sciendo

Physical Culture and Sport. Studies and Research, 2025, 111, 14–24
https://doi.org/10.2478/pcssr-2025-0026

OPEN ACCESS

The Structure of Psychological Immunity among Youth Team Sports Players

Authors' contribution:

A) conception and design of the study
B) acquisition of data
C) analysis and interpretation of data
D) manuscript preparation
E) obtaining funding

Zalán Négele[1A-D], Tamás Berki[1*A-D], Renátó Tóth[1D], Noémi Gyömbér[1CD], Júlia Pápai[1AD], Zsófia Tróznai[1B], Csaba Nyakas[1,2ABE], László Tóth[1A-E]

[1]*Hungarian University of Sports Science, Budapest, Hungary*
[2]*University of Groningen, Groningen, The Netherlands*

Received: 15.08.2024
Accepted: 07.04.2025

***Correspondence:** Tamás Berki; 1123, Alkotas street, 42-48, Hungary; email: berki.tamas@tf.hu

Abstract

The psychological immune system provides cognitive, emotional, and behavioral responses to stress and provides immunity to promote healthy development, which would be key in sports settings. Therefore, this study aims to investigate the psychological immunity system among adolescent team sports players. We aimed to explore the structure of the psychological immunity system to see how it is used. Furthermore, we examined the effects of training frequency as well as the differences between team sports. Our study included 338 team sports players (Mage = 12.60) of both genders (boys = 244; girls = 94). The players represented four team sports: basketball (95 players), handball (84 players), football (82 players), and ice hockey (77 players). Our self-administered questionnaire included sociodemographic and sports-related questions. The psychological immune system was measured using the Psychological Immune System Inventory Junior. After structural equation modeling, our study revealed that the psychological immunity model applies to team sports settings. However, Social Creating Capacity seems to weaken psychological immunity in this study. Furthermore, the correlation analysis revealed no significant connection between training frequency and psychological immunity. However, MANCOVA revealed significant differences among the team sports regarding the combined dependent variables while controlling for weekly training hours. This indicates, through follow-up ANCOVA, that ice hockey players who trained more reported higher levels of psychological immunity compared to athletes in other team sports. We believe that our study increases confidence in working with specific samples on psychological immunity, thereby enhancing our understanding of the psychology of sports.

Keywords: Sports participation, Disadvantaged Children, Slovakia

Introduction

In the competitive realm of adolescent sports, psychological resilience not only enhances performance (e.g., Fletcher & Sarkar, 2016; Galli & Gonzalez, 2015) but also contributes to the overall mental health and developmental success of young athletes (e.g., Bryan et al., 2019; Sarkar & Fletcher, 2014). Psychological resilience, often termed "ordinary magic" (Masten, 2001), involves the capacity to endure and adapt to adversities, a quality that can be nurtured in children through supportive environments, relationships, and safe exploration. Currently, the number of studies on resilience is rapidly increasing (Bicalho et al., 2020); it has been extensively studied in contexts ranging from high-risk children to survivors of severe trauma like childhood sexual abuse, bereavement, and

terrorism (Bonanno et al., 2007; Mancini & Bonanno, 2009). It is important to emphasize that resilience is not an exact psychological phenomenon, but rather a collective term for various traits and coping methods, whose study is also becoming increasingly popular in the field of sports psychology (Gupta & McCarthy, 2022). Coping is important for psychological resilience, since it involves strategies and behavior that can be used to manage and reduce stress (Skinner et al., 2003). Due to the multifaceted nature of resilience, there is much debate about its precise definition and conceptualization (Fletcher & Sarkar, 2013). According to Kaur and Som (2020), the psychological immune system encompasses resilience, which often shares similar characteristics, and understanding the conceptualization of resilience can be aided by the framework of the psychological immune system.

Psychological immunity was first discussed in detail by Oláh (1995), who described it as an integrated system of personality traits and coping mechanisms that shield an individual from the adverse effects of stress and anxiety. The Psychological Immune System (Oláh, 2005) is comprised of several interrelated components that include cognitive, emotional, and behavioral responses to stress and provide immunity to promote healthy development. According to Oláh (2005), these components can be broadly categorized into three subsystems (see Table 1.). The Approach-Belief Subsystem (ABS) focuses on how individuals perceive and evaluate their environment, fostering a mindset that anticipates positive outcomes and opportunities rather than threats. ABS includes positive thinking, sense of coherence, sense of control, sense of self-growth, change and challenge orientation, social monitoring, and goal orientation. The Monitoring-Creating-Executing Subsystem (MCES) involves the exploration and manipulation of one's surroundings to assert control and generate favorable conditions for personal growth and goal achievement. MCES contains creative Self-Concept, Problem Solving, Self-Efficacy, Social Mobilizing Capacity, and Social Creating Capacity. The Self-Regulation Subsystem (SRS) maintains Emotional Stability and ensures that the interactions between the other two subsystems are balanced and effective. Synchronicity, Impulse Control, Irritability Control, and Emotional Control belong to SRS. These subsystems operate in a dynamic and interactive manner, suggesting that psychological immunity is not merely a defensive mechanism but also a proactive system that enhances an individual's capacity to adapt and thrive in challenging environments (Oláh, 2005). Attaran et al. (2019) expanded on this by illustrating how such immunity could be specifically applied to educational settings, drawing parallels between the challenges faced by students in terms of performance pressure and expectations.

Table 1. Description of the subsystems of Psychological Immune System and their factors

Subsystem	Factor	Description
Approach-Belief Subsystem (ABS)	Positive Thinking	The tendency to maintain a positive outlook and anticipate positive outcomes.
	Sense of Coherence	A holistic perception of the world as comprehensible, manageable, and meaningful.
	Sense of Control	The belief in one's ability to influence events and outcomes in their environment.
	Sense of Self-Growth	The perception of continuous personal development and the ability to adapt.
	Change and Challenge Orientation	The orientation towards change and viewing challenges as opportunities for growth.
	Social Monitoring	The ability to monitor social environments and dynamics effectively.
	Goal Orientation	The capacity to set and pursue personal and professional goals with determination.
Monitoring-Creating-Executing Subsystem (MCES)	Creative Self-Concept	The ability to see oneself as a creative and innovative individual.
	Problem Solving	The skill to identify problems and develop effective solutions.
	Self-Efficacy	The belief in one's abilities to achieve goals and handle tasks successfully.
	Social Mobilizing Capacity	The ability to mobilize social resources and support networks.
	Social Creating Capacity	The capacity to create and foster social connections and relationships.

Subsystem	Factor	Description
Self-Regulation Subsystem (SRS)	Synchronicity	The ability to synchronize thoughts, emotions, and behaviors in a balanced manner.
	Impulse Control	The capacity to control impulses and delay gratification.
	Irritability Control	The ability to manage irritability and maintain calm under stress.
	Emotional Control	The skill to regulate and control emotional responses effectively.

Although the psychological relevance of the Psychological Immune System in sports has been scarcely explored, some promising research has been conducted in this area. Szabó (2011) concluded in his study that athletes (specifically kayakers) scored higher on the factors of Sense of Control, Social Creating Capacity, and Impulse Control compared to their non-athletic peers, while scoring lower on the Sense of Coherence scale. Oláh et al. (2012) reported on a larger study in which they longitudinally examined more than 1600 adolescent athletes, seeking to identify which psychological factors could predict a successful sports career. Their findings indicate that more talented adolescent athletes score higher on the following scales compared to their peers: Positive Thinking, Sense of Control, Sense of Coherence, Sense of Self-Growth, Problem Solving, Self-Efficacy, and Synchronicity. Consequently, they concluded that these athletes possess better coping skills in addition to their athletic talent, even at this stage of their career. Talented adolescent athletes are particularly characterized by a development- and solution-oriented attitude, internal motivation, and a sense of meaningfulness and coherence. These factors are related to the aspects of the Psychological Immune System highlighted by previous research in the context of adolescent athletes (Oláh et al., 2012). Besides these, other sports-related factors (e.g., training amount, types of sports) were not investigated before; therefore, this study aims to fill this gap.

This study seeks to explore the structure of psychological immunity among adolescent team sports players, aiming to add depth to the existing sports psychology literature by focusing on this specific, team sports. To investigate this structure, we would like to propose a structural model (Figure 1.) As an additional aim of this study, we want the see the differences of psychological immunity between the team sports and the effects of training frequency, since previous studies highlighted the importance of regular sport and physical activity on mental health and other aspects of their fitness (e.g., Berki & Pikó, 2018; Milner et al., 2017; Uvacsek et al., 2024); however, these factors were not investigated earlier. In alignment with the study's aims, we hypothesize the following:

1. The proposed construct of psychological immunity in this study is in line with the original model by Oláh (2005).
2. We hypothesize that the factors of psychological immunity (ABS, MCES, SRS) did not differ among team sports (handball, basketball, football, ice-hockey).
3. We hypothesize that training frequency, which could increase the factors of psychological immunity (ABS, MCES, SRS), did not differ among team sports (handball, basketball, football, ice-hockey).

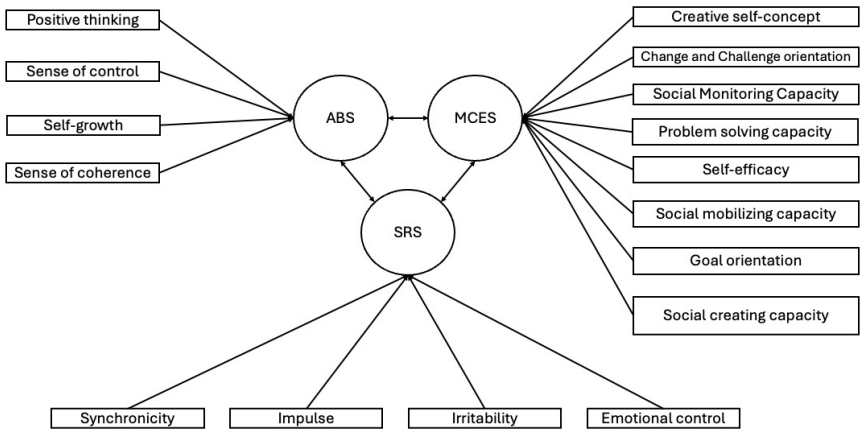

Figure 1. Hypothesized model and its associations of psychological immunity

Note. ABS = Approach-Belief Subsystem; MCES = Monitoring-Creating-Executing Subsystem; SRS = Self-Regulation Subsystem

Methods

Participants and Procedure

The study was conducted on a sample of 338 team sports players, including 244 boys and 94 girls. Their age range was between 8 and 18 years old, with an average age of 12.60 years (SD=2.56 years). On average, the players spent 6.86 hours per week in training, and they started training when they were around six years old (M=6.42 years; SD=2.18 years). 69% of the participants trained every day, and 56% of them competed at the national level. Additionally, 12% of the players were part of the national team. The team sports included in this study were basketball (95 players), handball (84 players), football (82 players), and ice hockey (77 players).

The data were collected between the 2022 and 2023 seasons. Initially, we reached out to 12 managers and coaches from Hungarian youth academies to take part in the study, and 7 of them agreed to participate. After receiving approval from the club managers, the athletes completed our survey on paper during their training sessions. Prior to data collection, all the students were briefed about the study and assured that their participation was voluntary and that no personal data, such as names, would be collected. The parents were also informed and provided consent for their children to take part in the study. Additionally, all participants signed a consent form. The study received ethical approval from the Institutional Review Board of the Hungarian University of Sport Sciences (Ethical Approval Number: MTSE-OKE-KEB/04/2023).

Measures

Socio-demographic and sport variables

Socio-demographic data was collected on the participants' age, gender, and sports background. They were asked about the team sports they participated in, the age at which they started training, and the amount of time they spent training each week (i.e., "How many hours do you spend training in a week?").

Psychological Immune System Inventory Junior

Psychological Immune System was measured by the "Psychological Immune System Inventory Junior," which was developed by Olah (2005); and then standardized for adolescents. The scale consisted of 48 items and the following 16 subscales: Positive Thinking, Sense of Control, Sense of Coherence, Creative Self-Concept, Sense of Self-Growth, Change and Challenge Orientation, Social Monitoring Capacity, Problem-Solving Capacity, Self-Efficacy, Social Mobilizing Capacity, Social Creation Capacity, Synchronicity, Goal Orientation, Impulse Control, Emotional Control, Irritability Control. All scales were answered in a four-point Likert Type scale where 1 means "does not describe me at all" and 4 means "describes me completely." The subscales were described earlier (Table 1.).

Statistical Analysis

Before our main analysis, Pearson correlation was conducted to examine the relationships between the study variables. Then, structural equation modeling (SEM) was used to see the structure of psychological immunity. The following fit indices were used to understand our results: Chi-square (x^2); relative Chi-square divided by the degree of freedom (CMIN/d.f); Root Mean Square Error of Approximation (RMSEA); Tucker-Lewis index (TLI); Comparative Fit Index (CFI); Standardized Root Mean Square Residual (SRMR). The acceptable ranges for fit indices are as follows: a non-significant chi-square (x^2) is preferred, though it is highly sensitive to sample size. Therefore, we also utilized CMIN/d.f., considering a value below 3 as indicative of an acceptable model. RMSEA values under 0.08 are deemed acceptable, and a TLI score above 0.90 is acceptable, with a score above 0.95 required for a good fit. A CFI value exceeding 0.90 is also considered acceptable, and an SRMR value below 0.08 suggests a good model fit (Hu & Bentler, 1999). Finally, we conducted a MANCOVA using teams' sports as groups and psychological immunity factors as dependent variables while controlling for training per week. Significant multivariate results were followed by ANOVA and ANCOVA with Tukey's post-hoc analysis, and the significant level of acceptance was 0.05. Finally, effect size was measured using the "Partial Eta squared" (ηp^2). The interpretation was the following: $\eta p^2 = 0.01$ indicated a small effect, $\eta p^2 = 0.06$ indicated a medium effect and $\eta p^2 = 0.14$ indicated a large effect (Cohen, 1988). All analyses were conducted via Jamovi 2.3 for Mac. Jamovi is an open-source statistical program that is freely available for everyone.

Results

Descriptive Statistics and Bivariate Relationships

Table 2 shows the characteristics of psychological immune variables. The highest value was observed for Sense of Self-growth (M=9.66) and the lowest for Social Creating Capacity (M=7.31). Most of the variables ranged between 9.66 and 8.22, except for Social Creating Capacity. The skewness and kurtosis values were within an acceptable range (-1.5, 1.5) for normal distributions (Forero, Maydeu-Olivares, & Gallardo-Pujol, 2009). The internal validity of the variables ranged between 0.69 and 0.83

Table 3 presents the correlations of the study variables. Weekly training per hour did not associate with any factors of psychological immunity. There were moderate correlations between the study variables regarding psychological immunity. However, Social Creating Capacity was only correlated with age (r=0.20), Positive Thinking (r=0.16), Problem Solving Capacity (r=0.24), and Social Mobilizing Capacity (r=0.17).

Table. 2. Descriptive statistics of the study variables.

Variable	Mean	SD	Median	Minimum	Maximum	Skewness	Kurtosis	CI95%	Cronbach's alpha
Positive Thinking	9.06	1.60	9.00	4	12	-0.69	0.95	8.88-9.23	0.72
Sense of Control	9.22	1.68	9.00	6	12	-0.52	0.18	9.04-9.40	0.77
Sense of Coherence	8.49	1.82	8.00	3	12	-0.04	-0.05	8.30-8.69	0.73
Sense of Self-growth	9.66	1.70	10.00	6	12	-0.73	0.21	9.48-9.84	0.78
Creative Self-concept	8.62	1.95	9.00	3	12	-0.31	-0.20	8.41-8.82	0.81
Change and Challenge orientation	9.36	1.66	9.00	4	12	-0.47	0.11	9.18-9.54	0.69
Social Monitoring Capacity	9.35	1.61	9.00	6	12	-0.54	0.55	9.17-9.52	0.77
Problem Solving Capacity	8.33	1.82	8.00	5	12	-0.13	-0.25	8.14-8.53	0.71
Self-efficacy	9.12	1.74	9.00	5	12	-0.39	-0.13	8.93-9.31	0.78
Social Mobilizing Capacity	8.93	1.58	9.00	4	12	-0.45	0.55	8.76-9.10	0.75
Social Creating Capacity	7.31	1.56	7.00	3	11	0.18	0.51	7.31-7.14	0.83
Goal Orientation	9.00	1.95	9.00	5	12	-0.39	-0.50	8.79-9.21	0.76
Synchronicity	8.21	1.87	8.00	3	12	-0.19	-0.09	8.01-8.41	0.80
Impulse	8.63	1.88	9.00	4	12	-0.54	0.39	8.43-8.83	0.78
Emotional control	8.58	2.03	9.00	3	12	-0.55	-0.23	8.58-8.36	0.79
Irritability	8.91	2.14	9.00	3	12	-0.54	-0.21	8.91-8.68	0.77

Note. CI95% = 95% Confidence Interval

Table 3. Bivariate correlations of the study variables

	1	2	3	3	5	6	7	8	9	10	11	12	13	14	15	16
1. Weekly training per hour	—															
2. Positive Thinking	0.04	—														
3. Sense of Control	0.06	0.37***	—													
4. Sense of Coherence	0.00	0.30***	0.20***	—												
5. Sense of Self-growth	-0.03	0.53***	0.48***	0.22***	—											
6. Creative Self-concept	0.06	0.48***	0.48***	0.27***	0.45***	—										
7. Change and Challenge orientation	0.02	0.41***	0.34***	0.32***	0.38***	0.34***	—									
8. Social Monitoring Capacity	-0.01	0.43***	0.38***	0.23***	0.37***	0.32***	0.34***	—								
9. Problem Solving Capacity	-0.03	0.37***	0.11*	0.29***	0.23***	0.31***	0.31***	0.33***	—							
10. Self-efficacy	0.07	0.45***	0.41***	0.20***	0.51***	0.52***	0.38***	0.34***	0.39***	—						
11. Social Mobilizing Capacity	-0.06	0.34***	0.33***	0.24***	0.39***	0.24***	0.38***	0.53***	0.36***	0.33***	—					
12. Social Creating Capacity	0.01	0.16**	-0.05	0.10	-0.08	0.08	0.10	0.15**	0.24***	-0.02	0.17**	—				
13. Goal Orientation	0.07	0.32***	0.38***	0.10	0.50***	0.31***	0.42***	0.32***	0.23***	0.47***	0.28***	-0.07	—			
14.Synchronicity	0.11	0.32***	0.34***	0.08	0.32***	0.21***	0.38***	0.28***	0.10	0.36***	0.19***	-0.10	0.51***	—		
15. Impulse	0.11	0.22***	0.32***	0.16**	0.28***	0.29***	0.23***	0.26***	0.13*	0.31***	0.25***	0.01	0.32***	0.34***	—	
16. Emotional control	0.03	0.29***	0.37***	0.11*	0.34***	0.42***	0.20***	0.26***	0.07	0.27***	0.16**	-0.05	0.25***	0.25***	0.36***	—
17. Irritability	0.00	0.26***	0.37***	0.10	0.37***	0.28***	0.25***	0.24***	0.05	0.26***	0.21***	-0.06	0.34***	0.34***	0.42***	0.52***

Note. * p < .05. ** p < .01. *** p < .001

Structural Analysis of Psychological Immunity

The structure of psychological immunity was tested using structural equation modeling. Initially, the hypothesized model was tested, but it did not fit our data adequately ($x^2(90) = 252.90$, p = 0.01; CMIN/d.f. = 2.81; CFI = 0.90; TLI = 0.87; SRMR = 0.06; RMSEA = 0.07). To improve the model, we removed the weakest path, which was the Social Creating Capacity (β=0.09). The modified model showed adequate fit ($x^2(90) = 195.60$, p = 0.01; CMIN/d.f. = 2.57; CFI = 0.93; TLI = 0.90; SRMR = 0.05; RMSEA = 0.06). However, we decided to keep Social Creating Capacity in our model and further analyzed the variables of different team sports (Table 4; Figure 2). The results showed that basketball had the strongest model, while handball was the weakest. We also analyzed our sample by excluding handball, and the model still showed adequate fit ($x^2(90) = 161.80$, p = 0.01; CMIN/d.f. = 1.79; CFI = 0.94; TLI = 0.93; SRMR = 0.05; RMSEA = 0.06).

Table 4. Model fit indices for the hypothesized models and modified versions.

Models	X^2	CMIN/DF	CFI	TLI	SRMS	RMSEA
Model 1. (Hip)	252.90	2.81	0.90	0.87	0.06	0.07
Model 2. (Mod)	195.60	2.57	0.93	0.90	0.05	0.06
Football	112.95	1.48	0.91	0.87	0.08	0.07
Handball	205.17	2.27	0.71	0.61	0.11	0.12
Ice Hockey	141.06	1.56	0.91	0.88	0.07	0.09
Basketball	100.50	1.11	0.98	0.97	0.06	0.06
Team sports (exep. Handball)	161.80	1.79	0.94	0.93	0.05	0.06

Note. Hip = Hypothesized model; Mod = Modified model

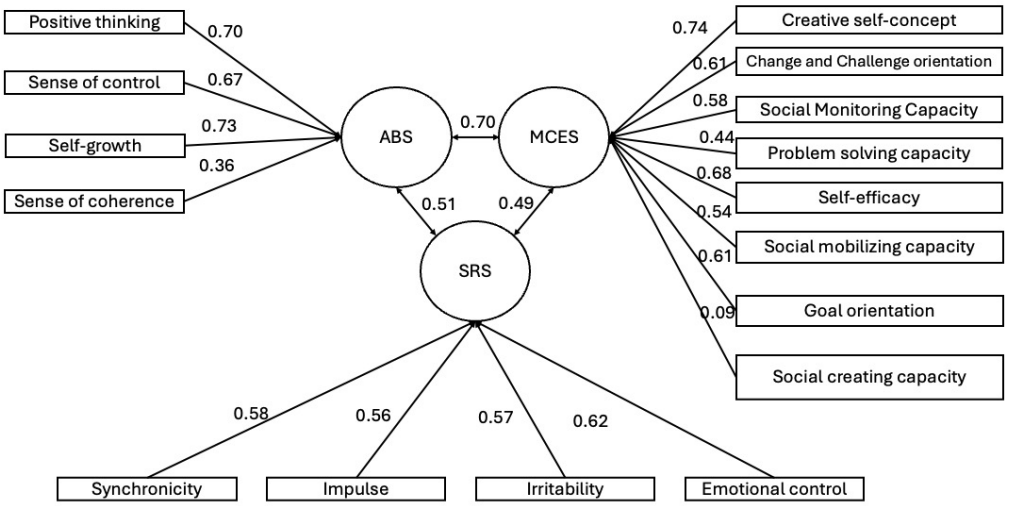

Figure 2. Result of Structural Equation modelling for psychological immunity

Note. ABS = Approach-Belief Subsystem; MCES = Monitoring-Creating-Executing Subsystem; SRS = Self-Regulation Subsystem

Group Difference Analysis

In the final step of our analysis, a multivariate analysis of covariance (MANCOVA) was used to investigate the impact of psychological immunity on the four types of team sports. MANCOVA showed significant differences between the team sports in the combined dependent variables while controlling for weekly training per hour (Wilk's $\Lambda = 0.88$, $F(9)=3.56$, $p=0.00$, $\eta p^2=0.16$). a further univariate test of covariance (ANCOVA) was conducted in this study. ABS was found to be significantly differentiated between team sports (Table 5). Tukey's post hoc comparison revealed that ice hockey was significantly higher than the other team sports ($p < .001$) and basketball was also significantly different from handball ($p < .05$). We found similar results if weekly training was left out of the model. MCES did not differentiate between the team sports. However, if weekly training was added to the model, ice hockey had a significantly higher level of MCES than football ($p < .05$) and handball ($p < .05$). Finally, SRS was analyzed. We only found differences if weekly training was added. Tukey's post hoc test showed that handball was significantly lower than ice hockey ($p < .05$) and basketball ($p < .05$). The effect size was low without adjusting for weekly training, but it was moderate in the case of ABS and MCES when controlled for weekly training.

Table 5. Univariate tests of the psychological immunity between team sport players

	Basketball (n=95)		Handball (n=84)		Football (n=82)		Ice Hockey (n=77)			
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	F - Test	ηp^2
ABS	36.83	0.48	35.04	0.45	35.91	0.46	37.97	0.68	5.67***	0.05
Adjusted for weekly training	36.96	0.54	34.83	0.61	36.50	0.55	39.26	0.60	9.20***	0.10
MCES	70.16	0.85	68.90	0.98	69.18	0.85	71.95	1.05	1.86	0.05
Adjusted for weekly training	70.66	0.97	68.22	1.08	69.90	0.97	73.79	1.07	4.74**	0.06
SRS	35.05	0.51	33.02	0.61	34.76	0.62	34.39	0.79	2.35	0.04
Adjusted for weekly training	35.40	0.69	32.53	0.78	35.20	0.70	35.44	0.77	3.41*	0.04

Note. * $p < .05$. ** $p < .01$. *** $p < .001$; ABS = Approach-Belief Subsystem; MCES = Monitoring-Creating-Executing Subsystem; SRS = Self-Regulation Subsystem

Discussion

The primary objective of this study was to investigate the psychological immunity structure among adolescent team sports players. To the best of our knowledge no previous studies had investigated this aspect. Moreover there are only a few studies that use Oláh's psychological immunity model in the sports context (Bóna, 2014; Szabó, 2011; Oláh et al., 2012). Additionally, we aimed to compare the psychological immunity between different team sports and examine the effects of training frequency. Our study revealed that the psychological immunity model is suitable for use, and it also turned out that basketball had the strongest model. Furthermore, the correlation analysis revealed no significant connection between training frequency and psychological immunity. However, psychological immunity varied among different team sports when controlled for weekly training frequency.

First, the structure of psychological immunity was tested. Our results were in line with our first hypothesis, and it showed that the model of psychological immunity constructed by Oláh (2005) is suitable for use in a team sports context. However, our results were different among the team sports. Basketball had the strongest model, meaning that the factors of psychological immunity were stronger than the players of basketball in our sample. The reasons for this could be that basketball players in our study may be utilizing the services of psychologists to enhance their performance, indicating a focus on mental aspects, or due to the inherent characteristics of basketball itself. The sports-specific academic background and principles can play an important role in the availability and structure of psychological support. Previous research has shown that basketball players tend to have better mental health compared to players of other sports, which could be attributed to the positive impact of good mental health on their ability to face challenges, make sound decisions, and

maintain a positive mindset during games (Pujari, 2018). Interestingly, our findings showed the weakest structure of psychological immunity in handball. There is a lack of research on the psychological aspects of handball; however, some studies suggest that a decrease in anxiety level could decrease coping and indicate better psychological immunity (Kovács & Nagy, 2016). Other studies primarily focus on cognitive aspects, which indicates that cognitive models may be more suitable for understanding the psychological aspects of handball (Vogel & Schack, 2023). In the context of psychological resilience among adolescent athletes, basketball players often show stronger psychological immune systems compared to handball players due to several factors. Basketball generally provides a supportive environment that fosters the emotional control and resilience crucial for psychological immunity. On the other hand, handball players might face different psychological pressures that are not as prevalent in basketball, potentially leading to weaker psychological resilience, as found in studies examining psychological profiling and injury susceptibility among female athletes in these sports (Shima et al., 2011). These environmental and sports-specific factors play significant roles in shaping the psychological characteristics of these athletes.

It is important to note that Social Creating Capacity was the lowest in all the models. Social creating capacity is a part of the monitoring-creating-executing subsystem and explains social connection and relationships. This result is particularly intriguing because sports have been shown to be an effective way to connect with peers and cultivate new relationships. Previous studies have indicated that sports support psychological immunity in schools and are linked to the academic, social, and emotional competence of students (McLaughlin et al., 1997; Bedard, 2020). Our findings suggest that these athletes may already possess strong social skills, and thus other aspects of psychological immunity might be more pivotal for them. However, it is also important to highlight that while sports can aid in forming relationships, this often means that teammates develop close bonds with each other but may lack connections outside of the team (e.g., with classmates). One reason for this is the specialized subcultural environment of elite sports, where the quantity of training and matches often leaves little time for adolescent athletes to connect with non-sporting peers. This is evident not only in their social circles but also in their choice of partners, as it is common to find relationships among athletes where both parties are elite athletes, mainly because they can better understand each other and adapt to the unconventional schedules associated with elite sports. Moreover, in elite adolescent athletes, the specialized and intense nature of their training environments can lead to significant stress and a high prevalence of burnout, which further affects their social relationships. The high demands of elite sports can monopolize time and focus, reducing opportunities for athletes to develop and maintain relationships outside of their sport. This can result in a less diverse social life compared to their non-athlete peers (Walton et al., 2022). Overall, the low Social-Creating Capacity of team athletes in Hungarian academies may indicate that they acquire atypical social relationship formation and maintenance skills due to the specialized environment of sports. However, further analysis is necessary to fully grasp this phenomenon.

After the structural analysis, team sports differences in psychological immunity were seen in this study. It turned that only ABS was differentiated in our results, which were inconsistent with our second hypotheses. However, when we controlled our results with weekly training, there were significant differences in all cases. Interestingly, weekly training frequency did not affect the factors of psychological immunity as it was expected in our third hypotheses, but it played an important role in the difference of team players. In all significant cases, ice hockey players had the highest of the three dimensions of psychological immunity, indicating that training for ice hockey players seems to have an important role. The reason behind this phenomenon is unknown, but previous studies focusing on ice hockey players found that training frequency enhances psychological skills and characteristics, and supports career development and performance (Pankow et al., 2021). Furthermore, training frequency enhances imagery use and movement imagery ability and helps to develop mental skills for performance (Hallman & Munroe-Chandler, 2009). ABS was also the highest for ice hockey players when it was not controlled with weekly training frequency. ABS includes feelings such as positive thinking or self-growth. Previous research shows that hockey players tend to have more self-confidence than athletic players, and they demonstrate favorable results in terms of sports self-confidence, especially among male athletes and those with more experience in the sport (Aygün & Öztaşyonar, 2019). Another reason for the highest ABS scores among ice hockey players could be that, compared to athletes in the other sports, a greater proportion of ice hockey players at academies are among the strongest in the country and have the highest potential to become professional athletes. This environmental factor can clearly influence positive thinking and self-growth.

The strength of this study lies in the applicability of Olah's (2005) structure in a team sports context. Notably, ice hockey players demonstrated stronger immunity compared to athletes in other team sports, and the frequency of weekly training also played a role in the differences observed among these sports. This phenomenon has not been investigated in previous research, and we believe it could contribute to a better understanding of the psy-

chological factors influencing sports performance. We hope our study will assist coaches and professionals in gaining insight into the mental aspects behind athletic performance.

However, our study also has some limitations. Firstly, generalizability is limited due to convenience sampling and the predominance of boys in the study. Additionally, the use of convenience sampling and self-administered scales are also study limitations. One major limitation is the lack of information regarding whether players sought psychological help, which could have impacted our results. Furthermore, our study did not address the impact of environmental aspects, such as academic processes and pressures, as well as the parental effects related to age differences. Other limitations were the low and moderate effect size in our multivariate analysis. However, further research is necessary to explore the potential effect of parental involvement and autonomy support. To address these limitations, our aim is to expand this study to include more variables. However, psychological immunity seems to be a relevant factor in the team sports environment.

Conclusion

In conclusion, our first hypothesis was confirmed, indicating that the concept of psychological immunity is applicable in team sports. However, our second hypothesis was not supported, as ice hockey players demonstrated stronger psychological immunity compared to players in other sports. Similarly, our third hypothesis was not confirmed, as training frequency alone did not show a direct correlation with psychological immunity, though it did reveal significant differences between team sports. These findings suggest that factors beyond training frequency, such as sport-specific demands or team dynamics, may play a more critical role in shaping psychological immunity.

We believe that our study offers valuable insights for sports coaches, researchers, and other professionals interested in exploring psychological immunity. By highlighting the nuances of psychological resilience across different team sports, this research provides a foundation for developing targeted interventions to strengthen mental resilience in athletes. We hope that this study instills confidence in working with specific samples on psychological immunity, thereby enhancing our understanding of the psychology of sports and contributing to the overall well-being and performance of athletes. Future research could further investigate the underlying mechanisms and sport-specific factors that influence psychological immunity, paving the way for more tailored approaches in sports psychology.

Ethics approval and informed consent

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethical Committee of the Hungarian University of Sports Science (Ethical number: MTSE-OKE-KEB/03/2023). Informed consent was signed by all participants prior to the survey. Furthermore, all participants' parents or legal guardians were informed, and they provided parental consent to allow their children to participate in this study.

Competing interests

The authors declare no competing interests.

Funding

The authors received no founding for this study.

Acknowledgments

Not applicable.

Reference

Attaran, A., Ghonsooly, B., Hosseini Fatemi, A., & Shahriari, H. (2019). Immunology of language learners: A social psychological perspective. *Interchange*, *50*(1), 57–76. https://doi.org/10.1007/s10780-018-9339-0

Aygün, M., & Öztaşyonar, Y. (2019). Buz hokeyi sporcularinin sportif sürekli kendine güven özelliklerinin incelenmesi. *Spormetre Beden Eğitimi Ve Spor Bilimleri Dergisi*, *17*(3), 202–212. https://doi.org/10.33689/spormetre.508266

Bedard, C., Hanna, S., & Cairney, J. (2020). A longitudinal study of sport participation and perceived social competence in youth. *Journal of Adolescent Health*, *66*(3), 352–359. https://doi.org/10.1016/j.jadohealth.2019.09.017

Berki, T., & Piko, B. (2018). The relationship of commitment to sports with sports habits and demographic factors among adolescent athletes. In. P. Hamar, K. Köpf, P. Hamar, & K. Köpf (Eds), *Movement–biology–sport–scienc*e, *47*, 170–180.

Bóna, K. (2014). An exploration of the psychological immune system in hungarian gymnast. Master Thesis, University of Jyväskylä. https://jyx.jyu.fi/bitstream/handle/123456789/44547/URN%3ANBN%3Afi%3Ajyu-201411063185.pdf?sequence=1

Bicalho, C. C. F., de 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), Article 3. https://doi.org/10.6018/cpd.391581

Bonanno, G. A., Galea, S., Bucciarelli, A., & Vlahov, D. (2007). What predicts psychological resilience after disaster? The role of demographics, resources, and life stress. *Journal of Consulting and Clinical Psychology*, *75*(5), 671–682. https://doi.org/10.1037/0022-006X.75.5.671

Bryan, C., O'Shea, D., & MacIntyre, T. (2019). Stressing the relevance of resilience: A systematic review of resilience across the domains of sport and work. *International Review of Sport*

and Exercise Psychology, *12*(1), 70–111. https://doi.org/10.1080/1750984X.2017.1381140

Cohen, J. A. (1988). *Statistical power analysis for the behavioral sciences*. Lawrence Erlbaum Associates.

Fletcher, D., & Sarkar, M. (2013). Psychological resilience: A review and critique of definitions, concepts, and theory. *European Psychologist*, *18*(1), 12–23. https://doi.org/10.1027/1016-9040/a000124

Fletcher, D., & Sarkar, M. (2016). Mental fortitude training: An evidence-based approach to developing psychological resilience for sustained success. *Journal of Sport Psychology in Action*, *7*(3), 135–157. https://doi.org/10.1080/21520704.2016.1255496

Forero, C. G., Maydeu-Olivares, A., & Gallardo-Pujol, D. (2009). Factor analysis with ordinal indicators: A monte carlo study comparing dwls and uls estimation. *Structural equation modeling*, *16*(4), 625–641.

Galli, N., & Gonzalez, S. P. (2015). Psychological resilience in sport: A review of the literature and implications for research and practice. *International Journal of Sport and Exercise Psychology*, *13*(3), 243–257. https://doi.org/10.1080/1612197X.2014.946947

Gupta, S., & McCarthy, P. J. (2022). The sporting resilience model: A systematic review of resilience in sport performers. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.1003053

Hallman, T. A. D., & Munroe-Chandler, K. J. (2009). An examination of ice hockey players' imagery use and movement imagery ability. *Journal of Imagery Research in Sport and Physical Activity*, *4*(1), Article 3. https://doi.org/10.2202/1932-0191.1040

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Kaur, T., & Som, R. R. (2020). The predictive role of resilience in psychological immunity: A theoretical review. *International Journal of Current Research and Review*, *12*(22), 139–143. https://doi.org/10.31782/IJCRR.2020.122231

Kovács, K., & Nagy, B. (2016). Coping and sport-motivation of adolescent Handballers in Debrecen. *Practice and Theory in Systems of Education*, *11*(3), 205–222. https://doi.org/10.1515/ptse-2016-0020

Mancini, A. D., & Bonanno, G. A. (2009). Predictors and parameters of resilience to loss: Toward an individual differences model. *Journal of Personality*, *77*(6), 1805–1832. https://doi.org/10.1111/j.1467-6494.2009.00601.x

Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist*, *56*(3), 227–238. https://doi.org/10.1037/0003-066X.56.3.227

McLaughlin, M. J., Leone, P. E., Meisel, S., & Henderson, K. (1997). Strengthen School and Community Capacity. *Journal of Emotional and Behavioral Disorders*, *5*(1), 15–23. https://doi.org/10.1177/106342669700500103

Milner, A., Badland, H., Kavanagh, A., & LaMontagne, A. D. (2017). Time Spent Commuting to Work and Mental Health: Evidence From 13 Waves of an Australian Cohort Study. *American Journal of Epidemiology*. https://doi.org/10.1093/AJE/KWW243

Oláh, A. (1995). *Anxiety, coping, and psychological immunity. PhD dissertation*. ELTE.

Oláh, A. (2005). *Emotions, coping and optimal experience*. Trefort Kiadó.

Oláh, A., Szabó, T., Mészáros, V., & Pápai, J. (2012). A sportolói tehetségek kiválasztásának és nevelésének lehetséges útjai (Ways of talent detection and development in sports). In T. Kurimay, V. Faludi, & R. Kárpáti, *A sport pszichológiája. Fejezetek a sportlélektan és határterületeiről I.* (pp. 17–60). Oriold és Társai Kft.

Pankow, K., Fraser, S. N., & Holt, N. L. (2020). A retrospective analysis of the development of psychological skills and characteristics among National Hockey League players. *International Journal of Sport and Exercise Psychology*, *19*(6), 988–1004. https://doi.org/10.1080/1612197X.2020.1827003

Pujari, H. (2018). Mental health among the athletes and non-athletes. *International Journal of Yoga, Physiotherapy and Physical Education*, *3*(1), 208–210.

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

Shima, Y., Kitaoka, K., Nakase, J., Goshima, K., Takahashi, R., Tsukagoshi, S., Yoneda, Y., Moriyama, S., Ogawa, Y., & Tsuchiya, H. (2011). Psychological profiling of young female handball and basketball players – a pilot study. *British Journal of Sports Medicine*, *45*(4), 372–373. https://doi.org/10.1136/bjsm.2011.084038.177

Skinner, E. A., Edge, K., Altman, J., & Sherwood, H. (2003). Searching for the structure of coping: A review and critique of category systems for classifying ways of coping. *Psychological bulletin*, *129*(2), 216–269. https://doi.org/10.1037/0033-2909.129.2.216

Szabó, A. (2011). Another possible way to Rio. *Journal of Human Sport and Exercise*, *7*(1), 17–23.

Uvacsek, M., Wágner, B., & Simkó, G. (2024). Sport and physical activity participation by weight groups in school-aged Hungarian children. *Applied Sciences*, *14*(15), 6575. https://doi.org/10.3390/app14156575

Vogel, L., & Schack, T. (2023). Cognitive representations of handball tactic actions in athletes: The function of expertise and age. *Plos One*, *18*(5), Article e0284941. https://doi.org/10.1371/journal.pone.0284941