

Athletes' resilience typology: a comparative analysis of individual and team sports

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Published online: September 30, 2022

(Accepted for publication September 15, 2022)

DOI:10.7752/jpes.2022.09260

Abstract:

The purpose of the empirical study is to develop and substantiate a typology of athletes' resilience, as well as to compare different types of resilience among representatives of individual sports and team sports. Individual sports are represented by athletes from athletics, boxing, and weightlifting (n=312; average age M=26.2), and team sports are represented by representatives from mini-football, football, handball, and volleyball (n=322, average age M=28.1). **Research methods:** psychodiagnostic methods that used scales to evaluate the content parameters of the researched phenomena in a relevant way; participant observation; k-means cluster analysis; Spearman method correlation analysis (r_s); criterion angle-transformation of Fisher's (φ). **Results.** It is substantiated that athletes' resilience typology is a scientific classification of abstract theoretical complexes (types) that integrate the most essential content parameters, structural and functional characteristics of athletes' resilience. Commitment ($r_s=.148$), Control ($r_s=.086$), Challenge ($r_s=.076$), Hardiness ($r_s=.115$), Emotional Stability ($r_s=.146$), Cheerfulness ($r_s=.186$), and Motivation to Succeed ($r_s=.202$) were determined as the content factors with the strongest connection to Resilience ($p<.01$; $p<.05$). Individual and team sports were formed as empirical typologies of athletes' resilience. Individual athletes' resilience was classified into four types: Value-Oriented (VO), Motivational-Oriented (MO), Socially Acceptable (SA), and Emotionally Stable (ES). The following types of team sports athletes' resilience were identified: Motivational-Valued (MV), Control-Pragmatic (CP), Socially Acceptable (SA), and Resilient (RS). The distinctions in content features of athletes' socially acceptable types of resilience in individual and team sports are substantiated. **Conclusions.** The first hypothesis was confirmed when two types of athlete resilience were developed. The second hypothesis is confirmed since the construction of resilience types is based on the dominating levels of content parameters. The third hypothesis cannot be statistically proven or disproven since the three types of athletes' resilience differ in content parameters and cannot be compared. The Socially Acceptable type was compared, but no significant differences were found ($p \geq .05$). It is recommended that representatives of individual and team sports consider the obtained results and that they be operationalized in athletes' tactical training.

Key words: resilience, defense mechanism, mental state, psychological health, mental health.

Introduction

Resilience in sports is one of the most sought-after and emphasized scientific problems. The study of C. Bicalho et al. (2020) provides evidence since they conducted a thorough evaluation of the parameters and theoretical models of resilience in sports. C. Bicalho et al. (2020) analyzed the forty-seven most referenced original scholarly articles in the last ten years. We only considered theoretical models and empirical investigations that were used to interpret athletes' resilience. The emphasis was on studies that established important directions for the study of the resilience problem and contributed to the identification of patterns in empirical research. It was discovered that in modern studies, the desire to understand the construct of resilience predominates, with particular attention given to the characteristics of sports and athletes. Based on such a detailed theoretical investigation, the researchers concluded that sports resilience is a constant dynamic process based on psychological individual qualities and the athlete's interaction with the environment (Bicalho et al., 2020). These are one-of-a-kind publications on the psychology of resilience and sports psychology that deal with the systematization and generalization of scientific data. The study of systematizations and classifications leads scientists to identify typological features and create typologies. Typology contributes to the systematization of scientific achievements, the ordering and multiplication of knowledge, and the search for regularities and significant scientific facts based on this basis (Popovych, 2014b).

Let us now proceed to a review of works that fall within the scope of the research subject. Resilience is frequently associated with overcoming injuries and recovering athletes (Codonhato et al., 2018; Ruud et al., 2022; Southwick et al., 2014; Staude & Radzyshevska, 2021). It is considered that rapid changes in the environmental surroundings might injure an athlete if they have an adequately developed ability to withstand misfortune. There are three types of traumatic stress consequences: negative, neutral, and positive. Personal changes are connected to these types of consequences in the following ways: disorder, resilience, and growth. The disorder is distinguished by intense sensations, pain, trauma, and loss. Resilience enables you to keep balance and integrity while doing development tasks efficiently and successfully. Growth is the ability to use painful situations as a source of growth, to make sense of a traumatic scenario, and to support others. The authors came to the realization that resilience is the ability to bend but not break, to return to the norm, and even to grow in the face of unfavorable events and challenges (Southwick et al., 2014). An athlete's arsenal of coping mechanisms is an essential dynamic element of their resilience. G. Bonanno and C. Burton (2013) define non-constructive emotional regulation techniques as normal in acute stress. Reevaluation, in particular, supports a change in the situation and decreases the emotional effect; suppression – inhibits emotional expression; distraction – limits emotional processing in the early stages of acute stress (Bonanno & Burton, 2013). Furthermore, the researchers believe that sensitivity is the most significant attribute of resilience. Sensitivity (sensitive reaction) helps in emotional control of events and decision-making in stressful situations. The researchers differentiate the scenarios based on the emphasis on reaction deployment, cognitive changes, rhythmicity, and diversity of emotions, as well as their separation and interplay (Bonanno & Burton, 2013). S. Maddi (1994), who investigated resilience, came to the conclusion that it has a variety of elements, including the sense of problems, inclusion, and control. They are thought to be effective stress-reduction techniques by the researcher (Maddi, 1994).

The research of athlete resilience attracted significant scientific interest due to the forced isolation caused by the COVID-19 pandemic, which induced a shift in social life circumstances. The resiliency of elite athletes in sports was studied as a result of forced isolation due to the COVID-19 pandemic (Gupta & McCarthy, 2021). The difficult experience of elite athletes is highlighted, which helped to adaptability in adverse circumstances. According to a number of studies, the primary adversities produced by the lockdown include loss, reduced physical activity, and inconsistency, all of which have a direct impact on the mental health and well-being of athletes (Gupta & McCarthy, 2021; Hudimova, 2021; Hudimova et al., 2021). The prolongation of the stated problems is a comparative examination of the mental health of athletes and non-athletes after exiting the COVID-19 pandemic-induced lockdown (Knowles et al., 2021). Sports isolation is the most challenging for athletes who have a strong sports identity. It was shown that such athletes are the first to exhibit anxiety symptoms, which are more prevalent than those in non-athletes.

P. Morgan's (2016) dissertation study on team resilience in competitive sports is interesting. It was discovered that a significant portion of the teams endures negative consequences as a result of defeats and failures. The author presents a study system on team resilience that, in his opinion, may ensure the mobilization of psychological resources within the team with the goal of jointly resisting stressful conditions (Morgan, 2016). Research comparing the psychological endurance and competitiveness of female student-athletes in individual and team sports is a logical extension of the theoretical analysis (Devin et al., 2015). The researched factors' reliable differences in female athletes' preference for individual sports over team sports were clarified. We conclude that comparing resilience typologies of athletes in individual and team sports might reveal major variations and fascinating scientific facts. Continuing with the typology problem, consider the research on resilience in sports, which contains a comparison of sports types, gender differences, sexual differentiation, age component, and degree of sports qualification (Blanco-García et al., 2021). The researchers discovered connections between endurance levels and sports in 1047 athletes based on gender, age, and qualification in the sports of handball, basketball, volleyball, athletics, and judo. Males had higher indications than females, and there was a positive correlation with age. A recent study comparing the resiliency of elite German athletes, students, and employees is definitely interesting (Westmattmann et al., 2021). The elite athlete group, as expected, demonstrated much more resilience than the other two groups. The study established that resilience is a requirement for participating in sports rather than a component of sports performance. Furthermore, it was discovered in research on the connection of resilience and endurance with sports successes and mental health that resilience and endurance can predict changes in athletes' sports achievements and mental health (Salehi Nezhad & Besharat, 2010).

According to E. Hrishyn (2021), resilience should be researched in three dimensions: 1) characteristic or ability; 2) process; 3) adaption mechanism. G. Lazos (2018) reached the following conclusions on resilience: 1) a bio-psycho-social phenomenon including personal, interpersonal, and social experiences that develops naturally over time as a consequence of numerous developmental processes; 2) related to the psyche's ability to recover after adversity; 3) depending on the focus and subject of the research, resilience can be considered as a personality trait inherent in one or another person, as well as a dynamic process; 4) is crucial in the ability and formation of post-traumatic stress personality growth (Lazos, 2018: 34). Psychological resilience was investigated, and it was shown that athletes may organize their psycho-emotional and physical resources to

survive extreme challenges. Scientists have discovered the following resilience factors: motivation, a positive attitude, confidence in one's own talents, purposefulness in achieving the goal, social approval and support (Sarkar & Fletcher, 2014).

The authors conducted a retrospective analysis of scientific research on resilience typology and identified the following directions: 1) analysis of athletes' mental states (Popovych et al., 2019b; 2021e; 2022a; 2022e); 2) investigation of athletes' anticipatory and expected self-regulatory readiness (Popovych et al., 2020b; 2021b); 3) study of vitality and emotional stability content characteristics (Popovych et al., 2021a; 2022d); 4) study of adaptive and psychoemotional resources (Blynova et al., 2019; 2022); 5) study of psychological well-being (Popovych et al., 2021d; 2021g; 2022b).

The scientific classification of abstract theoretical complexes (types) that incorporated the most essential content characteristics and structural and functional properties of athletes' resilience is referred to as the typology of athletes' resilience. It is worth noting that we offered two types of athlete resilience based on the purpose of the article: 1) Individual athletes' resilience typology; 2) Team athletes' resilience typology.

Hypotheses. 1. The development of a typology of resilience in athletes from individual and team sports will allow for the establishment of important scientific facts that should be included in athletes' tactical training. 2. The categories of resilience are determined by the respondents' levels of content parameters of resilience. 3. The types of resilience of athletes in individual sports differ significantly from those of athletes in team sports.

Purpose. Development and substantiation of an athlete resilience typology; comparison of resilience types among representatives of individual and team sports.

Material and methods

Methodology. The research on resilience typology involved the identification of a relevant list of criteria indicating the resilience of athletes in individual and team sports. Significant types of resilience were then defined based on these variables. Since the emphasis was on the comparison of resilience typologies, a correlation matrix was constructed from the start of the study. S. Maddi's (1994) concept of resilience, self-regulatory anticipated preparedness, served as the research's methodological basis (Popovych, 2014a; 2014c; 2017). In our perspective, a complex combination of the investigated resilience content characteristics of S. Maddi (1994): Challenge, Commitment, Control, and Hardiness best reflected the content of training/competitive/restorative sports activities in stressful/traumatic sports events. All of the listed sports acts are accompanied by a high level of self-regulation expected preparation. This interpretation allows focusing on the "Expected Sports Activity Result" scale. The athlete's attitude toward the individual performance/game has procedural and resultant relevance, influences the course of the game, and is an effective method of situational reconstruction to overcome stress, prevent injury, or enter a stressful situation and injury. Motivation to Succeed (Elers, 2002) is seen as a system-forming component on which a variety of other factors, such as triumph tiredness, or injury recovery, rely.

A number of works similar to ours were considered in order to build an empirical picture of the research with the subsequent establishment of clusters (Hulias, 2020; Hulias & Hoian, 2022; Hulias & Karpenko, 2022; Kobets et al., 2021a; 2021b), outlining the methodology of sensorimotor and thinking activity (Plokhikh, 2021; Popovych, 2014b; Popovych et al., 2021f), the regularities of training, competitive and restorative processes (Kozina, 2019; Marques, 2011; Popovych et al., 2021c; Shalar et al., 2019), and the regularities of creating a safe space of activity (Mamenko et al., 2022; Popovych et al., 2020a). The studies of factors and the identification of typologies in sporting activities are examined (Popovych et al., 2020c; 2022c). Empirical research on how respondents cope with stressful events (Nosov et al., 2020; 2021a; 2021b) as well as studies on severely challenging working conditions (Zinchenko et al., 2020; 2021; 2022), are considered. All of the studies analyzed are directly or indirectly relevant to the development of typologies of athlete resilience.

Participants. Individual sports include athletes in athletics, boxing, and weightlifting (n=312; average age M=26.2). All Ukrainian respondents came from the Kherson, Ivano-Frankivsk, and Lviv regions. The team sports include athletes in mini-football, football, handball, and volleyball (n=322, average age M=28.1). They are all from Ukraine's Kherson, Sumy, and Mykolaiv regions. The total number of subjects was n=634, ranging in age from 14 to 42 years, with n=269 females (42.43 %) and n=365 males (57.57 %). Athletes compete in a variety of competitions ranging from regional to global, with levels ranging from amateur to World Championship champions and Olympic Games competitors.

Organization of research. Data was acquired empirically from August to December 2021. The study of resilience typologies is based on an ascertaining strategy that includes the identification of the most important components. The Spearman (rs) correlation matrix was used to identify relevant components. The factor ranking method was then carried out. The procedure for defining types by clustering using the k-means approach was carried out based on the specified rating factors. Before the key matches of representatives of team sports and the final stages of individual sports events, empirical data were collected. These athletes are taken into consideration since they competed from the start. We highlight that eighteen injuries were registered during the included observation, which occurred after the collection of empirical findings. Injuries varied from small (contusions, muscular strains) to severe (closed and open fractures). The data presented are proof of the competitors' struggle

and dedication to winning sporting tournaments. The collection of empirical data was coordinated with the ethical committees of Ukraine’s relevant regional Federations, as well as head and senior coaches of teams and athletes. The described structure maintained data privacy, voluntariness, and awareness, resulting in high-quality and sincere testing.

Procedures and instruments. The “Brief Resilience Scale” (“BRS”) (Smith et al., 2008) is the main method for determining Resilience (R). B. Smith et al. (2008), the method’s authors, define resilience as an athlete’s ability to withstand stress/injuries/challenges, adapt to stress, heal injuries, recover, and achieve a greater level of awareness of sports activities. The α -Cronbach parameter had a value of $\alpha_{BRS}=.904$. The factors evaluated by the scales of the questionnaire “Hardiness Survey” (“HS”) (Maddi, 1994) are important parameters that were substantiated in the study methodology. An adapted version (Leontiev & Rasskazova, 2006) was applied with the following scales: “Hardiness” (HR), “Commitment” (CM), “Control” (CN), and “Challenge” (ChL). The α -Cronbach parameter was $\alpha_{HS}=.821$. The “Motivation to Succeed” (“MS”) (Elers, 2002) is a psychodiagnostic test of the same name with one scale to determine the motivation to achieve success in athletes. Because there is only one scale, the level of homogeneity is high, therefore determining is not acceptable. The author’s questionnaire “Level of Social Expectations of a Sportsman” (“LSES”) (Popovych, 2017) was used to determine the “Expected Result of Sports Activity” (ERSA). α -Cronbach was at the level of $\alpha_{LSES}=.841$. The “Purpose in Life Test” (“PIL”) (Leontiev, 2006) is a psychodiagnostic instrument that defines the “General Meaningfulness of an Athlete’s Life” (GMAL). The α -Cronbach was $\alpha_{PIL}=.891$. The 16 PF Cattell test (2014) obtained information on four scales: Emotional Stability (C), Sensitivity (I), Openness to Change (Q1), and Liveliness (F). All four scales are important factors in athletes’ resilience. α -Cronbach homogeneity was between .821 (medium level) and .904 (high level) according to all applicable psychodiagnostic methods.

Statistical analysis. “SPSS” v. 23.0 was used for statistical processing of empirical data of the ascertaining research strategy, the establishment of descriptive frequency characteristics, the construction of correlation matrices, and the establishment of cluster boundaries, based on which the types of resilience were determined. All differences at the $p \leq .05$ and $p \leq .01$ levels are considered significant.

Results

The following descriptive frequency characteristics were presented as empirical data from respondents used to construct a resilience typology: M is the arithmetic mean; SD represents the mean squared deviation. To establish the most precise typological profiles of resilience, descriptive frequency characteristics were delimited by the groups in this study: Group 1 – Individual sports representatives (n=312); Group 2 – Team sports representatives (n=312). Table 1 shows data from the following psychodiagnostic methods: “BRS” (Smith et al., 2008), “HS” (Maddi, 1994), “MS” (Elers, 2002), “LSES” (Popovych, 2017), “PIL” (Leontiev, 2006) and 16 PF Cattell test (2014).

Table 1. Descriptive Frequency Characteristics for Group 1 and Group 2

Scale	Group 1		Group 2	
	M ₁	SD ₁	M ₂	SD ₂
“Brief Resilience Scale”				
Resilience (RS)	3.92	±.58	3.37	±.51
“Hardiness Survey”				
Hardiness (HR)	75.51	±15.54	79.51	±16.49
Commitment (CM)	35.04	±8.19	36.95	±8.82
Control (CN)	29.96	±6.77	27.54	±5.98
Challenge (ChL)	14.41	±3.59	12.79	±3.39
“Motivation to Succeed”				
Motivation to Succeed (MS)	27.02	±6.23	24.78	±6.09
“Level of Social Expectations of a Sportsman”				
Expected Result of Sports Activity (ERSA)	11.04	±2.63	10.12	±2.37
“Purpose in Life Test”				
General Meaningfulness of an Athlete’s Life (GMAL)	107.36	±15.24	102.45	±14.32
16 PF Cattell test				
Emotional Stability (C)	6.14	±.78	5.63	±.67
Sensitivity (I)	7.14	±1.12	6.83	±1.02
Openness to Change (Q1)	7.44	±1.01	6.54	±.93
Liveliness (F)	5.84	±.69	6.14	±.81

Note: Group 1 – representatives of individual sports; Group 2 – representatives of team sports; M₁ – arithmetic mean of Group 1; SD₁ – square deviation of Group 1; M₂ – arithmetic mean of Group 2; SD₂ – square deviation of Group 2.

We state that the descriptive frequency characteristics of the groups analyzed by all methods did not differ significantly from the norms obtained in previous empirical sports research (Popovych et al., 2019a; 2021d) and were within the statistical error of the norms established by the methods' authors (Maddi, 1994; Popovych, 2017). According to the quantitative comparison of Group 1 and Group 2 data, the arithmetic mean showed that Group 1 had an advantage in the following parameters: RS (M=3.92; SD=±.58), CN (M=29.96; SD=±6.77), ChL (M=14.41; SD=±3.59), MS (M=27.02; SD=±6.23), ERSA (M=39.04; SD=±8.63), GMAL (M=107.36; SD=±15.24), C (M=6.14; SD=±.78), I (M=7.14; SD=±1.12), Q1 (M=7.44; SD=±1.01). Obviously, the determined difference based on the provided factors can have an impact on the determination of the types of athletes' resilience.

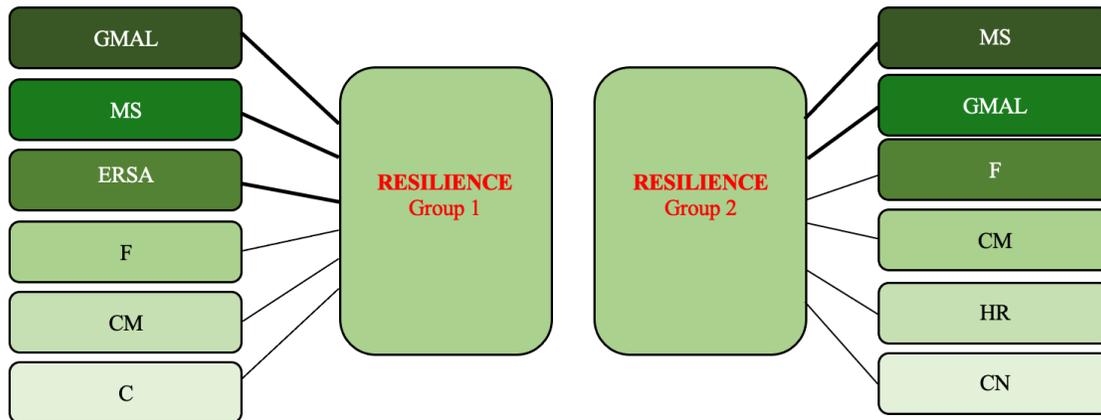
The correlational connections of the major dimension – Resilience (RS) with all the related scales were explained in order to identify the most essential parameters, which were used to determine the types of resilience. Table 2 presents the correlation for two subject groups: Group 1 and Group 2.

Table 2. Correlation matrix of resilience connections by groups of subjects

Parameters	Resilience (RS)			
	Group 1		Group 2	
	r_s	R	r_s	R
Hardiness (HR)	.113*	-	.143*	5
Commitment (CM)	.148*	5	.152*	4
Control (CN)	.085*	-	.141*	6
Challenge (ChL)	.076	-	.069	-
Motivation to Succeed (MS)	.222**	2	.212**	1
Expected Result of Sports Activity (ERSA)	.201**	3	.136*	-
General Meaningfulness of an Athlete's Life (GMAL)	.242**	1	.202**	2
Emotional Stability (C)	.146*	6	.136*	-
Sensitivity(I)	.126*	-	.096*	-
Openness to Change (Q1)	.119*	-	.112*	-
Liveliness (F)	.186*	4	.167*	3

Note: Group 1 – representatives of individual sports; Group 2 – representatives of team sports; r_s – correlation by the Spearman method; R – ranking (six ranks of the strongest correlations); * – $p < .05$; ** – $p < .01$.

Figure I demonstrates, by rank, the content parameters with the major parameter – Resilience (RS) – that had the strongest interconnections identified by Spearman's (r_s) method.



Note: ——— positive correlations at $p \leq .05$; ——— positive correlations at $p \leq .01$; Group 1 – representatives of individual sports; Group 2 – representatives of team sports; GMAL – General Meaningfulness of an Athlete's Life; MS – Motivation to Succeed; ERSA – Expected Result of Sports Activity; F – Liveliness; CM – Commitment; C – Emotional Stability; HR – Hardiness; CN – Control.

Figure I. Correlation galaxy of resilience by ranks

It was established that the four correlations of Resilience with the studied parameters in Group 1 and Group 2 were the same: GMAL, MS, F, and CM. The strongest were in Group 1: RE and GMAL (.242; $p \leq .01$); RE and MS (.222; $p \leq .01$), and in Group 2 were: RE and MS (.212; $p \leq .01$); RE and GMAL (.202; $p \leq .01$). Distinctive parameters in the studied groups were: Group 1 – Expected Result of Sports Activity (.201; $p \leq .01$) and Emotional Stability (.146; $p \leq .05$); Group 2 – Hardiness (.143; $p \leq .05$) and Control (.141; $p \leq .05$). We explain such discrepancies in rankings by stating that in representatives of individual sports, the parameters of emotional

stability and the expected result of sports activities were critical in coping, and self-regulatory readiness for sports activities, which was a content-forming factor of their resilience. Team athletes had Control (CN) and Hardiness (HR). The athlete's ability to focus on the procedural component of sports activity, on high-quality completion of given tasks, and on game control, as evidenced in the level and type of resilience, was significant.

Let us now define types of resilience using cluster analysis and the k- means approach. The essence of this method is to determine the optimally specified number of clusters that are grouped by statistical homogeneity variables. Clusters are statistical homogeneous groups. Each cluster is a distinct type. The distribution principle is based on minimizing the sum of squared distances between measurements and the cluster's center. The k-means approach was preferred in finding clustering types due to a large volume of empirical data (n=634). Also, complexes of the researched parameters were determined under the conditions of use of this approach. Complexes that have been defined are visual taxonomies. Group 1 parameters studied: GMAL, MS, ERSA, F, CM, C. Group 2 parameters studied: MS, GMAL, F, CM, HR, CN. We used the strongest correlation principle to determine the parameters. According to our preliminary findings, the primary requirement is the presence of at least $n \geq 31$ parameters in the cluster. Empirically, using "SPSS" v. 23.0 determined that the optimal number of clusters matching the main requirement was four clusters. The initial and final values of each cluster's centers were set. Table 3 displays the initial and final values of the cluster centers in Group 1.

Table 3. Initial and final values of cluster centers of Group 1 (n=312)

Parameters	Cluster 1.1 (n=35)	Cluster 2.1 (n=61)	Cluster 3.1 (n=139)	Cluster 4.1 (n=77)
General Meaningfulness of an Athlete's Life (GMAL)	123-115	121-104	58-93	92-115
Motivation to Succeed (MS)	22-37	27-36	15-19	14-28
Expected Result of Sports Activity (ERSA)	7-10	13-11	13-9	4-8
Liveliness (F)	5-10	4-8	8-11	7-10
Commitment (CM)	37-39	28-35	36-41	23-31
Emotional Stability (C)	5-11	4-10	6-9	9-12

Note: Group 1 – representatives of individual sports; GMAL – General Meaningfulness of an Athlete's Life; MS – Motivation to Succeed; ERSA – Expected Result of Sports Activity; F – Liveliness; CM – Commitment; C – Emotional Stability.

Setting the initial and final values of the cluster centers demonstrated the limit of the parameter allocated to the particular cluster on each scale. The characteristics of each Group 1 cluster were described, led by descriptive frequency characteristics (see Table 1).

Cluster 1.1 (n=35) was the smallest. Athletes in this cluster had a high level of general meaningfulness of life (123-115) and a high level of inclusion (37-39). The remaining parameters were in the medium and high levels. As a result, the type of resilience was named Value-Oriented "VO" based on the pronounced levels of the first two factors. Athletes' ability to perceive purpose in sports activities, live sports, and commit themselves to sports were important qualities of the value-oriented type of resilience. As indicated by observation protocol data, such representatives competed in and won the most prestigious competitions.

Cluster 2.1 was one of the averages in terms of the number of athletes (n=61). Representatives of this cluster have stated a strong desire for success (27-36) and high expectations for the Expected Result of Sports Activity (13-11). The GMAL and CM parameters had medium and high values, correspondingly, whereas the F and C parameters had levels ranging from low to high. The type of resilience was named Motivational-Oriented "MO" based on the explicitly acknowledged drive for achievement and the expected result. The essence and significance of sports battling was the motivation for victory. It was important for such athletes to win a hard battle. Their triumphs due to their opponents' disqualifications did not fatigue them but rather disappointed them.

Cluster 3.1 had the highest representation (n=139). Representatives of this cluster exhibited high levels of liveliness (8-11) and inclusion (37-39). GMAL (58-93) and MS (15-19) had low and medium levels, correspondingly; the remaining parameters did not have a bright manifestation but were distributed equally. Socially acceptable "SA" was the name given to this type of resilience. The energy charge that athletes received from supporters was undeniably a tremendous source of energy and drive for sporting activity. Athletes with a Socially Acceptable type of resilience, in contrast to the previous two categories, had a difficult time suffering setbacks and injuries. Representatives of this type were more likely to participate in large-scale sporting events than to win small closed tournaments.

Cluster 4.1 had an average number of athletes (n=77). Representatives of this cluster had high levels of Emotional Stability (9-12). GMAL (92-115) and F (7-10) had medium and high levels, whereas the remaining parameters had low to high levels. As a result, the type of resilience was named Emotionally Stable "ES" after the dominating high level of Emotional Stability. Athletes with emotionally stable resilience could withstand

peak emotional loads better. They rapidly recovered from failure, and after a triumph, they immediately devised a new strategy for success.

Let us now proceed to the k-means clustering of the researched parameters of team sports representatives. Table 4 displays the initial and final values of the cluster centers in Group 2.

Table 4. Initial and final values of the centers of clusters of Group 2 (n=322)

Parameters	Cluster 1.2 (n=59)	Cluster 2.2 (n=76)	Cluster 3.2 (n=154)	Cluster 4.2 (n=33)
Motivation to Succeed (MS)	29-38	23-31	13-18	14-27
General Meaningfulness of an Athlete's Life (GMAL)	112-118	119-107	49-89	143-88
Liveliness (F)	8-11	12-10	14-11	4-9
Commitment (CM)	35-41	28-35	37-40	22-31
Hardiness (HR)	70-95	88-101	48-61	93-112
Control (CN)	27-34	33-39	18-27	22-36

Note: Group 2 – representatives of team sports; GMAL – General Meaningfulness of an Athlete's Life; MS – Motivation to Succeed; F – Liveliness; CM – Commitment; C – Emotional Stability; HR – Hardiness; CN – Control.

Clusters of Group 2 were characterized by descriptive frequency characteristics (see Table 1).

Cluster 1.2 was one of the medium-sized ones (n=59). This cluster's representatives had a high level of Motivation to Succeed (29-38). The rest of the parameters were at medium and high levels. The type of resilience was named Motivational-Valued "MV" after the explicitly emphasized value of motivation to athlete achievement. The willingness of representatives of team sports to constantly win, often at the expense of injuries and irresponsible psycho-emotional expenses, was an important aspect of the Motivational-Valued type of resilience. For athletes, this type of resilience was a powerful fatigue tool.

Cluster 2.2 was also the average in terms of athlete number (n=76). Representatives of this cluster had considerable Control (33-39), medium, and high levels of GMAL (119-107), MS (23-31), CM (28-35), and HR (88-101) parameters. The Control-Pragmatic "CP" type of resilience was named for its clearly expressed control functions and medium and high levels of other parameters. The desire to control the course of events on the sports field, to calculate and implement the victory algorithm in advance, differentiated members of this type from others. The application of control and a pre-planned strategy was the source of such players' resilience.

Cluster 3.2 had the most representation (n=154). Representatives of this cluster exhibited high levels of liveliness (11-14) and inclusion (37-40). All other parameters were indicated on a scale of low to medium. There might be high indications among the parameters at times, but only if the F and CM levels were also high. Socially Acceptable "SA" was the name given to this type of resilience. Social acceptance was a potent motivator and resilient force in team sports. Not for nothing is an active supporter in the stands referred to as an additional team player. It was incredibly difficult for representatives of this type to play their tournaments under quarantine restrictions, without an audience.

Cluster 4.2 was the smallest in terms of the number of athletes (n=33). Hardiness (93-112) was a prominent parameter in representatives of this cluster. GMAL (143-88), CM (22-31), and CN (22-36) were given medium and high levels. Other parameters were provided in an equal progression from low to high levels. Because of the prevalent high level of Hardiness, the type of resilience is defined as Resilient "RS". Athletes with a Resilient type of resilience were optimistic, enjoyed life, and cherished competitiveness on the field. As evidenced by observations, such athletes frequently lacked the Motivation to Succeed. At the same time, representatives of this type were unconcerned with defeats.

It was appropriate to compare the types of resilience of athletes in individual and team sports, based on the conditions of the third hypothesis. The comparison did not appear rational because the content parameters of the specified categories differ. The only difference was that we compared representatives of individual and team sports, a Socially Acceptable type of resilience with the same name. For comparison, criterion angle-transformation of Fisher's (ϕ) was used (Tabl. 5).

Table 5. Differences between Group 1 and Group 2 by type of resilience (n1=139; n2=154)

Type of Resilience	Group 1 (n1=139)	Group 2 (n2=154)	Fisher's criterion	Level of significance
Socially Acceptable (SA)	44.55%	47.83%	-1.190;	p<.0813

Note: Group 1 – representatives of individual sports; Group 2 – representatives of team sports.

We may conclude from Fisher's (ϕ) comparison that there were no variations in the quantitative parameter of the Socially Acceptable type of resilience between Group 1 and Group 2.

Discussions

We have not discovered any sports science study that deals with the development and validation of a typology of athletes' resilience. At the same time, academics are attempting to standardize, classify, and generalize knowledge about athlete resilience (Bicalho et al., 2020; Morgan, 2016). We chose the variables that were found to establish the categories after analyzing works (Haminich, 2016; Lazos, 2018; Maddi, 1994). We tested and documented a reliable level of correlation ($p < .05$; $p < .01$) for the following relevant parameters: social support, control, resilience, and positive attitude. This validates the specified resilience parameters and the outcomes established by other authors (Lazos, 2018; Maddi, 1994). Sensitivity (I) was shown to have a significant connection in two groups: Group 1 ($r_s = .126$; $p < .05$) and Group 2 ($r_s = .096$; $p < .05$). This supports the findings of the authors G. Bonanno and C. Burton (2013), who connect sensitivity to resilience characteristics. However, it contradicts their claim that sensitivity is the most important factor in resilience. We believe this is incorrect because the Sensitivity (I) parameter did not meet the passing standard in our ranking and was not defined in any of the typologies. Simultaneously, it has been established that efficiency and self-efficacy are essential factors in resilience. We contend that Motivation to Succeed (Group 1: $r_s = .222$; $p < .01$; Group 2: $r_s = .212$; $p < .01$) and Expected Result of Sports Activity (Group 1: $r_s = .201$; $p < .01$; Group 2: $r_s = .136$; $p < .05$), which indicate the essence of efficiency and self-efficacy, have a substantial level of correlation with Resilience.

The content parameters of the established types of resilience are comparable to the prevailing mental states of representatives of individual (Popovych et al., 2021a) and team sports (Popovych et al., 2019a), as well as established in sports-related types of human activity (Popovych et al., 2019b). The "Value-meaning self-regulation of victory" mental state is based on the parameter "General Meaningfulness of the Athlete's Life", which is significant in the Value-Oriented type of resilience (Group 1). We focus on the Control parameter in the Control-Pragmatic type of resilience in Group 2, which is congruent with the mental state of "Pragmatic self-regulation of victory" (Popovych et al., 2019a).

Based on the results given (see Tabl. 2 and Fig. I), we conclude that the first hypothesis is rejected, because the significant differences in resilience between Groups 2 and 1 were $t = 2.3$; $p < .05$. The second hypothesis is verified since Group 1 respondents outperform Group 2 in all parameters, with significant differences ($p < .05$) in two RS and MS. Without a doubt, the obtained scientific fact is interesting in the context of sports psychology and high success, but it needs to be validated using other samples.

After analyzing the data shown in Tables 3 and 4, we can conclude that the first hypothesis was verified since two typologies of athletes' resilience were developed. The second hypothesis is supported since the construction of resilience types is based on the dominating levels of content parameters. Group 1 includes GMAL, MS, ERSA, F, CM, and C; Group 2 includes MS, GMAL, F, CM, HR, and CN. The third hypothesis cannot be statistically proven or disproven since the three types of athlete resilience differ in content parameters and cannot be compared; a comparison of the Socially Acceptable type was conducted, but no significant differences were found ($p \geq .05$).

Conclusions

1. Individual and team sports resilience typology is a scientific categorization of abstract theoretical complexes (types) that integrate the most essential content criteria, structural and functional elements of athletes' resilience.

2. Reliable theoretical sets of parameters for the researched groups were developed using Spearman's correlation analysis (r_s) and ranking (R). Group 1 includes GMAL, MS, ERSA, F, CM, and C; Group 2 includes MS, GMAL, F, CM, HR, and CN.

3. Cluster analysis using the k-means method was used to determine the different types of athletes' resilience. Individual athletes' resilience was classified into four types: Value-Oriented ("VO"), Motivational-Oriented ("MO"), Socially Acceptable ("SA"), and Emotionally Stable ("ES"). The following types of team sports athletes' resilience were identified: Motivational-Valued ("MV"), Control-Pragmatic ("CP"), Socially Acceptable ("SA"), and Resilient ("RS").

4. Fisher's (ϕ) approach was used to clarify and establish distinctions in the substance of the Socially Acceptable type of resilience of athletes in individual and team sports. There were no variations in the quantitative parameters of the Socially Acceptable type of resilience between Group 1 and Group 2.

5. The obtained results are advised to be considered by representatives of individual and team sports for the purpose of operationalization in athletes' tactical training.

References:

- Bicalho, C. C. F., Melo, G. F., & Noce, F. (2020). Resilience of athletes: a systematic review based on a citation network analysis. *Cuadernos de Psicología del Deporte*, 20(3), 26-40.
- Blanco-García, C., Acebes-Sánchez, J., Rodríguez-Romo, G., Mon-López, D. (2021). Resilience in Sports: Sport Type, Gender, Age and Sport Level Differences. *Int. J. Environ. Res. Public Health*, 18, 8196. <https://doi.org/10.3390/ijerph18158196>

- Blynova, O., Derevianko, S., Ivanova, O., Popovych, I., & Estay Sepulveda, J. G. (2022). Professional relevance of potential labor emigrants. *Revista Notas Históricas y Geográficas*, 29, 88-106.
- Blynova, O. Ye., Popovych, I. S., Bokshan, H. I., Tsilmak, O. M., & Zavatska, N. Ye. (2019). Social and Psychological Factors of Migration Readiness of Ukrainian Students. *Revista ESPACIOS*, 40(36), 4.
- Bonanno, G. A., & Burton C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science*, 8(6), 591–612.
- Cattell test 16PF personality. (Form A /187 questions). (2014). New York: Oxford University Press.
- Codinhato, R., Nickenig Vissoci, J. R., Andrade do Nascimento Junior, J. R., Mizoguchi, M. V., & Fiorese, L. (2018). Impact of resilience on stress and recovery in athletes. *Rev. Bras. Med. Esporte*, 24(5), 352–356. <http://dx.doi.org/10.1590/1517-869220182405170328>
- Devin, F. H., Farbod, D., Ghasabian, Y., & Bidel, T., & Ghahremanlou, F. (2015). Comparative and Correlative Study of Psychological Hardiness and Competitiveness among Female Student Athletes in Individual and Team Sports. *Sport Science Review*, 24(3-4), 201-214. <https://doi.org/10.1515/ssr-2015-0016>
- Elers, T. (2002). Motivation for Achieving Success and Avoiding Failures. St. Petersburg: Piter.
- Gupta, S., & McCarthy, P. J. (2021). Sporting Resilience During COVID-19: What Is the Nature of This Adversity and How Are Competitive Elite Athletes Adapting? *Front. Psychol.*, 12, 611261. <https://doi.org/10.3389/fpsyg.2021.611261>
- Haminich, A. M. (2016). Resilience: vitality, viability or resilience? *Scientific Bulletin of KSU*, 6(2), 160-165.
- Hudimova, A., Popovych, I., Savchuk, O., Liashko, V., Pyslar, A., & Hrys, A. (2021). Research on the relationship between excessive use of social media and young athletes' physical activity. *Journal of Physical Education and Sport*, 21(6), 3364-3373. <https://doi.org/10.7752/jpes.2021.06456>
- Hudimova, A. Kh. (2021). Psychological well-being and social media users' behavioral online patterns in everyday life and during COVID-19 pandemic. *Insight: the psychological dimensions of society*, 5, 133-147. <https://doi.org/10.32999/2663-970X/2021-5-9>
- Hrshyn, E. O. (2021). Resistance of personality: the essence of the phenomenon, psychodiagnosis and means of development. *Bulletin of KhNPU named after G. S. Skovoroda. Psychology*, 64, 62-81.
- Hulias, I. (2020). Axiopsychological projection of life achievements of the personality. Kyiv: Lyudmila Publishing House.
- Hulias, I. A., & Hoian, I. M. (2022). Explication of factors of the axiopsychological design of life achievements of modern youth. *Insight: the psychological dimensions of society*, 7, 41-57. <https://doi.org/10.32999/2663-970X/2022-7-4>
- Hulias, I., & Karpenko, Z. (2022). Axiopsychological Differences of Men's and Women's Gender Displays in Modern Ukraine. *Journal of Education Culture and Society*, 13(1), 351-368. <https://doi.org/10.15503/jecs2022.1.351.368>
- Knowles, C., Shannon, S., Prentice, G., & Breslin, G. (2021). Comparing Mental Health of Athletes and Non-athletes as They Emerge From a COVID-19 Pandemic Lockdown. *Front. Sports Act. Living*, 3, 612532. <https://doi.org/10.3389/fspor.2021.612532>
- Kobets, V., Liubchenko, V., Popovych, I., & Koval, S. (2021a). Institutional Aspects of Integrated Quality Assurance of Engineering Study Programs at HEI Using ICT. In: Ivanov V., Trojanowska J., Pavlenko I., Zajac J., Peraković D. (eds). *Advances in Design, Simulation and Manufacturing IV. DSMIE 2021. Lecture Notes in Mechanical Engineering*. Springer, Cham. https://doi.org/10.1007/978-3-030-77719-7_30
- Kobets, V., Liubchenko, V., Popovych, I., & Koval, S. (2021b). Institutional Aspects of Integrated Quality Assurance of Study Programs at HEI Using ICT. *CEUR Workshop Proceedings*, 2833, 83-92.
- Kozina, Z., Cretu, M., Safronov, D., Gryn, I., Shkrebti, Yu., Shepelenko, T., & Tanko, A. (2019). Dynamics of psychophysiological functions and indicators of physical and technical readiness in young football players aged 12-13 and 15-16 years during a 3-month training process. *Physiotherapy Quarterly*, 27(3), 20-27. <https://doi.org/10.5114/pq.2019.86464>
- Lazos, G. P. (2018). Resilience: conceptualization of concepts, review of modern research. *Current issues of psychology*, 3(14), 26-64.
- Leontyev, D. A. (2006). Test of life-meaningful orientations (LMO). Psychodiagnostic series. Moscow: Smysl.
- Leontiev, D. A., & Rasskazova, E. I. (2006). Hardiness-test. Moscow: Smysl.
- Maddi, S. R. (1994). Hardiness and Mental Health. *Journal of Personality Assessment*, 63(2), 265-274.
- Mamenko, P., Zinchenko, S., Kobets, V., Nosov, P., & Popovych I. (2022). Solution of the Problem of Optimizing Route with Using the Risk Criterion. In: Babichev, S., Lytvynenko, V. (eds). *Lecture Notes in Computational Intelligence and Decision Making. ISDMCI 2021. Lecture Notes on Data Engineering and Communications Technologies*, 77. Springer, Cham. https://doi.org/10.1007/978-3-030-82014-5_17
- Marques, M. C., Pereira, F., Marinho, D. A., Reis, M., Cretu, M., & Tillaar, R. V. (2011). A comparison of ball velocity in different kicking positions with dominant and non-dominant leg in junior soccer players. *Journal of Physical Education and Sport*, 11(2), 159-166.
- Morgan, P. (2016). Team Resilience in Competitive Sport. Doctoral thesis. Loughborough: Loughborough University.

- Nosov, P., Zinchenko, S., Ben, A., Prokopchuk, Y., Mamenko, P., Popovych, I., Moiseienko, V., & Kruglyj, D. (2021a). Navigation safety control system development through navigator action prediction by Data mining means. *Eastern-European Journal of Enterprise Technologies*, 2(9(110)), 55–68. DOI: 10.15587/1729-4061.2021.229237
- Nosov, P., Zinchenko, S., Plokhikh, V., Popovych, I., Prokopchuk, Y., Makarchuk, D., Mamenko, P., Moiseienko, V., & Ben, A. (2021b). Development and experimental study of analyzer to enhance maritime safety. *Eastern-European Journal of Enterprise Technologies*, 4(3(112)), 27–35. DOI: <https://doi.org/10.15587/1729-4061.2021.239093>
- Nosov, P., Zinchenko, S., Popovych, I., Safonov, M., Palamarchuk, I., & Blakh, V. (2020). Decision support during the vessel control at the time of negative manifestation of human factor. *CEUR Workshop Proceedings*, 2608, 12-26.
- Plokhikh, V. V. (2021). Assessment of subject's readiness for urgent actions using the variations of sensorimotor response tasks. *Insight: the psychological dimensions of society*, 5, 46-65. <http://doi.org/10.32999/2663-970X/2021-5-4>
- Popovych, I. S., Blynova, O. Ye., Bokshan, H. I., Nosov, P. S., Kovalchuk, Z. Ya., Piletska, L. S., & Berbentsev, V. I. (2019a). The Research of the Mental States of Expecting a Victory in Men Mini-football Teams. *Journal of Physical Education and Sport*, 19(4), 2343-2351. <https://doi.org/10.7752/jpes.2019.04355>
- Popovych, I., Blynova, O., Kuzikova, S., Shcherbak, T., Lappo, V., & Bilous, R. (2021a). Empirical research of vitality of representatives of parachuting and yoga practice: a comparative analysis. *Journal of Physical Education and Sport*, 21(1), 218-226. <https://doi.org/10.7752/jpes.2021.01029>
- Popovych, I., Blynova, O., Nass Álvarez, J. L., Nosov, P., & Zinchenko, S. (2021b). A historical dimension of the research on social expectations of an individual. *Revista Notas Históricas y Geográficas*, 27, 190-217.
- Popovych, I., Blynova, O., Nosov, P., Zinchenko, S., & Kononenko, O. (2021c). Psychological factors of competitiveness of the women's youth handball team. *Journal of Physical Education and Sport*, 21(1), 227-235. <https://doi.org/10.7752/jpes.2021.01030>
- Popovych, I., Blynova, O., Savchuk O., & Halian, I. (2020a). Self-efficacy of future athletes with different levels of psychological safety. *Journal of Physical Education and Sport*, 20(5), 2718-2724. <https://doi.org/10.7752/jpes.2020.05370>
- Popovych, I., Blynova, O., Savchuk, O., Zasenka, V., & Prokhorenko, L. (2020b). Expectations of a winning result in women's handball team: comparison of different age groups. *Journal of Physical Education and Sport*, 20(5), 2709-2717. <https://doi.org/10.7752/jpes.2020.05369>
- Popovych, I., Borysiuk, A., Semenov, O., Semenova, N., Serbin, I., & Reznikova, O. (2022a). Comparative analysis of the mental state of athletes for risk-taking in team sports. *Journal of Physical Education and Sport*, 22(4), 848-857. DOI: 10.7752/jpes.2022.04107
- Popovych, I., Hoi, N., Koval, I., Vorobel, M., Semenov, O., Semenova, N., & Hrys, A. (2022b). Strengthening of student youth's mental health using play sports. *Journal of Physical Education and Sport*, 22(6), 1384-1395. DOI: 10.7752/jpes.2022.06174
- Popovych, I., Kurova, A., Koval, I., Kazibekova, V., Maksymov, M., & Huzar, V. (2022bc). Interdependence of emotionality, anxiety, aggressiveness and subjective control in handball referees before the beginning of a game: a comparative analysis. *Journal of Physical Education and Sport*, 22(3), 680-689. DOI: 10.7752/jpes.2022.03085
- Popovych, I., Halian, I., O., Nosov, P., Zinchenko, S., & Panok, V. (2021d). Research on personality determinants of athlete's mental exhaustion during the ongoing COVID-19 pandemic. *Journal of Physical Education and Sport*, 21(4), 1769-1780. <https://doi.org/10.7752/jpes.2021.04224>
- Popovych, I., Halian, I., Pavliuk, M., Kononenko, A., Hrys, A., & Tkachuk, T. (2022cd). Emotional quotient in the structure of mental burnout of athletes. *Journal of Physical Education and Sport*, 22(2), 337-345. DOI: 10.7752/jpes.2022.02043
- Popovych, I., Pavliuk, M., Hrys, A., Sydorenko, O., Fedorenko, A., & Khanetska, T. (2021e). Pre-game expected mental states in men's mini-football teams: a comparative analysis. *Journal of Physical Education and Sport*, 21(2), 772-782. <https://doi.org/10.7752/jpes.2021.02096>
- Popovych, I. S. (2014a). Social expectations in primary school age. *Proceedings of the 2nd International Academic Congress "Fundamental Studies in America, Europe, Asia and Africa"*, 27 Sept. 2014. USA. Vol. II. New York, 176-180.
- Popovych, I. S. (2014b). Social expectations in theories of personality motivation. *Bulletin of the Perm University. Philosophy. Psychology. Sociology*, 4(20), 53-63.
- Popovych, I. S. (2014c). Typological features of expectations. *Scientific Bulletin of Kherson State University. Series: Psychological Sciences*, 1(2), 64-70.
- Popovych, I. S. (2017). Psychology of social expectations of personality. Extended abstract of Doctor's thesis. Severodonetsk: Volodymyr Dahl East-Ukrainian National University.

- Popovych, I., Shcherbak, T., Kuzikova, S., Blynova, O., Nosov, P., & Zinchenko, S. (2021f). Operationalization of tactical thinking of football players by main game roles. *Journal of Physical Education and Sport*, 21(5), 334, 2480–2491. <https://doi.org/10.7752/jpes.2021.05334>
- Popovych, I., Shevchenko, A., Galvez, L. M., Klenina, K. (2021g). Research of the relationship between social desirability and value orientations of adolescents. *Revista Notas Históricas y Geográficas*, 26, 241-268.
- Popovych, I., Semenov, O., Hrys, A., Aleksieieva, M., Pavliuk, M., & Semenova, N. (2022de). Research on mental states of weightlifters' self-regulation readiness for competitions. *Journal of Physical Education and Sport*, 22(5), 1134-1144. DOI: 10.7752/jpes.2022.05143
- Popovych, I. S., Zavatskyi, V. Yu., Geyko, Ie. V., Halian, O. I., Zavatskyi, Yu. A., & Radul, I. H. (2019b). Research on the Structure, Variables and Interdependence of the Factors of Tourists' Mental States of Expectation for Leisure in Ukraine. *Revista ESPACIOS*, 40(37), page 22.
- Popovych, I., Zavatskyi, V., Tsiuniak, O., Nosov, P., Zinchenko, S., Mateichuk, V., Zavatskyi, Yu., & Blynova, O. (2020c). Research on the Types of Pre-game Expectations in the Athletes of Sports Games. *Journal of Physical Education and Sport*, 20(1), 43-52. <https://doi.org/10.7752/jpes.2020.01006>
- Ruud, J. R., Den Hartigh, L., Rens A., et al., (2022). Resilience in sports: a multidisciplinary, dynamic, and personalized perspective. *International Review of Sport and Exercise Psychology*, <https://doi.org/10.1080/1750984X.2022.2039749>
- Salehi Nezhad, M. A., & Besharat, M. A. (2010). Relations of resilience and hardiness with sport achievement and mental health in a sample of athletes. *Procedia – Social and Behavioral Sciences*, 5, 757-763. <https://doi.org/10.1016/j.sbspro.2010.07.180>
- Sarkar, M., & Fletcher, D. (2014). Psychological resilience in sport performers: a review of stressors and protective factors. *Journal of Sports Sciences*, 32(15), 1419-1434. <https://doi.org/10.1080/02640414.2014.901551>
- Shalar, O., Huzar, V., Strykalenko, Y., Yuskiv, S., Homenko, V., & Novokshanova, A. (2019). Psychopedagogical aspects of interaction between personality traits and physical qualities of the young gymnasts of the variety and circus studio. *Journal of Physical Education and Sport*, 19(SI 6), 2283-2288. <http://dx.doi.org/10.7752/jpes.2019.s6344>
- Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *International journal of behavioral medicine*, 15(3), 194-200.
- Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: interdisciplinary perspectives. *European Journal of Psychotraumatology*, 5. <https://doi.org/10.3402/ejpt.v5.25338>
- Staude, V., & Radzyshevska, Y. (2021). Influence of massage and selective gymnastics on roentgenometric parameters of the spinopelvic sagittal balance in patients with sacroiliac joint dysfunction. *Journal of Physical Education and Sport*, 21(SI 6), 3236-3245. <https://doi.org/10.7752/jpes.2021.s6442>
- Westmattmann, D., Hossiep, R., Bruckes, M., & Schewe, G. (2021). Resilience in elite sport and at work – A comparative analysis among German elite athletes and employees. *Psychology of Sport and Exercise*, 57. <https://doi.org/10.1016/j.psychsport.2021.102042>
- Zinchenko, S., Moiseienko, V., Tovstokoryi, O., Nosov, P., & Popovych, I. (2021). Automatic Beam Aiming of the Laser Optical Reference System at the Center of Reflector to Improve the Accuracy and Reliability of Dynamic Positioning. In: Hu, Z., Petoukhov, S., Dychka, I., He, M. (eds). *Advances in Computer Science for Engineering and Education IV. ICCSEEA 2021. Lecture Notes on Data Engineering and Communications Technologies*, 83. Springer, Cham. https://doi.org/10.1007/978-3-030-80472-5_1
- Zinchenko S., Tovstokoryi O., Ben A., Nosov P., Popovych I., & Nahrybelnyi Y. (2022). Automatic Optimal Control of a Vessel with Redundant Structure of Executive Devices. In: Babichev S., Lytvynenko V. (eds). *Lecture Notes in Computational Intelligence and Decision Making. ISDMCI 2021. Lecture Notes on Data Engineering and Communications Technologies*, 77. Springer, Cham.
- Zinchenko, S., Tovstokoryi, O., Nosov, P., Popovych, I., Kobets, V., & Abramov, G. (2020). Mathematical Support of the Vessel Information and Risk Control Systems. *CEUR Workshop Proceedings*, 2805, 335-354.