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Characteristics of mental toughness in young basketball players of different age groups

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ABSTRACT
Purpose. Assessing the development of skills that ensure personal mental toughness in adolescence is important because adolescents' increasing autonomy and socialisation during adolescence inevitably create the conditions for an increasing number of external stressors to emerge. Paradoxically, adolescents' confidence in their ability to cope with external stressors decreases during adolescence, which may lead to poorer sports performance in adolescent athletes. This study aimed to determine and analyse mental toughness skills in the cadet and junior age groups of young basketball players. Another aim was to reveal how general (total) mental toughness and age predict each athletic mental toughness skill.
Methods. This study surveyed 378 young basketball players using a two-stage cluster sampling approach. The Mental Toughness Questionnaire 48 (MTQ48) was chosen to assess general mental toughness skills. The Performance Inventory-Alternative (PPI-A) was chosen to assess athletic mental toughness skills.
Results. The study's results revealed that players in the junior age group scored significantly higher on challenge ($p < 0.001$; $d = -0.41$), commitment ($p < 0.001$; $d = -0.65$), emotional control ($p < 0.001$; $d = -0.76$), life control ($p = 0.02$; $d = -0.26$), overall control ($p < 0.001$; $d = -0.64$), self-confidence in one's abilities ($p < 0.001$; $d = -0.73$), self-confidence in interpersonal interactions ($p < 0.001$; $d = -0.50$), overall self-confidence ($p < 0.001$; $d = -0.73$), total mental toughness (MTQ-48) ($p < 0.001$; $d = -0.78$), determination ($p < 0.001$; $d = -0.47$) and visualisation ($p < 0.001$; $d = -0.81$). Significant correlations (r ranges from 0.12 to 0.37) were found between mental toughness skills and age groups for all scales mentioned above, except positive cognition and self-belief. Total mental toughness strongly predicted athletic mental toughness skills, but age did not predict determination and self-belief skills.
Conclusions. The findings of the present study suggest that promoting mental toughness can lead to improved athletic mental toughness indicators, emphasising its relevance for coaches, trainers, and sports psychologists in enhancing athletes' development and performance.
Key words: mental toughness skills, young athletes, basketball, age groups

Introduction

It is known that psychological factors typically determine success and achievements in sports [1, 2]. It has been claimed that at least 50% of success in sports is influenced by psychological factors related to mental processes [3]. There is increasing interest in the phenomenon of mental toughness to understand the possible causes of experienced failures in sports [4]. Mental toughness is one of the indicators that could help measure and monitor the sustainable development of athletes and assist in finding an equilibrium between the demands of competition, organisational objectives, and the athletes' mental well-being and resilience, ensuring their overall mental health [3, 5]. Mental toughness is defined as the athlete's ability to recover from failure, cope with external pressure, and overcome emerging difficulties [6]. Therefore, mental toughness is a term related to positive personal resources that are crucial in various achievement contexts [7]. Mental toughness reflects an effective mechanism for coping with stress as a response to stressors (e.g., evaluating stressful situations as opportunities for self-improvement). It also enables individuals to actively seek per-

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sonal growth opportunities driven by high self-confidence [8].

It has been stated that individuals with greater mental toughness are better able to set goals and are more inclined to reflect on the goal-pursuit process [9, 10], cope more effectively with external stressors in achieving their goals [7, 11], and experience less anxiety [12, 13]. It is also important to note that such psychological skills as mental toughness allow individuals to achieve success not only in the context of sports but also in other life areas [3]. While it is claimed that the sports environment and its characteristic features can contribute to the development of mental toughness, there remains a lack of empirically based information on the best practices for fostering and maintaining mental toughness [14].

Several attributes can be identified in the most recent definitions of mental toughness, including self-confidence and self-efficacy, emotion and attention regulation, optimism, and a goal-oriented mindset [15]. Therefore, mental toughness can be interpreted as a multidimensional skill consisting of a set of psychological abilities, where the components essentially relate to effective problem-solving in stressful situations [16]. One of the pioneers in discussing mental toughness was Loehr [17], who presented a concept of mental toughness exclusively focused on the sports domain and its associated achievements. It was the first concept that treated mental toughness as a complex of skills. In Loehr's theory, mental toughness is the ability to consistently pursue the highest level of talent and skills, regardless of competitive circumstances [18]. Despite its specificity and increasing popularity in the sports field, Loehr's concept was not considered reliable. Golby et al. [19] presented a reliable version of this concept, consisting of four main components of athletic mental toughness: determination, visualisation, positive cognition, and self-belief. The reliability of this four-component model was later confirmed by Gucciardi [20]. To measure the skills in Golby et al.'s athletic mental toughness skills model, they proposed an assessment tool called the Psychological Performance Inventory-Alternative (PPI-A) [19]. They validated the instrument's validity and reliability, stating that the PPI-A is suitable for scientific research.

According to various authors [3, 21], the research and practice of developing athletes' mental toughness should focus on the skills that determine mental toughness, enabling them to experience success in sports and in other contexts that contribute to their personal growth. Therefore, the scientific community is encouraged to explore other mental toughness skill models applicable to different contexts. Clough et al. [22] proposed one such model of mental toughness skills. They conceptualised the 4C model, which has become the most desirable conceptual framework for studying mental toughness in sports [23] and has recently gained popularity and application in other contexts [24]. The 4C model [22] is based on Kobasa's [25] model of psychological resilience. Indeed, Kobasa's resilience theory served as the foundation for the modern conceptualisation of mental toughness. However, Kobasa's conceptualisation of resilience differs from mental toughness in two aspects. Firstly, resilience is a broad construct encompassing multiple protective processes (e.g., biological and social factors) and cannot be directly measured, necessitating indirect conclusions in research [26]. Secondly, mental toughness is measured as a specific set of skills that are important for creating educational programs to enhance individuals' achievements in various contexts [7]. This concept led to the development of the 4C model [22].

The 4C conceptualisation [22] comprises three dimensions: control, commitment, and challenge. The fourth dimension, confidence, forms the uniqueness of the 4C model [22]. Two of the four dimensions of the 4C model (control and confidence) were expanded to reflect emotional and life control, self-confidence in one's abilities, and self-confidence in interpersonal interactions. In this conceptualisation, each dimension represents skills considered foundational for mental toughness and important in various life situations [22]. The authors of the 4C model also created the Mental Toughness Questionnaire 48 (MTQ48) [22], which measures the skills constituting the 4C model. Its validity and reliability have been confirmed in various life contexts, including sports [27–30]. It has been claimed that the MTQ48 is the most reliable instrument for measuring general mental toughness skills [31].

In summary, two main models of mental toughness skills currently dominate: the athletic mental toughness skills model [19], which is exclusively focused on the sports context and holds significant importance in that domain, and the 4C general mental toughness skills model [22], which serves as a conceptual foundation for mental toughness in various contexts. Behnke et al. [32] recommended conducting studies and implementing mental toughness training programs that combine the skills encompassed by both of these conceptual frameworks.

This study aims to fill specific existing gaps in the scientific research. It has been argued that the scientific community lacks evidence-based data on effective practices for developing mental toughness skills, which

would strengthen their methodological foundation and create effective training programs [33]. For example, most mental toughness research has focused on highly skilled adult athletes [3, 34–39], despite scientific data indicating a decrease in adolescents' belief in their ability to cope with external stressors at the age of 16 or 17 [40, 41]. Therefore, the significance of mental toughness skills during adolescence can be particularly important. Adolescence is a period of rapid physical growth and development, including changes in body composition, muscle strength, and cardiovascular fitness [41]. Physical fitness and overall health can directly impact mental toughness by providing a solid foundation for resilience: the ability to withstand physical and mental stressors [41]. In addition, mental toughness is vital for athletic performance since it enhances the ability to respond effectively to both positive and negative pressures, essentially regulating stress levels [42]. Therefore, a study on the expression of mental toughness skills in cadets (15–16 years old) and juniors (17–18 years old) is highly relevant during this transitional period.

Existing scientific studies examining mental toughness during adolescence [41, 43–45] selected specific adolescent age ranges and compared them with others [46–48]. Additionally, studies on mental toughness skills during adolescence only cover a specific and narrow range of skills, such as athletic mental toughness skills [3], which can be measured by the PPI-A or general mental toughness skills, which can be measured by the MTQ48 [49].

Considering the existing gaps in the scientific research, this study's main aim was to reveal the peculiarities of mental toughness skills in male basketball players in the cadet and junior age categories. Athletes of a team sport (basketball) were chosen because team athletes face more challenging mental conditions than individual athletes [50]. Specifically, managing relationships and emotions within a team setting requires higher levels of toughness to thrive and succeed [50]. The first hypothesis was that the mental toughness skills of young basketball players relate to their age. This assumption is based on the findings of a previous study [51] that reported a significant relationship between age and mental toughness. The second hypothesis was that junior basketball players would have stronger mental toughness skills than cadets. The assumption of differences in these age ranges is based on previous research showing that mental toughness generally increases with age [52]. Specifically, when studying footballers in these age groups, older adolescent footballers had higher levels of mental toughness than younger adolescent footballers [3, 53].

An additional aim was to reveal how general (total) mental toughness and age (sociodemographic factor) predict each athletic mental toughness skill (determination, visualisation, positive cognition, and self-belief). This additional aim was justified by the observed linear relationship between general mental toughness and the use of athletes' psychological skills in young athletes [36]. The third hypothesis was that age (sociodemographic factor) and general mental toughness possibly predict athletic mental toughness skills. The rationale for this hypothesis was based on previous studies that found self-talk, emotional control, and relaxation strategies were significantly positively correlated with mental toughness in both practice and competition [36] and that age was a significant predictor of athletic (sports) mental toughness [54].

Material and methods

Study design and procedure

A cross-sectional study design was chosen to achieve the objectives of this study [55]. Based on the most recent data obtained from the roster of Lithuanian basketball sports schools during the research period, there were a total of 1401 cadets and 1546 juniors actively participating in basketball sports, resulting in a combined count of 2947 young athletes [56].

This study surveyed 378 young basketball players using a two-stage cluster sampling approach. Initially, the necessary number of basketball schools was randomly chosen from among 57 sports schools (the first stage). Then, all male cadet and junior players from the selected basketball schools participated in the study (second stage). The study was conducted in nine Lithuanian basketball sports schools. The teams of all basketball players involved in this study competed in the same elite Lithuanian Schoolchildren Basketball League during the study period. With only a month since the start of the season and only a few matches played, it was fair to say that all teams were in similar start positions according to their season achievements during the study. In order to ensure the homogeneity of the teams of athletes tested, the questionnaires were administered during the season (two months after its start), attempting to avoid administering questionnaires during high-stress periods, such as the playoffs or important competitions, which can impact athletes' perceptions of their mental toughness.

The surveys were conducted before the young basketball players' training sessions, with the participation of their coaches. The confidentiality and anonymity

of the research data were ensured during this study, and the questionnaires it used did not require any personal information that could identify the participants. This study received approval from the university's Ethics Committee. If the basketball player was a junior, informed consent was delivered to the athlete. If the basketball player was a minor, informed consent was asked to the parents, and the athlete had to agree to participate as well. Additionally, permissions were obtained from the administrations of the respective sports schools where this study was conducted. The survey included information about the ongoing study, a statement regarding personal consent to participate in the research, demographic questions (regarding the participants' age), and two validated instruments for measuring mental toughness indicators used in Lithuania.

Participants

The study sample comprised 177 cadet basketball players aged 15–16 (46.8%) and 201 junior basketball players aged 17–18 (53.2%). Inclusion criteria were as follows: 15–18 years old, male, playing basketball. Exclusion criteria: refusal to give informed consent, incomplete answer sheet. The age groups did not differ significantly in size (χ^2 [df = 1] = 1.52, p > 0.05), indicating that their disparate sizes should not significantly affect the results. Therefore, 378 young basketball players participated in this study. All participants were male, and their average age was 16.36 ± 1.15 years.

General mental toughness skills

The MTQ48 [22] was chosen to assess general mental toughness skills. This questionnaire comprises 48 statements and has four scales, two of which have two additional subscales. The challenge scale includes nine questionnaire statements, while the commitment scale includes 10 questionnaire statements. The control scale comprises two additional subscales: life control, which includes seven questionnaire statements, and emotional control, which also includes seven questionnaire statements. The self-confidence scale also comprises two additional subscales: self-confidence in interpersonal interactions, which includes six questionnaire statements, and self-confidence in one's abilities, which includes nine questionnaire statements. Additionally, a composite indicator called total mental toughness is calculated. Each questionnaire statement is rated on a five-point Likert scale: 1, strongly disagree; 2, disagree; 3, neither agree nor disagree; 4, agree; 5, strongly agree [22]. This questionnaire has been adapted for use in Lithuania in the sample of cadet and junior athlete groups (aged 15–16 and 17–18 years, respectively) [57]. The consistency of the questionnaire (Cronbach's α coefficient = 0.79) and its subscales (Cronbach's α = 0.76–0.82) was satisfactory. Comparisons were made between the overall MTQ48 scores to examine the external validity of its Lithuanian version. The results revealed no significant mean difference and a small effect size (Cohen's d = 0.08) between the questionnaire's English and Lithuanian versions, confirming its validity [57]. In this study, the following acceptable internal consistency values were determined for the scales in the overall study sample (Cronbach's α): challenge = 0.62, commitment = 0.62, life control = 0.60, emotional control = 0.60, overall control = 0.67, self-confidence in interpersonal interactions = 0.69, self-confidence in one's abilities = 0.60, overall self-confidence = 0.63, and total MTQ48 = 0.82.

Athletic mental toughness skills

The PPI-A [19] was chosen to assess athletic mental toughness skills. The alternative version of the PPI-A questionnaire comprises 14 statements. This questionnaire has four scales. The determination scale includes three questionnaire statements, the visualisation scale includes four questionnaire statements, the positive cognition scale includes four statements, and the self-belief scale includes three questionnaire statements. Each questionnaire statement is rated on a five-point Likert scale: 1, almost never; 2, rarely; 3, sometimes; 4, often; 5, almost always [19, 20]. The Lithuanian version of the PPI-A has been adapted and validated for young athletes [58], and its internal consistency is satisfactory (Cronbach's alpha of the questionnaire scales ranged from 0.69 to 0.83) [58]. Factor analysis of the PPI-A revealed a four-factor solution that completely agreed with those identified by the authors of the original scale version, and distinguishing the four factors (scales) similar to those of the original scale version was interpreted as an indication of the instrument's construct validity [58]. In this study, the following internal consistency values were determined for the scales in the overall study sample (Cronbach's α): determination = 0.84, visualisation = 0.75, positive cognition = 0.75, and self-belief = 0.82.

Statistical data analysis

Data analysis was conducted using the IBM SPSS Statistics 28.0 software. The normality of the variables

was assessed using skewness and kurtosis, and all values fell within the acceptable range of –2 to 2 (Table 1). Various calculations were conducted on the study variables, including means, standard deviations, mean differences (Ds), and Pearson's *r* correlations. Student's *t*-test was used to assess the equality of means between independent samples. Two hierarchical (stepwise) regression analyses were conducted to examine the predictive relationship between general (total) mental toughness and age on each athletic mental toughness skill (determination, visualisation, positive cognition, and self-belief). In the regression analysis, the first step included only total mental toughness as a predictor, while the second step included both total mental toughness and age as predictors. The reliability of the questionnaire scales used in this study was evaluated and confirmed by calculating the Cronbach's alpha coefficient. Cohen's *d* was used to assess the effect size in this study. Pearson's r was interpreted in as: 0.00–0.09 = trivial, 0.10–0.29 = small, 0.30–0.49 = moderate, 0.50–0.69 = large, and 0.70–0.89 = very large. Cohen's *d* effect sizes are categorised as: 0.00–0.19 = trivial, 0.20–0.49 = small, 0.50–0.79 = moderate, 0.80–1.19 = large, and ≥ 1.20 = very large.

Results

The independent samples *t*-test was used to compare the mental toughness indicators between the cadet and junior age categories of the basketball players (Table 1).

The statistical analysis of the collected research data revealed that junior basketball players had higher scores in all measured skill scales than cadet players. The effect size (Cohen's *d*) ranged from small (–0.11) to medium (–0.78). In addition, junior basketball players had higher scores (effect sizes range from small to moderate) in general mental toughness skills than cadet players: challenge ($D = 0.17$; $p < 0.001$), commitment ($D = 0.24$; $p < 0.001$), emotional control ($D = 0.31$; $p < 0.001$), life control ($D = 0.10$; $p = 0.02$), overall control ($D = 0.20$; $p < 0.001$), self-confidence in one's abilities ($D = 0.40$; $p < 0.001$), self-confidence in interpersonal interactions ($D = 0.19$; $p < 0.001$), overall self-confidence ($D = 0.29$; $p < 0.001$), and total mental toughness (MTQ-48) ($D = 0.23$; $p < 0.001$). Moreover, junior basketball players had higher scores in athletic mental toughness skills than cadet players: determination ($D = 1.10$; $p < 0.001$), and visualisation ($D = 2.37$; $p < 0.001$). The athletic mental toughness skills of positive cognition and self-belief did not differ significantly between the junior and cadet basketball players.

Pearson's correlation coefficient was calculated to assess correlations between the two questionnaires on mental toughness and the age of the athletes (Table 2). The strongest (moderate) positive correlations were observed between age and visualisation, total mental toughness (MTQ48), emotional control, overall self-confidence, and self-confidence in one's abilities. No negative correlations were observed between the study variables.

A regression analysis with determination skills as the dependent variable and considering only total mental toughness as the predictor showed a significant impact ($F_{(1,376)} = 397.20$, $p < 0.01$; $R^2 = 0.51$; Table 3). Adding age in Step 2 did not significantly increase

Table 1. Comparison of U16 and U18 players' mental toughness skills

	Cadets ($N = 177$)	Juniors ($N = 201$)	*t*-value	*p*-value	Cohen's *d*
Challenge	3.55 ± 0.49	3.72 ± 0.32	–4.01	< 0.001**	–0.41 small
Commitment	3.35 ± 0.41	3.59 ± 0.32	–6.39	< 0.001**	–0.65 mod.
Emotional control	3.14 ± 0.37	3.45 ± 0.44	–7.31	< 0.001**	–0.76 mod.
Life control	3.24 ± 0.41	3.34 ± 0.37	–2.38	0.020*	–0.26 small
Overall control	3.19 ± 0.30	3.39 ± 0.32	–6.34	< 0.001**	–0.64 mod.
Self-confidence in one's abilities	3.30 ± 0.57	3.70 ± 0.52	–7.14	< 0.001**	–0.73 mod.
Self-confidence in interpersonal interactions	3.24 ± 0.40	3.43 ± 0.36	–4.83	< 0.001**	–0.50 mod.
Overall self-confidence	3.27 ± 0.40	3.56 ± 0.39	–7.22	< 0.001**	–0.73 mod.
Total MTQ48	3.34 ± 0.32	3.57 ± 0.27	–7.48	< 0.001**	–0.78 mod.
Determination	11.69 ± 2.64	12.79 ± 2.01	–4.57	< 0.001**	–0.47 small
Visualisation	13.47 ± 3.07	15.84 ± 2.80	–7.83	< 0.001**	–0.81 large
Positive cognition	15.07 ± 2.85	15.35 ± 2.08	–1.12	0.260	–0.11 trivial
Self-belief	10.27 ± 2.70	10.38 ± 2.37	–0.45	0.650	–0.04 trivial

Total MTQ48 – total mental toughness, mod. – moderate effect size, * $p < 0.05$, ** $p < 0.001$

Table 2. Study variables' Pearson's correlation coefficients, skewness, and kurtosis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Challenge	1													
2. Commitment	0.536**	1												
3. Emotional control	0.307**	0.536**	1											
4. Life control	0.622**	0.228**	0.229**	1										
5. Overall control	0.581**	0.497**	0.810**	0.756**	1									
6. Self-confidence in one's abilities	0.445**	0.739**	0.670**	0.243**	0.597**	1								
7. Self-confidence in interpersonal interactions	0.207**	0.467**	0.375**	0.077	0.299**	0.497**	1							
8. Overall self-confidence	0.401**	0.723**	0.634**	0.202**	0.548**	0.917**	0.803**	1						
9. Total MTQ48	0.779**	0.853**	0.688**	0.539**	0.787**	0.835**	0.557**	0.831**	1					
10. Determination	0.623**	0.628**	0.391**	0.363**	0.481**	0.617**	0.340**	0.581**	0.717**	1				
11. Visualisation	0.380**	0.713**	0.630**	0.207**	0.549**	0.780**	0.421**	0.730**	0.730**	0.611**	1			
12. Positive cognition	0.616**	0.607**	0.358**	0.358**	0.456**	0.516**	0.307**	0.496**	0.673**	0.696**	0.552**	1		
13. Self-belief	0.288**	0.270**	0.108*	0.227**	0.209**	0.192**	0.098	0.177**	0.291**	0.343**	0.186**	0.432**	1	
14. Age	0.202**	0.313**	0.353**	0.122*	0.311**	0.345**	0.242**	0.349**	0.360**	0.230**	0.374**	0.058	0.023	1
Skewness	0.007	–0.180	–0.214	0.708	–0.380	–0.423	–0.119	0.001	–0.367	–0.885	–0.422	–0.669	–0.148	0.004

* $p < 0.05$, ** $p < 0.001$

Table 3. Hierarchical regression results for athletic mental toughness indicators (determination, visualisation, positive cognition, and self-belief)

Step	Dependent variable	Predictor variable(s)	R^2	R^2 change	F change	df_1, df_2	β
1	Determination	Total mental toughness	0.51	0.5100	397.20**	1, 376	0.717**
2		Total mental toughness	0.51	0.0003	0.02	1, 375	0.719**
		Age					–0.006
1	Visualisation	Total mental toughness	0.53	0.5300	429.72**	1, 376	0.730**
2		Total mental toughness	0.54	0.0100	9.15	1, 375	0.691**
		Age					0.113**
1	Positive cognition	Total mental toughness	0.45	0.4500	311.65**	1, 376	0.673**
2		Total mental toughness	0.48	0.0300	22.60*	1, 375	0.739**
		Age					–0.188**
1	Self-belief	Total mental toughness	0.09	0.0850	34.79**	1, 376	0.291**
2		Total mental toughness	0.09	0.0050	2.16	1, 375	0.318**
		Age					–0.077

* $p < 0.05$, ** $p < 0.001$, R^2 – coefficient of determination, R^2 change – proportion of variance in the dependent variable that can be uniquely attributed to the independent variables of interest, F change – an F change is a test based on F-test used to determine the significance of an R square change, β – regression coefficient for standardised data, df – degrees of freedom

the variance explained (R^2 change = 0.0003; $F_{(1,375)}$ = 0.022, p = 0.883), suggesting that age did not contribute significantly to predicting the dependent variable (determination).

A regression analysis model with visualisation as the dependent variable (Table 3), considering only total mental toughness as a predictor disclosed a significant effect (R^2 = 0.53, $F_{(1,376)}$ = 429.72, $p < 0.001$). Adding age (in Step 2) significantly increased the variance explained (R^2 change = 0.01; $F_{(1,375)}$ = 9.15, p = 0.003), suggesting that age contributes significantly to visualisation. The explanatory power of the overall regression model was found to be about 54% (R^2adj = 0.54), an effect-size that can be interpreted as large.

A regression analysis model with positive cognition as the dependent variable, considering only total mental toughness as a predictor disclosed a significant effect (R^2 = 0.45; $F_{(1,376)}$ = 311.65, $p < 0.001$). Adding age in Step 2 significantly increased the variance explained (R^2 change = 0.03; $F_{(1,375)}$ = 22.60, $p < 0.001$), suggesting that age contributes significantly to predicting positive cognition. The explanatory power of the overall

regression model was found to be 48% (R^2adj = 0.48), an effect-size that can be interpreted as large.

For the fourth regression analysis with self-belief as the dependent variable, considering only total mental toughness as a predictor, showed a significant impact (R^2 = 0.09, $F_{(1,376)}$ = 34.79, p < 0.001). Adding age in Step 2 did not significantly increase the variance explained (R^2 change = 0.005; $F_{(1,375)}$ = 2.16, p = 0.143), suggesting that age does not contribute significantly to predicting self-belief.

Discussion

This study aimed to determine and analyse mental toughness skills in the cadet and junior age groups of young basketball players, and to reveal how general (total) mental toughness and age predict each athletic mental toughness skill. The results showed that the junior players presented higher levels of both the general and athletic mental toughness skills than the cadets. It was also discovered that general (total) mental toughness significantly predicts the athletic mental toughness skills, whereas age does not serve as a predictor for the determination and self-belief skills.

The hypothesis that junior basketball players would have stronger mental toughness skills was confirmed. This study revealed that junior athletes had higher levels of general mental toughness indicators and two athletic mental toughness indicators (determination and visualisation) than cadet athletes. These findings are consistent with other studies conducted by different authors. Benítez-Sillero et al. [3] examined the mental toughness skills of adolescent soccer players in different age categories. They revealed that junior soccer players had higher levels of overall self-confidence (effect size was moderate; d = –0.50) and visualisation (effect size was small; d = –0.31) skills than cadet soccer players [3]. Another study by a different author [59] explored the level of mental toughness skills among adolescent basketball players. It revealed that junior basketball players had higher levels of emotional control (effect size was trivial; d = 0.08) and overall self-confidence (effect size was small; d = 0.22) skills than cadet basketball players [59]. Csáki et al. [60] investigated the mental toughness outcomes of elite soccer players from different age categories, finding that junior athletes had higher levels of overall self-confidence (effect size was small; d = 0.22) skills. Our study results are also consistent with a study by Sural et al. [49] on elite boxers, who found that junior boxers had higher levels of self-confidence in interpersonal interactions (effect size was small; d = –0.25) and overall self-confidence (effect size was moderate; d = –0.53) skills than cadet boxers.

Understanding the differences in mental toughness between junior and cadet athletes allows coaches to adopt tailored coaching strategies or programs that cater to the specific needs and strengths of each group. For example, coaches can incorporate exercises and drills that further enhance determination and visualisation skills in cadet athletes to bring them up to the level of junior athletes. Coaches can work closely with both junior and cadet athletes to set clear, achievable goals related to enhancing their mental toughness skills. By monitoring progress over time, coaches can track improvements in the general and athletic mental toughness skills among cadet athletes and provide targeted feedback and support to facilitate their development. Overall, coaches and athletes can benefit from these findings by leveraging them to justify training programs, set goals, and run mindset development initiatives aimed at enhancing mental toughness skills and optimising performance at both the junior and cadet levels.

The hypothesis that young players' psychological toughness skills relate to their age was partially supported. Positive and statistically significant correlations with small to moderate magnitudes were found between all general mental toughness indicators and age. This finding is consistent with Konter et al. [51], who also identified a statistically significant relationship with a similar small magnitude (r = 0.24) between age and the athletic mental toughness indicator determination. However, we also found a statistically significant correlation with a moderate magnitude between the athletic mental toughness indicator visualisation and age. Again, in line with our study, statistically significant relationships were established with small magnitudes between age and the athletic mental toughness index (r = 0.17) [61], and between age and visualisation (r = 0.19) [3]. However, trivial nonsignificant correlations were observed in the present study between age and positive cognition, and between age and self-belief. Likewise, previous research found a nonsignificant trivial relationship between age and total mental toughness (r = 0.04) [10], and between age and self-confidence (r = 0.08) [3]. The participants' similar age distributions may have contributed to the lack of significant high-level correlations between age and mental toughness, which a previous study [62] used to explain the absence of statistically significant associations. A combination of individual athletes' performance results (number of minutes and efficiency rating) and some demographic data (socioeconomic status and social support networks) may also influence the mag-

nitude of the correlation between mental toughness and age [62]. Additional research may be necessary to obtain more conclusive results regarding the relationship between mental toughness and age.

The presence of significant correlations between mental toughness skills and age suggests that while mental toughness skills may develop with age, there is still room for improvement at all stages of development. By fostering the development of mental toughness skills early on and supporting ongoing growth and refinement throughout an athlete's career, coaches can help athletes maximise their resilience.

The third hypothesis, that age (sociodemographic factor) and general (total) mental toughness predict each athletic mental toughness skill (determination, visualisation, positive cognition, and self-belief), has been partially confirmed. Total mental toughness strongly predicted athletic mental toughness skills, but age did not predict the determination and self-belief skills. The fact that general (total) mental toughness predicts determination could be explained by the study [41], which argued that adolescents with high mental toughness levels are more resilient to stress and are better equipped to maintain determination. Considering the visualisation determinant, it could be argued that athletes with high levels of general mental toughness are better equipped to visualise success [2]. The predictive value of positive cognition can be explained by the fact that athletes with high general mental toughness are more likely to use positive thoughts, viewing challenges as opportunities for growth [63]. The results that general (total) mental toughness predict self-belief could be explained by the fact that athletes with high levels of general mental toughness are more likely to strengthen self-belief by emphasising the role of effort and persistence in achieving success [63].

The findings that general (total) mental toughness and age did not predict determination and self-belief skills may be explained by the fact that we investigated only groups of athletes in late adolescence (15–18 years old). However, when young athletes with a broader age range (14–20 years old) were analysed, the researchers found that age was a significant predictor of mental toughness skills among young male athletes and that mental toughness increased with age [54]. When a narrower age range (15–18 years old) was analysed, age was not a significant predictor of mental toughness skills [64]. Nevertheless, further empirical studies are necessary to confirm or reject this explanation.

Coaches can use general (total) mental toughness skills to improve athletic mental toughness measures by encouraging athletes to set specific, measurable, achievable, and relevant goals because by setting and achieving goals, athletes can build confidence and self-belief [63]. Coaches can introduce visualisation techniques to help athletes mentally prepare for challenges and visualise success, can teach athletes cognitive restructuring techniques to challenge and replace negative thoughts with positive, constructive ones, and incorporate mindfulness practices and stress management techniques into training sessions to help athletes stay focused, calm, and resilient under pressure.

Several limitations of the study could be noted. The questionnaires were administered to homogenous teams according to their classification and competitive start position. However, this study is limited regarding the background variables, such as individual athletes' performance results (number of minutes and efficiency rating) and some demographic data (socioeconomic status, social support networks, and parents' educational background) because these data were not considered. Only age and the questionnaires were collected as data. The low age difference between the groups may have influenced the results. However, this is a consequence of the realities of the sport, since there are two divisions of adolescent athletes in many countries: cadet (under 16) and junior (under 18).

The limitations of this study primarily relate to the fact that it identifies the optimal period for developing mental toughness skills, but does not design or implement a specific mental toughness training program for young male basketball players. This study also revealed that cadet athletes had lower levels of both general and athletic mental toughness skills. Therefore, future studies should also investigate younger athletes (12–14 years old) since younger adolescents may have even lower scores on mental toughness skill indicators.

The study findings have several practical implications, particularly in developing and supporting cadet and junior athletes. These findings highlight the importance of considering mental toughness as a crucial component of the sustainable development of athletes. Coaches and sports organisations should adopt a holistic approach to athlete sustainable development, integrating mental toughness skills training alongside physical training, which could involve incorporating mental toughness training, such as visualisation exercises, mindfulness practices, and techniques for maintaining focus and concentration. Overall, this study underscores the significance of mental toughness in sports and highlights the need for targeted interventions and support for athletes, especially at a younger age. By understanding the differences in mental toughness skills between junior and cadet athletes, coaches

and sports organisations can better cater to the needs of young athletes, promoting their overall sustainable development and well-being.

Conclusions

This study revealed that junior athletes are better able to accept and overcome challenges, actively engage in and commit to their activities, manage their emotions and lives, have higher self-confidence in interpersonal interactions, and trust their abilities more than cadet athletes. It also found that general (total) mental toughness strongly predicts athletic mental toughness skills, but age does not predict determination and self-belief skills. These findings can be valuable for future studies that develop mental toughness training programs for young athletes that focus on the general and athletic mental toughness skills investigated in this study. Mental toughness skill training programs should be specifically designed for cadet athletes since they generally have lower levels of mental toughness skills.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Ethics Committee of the Lithuanian Sports University (approval No.: SMTEK–47).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Disclosure statement

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Conflict of interest

The authors state no conflict of interest.

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References

[1] Brewer BW (ed.). Handbook of Sports Medicine and Science. Sport Psychology. Chichester: Wiley and Sons; 2009.
[2] Liew GC, Kuan G, Chin NS, Hashim HA. Mental toughness in sport. Ger J Exerc Sport Res. 2019;49: 381–94; doi: 10.1007/s12662-019-00603-3.
[3] Benítez-Sillero JdD, Martínez-Aranda LM, Sanz-Matesanz M, Domínguez-Escribano M. Determining factors of psychological performance and differences among age categories in youth football players. Sustainability. 2021;13(14):7713; doi: 10.3390/su13147713.
[4] Powell AJ, Myers TD. Developing mental toughness: Lessons from paralympians. Front Psychol. 2017;8:1270; doi: 10.3389/fpsyg.2017.01270.
[5] Mira T, Costa AM, Jacinto M, Diz S, Monteiro D, Rodrigues F, Matos R, Antunes R. Well-being, resilience and social support of athletes with disabilities: a systematic review. Behav Sci. 2023;13(5): 389; doi: 10.3390/bs13050389.
[6] Kristjánsdóttir H, Erlingsdóttir AV, Sveinsson G, Saavedra JM. Psychological skills, mental toughness, and anxiety in elite handball players. Pers Individ Differ. 2018;134:125–30; doi: 10.1016/j.paid.2018.06.011.
[7] Lin Y, Mutz J, Clough PJ, Papageorgiou KA. Mental toughness and individual differences in learning, educational and work performance, psychological well-being, and personality: a systematic review. Front Psychol. 2017;8:1345; doi: 10.3389/fpsyg.2017.01345.
[8] St Clair-Thompson H, Bugler M, Robinson J, Clough P, McGeown SP, Perry J. Mental toughness in education: exploring relationships with attainment, attendance, behaviour and peer relationships. Educ Psychol. 2015;35(7):886–907; doi: 10.1080/01443410.2014.895294.
[9] Mahoney JW, Gucciardi DF, Ntoumanis N, Mallet CJ. Mental toughness in sport: motivational antecedents and associations with performance and psychological health. J Sport Exer Psychol. 2014;36(3):281–92; doi: 10.1123/jsep.2013-0260.
[10] Murray RM, Dugdale JH, Habeeb CM, Arthur CA. Transformational parenting and coaching on mental toughness and physical performance in adolescent soccer players: the moderating effect of athlete age. Eur J Sport Sci. 2021;21(4):580–9; doi: 10.1080/17461391.2020.1765027.
[11] Gordon S, Anthony DR, Gucciardi DF. A case study of strengths-based coaching of mental toughness in cricket. Int J Sport Psychol. 2017;48(3): 223–45.

[12] Bédard Thom C, Guay F, Trottier C. Mental toughness in sport: the goal-expectancy-self-control (GES) model. J Appl Sport Psychol. 2021;33(6): 627–43; doi: 10.1080/10413200.2020.1808736.
[13] Gucciardi DF. Mental toughness as a moderator of the intention–behaviour gap in the rehabilitation of knee pain. J Sci Med Sport. 2016;19(6): 454–8; doi: 10.1016/j.jsams.2015.06.010.
[14] Stamatis A, Grandjean P, Morgan G, Padgett RN, Cowden R, Koutakis P. Developing and training mental toughness in sport: a systematic review and meta-analysis of observational studies and pre-test and post-test experiments. BMJ Open Sport Exerc Med. 2020;6(1):e000747; doi: 10.1136/bmjsem-2020-000747.
[15] Connaughton D, Thelwell R, Hanton S. Mental toughness development: issues, practical implications, and future directions. In: Gucciardi D, Gordon S (eds.) Mental Toughness in Sport. Developments in Theory and Research. Routledge; 2011, pp. 135–62.
[16] Strycharczyk D, Clough P, Perry J. Developing Mental Toughness. Strategies to Improve Performance, Resilience and Wellbeing in Individuals and Organizations. Kogan Page; 2021.
[17] Loehr JE. Mental toughness training for athletes. Achieving athletic excellence. New York: New American Library; 1991.
[18] Loehr JE. The New Toughness Training for Sports. Mental, Emotional, and Physical Conditioning. Nueva York: Plume; 1995.
[19] Golby J, Sheard M, van Wersch A. Evaluating the factor structure of the psychological performance inventory. Percept Mot Skills. 2007;105(1):309–25; doi: 10.2466/pms.105.1.309-325.
[20] Gucciardi DF. Measuring mental toughness in sport: a psychometric examination of the Psychological Performance Inventory–A and its predecessor. J Pers Assess. 2012;94(4):393–403; doi: 10.1080/00223891.2012.660292.
[21] Jones G, Hanton S, Connaughton D. What is this thing called mental toughness? An investigation of elite sport performers. J Appl Sport Psychol. 2002; 14(3):205–18; doi: 10.1080/10413200290103509.
[22] Clough P, Earle K, Sewell D. Mental toughness: the concept and its measurement. In: Cockerill I (ed.) Solutions in Sport Psychology. London: Thomson; 2002; pp. 32–43.
[23] Gucciardi DF. Mental toughness: progress and prospects. Curr Opin Psychol. 2017;16:17–23; doi: 10.1016/j.copsyc.2017.03.010.
[24] Tenenbaum G, Eklund RC (eds.). Handbook of Sport Psychology. Hoboken: Wiley and Sons; 2020.
[25] Kobasa SC. Stressful life events, personality, and health: an inquiry into hardiness. J Pers Soc Psychol. 1979;37(1):1–11; doi: 10.1037/0022-3514.37.1.1.
[26] Luthar SS, Sawyer JA, Brown PJ. Conceptual issues in studies of resilience: past, present, and future research. Ann NY Acad Sci. 2006;1094:105–15; doi: 10.1196/annals.1376.009.
[27] Clough P, Marchant D, Earle K. The MTQ48 handbook. AQR; 2007. Available from: https://research.edgehill.ac.uk/en/publications/the-mtq48-handbook-2 (accessed November 28, 2023).
[28] Clough PJ, Perry JL, Strycharczyk D, Rowlands C. The Mental Toughness Questionnaire 48 (MTQ48) technical manual. AQR International, UK; 2015. Available uploads/2018/02/i2KDVs89QCTbXMjhOeSQ_The-MTQ48-Technical-Manual.pdf (accessed November 12, 2023).
[29] Geikie TL. The relationship between young athletes' imagery use and mental toughness. Doctoral dissertation. Windsor: University of Windsor; 2016.
[30] Perry JL, Strycharczyk D, Dagnall N, Denovan A, Papageorgiou KA, Clough PJ. Dimensionality of the mental toughness questionnaire (MTQ48). Front Psychol. 2021;12:654836; doi: 10.3389/fpsyg.2021.654836.
[31] Farnsworth JL, Marshal A, Myers NL. Mental toughness measures: a systematic review of measurement properties for practitioners. J Appl Sport Psychol. 2022;34(3):479–94; doi: 10.1080/10413200.2020.1866710.
[32] Behnke M, Tomczak M, Kaczmarek LD, Komar M, Gracz J. The sport mental training questionnaire: development and validation. Curr Psychol. 2019; 38:504–16; doi: 10.1007/s12144-017-9629-1.
[33] Stamatis A, Morgan GB, Cowden RG, Koutakis P. Conceptualizing, measuring, and training mental toughness in sport: perspectives of master strength and conditioning coaches. J Study Sports Athletes Educ (JSSAE). 2023;17(1):1–28; doi: 10.1080/19357397.2021.1989278
[34] Brace AW, George K, Lovell GP. Mental toughness and self-efficacy of elite ultra-marathon runners. PLOS ONE. 2020;15(11):e0241284; doi: 10.1371/journal.pone.0241284.
[35] Connaughton D, Wadey R, Hanton S, Jones G. The development and maintenance of mental toughness: perceptions of elite performers. J Sports

Sci. 2008;26(1):83–95; doi: 10.1080/02640410701310958.
[36] Crust L, Azadi K. Mental toughness and athletes' use of psychological strategies. Eur J Sport Sci. 2010;10(1):43–51; doi: 10.1080/17461390903049972.
[37] Crust L, Clough PJ. Relationship between mental toughness and physical endurance. Percept Mot Skills. 2005;100(1):192–4; doi: 10.2466/pms.100.1.192-194.
[38] Dereceli Ç. An examination of concentration and mental toughness in professional basketball players. J Educ Train Stud. 2019;7(1):17–22; doi: 10.11114/jets.v7i1.3841.
[39] Wheatley C, Batey M, Denovan A, Dagnall N. Mental toughness in the Football Association Women's Super League: relationships with playing experience, perceptions of club infrastructure, support mechanisms and self-esteem. PLOS ONE. 2023;18(5):e0285594; doi: 10.1371/journal.pone.0285594.
[40] Frydenberg E, Lewis R. Boys play sport and girls turn to others: age, gender and ethnicity as determinants of coping. J Adolesc. 1993;16(3):253–66; doi: 10.1006/jado.1993.1024.
[41] Gerber M, Kalak N, Lemola S, Clough PJ, Perry JL, Pühse U, Elliot C, Holsboer-Trachsler E, Brand S. Are adolescents with high mental toughness levels more resilient against stress? Stress Health. 2013;29(2):164–71; doi: 10.1002/smi.2447.
[42] Gameiro N, Rodrigues F, Antunes R, Matos R, Amaro N, Jacinto M, Monteiro D. Mental toughness and resilience in trail runner's performance. Percept Mot Skills. 2023;130(3):1202–20; doi: 10.1177/00315125231165811.
[43] Gucciardi DF, Jones MI. Beyond optimal performance: mental toughness profiles and developmental success in adolescent cricketers. J Sport Exerc Psychol. 2012;34(1):16–36; doi: 10.1123/jsep.34.1.16.
[44] Gucciardi DF. Mental toughness profiles and their relations with achievement goals and sport motivation in adolescent Australian footballers. J Sports Sci. 2010;28(6):615–25; doi: 10.1080/02640410903582792.
[45] Mousavi SM, Abedanzadeh R, Darvishi V. The relationship between talent development environment and mental toughness among adolescent football players. J Sport Psychol. 2023;15(1):48–31; doi: 10.48308/MBSP.2021.220602.1007.
[46] Kristjánsdóttir H, Jóhannsdóttir KR, Pic M, Saavedra JM. Psychological characteristics in women football players: skills, mental toughness, and anxiety. Scand J Psychol. 2019;60(6):609–15; doi: 10.1111/sjop.12571.
[47] Nicholls AR, Polman RCJ, Levy AR, Backhouse SH. Mental toughness in sport: achievement level, gender, age, experience, and sport type differences. Pers Individ Differ. 2009;47(1):73–5; doi: 10.1016/j.paid.2009.02.006.
[48] McManama O'Brien KH, Rowan M, Willoughby K, Griffith K, Christino MA. Psychological resilience in young female athletes. Int J Environ Res Public Health. 2021;18(16):8668; doi: 10.3390/ijerph18168668.
[49] Sural V, Güler H, Çar B. Examination of mental training and mental toughness in elite boxers. Pak J Med Health Sci. 2021;15(6):1647–53; doi: 10.53350/pjmhs211561647.
[50] Inceoglu Ayaz E, Ilgar Y. The investigation of the relationship between mental toughness and cope with sporting problems in team and individual sports. J Sport Rec Res. 2023;5(1):1–12; doi: 10.52272/srad.1259854.
[51] Konter E, Gledhill A, Kueh YC, Kuan G. Understanding the relationship between sport courage and female soccer performance variables. Int J Environ Res Public Health. 2022;19(8):4654; doi: 10.3390/ijerph19084654.
[52] Crust L, Earle K, Perry J, Earle F, Clough A, Clough PJ. Mental toughness in higher education: Relationships with achievement and progression in first-year university sports students. Pers Individ Differ. 2014;69:87–91; doi: 10.1016/j.paid.2014.05.016.
[53] Gucciardi DF, Gordon S, Dimmock JA. Development and preliminary validation of a mental toughness inventory for Australian football. Psychol Sport Exerc. 2009;10(1):201–209; doi: 10.1016/j.psychsport.2008.07.011.
[54] Cowden RG. Mental toughness, emotional intelligence, and coping effectiveness: an analysis of construct interrelatedness among high-performing adolescent male athletes. Percept Mot Skills. 2016;123(3):737–53; doi: 10.1177/0031512516666027.
[55] Cohen L, Manion L, Morrison K. Research methods in education. 8th ed. New York: Routledge; 2018, pp. 334–336.
[56] Pocius E, Malinauskas R. Determining positive behavioral skills in different age groups of young basketball players during the pandemic. Children. 2023;10(6):914; doi: 10.3390/children10060914.

[57] Malinauskas RK, Balciunas P. Peculiarities of mental toughness among cadet and junior basketball players [in Russian]. In: XI Proceedings of the International Scientific and Practical Conference "Educational environment today: development strategy". Cheboksary; 2020:100–102; doi: 10.21661/r-530497.
[58] Pocius E, Malinauskas R. Examining the level of mental toughness skills in young athletes. In: Proceedings of the AHI EVRAN III-International Congress on Scientific Research. Baku; 2023;1: 408–413.
[59] Hannibalsson KÁ. Psychological skills, mental toughness, anxiety and performance in young basketball players. Doctoral dissertation. Reykjavík: Reykjavík University; 2018.
[60] Csáki I, Szakály Z, Fózer-Selmec B, Kiss SZ, Bognár J. Psychological and anthropometric characteristics of a Hungarian elite football academy's players. Phys Cult Sport Stud Res. 2017;73:15–26; doi: 10.1515/pcssr-2017-0002.
[61] Guillen F, Santana J. Exploring mental toughness in soccer players of different levels of performance. Rev Iberoam Psicol Ejerc Deporte. 2018;13(2): 297–303.
[62] Toros T, Ogras EB, Okan İ, Temel C, Keskin MT, Korkmaz C, Uluoz E. Investigation the relationship between mental toughness and courage levels of sports sciences faculty students for sustainable performance. Sustainability. 2023;15(12):9406; doi: 10.3390/su15129406.
[63] Meggs J, Ditzfeld C, Golby J. Self-concept organisation and mental toughness in sport. J Sports Sci. 2014;32(2):101–9; doi: 10.1080/02640414.2013.812230.
[64] Beckford TS, Poudevigne M, Irving RR, Golden KD. Mental toughness and coping skills in male sprinters. J Hum Sport Exerc. 2016;11(3):338–47; doi: 10.14198/jhse.2016.113.01.