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Executive Functions and Competitive Attitudes in Near-Elite Ice Hockey Players

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Abstract

Ice hockey is considered one of the most competitive sports, and it requires physical and mental preparation to perform appropriately under the pressure of a competitive environment. The present study aims to investigate the impact of competitive sports on executive functions such as emotion regulation, inhibitory control, working memory, and competitive attitudes among near-elite ice hockey players. Near-elite athletes have been gathered (N = 67) from the four Hungarian Ice-Hockey Academies. Our results indicated a small positive association between Canadian points and maladaptive emotion regulation and a slight positive correlation between maladaptive cognitive emotion regulation and false alarms of the N-back task. The result revealed a significant difference between National and Non-National Team members in maladaptive cognitive emotion regulation regarding hypercompetitive attitude. The result of linear regression revealed that maladaptive cognitive emotion regulation significantly predicts false alarms, indicating that the maladaptive cognitive emotion regulation explains 10% of the variance. In conclusion, we highlight the role of the environment, which affects executive functions and competitive attitudes alongside sports performance. Although the findings were mainly correlational, we can conclude that the nature of competitive ice hockey expects certain behavior for the players indifferent of the situation that could lead to emotion suppression, rumination and other maladaptive emotion regulation strategies. We can also conclude that inadequate emotion regulation might be related to the overstimulation of players, characterized by a hypersensitive state to stimuli. We suggest that practitioners ensure the development of adequate competitive attitudes of players to enable long-term physical and psychological benefits.

Keywords: inhibitory control, competitive attitudes, cognitive emotional regulation, near-elite ice hockey players

Introduction

The link between complex motor activation and cognitive performance enhancement has been explored on several occasions (Pesce et al., 2009; Formenti et al., 2021), although both processes can function as a starting point of the response circle. Enhanced performance is executed through higher-order cognitive processes such as executive functions. The term executive functions (EF) refers to the ability that elicits and maintains cognitive energy for appropriate problem-solving (Ropovik, 2014). Besides many other cognitive functions, EF is also responsible for delaying gratification (Rybanska et al., 2018), predicting consequences, and regulating emotions (Barkley, 2012). Although there is a lack of consensus in the literature regarding the categorization and definition

of EF, the most commonly used categorization is when cognitive processes are grouped into three major categories: inhibitory control, which refers to the ability to control or suppress impulses, distractions, or automatic responses, enabling focused and intentional actions; working memory, which refers to the capacity to temporarily hold and manipulate information, facilitating tasks like problem-solving, decision-making, and comprehension; cognitive flexibility, which refers to the mental agility to be able to adapt and switch between different tasks, ideas, or perspectives in response to changing circumstances. Self-regulation has been associated with enhanced sports performance through inhibitory control processes (Albuquerque et al., 2019). According to this definition, EF is the ability to sustain focused attention and energize mental approaches for solving problems effectively. It involves holding back for later rewards, foreseeing outcomes, and managing emotions. A recent meta-analysis revealed that athletes' reaction time for stop-signal tasks was shorter compared to non-athletes, and this result was mediated by age (Albaladejo-García et al., 2023), suggesting the beneficial impact of frequent engagement in a demanding environment on response suppression. Although some study results indicate inhibitory control enhancement in a sports context, a systematic review indicates that aerobic exercise intervention and resistance training show the least evidence of gain in working memory (Diamond & Ling, 2019).

Mental preparedness in sports involves essential cognitive processes, such as inhibitory control, working memory and emotion regulation (Koch & Krenn, 2021). By the nature of sports contexts, the level of competition as a trait of the athletes or the teams can decide the outcome of the competition (Brustad, 1988). However, the competition of comparable performances is best when the goal is improving through competition (Breitbach et al., 2014). Ice hockey is considered to be an open-skills sport, which means the competitive environment is continuously changing, requiring the players to adapt their skills to this environment. In many open-skills sports, besides the level of competition, executive functions gain significance as athletes compete mentally. This phenomenon affects the well-being of the athletes, possibly through resilience (Galli & Gonzalez, 2014). Considering sports teams as complex systems, the sum of the individual competition levels does not equal a team-level competitive trait, as in these systems non-linear processes emerge (Ramos-Villagrasa et al., 2018). Athletes are assumed to develop more context-relevant competitive skills compared to non-athletes, and competitive skills can predict how the athlete fits into the competitive sports environment (Beckmann & Elbe, 2015). A good fit in the sports environment results in effective and successful performance (Janelle & Hillman, 2003). An athlete's attitude is one of the most influential determinants in sports (Lorimer et al., 2011). Attitude is one's evaluation or feeling about a particular situation, group, person, or object, which is measured on a continuum from negative to positive, depending on various factors such as social norms, personal experiences, and cultural values. On the other hand, behavior is a person's actions, influenced by many factors such as environment, situations, personal experiences, beliefs, social norms, and, most valuable for us, attitudes. Behavior and attitude are closely related, but they are only sometimes consistent. The competitive attitude style is a psychological phenomenon that refers to an individual's beliefs and attitudes towards competitions or competitive situations. Individuals with a strong competitive attitude style are highly motivated by competitive challenges. They are more likely to view them as an opportunity to succeed rather than as improving self-esteem (Martinent & Ferrand, 2015). Research has found that athletes with a competitive attitude tend to have better sports performance outcomes, including greater enjoyment, higher self-esteem, and less anxiety (Martinent & Ferrand, 2015; Tamminen & Gaudreau, 2014).

In addition to these constructs, dual process theory and self-perception theory have been applied to the study of sports psychology. Dual process theory proposes that the following two cognitive systems function in human behavior: the intuitive system is automatic, fast, and unconscious, while the analytical system is deliberative, slow, and conscious (Evans, 2010). Athlete preparation is a complex process that aims at automatizing mental and physical methods, i.e., competitive developmental styles (Ryckman et al., 1996) and emotion regulation processes (Wagstaff, 2014) that require the knowledge of multiple experts, which explains why teamwork is frequently employed even in individual sports. (Reid et al., 2004). Although competitive attitudes fit well in competitive environments, being overly competitive in sports hinders performance, prohibiting teams from functioning correctly. By contrast, being insufficiently competitive in such an environment will likely result in underperformance.

Ice hockey is among the world's most highly competitive team sports. Various factors, including coaching, team dynamics, and individual player characteristics, influence the success of ice hockey national teams. Research has found that team cohesion, communication, and goal-setting contribute to the success of ice hockey teams (Carron et al., 2002). On the individual level, players perform at their best if the three factors of self-determination theory are present: autonomy, competence, and relatedness (Ryan & Deci, 2000). The level of autonomy in ice hockey depends on the relationship between the coach and the players. Some coaches prefer highly autonomous players, while others prefer players that rely on the team's tactics (Jakobsen, 2021). In this case, competence is related to the

players' fit in the competitive environment. Players who fit well achieve more in these environments, which is the basis of feeling competent. Relatedness is experienced as being a valued member of the ice hockey team (Amiot, Sansfaçon, and Louis, 2014).

Having a competitive attitude has also been identified as a factor affecting team sports performance. Athletes with a highly competitive attitude may be more motivated to perform well, but this can also lead to negative emotional experiences such as frustration and anger when performance is not optimal. In ice hockey, the highly competitive attitude is associated with increased aggression (Kavussanu & Roberts, 2001), which can negatively affect team dynamics and performance. It is a phenomenon to be avoided, as it means over-competition (Schields & Bredemeier, 2009). Therefore, competitive attitudes describe individuals having a compelling desire to compete and succeed (while avoiding losses) as a way to uphold or boost their self-esteem and self-worth. Competitive attitudes may help players master their chosen game positions. Regardless of the position played, all players are required to be competitive.

In ice hockey, forwards compete primarily to find and exploit opportunities to score, while defenders compete to extinguish their opponents' opportunities. Goalies are primarily competing against the opposing goalie. The competition is best if the skill discrepancy between the teams is minimal, though the difference can be huge in motor and technical skills or tactics between the teams. Besides attacker-defender interactions, ice hockey games offer situations for players with no attacker-defender roles, only neutral competing parties, in which pure competition emerges. One such example is when two opposing players compete for a loose puck, a situation in which both players want to gain possession of the puck. The outcome of the games is highly correlated with the competitive performance in these loose puck battles (Parnican et al., 2020). Although performance measures are frequently used in ice hockey, offering individual performance indicators (goals, assists, and plus-minus measures), a great performance indicator remains if the player is invited to play for the national team. In ice hockey, the national teams of countries compete in World Championships in U18, U20, and senior age groups. On the individual level, self-perception theory suggests that the athletes of an ice hockey team are likely to develop their attitudes and beliefs about their abilities based on their performance and feedback from coaches and teammates (Bem, 1972; Tamminen & Gaudreau, 2014). A player that fits well in the competitive environment is likely to be invited to join the national team. Therefore, the national team is likely to consist of the best-fitting players of a country. In order to become a member of the national team, competitive skills alone are insufficient to explain sports performance. Therefore, the executive functions of players are analyzed in the present study.

Ice hockey is a dynamic game that requires players to regulate their emotions, otherwise the opposing team can exploit them. Adaptive emotion regulation refers to the ability to effectively manage and respond to emotions in a healthy and constructive manner. It involves strategies that contribute positively to well-being, relationships, and overall psychological adjustment. Such strategies include expressing emotions appropriately, seeking support, and using positive coping mechanisms. Maladaptive emotion regulation refers to ineffective or harmful ways of managing and responding to emotions. These strategies can have negative consequences for mental health, relationships, and overall well-being. Athletes in high-pressure situations often employ cognitive emotion regulation strategies to manage their emotions. Maladaptive cognitive emotion regulation strategies are cognitive processes used to regulate ineffective or counterproductive emotions, leading to adverse outcomes. Maladaptive cognitive emotion regulation strategies include rumination, catastrophizing, and self-blame. These strategies are associated with higher levels of psychological distress and more inadequate mental health outcomes. Research has found that maladaptive cognitive emotion regulation strategies are associated with more unsatisfactory performance in sports, including ice hockey (Robazza et al., 2016). Players who channel their emotions to increase performance will likely fit better than those who are unable to do so (Feltz et al., 2008). Although regulating emotions is mostly beneficial for sports performance in the long term, unregulated emotions might energize the athlete, resulting in increased efficiency (Grandey, 2000).

Complex games like ice hockey require players to make fast and accurate decisions. Under the effect of strong emotional states, these decisions are likely to be far from optimal. Inappropriate emotional responses for different situations may result in being penalized by the game rules, causing penalty-kill situations for the team, in which the team is playing shorthanded, in a four-versus-five structure for two minutes. If the opponent scores during the two-minute penalty, the game returns to a five-versus-five structure.

A well-functioning competitive sports team is cooperative on the inside while competitive on the outside. Team sports are related to unique emotional experiences, affecting athletes' performance and well-being. Several studies have examined the role of dynamic regulation strategies in team sports and have identified the importance of adaptive regulation strategies for athletes' success (Gross & John, 2003). In ice hockey, studies have explored the relationship between emotional regulation and performance. For example, Robazza et al. (2016) found that maladaptive cognitive emotion regulation strategies

were negatively associated with sports performance in Italian ice hockey players. It was also found that learning emotion regulation is fostered by a caring climate in the team (Fry et al., 2012). A caring climate, therefore, supports the performance of the team in the long term through better emotion regulation and protecting talented players from being burnt out before their performance peak is reached, which is seen as a positive characteristic of well-performing teams.

In a caring climate, teaching interactions happen frequently and adaptive cognitive regulation strategies spread in the team; through this mechanism, the team functions at the highest possible level. Supported by a caring climate, multiple emotional regulation strategies might emerge in the same team, offering a more comprehensive coverage of adaptive strategies for the team. Cognitive and emotional regulation strategies are predominantly used by athletes just before and during competitions (Martinent et al., 2015). Researchers claim that these strategies can be automatized, and this automatization may create competitive edges for the athletes in a highly competitive environment. They identify two subcategories for cognitive and emotional regulation strategies: attention deployment strategies (e.g., increased concentration, avoiding overthinking, planning future actions) and cognitive change strategies (e.g., rational self-talk, positive self-talk, humor). It was found that athletes essentially use these strategies to manage their negative emotions, while many athletes manage positive emotions with no regulation or automated regulation strategies. As cognitive and emotional regulation is considered the dominant method of dealing with emotions during competition, and ice hockey is found to be among the top sports regarding competition levels, it is reasonable to analyze the emotional regulation skills of its players. Near-elite U21 players are still at an age when many practical emotion regulation strategies can be learned. Therefore, this paper offers practitioners suggestions on preparing athletes for elite-level competition.

Cognitive-emotional regulation strategies are subject to modification based on the positive or negative feedback the athlete experiences when using a particular strategy (Beattie et al., 2016). Individual performance measures (i.e., Canadian points, which consists of the goals and assists achieved in competitive games) are inherent objective feedback for performance, and coaches often use verbal feedback to enhance the performance of their teams. These studies suggest that emotional regulation strategies are essential to ice hockey performance and well-being. Furthermore, the relationship between competitive attitude and emotional regulation has been explored in team sports and ice hockey. For example, a study by Hanin & Stambulova (2002) found that athletes with a highly competitive attitude were more likely to use cognitive emotion regulation strategies such as self-talk to manage their emotions during competition. However, these strategies may be maladaptive if they lead to rumination or self-blame. Emotional regulation and a competitive attitude are essential in team sports and ice hockey. Maladaptive cognitive emotion regulation strategies have been discovered to have negative consequences for performance and well-being, and competitive attitudes can lead to adverse emotional situations. Therefore, it is vital that coaches and trainers educate athletes on adaptive emotional regulation strategies and monitor their emotional experiences to optimize performance and well-being in team sports and ice hockey.

The current research investigates the effect of expertise on athletes' psychological well-being through participating in competitive environments. Secondly, it focuses on the possible relationships between measurable competitive attitudes, cognitive emotional regulation, and the most frequently used individual performance indicators for players, i.e., Canadian points. Thirdly, the predictive value of cognitive emotion regulation on working memory and inhibitory control was examined. Identifying the competitive characteristics of near-elite ice hockey players can help practitioners to develop players who fit better in the increasingly competitive environment.

Method

The present research design is quasi-experimental, ex post facto. The quasi-independent variables are participation in the national team and maladaptive cognitive emotion regulation strategy, and the dependent variable is the competitive attitude style.

A statistical power analysis – G*Power (Faul et al., 2007; Faul et al., 2009) – was used to compute sample size. To detect an effect of η 2 p = 0.4 with 80% power in the two-way analysis of variance ANOVA (four groups, alpha = .05), G*Power suggests we would need 20 participants in each group (N = 80).

The present study sample consisted of 67 male ice-hockey players aged between 17 and 21 (M = 19.03, SD = 1.06). Participants were enlisted from four Hungarian Ice-Hockey Academies, and their experience ranged from 7 years to 17 years (M = 13.43, SD = 1.90). Players from the following academies participated: 19 players from "Budapest Jégkorong Akadémia" (28.4 %), 17 players from "DVTK Jegesmedvék" (25.4 %), 13 players from "Fehérvár Hockey Academy" (19.4 %), and 18 players from "Újpesti Jégkorong Akadémia" (26.9 %); 38 were forwards (56.7 %), 22 defencemen (32.8 %), and 7 goalies (10.4 %). Of the 67 players, 21 are members of the national team (31.3 %). The majority were Hungarian players (91 %), one player was Slovenian (1.5 %), two of them were Hungarian-Romanian (3 %), and 3 players were Hungarian-Serbian (4.5 %).

The form of the study consisted of three main parts: a sociodemographic section; The Competitive Attitude Scale (CAS) developed by Menesini et al. (2018); and The Cognitive Emotion Regulation Questionnaire (CERQ), initially developed by Garnefski et al. (2001), the Hungarian version translated and validated by Miklósi et al. (2011). The Cognitive Emotion Regulation Questionnaire (Garnefski et al., 2001) was administered to evaluate emotion regulation strategies. Participants gave their answers on a Likert scale ranging from 1 (almost never) to 5 (most of the time). The questionnaire comprises 36 items divided into two emotion regulation categories, adaptive and maladaptive strategies. Adaptive strategies ($\alpha = .65$) are compiled by the average scores of the following dimensions: acceptance (e.g., "I think I have to accept that this happened"), positive refocusing (e.g., "I think of nicer things than what I have experienced"), refocus on planning (e.g., "I think of what I can do best"), positive reappraisal (e. g. "I think I can learn something from the situation"), and putting into perspective (e.g., "I think that it all could have been much worse"). Maladaptive strategies ($\alpha = .64$) are compiled by the average scores of the following dimensions: self-blame (e.g., "I feel that I am the one to blame for it"), rumination (e.g., "I often think about how I feel about what I have experienced"), catastrophizing (e.g., "I continually think how horrible the situation has been"), and other-blame (e. g. "I feel that others are to blame for it").

The Competitive Attitude Scale (CAS) (Menesini et al., 2018) was used to measure two dimensions of player attitude. The first dimension is the Hyper-competitive attitude ($\alpha = .63$), constructed by the first 26 items (e.g., "Winning in competition makes me feel more powerful as a person"). The second dimension is the Developmental-Competitive Attitude ($\alpha = .70$), constructed by the second block (from item 27 to item 41). The following items were reversed: 3, 5,6,10,13,15,16,18,19,20,25,28,32,36. On a 5-point Likert scale, participants gave each statement a rating ranging from "Never true for me" to "Always true for me."

The N-back task is complex, measuring working memory-related processes such as inhibition and interference control. The task consists of a series of stimuli, and for each stimulus, participants have to decide if it is the same stimuli as N stimuli ago. In this experiment, a modified N-back task was used. Each stimulus is presented for 500 ms with a 2500 ms no stimuli period. Stimuli consisted of letters from A to T. Participants needed to respond to the letters two letters ago in this implementation. We measured the correctness of the response and the response time (Jaeggi et al., 2010).

The institution's ethical committee granted ethical permission for this study. The study was carried out under license number TE-KEB/20/2022. The four state-accredited Hungarian ice-hockey academies were contacted and informed about the objective of the study before consenting to participate. The aim of the study, the confidentiality of the findings, and the voluntary nature of participation were all explained.

Before the study started, participants signed an informed consent form and generated a unique code to maintain anonymity. Data was collected through Google Forms, under the surveillance of our team and the coaches of the respective teams. The individual performance statistics of athletes used in the analysis were Canadian points of the 2022/23 Hungarian U21 championship regular season obtained from the official website of the Hungarian Ice Hockey Federation. The data were gathered on March 15, 2023. The measurement included questionnaires on Google Forms and N-Back tasks running on computers. As multiple tests were used and the time allowed for measurement was limited, we conducted the measurement in a circular design, in which six players started with the computer tests. In comparison, another six players started with the CAS and CERQ scales and switched between them. The randomization allowed the measurement to take place in an acceptable time frame. Three researchers supervised the computer tests to ensure the players focused on the tasks, while the two other researchers supervised the CAS and CERQ tests. Although groups of six athletes were given the same task, the CAS, the CERQ, and the N-Back tasks were completed individually.

Results

A Pearson correlation coefficient was computed to assess the linear relationship between Canadian points, adaptive- and maladaptive cognitive emotion regulation strategy points, Hypercompetitive attitudes (HCA), and Personal Development Competitive attitudes.

There was a positive correlation between the Maladaptive Cognitive Emotion Regulation score and the Canadian points $r(62) = .3$, $p = .015$. Our results also indicate a statistically significant positive correlation between Hypercompetitive Attitude scores and Adaptive Cognitive Emotion regulation scores $r(65) = .25$, $p = .04$. Our results (Table 1) also revealed a significant correlation between Personal Development Competitive attitude scores and Canadian points $r(62) = .41$, $p = .001$. We also found a significant negative correlation between False alarm reaction time and Maladaptive emotion regulation strategies $r(67) = -.31$, $p = 0.1$. Pearson correlation revealed a significant association between subdimensions of Competitive Attitudes scale scores and Cognitive Emotion Regulation strategy scores; as a next step, we conducted variance analysis to explore the dynamics of National Team membership status regarding cognitive emotion regulation and competitive attitudes. Significant correlations

Table 1. Descriptive Statistics and Correlation for Study Variables

Variable	*n*	*M*	*SD*	1	2	3	4	5	6.
1. Canadian points	64	7.59	6.68	-					
2. Adaptive cognitive emotion regulation score	67	65.77	9.11	.03	-				
3. Maladaptive cognitive emotion regulation score	67	41.97	7.34	.3*	.09	-			
4. Hypercompetitive Attitude score	67	3.18	0.36	.15	.25*	.11	-		
5. Personal Development Competitive attitude score	67	3.52	0.41	.3*	.23	-.02	.41**	-	
6. N- back task False Alarm Reaction time	67	556.72	443.08	-.13.2	.2	-.31**	-.13	.6	-

* p< .05 **p< .01.

were found between regular season Canadian points and maladaptive cognitive emotion regulation and personal development competitive attitude scores. A 2x2 Factorial ANOVA was conducted to compare the main effects of participation in the national team and the interaction effect of the maladaptive cognitive emotion regulation strategy on competitive attitude style. The significance level of Levenes's Test of Equality of Error Variance was higher than .05, so we can conclude that we have not violated the homogeneity of variances assumption. A two-way analysis of variance was conducted on the influence of two independent variables (participation in the national team and maladaptive cognitive emotion regulation strategy) on the competitive attitude style.

The effect of participation in the national team was statistically significant on the .05 significance level (Table 2). N = 67. ANOVA = analysis of variance; G = group, National Team member, Non-National Team member; MCERS = Maladaptive cognitive emotion regulation strategy. The main effect for National Team members, Non-National Team members yielded an F ratio of F (1,67) = 4.58, p < .001, with a medium effect size, indicating a significant difference between Players in the National Team (M = 4.2, SD = .38) and Non-National Team members (M = 4.02, SD = .56). The main effect for Maladaptive cognitive emotion regulation strategy did not reach statistical significance. There was no significant interaction effect between the Maladaptive cognitive emotion regulation strategy and the National team membership. Our results indicate a difference between players on the National team and Non-National Team members regarding maladaptive cognitive emotion regulation strategies. National Team players' maladaptive Cognitive Emotion Regulation strategy score is higher than that of Non-National Team members, influencing Hypercompetitive Attitude. Considering our results, we conclude that Players in the National Team who score higher in the Hypercompetitive dimension are also most likely to use more maladaptive cognitive regulation strategies. A single linear regression was calculated to predict False alarm reaction time based on Maladaptive emotion regulation strategies. The regression result indicated that the variable explained 10% of the variance. A significant regression equation was found F(1, 65) = 7.12, p < .01., with R2 = .10. Our results indicate

Table 2. Means, Standard Deviations, and Two-way ANOVA for Groups as a Function of National Team Membership and Competitive Attitude Style

Variable		NTM		NNTM		ANOVA			
		M	*SD*	*M*	*SD*	Effect	*F* ratio	*df*	η^2
MCERS	Above average	3.15	.36	3.05	.407	G	4.58*	1	.68
	Below average	3.39	.35	2.87	.38	MCERS	.35	1	.001
						G x MCERS	2.11	1	.032

Note. N = 67. ANOVA = analysis of variance; NTM = National Team member; NNTM = Non- National Team member; G = group; MCERS = Maladaptive cognitive emotion regulation strategies. * p< .05

that Maladaptive emotion regulation strategies significantly predicted False alarm reaction time (β = -.31, p = .01).

Altogether, a small positive correlation was found between Canadian points and maladaptive emotion regulation. Our results also revealed a slight positive correlation between maladaptive cognitive emotion regulation and False alarms of the N-back task, and maladaptive cognitive emotion regulation scores significantly predicted False alarm reaction time. Higher hypercompetitive attitude style was associated with higher maladaptive cognitive emotion regulation.

Discussion

In the present study, we investigated the difference between Non-National and National Team athletes, considering the athletes' Canadian points and the following factors: maladaptive cognitive emotion regulation, competitive attitude style, inhibitory control, and working memory. Our results indicate a significant difference between players who are officially National Team members and Non-National Team members. Statistical test results revealed that National Team players scored higher in the maladaptive emotion regulation dimension.

Considering our results regarding the maladaptive emotion regulation strategies, the explanation of the difference between the two groups might be in the developmental aspect of emotion regulation. Emotion regulation is a skill that changes over time; this change appears in the intensity, behavioral aspect, and temporal context of the evoked emotions; older adults use maladaptive emotion regulation strategies less frequently compared to young adults (Schirda et al., 2016, Robazza et al., 2016). Nevertheless, emotion regulation strategies are also influenced by environmental context (Charles & Piazza, 2009).

Participation in the National Team might represent a highly demanding environment, where young players could feel the need to prove their suitability for team membership, which leads to frequently used maladaptive emotion regulation strategies. The impact of contextual influence and developmental aspects of emotion regulation might also explain the differences between the two groups regarding the hypercompetitive attitude style.

Regarding the results of National Team membership, athletes engage in the competitive environment in more maladaptive emotion regulation strategies, which enables higher performance but is disadvantageous for well-being. National Team athletes also had higher scores on the Hypercompetitive Attitude Subscale. The hypercompetitive scores might be higher in non-elite athletes due to a lack of self-regulation strategies, self-confidence, and many other factors (Robazza et al., 2016).

On the other hand, the research leads us to another result, in which athletes with higher hypercompetitive attitudes perform better in their hockey careers. Better performance has many influential factors that can explain this phenomenon. Jones et al. (2010) found that athletes with higher trait anxiety perform better in high-pressure situations than low-anxiety athletes. Further research should consider the relationship between the athlete's expertise and their state of anxiety. The correlation between maladaptive CER and HCA has been found to be significant. It can be explained by rumination, self-blame, blaming others, and catastrophizing (Hannin & Stambulova, 2002). Maladaptive CER strategies, most of the time, indicate poorer performance. On the other hand, these factors can also be seen as motivating factors. It is reasonable to inform practitioners that Hungarian near-elite ice hockey players require learning to adaptively regulate their emotions, as improving international ice hockey competition requires every possible method that enables increased performance. Maladaptive strategies might pay off in the short term (Wolgast & Lundh, 2017), while adaptive strategies also pay off in the short- and long-term. Research shows that sports performance can be influenced by both automatic and controlled cognitive processes (Hardy et al., 2010). Therefore, it is suggested that practitioners should emphasize players' adaptive cognitive and emotional regulation skills more thoroughly and automatize these strategies to enable a more active focus on the game.

The linear regression results revealed that Maladaptive emotion regulation predicts False alarm reaction time, suggesting a difficulty in differentiating between match and no-match stimuli. In the N-back task, False alarm refers to stimuli that are not matching for the target stimuli. These results indicate that maladaptive emotion regulation impacts False alarm reaction time, implying a hypersensitive response to any stimuli that appear and a weakness in inhibitory control and working memory. Our results are scaffolded by previous study results, underlining the developmental aspect of EF, also highlighting the influence of the contextual aspect of the environment on EF (Carlson, 2009).

Functional changes emerge during adolescence due to the maturation of particular brain regions. Brain developmental changes also differ due to different environmental impacts; a supportive environment promotes neurocognitive development and adaptive EF processing, which impacts working memory capacity and inhibitory control function (Huffman & Oshri, 2022). Sustained attention over an extended period is also considered a demanding aspect of the cognitive system that can decrease cognitive processing efficacy (Al-Shargie et al., 2019).

Considering the evidence from the literature and our results, we can conclude that maladaptive emotion regulation influences response sensitivity to any contextual changes, resulting in decreased cognitive processing, such as inhibitory control and limitation in working memory capacity. During developmental changes, adolescents

acquire strategies to respond to stimuli. External factors such as social support systems can influence the adequacy of coping strategies by considering developmental changes and offering a safe atmosphere.

Adolescent athletes are also considered at higher risk regarding psychological well-being because the environment is competitively demanding. Sports practitioners are suggested to emphasize the mental development of athletes, since, based on the results, athletes require learning adaptive emotion regulation strategies to be competitive at an international level and to ensure the psychological well-being that enables high performance.

There are a few limitations associated with the current research. First, the quasi-experimental design lacks a concluding causal association and hinders the generalization of the results. Another limitation comes from the materials that were used to measure the variables. The Competitive Attitude Scale (CAS) and Cognitive Emotion Regulation Questionnaire were self-reported. We should also consider the limitation of the N-back task; previously, an inaccuracy was reported in differentiating the results of several aspects of working memory (Miller, 2009). Therefore, further investigation of working memory tasks is needed, along with exploring possibilities of athletes learning adaptive emotion regulation strategies.

Although the current research did not focus on other highly competitive team sports such as handball or soccer, we presuppose that the dynamics of these variables are similar to the results of the current study, based on their similarity as invasion team sports (Lemmink and Frencken, 2013). Further investigations are needed to validate and explore the phenomena in more detail.

Conclusion

Ice hockey is considered one of the most competitive sports, in which emotional regulation and competitive attitude are essential. Fitting into this environment requires highly developed executive functions, such as cognitive emotional regulation, inhibitory control and working memory, along with an outstanding competitive attitude style. Maladaptive cognitive emotion regulation strategies have been discovered to have negative consequences for performance and well-being (Robazza et al., 2016), and competitive attitudes can lead to adverse emotional situations (Hanin & Stambulova, 2002). The small positive correlation between Canadian points and maladaptive emotion regulation suggests that the nature of the sport expects certain behavior for the players regardless of the situation or the context that could lead to emotion suppression, rumination, etc. A slight positive correlation between maladaptive cognitive emotion regulation and False alarms of the N-back task was found, suggesting that inadequate emotion regulation might be related to the overstimulation of the players, characterized by hypersensitive state to stimuli. Hypercompetitive attitude style is linked to higher maladaptive cognitive emotion regulation, which suggests that the environment of ice hockey promotes players who are highly competitive, and this level of competitive attitude is inherently maladaptive. These conclusions are based on correlations, and we do not know the cause-and-effect relationship.

It is vital for coaches and practitioners to equip athletes with adaptive emotional regulation strategies and to monitor their emotional experiences in order to optimize performance and well-being in team sports and ice hockey. It is suggested that sports practitioners emphasize the mental development of athletes, since, based on the results, athletes require learning adaptive emotion regulation strategies to be competitive at an international level and to ensure their psychological well-being, which enables high performance. Although competitive team sports such as ice hockey are traditionally characterized by high competition, it is inevitable that adjustments toward players being highly competitive are made and also that they are fair and respectful toward their opponents. It is the responsibility of sports practitioners to enable players to be not only competitive but also to become great sportsmen with an appropriate attitude towards competition.

Ethics approval and informed consent

Permission for this study was granted by the ethical committee of the funding institution. The study was carried out under license number TE-KEB/20/2022. The participants of the study gave informed consent for the current research.

Competing interests

The authors declare no conflicts of interest to disclose.

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