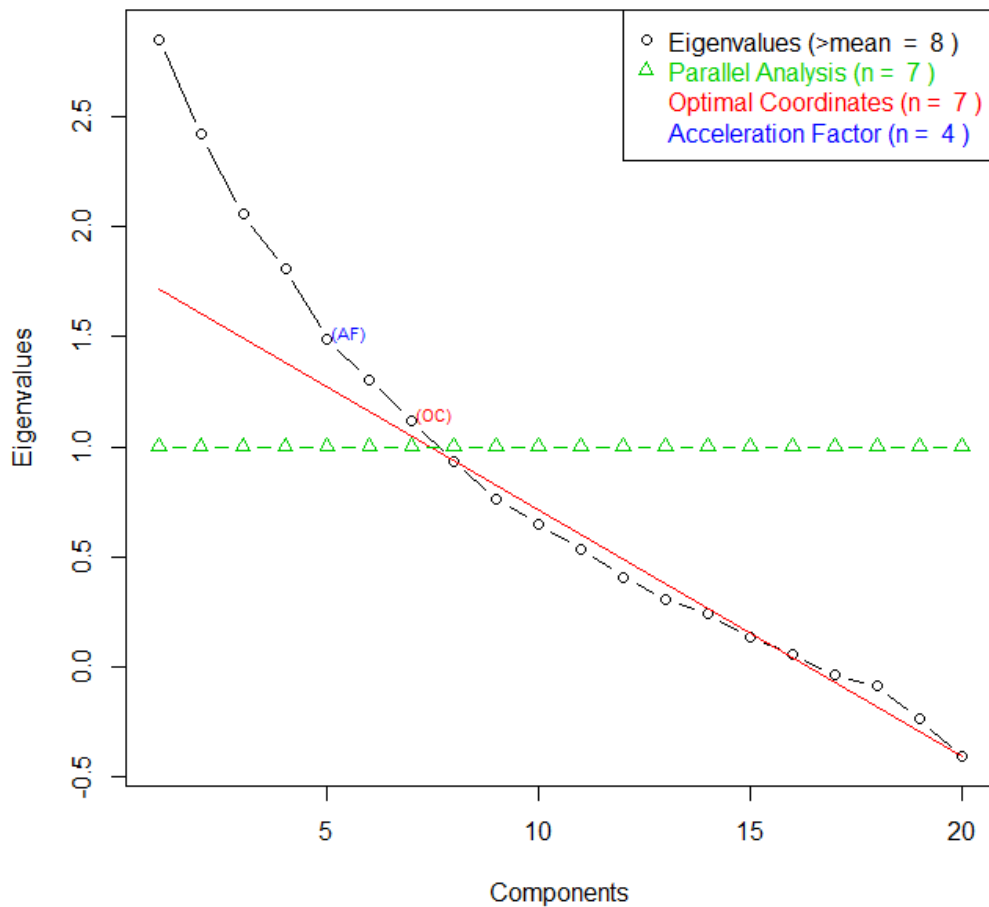
Figure 1. Determining number of factors

Based on the presented intercorrelation matrix (Table 2), as well as the Figure 1 analysis it was possible to conclude that different criteria for determining a significant number of factors singled out a different number of significant factor solutions. The CG criterion, which takes into consideration all those factors that have eigenvalues values ≥1, generally has a tendency of hyperfactorization, and therefore, as a rule, it should be applied with caution. Especially since the applied factor analysis was performed using ordinal variables, the author highlights that special caution be taken when defining the number of significant main components. The Scree (Parellel) criterion i.e., its mathematical approximation, and the optimal coordinates reduced the number of significant principal components by 1, from 8 to 7. However, the logical sequence that followed did not indicate meaningful solutions. It seems that only by applying the fourth criterion, an optimal solution was achieved, with a minimum number of single factors, and adequate values of communality and uniqueness.

The values of the first four main components are shown in Table 3, while the values of the assemblies by promax rotation of the main components into a more favorable factor solution, are shown in Table 4.

Table 3. Principal components (H), eigenvalues (λ) and percentage of common variance explained (R²)

Item	H1	H2	H3	H4
Item1	4.272	0.336	0.757	-0.044
Item2	-2.590	-1.773	-0.564	1.031
Item3	-2.151	1.485	-0.411	-1.536
Item4	-1.758	-1.312	-2.243	-1.177
Item5	-3.226	-1.646	-0.037	0.503
Item6	4.265	0.286	0.668	-1.777
Item7	3.654	0.092	-0.895	0.799
Item8	-3.563	-0.227	-0.195	-0.218
Item9	-3.051	0.092	1.268	0.543
Item10	5.165	0.034	0.802	0.131
Item11	-2.980	1.574	-0.136	0.577
Item12	-3.966	0.112	0.306	-0.540
Item13	4.965	-0.824	0.192	0.461
Item14	3.278	2.190	-1.529	1.263
Item15	-3.576	0.483	-0.189	-0.940
Item16	5.653	-0.355	-0.059	0.274
Item17	-3.591	0.229	0.139	0.772
Item18	-3.685	-0.378	1.174	0.044
Item19	5.749	-1.004	0.219	-0.619
Item20	-2.862	0.605	0.733	0.453
λ	4.119	2.957	1.960	1.421
R²	0.206	0.148	0.098	0.071

Table 4. Pattern (A) matrix and communalities (h²)

Item	A1	A2	A3	A4	h²
Item11	**0.737**	-0.140	-0.028	**0.447**	0.596
Item3	**0.716**	0.045	-0.233	0.162	0.401
Item20	**0.688**	0.167	0.109	0.032	0.440
Item17	**0.663**	0.108	0.347	0.123	0.600
Item9	**0.644**	0.199	0.162	-0.116	0.470
Item12	**0.589**	-0.136	0.035	-0.152	0.546
Item18	**0.535**	0.042	0.170	**-0.304**	0.547
Item8	**0.516**	-0.026	0.272	-0.043	0.461
Item15	**0.477**	-0.393	-0.158	-0.052	0.531
Item13	**-0.386**	0.375	0.141	0.030	0.398
Item1	0.243	**0.825**	-0.101	0.028	0.599
Item10	0.054	**0.798**	-0.072	0.047	0.648
Item16	-0.203	**0.609**	0.067	0.196	0.632
Item19	-0.365	**0.578**	-0.033	-0.176	0.603
Item6	0.141	**0.526**	**-0.482**	-0.189	0.505
Item2	0.005	-0.105	**0.722**	-0.039	0.573
Item5	0.156	0.011	**0.673**	-0.237	0.640
Item4	0.193	0.041	**0.385**	-0.001	0.220
Item14	0.207	0.038	-0.157	**0.860**	0.706
Item7	-0.026	0.284	0.130	**0.431**	0.342

Based on the conducted factor analysis of the latent space in the questionnaire, four factors were singled out. Ten items are projected on the first factor, one of which (item 13 I feel secure) is reversed. The items projected on this factor refer to characteristic cognitive and affective aspects of Trait anxiety. A high score of this factor indicates an increased degree of concern about one's own performance and ability, as well as a more pronounced negative affective experience such as sadness and anxiety. Therefore, this factor is named the Presence of Anxiety. The internal reliability of this factor is .760, however when item 13 is eliminated the internal reliability obtained by the Cronbach's Alpha coefficient is .832, therefore item 13 is excluded from further discussion and consideration of this factor.

Five anxiety-absent items were projected on the second factor and they refer to the experience of positive affect or the absence of anxiety, therefore it is named Positive affect. The internal reliability of this factor is .750.

The third factor is formed by three positively directed items which are focused on the experience of fatigue and discouragement due to the assessment of the impossibility of coping with difficulties. Items indicate the absence of activity, so this factor is called the Absence of proactivity. The internal reliability of this factor is .565.

Only two items are projected on the last, fourth factor, with the item 7 directed towards the experience of athletes in which they feel detached when it comes to crisis situations, whereas item 14 is aimed at avoiding crises and difficulties. The internal reliability of this factor is .394. Due to the above, the fourth factor was not taken into further consideration and interpretation.

Table 5. Correlation between factors

Factor	1.	2.	3.
1. Presence of anxiety		.000	.000
2. Positive affect	-.476		.000
3. Absence of proactivity	.466	-.362	

Correlation analysis show that there is moderate negative correlation between factors Presence of anxiety and Positive affect, as between Positive affect and Absence of proactivity. As expected, there is a positive moderate correlation between factors Presence of anxiety and Absence of proactivity.

Below is a presentation of the scores obtained by Serbian male and female handball players at the questionnaire State - Trait Anxiety Inventory X-2, having in mind the obtained factor solutions. The results are shown in Table 6.

Table 6. Differences between male and female handball players

Factor	Male Handball Players (N=97)			Female Handball Players (N=71)			U	p
	Median	IQR	KS	Median	IQR	KS		
Presence of anxiety	16.50	12-22	.001	17.00	13-20	0.810	3307.50	.584
Positive affect	18.00	15-19	.000	18.00	15-19	0.000	3407.50	.818
Absence of proactivity	5.00	4-7	.000	5.00	3-6	0.000	3059.00	.174

IQR – Interquartile range.

The obtained results show that there is no statistically significant difference between male and female handball players when it comes to the scores obtained at all three analyzed factors.

Figure 2 shows the difference in the scores obtained at the three factor solutions depending on the rank of the competition.
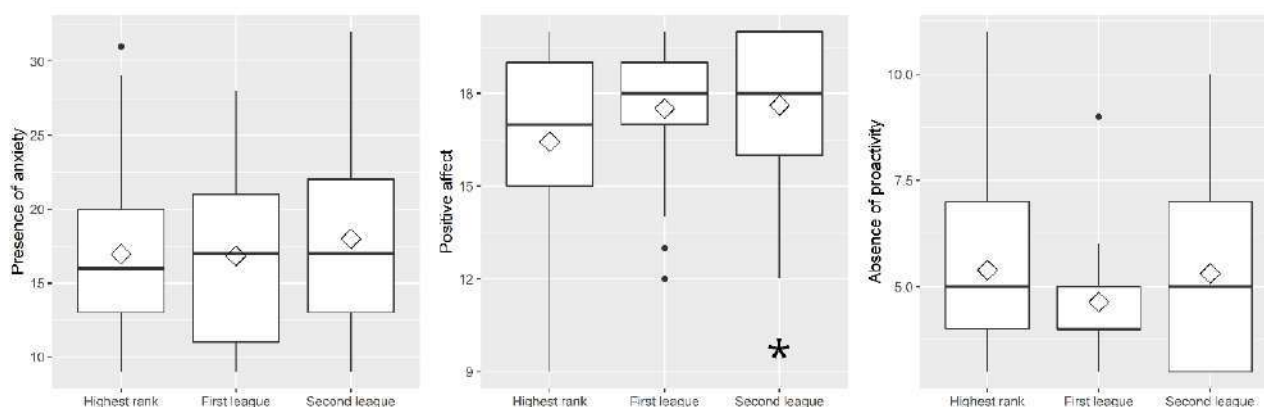
* – significant difference compared with Highest rank.

Figure 2. Differences between competition ranks

A statistically significant difference between male and female handball players of different competitive ranks exists only when it comes to the Positive Affect factor, and between athletes who compete in the highest rank and in the second league (p = .04). Athletes who compete in the second league scored higher on the Positive Affect factor than athletes who compete in the highest rank.

Discussion

An increasing number of researches in the fields of sport and sports psychology is aimed at understanding the individual characteristics that distinguish top athletes from athletes who do not reach that level.

Research so far has largely focused on examining the effects of anxiety on behavioral outcomes of athletes (Lavallee et al., 2004). Anxiety, as an unpleasant emotion, is a complex construct that can be analyzed from the State or Trait perspective. Research has focused more on examining the effects of anxiety as a condition on sports performance in the form of pre-competition anxiety, which is reflected in the cognitive and somatic elements. However, some research results have shown that athletes can experience a high degree of State anxiety as a facilitator i.e., that performance issues and somatic symptoms are motivating and athletes invest more effort to prevent these concerns from materializing (Lavallee et al., 2004). When it comes to Trait anxiety, the results consistently show that Trait

anxiety has a negative effect on sports performance (Rice et al., 2019). Therefore, this research is aimed at examining Trait anxiety in Serbian male and female handball players of different competitive rank, more precisely at examining one of the most common questionnaires for Trait anxiety assessment STAI (Lonner & Ibrahim, 1989) on a sample of Serbian athletes.

The initial aim of this research was to determine the latent space of the STAI version questionnaire for Trait anxiety in the population of Serbian handball players. Although the STAI questionnaire is valid in most cultures, the validation was done mainly on the student population or the clinical population, and additional data is missing on how this questionnaire describes the sport population, primarily their form of Trait anxiety. When applying and scoring the STAI questionnaire, most researchers take into account the global score achieved on the Trait or State form, very few studies have paid attention to checking the factor structure of separate questionnaire forms (Andrade et al., 2001). However, some studies single out a two-factor solution, a three-factor solution, and a four-factor solution (Fonseca-Pedrero et al., 2012).

In our sample, four factors were singled out, three of which were retained and named, according to the items projected on them: Presence of anxiety, Positive affect, and Absence of proactivity. Items aimed at assessing cognitive anxiety - concerns about one's own performance and abilities, as well as items focused on the emotional component - negative affective experience are projected on the first factor - the Presence of anxiety. This factor largely describes anxiety as a personality trait as defined by Spielberg et al. (1980). An item related to positive affectivity (item 13 I feel secure), which was eliminated from the first factor after the analysis of internal reliability, was also projected on this factor. High score on this factor indicates the presence of cognitive anxiety and negative affect. In contrast to the first factor, the second factor, Positive affect - consists of items that focus on positive emotional states, such as security, stability and self-confidence. An athlete who achieves a high score on this factor believes in his own performance and abilities. The high score on the third factor, Absence of proactivity, indicates athletes who are passive and do not react actively to overcome difficulties. A factor defined that way indicates an aspect of trait anxiety that refers to a lack of action for improving one's own mood or condition. People with trait anxiety mostly resort to avoidance strategies rather than active coping. Since it consists of only two items that are defined in the opposite way - one

towards emotional stability and the other towards avoiding difficulties, the fourth factor was not taken into further consideration due to low internal reliability and validity of the factor formation based on two items. The correlations between the factors (Table 5) confirm the stated assumptions regarding the naming and interpretation of the selected factors. Athletes who have a high score on the Presence of anxiety factor will achieve lower scores on Positive affect and a high score on the Absence of proactivity. This means that athletes who have more pronounced anxiety, use passive forms of problem solving to a greater extent, and feel positive emotions to a lesser extent.

Since the one-factor solution and global score used by most researches have not been obtained, it was not possible to compare the obtained scores of the respondents with some other studies, however, the obtained results give room for further research and consideration of STAI trait form questionnaire. According to the results achieved by Serbian handball players on the STAI form Trait anxiety, it can be noticed that Serbian male and female handball players achieve low scores on the subscale - Presence of anxiety as a personality trait. Although these results cannot be compared with the norms established in other studies due to the fact that our study did not extract the total score on the questionnaire, these results can be interpreted within this specific sample. Research has shown that athletes compared to the general population achieve lower scores on trait anxiety (Pacesova, Smela, & Kracek, 2019), and our results were obtained in line with other researches. Athletes belong to the "healthier" population, and it is not surprising that they have less trait anxiety, given the requirements and challenges posed to them by sport.

Although previous research has shown that there are significant gender differences in favor of female athletes (Rice et al., 2019) our sample showed no statistically significant differences between male and female handball players in three separate questionnaire factors. On the other hand, a statistically significant difference in the degree of Positive affect was noted between handball players of the highest competition rank and lower rank of the competition. Second-league handball players show a more Positive affect in relation to the highest-ranking handball players (Correia & Rosado, 2019). This result can be a product of the playing experience itself, where top athletes with a longer playing experience have a lower sense of enjoyment and positive affect due to overtraining and satiety - they

have already achieved everything they wanted. While, athletes who are younger and play in lower leagues have an urge to achieve more and training are still a challenge and a source of satisfaction.

The factor structure of the STAI – Trait form in our sample is similar to the structure of individual studies that singled out a two-factor solution - the presence and absence of anxiety (Bee Seok et al., 2018; Fonseca-Pedrero et al., 2012). However, the obtained factor structure is distinguished by the fact that it was conducted on a sample consisting of Serbian athletes, namely male and female handball players, which is both an advantage and a limitation of the research. The advantage is reflected in providing additional information on the existence of trait anxiety in the Serbian sample of athletes and the behavior of the widespread STAI questionnaire, while the disadvantage is reflected in the fact that a small sample was used, and only one form of questionnaire - the earliest version of the trait questionnaire, was used. Future research should focus on examining the latent dimensions of both forms of STAI questionnaires, and using a larger sample consisting of athletes of different sports, as well as comparing the obtained results with other scales and questionnaires that measure anxiety in athletes.

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