

BREAKABLE PERFORMANCE - THE ROLE OF MENTAL TOUGHNESS IN ELITE SPORT, INTERNATIONAL OUTLOOK

Eszter Panna Torma, László Balogh

University of Debrecen, Institute of Sport Science, Debrecen, Hungary

Abstract

Our study aimed to analyze mental toughness and its relationship to sports performance. We reviewed 50 qualitative and quantitative international studies. We performed an in-depth investigation on mental toughness; we also focused on how to improve mental toughness. We hypothesized a significant difference in both genders, suggesting that coaches substantially impact mental toughness. We primarily concentrate on valid, real-time assessments and psychological training in elite sports athletes. Sport psychologists, mental trainers play an essential role in elite sports performance. Results of related studies demonstrated that these age and gender-specific mental training sessions are effective in improving performance. There is an increasing need for computer-based interactive testing methods to analyze cognitive and psychomotor skills under pressure.

Keywords: *mental toughness, elite sport, sports performance, review*

INTRODUCTION

This research aimed to review articles that examine the construction of mental toughness and its relationship to athletic performance. This review considers both qualitative and quantitative approaches. Fifty studies were used for the examination.

THEORETICAL BACKGROUND

The success or failure of athletes is multifactorial. It depends on several factors, including physical, tactical, technical, and psychological aspects. The psychological component is usually the determinant between winner and loser in sport.

Mental toughness refers to a collection of psychological characteristics that play a central role in optimal performance. Athletes, coaches, and sports psychologists have consistently cited mental toughness as one of the most important psychological characteristics of success in sports. In recent decades, several studies have been conducted to examine the role that mental toughness plays in athletes' success (AHSAN – MOHAMMAD, 2017;



ÁLVAREZ et al., 2018; BALOGH – KISS, 2019; GOLBY – SHEARD, 2004; GONZÁLES et al. 2013)

For example, researchers reported that 82% of coaches considered mental toughness to be the most critical psychological attribute in judging the success of wrestlers. According to Jones & Parker (2013), mental toughness contributed more than 50% to athletes' success in their struggles with their opponents.

THE CONCEPT OF MENTAL TOUGHNESS

Mental toughness is recognized as an essential psychological feature. Both coaches and athletes attribute the competition's success to mental toughness and the negative results of its lack. Not surprisingly, this recognition has been accompanied by increased interest among athletes in enhancing mental toughness (CRUST, 2009; MASUM, 2014; SOLOMON, 2016; LEVY et al., 2012).

Researchers have not been able to agree on an exact definition of mental toughness. Still, the various reports generally refer to an athlete's ability to concentrate, recover from failure, put pressure on and face difficulties, and mentally resilience, commitment, and confidence (BULL et al., 2005; MEGGS – CHEN, 2018; GODDARD et al., 2019, COWDEN et al., 2016).

However, despite its frequent use, mental toughness is subjective. More specifically, it is often used to describe a broad term that reflects an athlete's ability to cope with training difficulties and competitions to remain as flexible and resilient as possible in certain situations (BULL et al., 2005; CONNAUGHTON et al., 2008; JONES et al., 2002; THELWELL et al., 2005).

COMPONENTS OF MENTAL TOUGHNESS

Athletes, coaches, and applied sports psychologists have consistently cited mental toughness as an achievement in elite sports and one of the most important psychological characteristics. However, it is one of the least understood terms in applied sports psychology (JONES et al., 2002). This is partly due to the wide variety of definitions, measurements, and research designs used in researching this construct.

Essentially, all positive psychological traits are no longer known as mental toughness at some point (Table 1). Despite many opinions surrounding this concept, everyone agrees that: mental toughness, according to the athlete, is stress; the resulting anxiety and the ability to handle high-pressure sports situations are evident.

Researchers published a model of mental toughness that includes seven characteristics: self-confidence, negative energy, attention control, visual and visual control, motivation, positive energy, and attitude control. Although this model is conceptually attractive, the seven mental toughness factors have not been justified. However, it was pointed out that mental toughness can be developed or mastered, not just an innate genetic trait (GUCCIARDI et al., 2009; CHOUDHARY, 2017).

During qualitative research, twelve mental toughness characteristics emerged. These factors include self-efficacy, cognitive self-concept, potential, task-specific attention, endurance, task cognition, personal outcomes, task value, commitment to the goal, positivity, stress minimization, and favorable comparisons (GUCCIARDI et al., 2015; HOUWER et al., 2017). Jones et al. (2002) developed a framework for mental toughness that classified 30 traits into 13 general dimensions under 13 subcomponents (attitude/mindset, training, competition, and post-competition: see Table 1). From an applied perspective, this framework provides the context in which attributes and subcomponents can be used and describe how and under what circumstances mental toughness can be developed and maintained.

Table 1: Dimensions and subcomponents of the mental hardness framework

Jones et al., 2007

Dimension	Subcomponent
Attitude / Mindset	<ul style="list-style-type: none">• Faith• Focus
Training	<ul style="list-style-type: none">• Use long-term goals as a source of motivation.• Extended to the limit• Controlling the environment
Competition	<ul style="list-style-type: none">• Controlling the environment.• Faith• Power control• Maintain concentration• Awareness and control of feelings and thoughts• Pressure management
Post-race stage	<ul style="list-style-type: none">• Failure management• Managing success

The development of mental toughness was called a long-term process. According to Connaughton et al., (2008), they appear to develop in three stages (early, middle, and late years) that reflect the three career phases. Based on qualitative interviews with elite athletes, the transition between these stages involves significant events, such as changing clubs, working with a new coach, being invited to the national team, or winning a significant event (KRISTJÁNSDÓTTIR et al., 2018)

Even if a wide range of factors and mechanisms influence the development of mental toughness at each stage, coaches appear to play an essential role throughout the process (CONNAUGHTON et al., 2008; GUCCIARDI et al., 2009). This is not surprising, given that

several studies have documented that coaches are essential in developing and maintaining athletes' attitudes, competencies, and performance in sports.

Studies have also reported that coaches can improve the mental toughness of their players by intentionally working on the “mental side,” such as building trust, positive expectations, and creating a positive environment. Connaughton et al. (2008) suggested that coaches should create conditions in which athletes are exposed to competition and social competition stressors. Mental toughness also affects an athlete's overall health. As Rátgéber et al. (2019) stated, basketball requires a high level of psychological abilities. It plays a significant role in maintaining health and is even an excellent tool (Newland et al., 2013).

OBJECTIVES

During my research, I sought answers to the following questions:

- What exactly does mental toughness rest on?
- Is there a measurement method that shows valid, real-time results from measuring mental toughness?
- To what extent does the coach appear in the analyzed literature as a factor influencing mental toughness?
- Is there a significant gender difference and, if so, how does it manifest itself?
- How can mental toughness be improved?

HYPOTHESES

H1: Mental toughness is a significant determinant of athletes' performance. It includes the athlete's ability to perform under stress, how he or she responds to a particular stimulus under pressure in certain situations, how they can stay mentally tough until the last minute, and how to overcome his or her opponent in crucial cases. A mentally tough athlete has adequate self-confidence, can control his emotions, and has faith and perseverance. He can manage environmental impacts, success, and failure, focus on a high level in competitive situations, and have incredible motivation.

H2: There is no uniform measurement method that shows valid, real-time results on the degree of mental toughness. (Non-questionnaire measurement)

H3: From the perspective of the athlete's career, the coaching attitude and behavior can be decisive, not only during the physical preparation but also in mental abilities, including mental toughness. The coach provides psychological and social support to the athlete, who overcomes the difficulties more efficiently and, consequently, helps develop and develop his mental toughness.

H4: There is no significant difference between the levels of mental toughness between men and women, but men are better able to control their emotions, which may be decisive for comparing mental toughness between the genders.

H5: Mental toughness can be improved through mental training, psychological methods, and the creation of competitive situations in training.

MATERIALS AND METHODS

The genre of research, secondary, systematic literature analysis, was called a review. The methodology of the literature review is PRISMA and snowball method. We have worked primarily on articles published on international scientific sites (Google Scholar, Taylor & Francis Online, SpringerLink, PubMed) for the following keywords: mental toughness in sport, mental toughness in handball, Stress, VTS, cognitive skills. After the first search results, scientific publications that did not examine the given concepts in sports were excluded. Reviews published on this topic, but examined based on other structural aspects, have also been used for the research, further expanding the number of articles reviewed.

RESULTS

During the review of the articles, we used 38 studies that met the structural considerations. In many cases, there were only generalized data but not specific ones. Accurate figures are needed in terms of the research's success. The results can be determined based on the hypotheses mentioned above.

Mental toughness is "a personal ability for an athlete to regularly provide a high level of performance despite varying degrees of situational needs." (GUCCIARDI et al., 2017, p.

442). Characteristics such as problem-centered coping (NICHOLLS et al., 2008) and self-confidence were found to be associated with mental toughness (Fig. 1). Mentally tough performers are highly motivated to succeed and can maintain their self-confidence despite occasional competitive failures. Consistent with previous research (JONES et al., 2002; THELWELL et al., 2005), self-confidence was unanimously cited as a critical characteristic of the mental toughness of Australian footballers. A socially supportive environment can positively affect mental toughness in and outside of sport (CRUST, 2010). The development of mental toughness was called a long-term process. According to Connaughton et al., (2008), they appear to develop in three stages (early, middle, and late years) that reflect the three career phases. Based on qualitative interviews with elite athletes, the transition between these stages involves significant events, such as a change of club, collaboration with a new coach, entry into the national team. Jones et al. (2002) reported characteristics of mental toughness that included awareness and control of thoughts and feelings, and maintaining focus (comparable to power), using long-term goals as a source of motivation (like commitment), pushing to the limit.

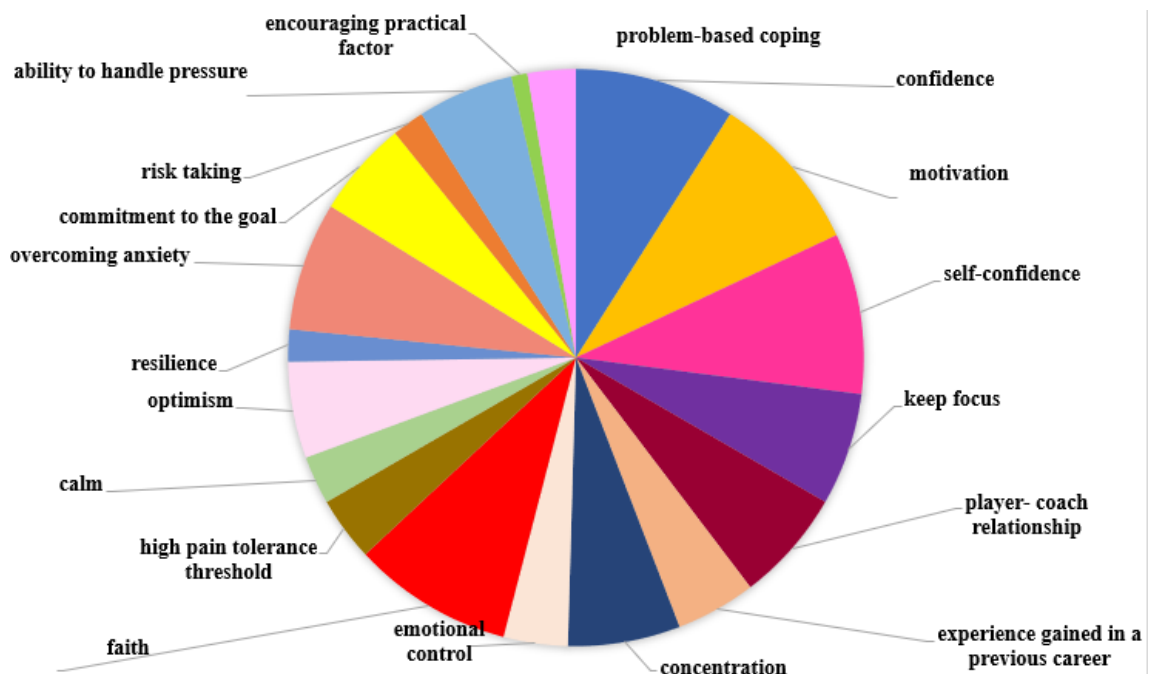


Figure 1: Characteristics of maintaining mental toughness.

Source: Own resource

It can be stated that the most common method of measurement, the questionnaire, also known as paper-pencil tests. (Figure 1) This is the most cost-effective and most straightforward way to measure mental toughness, but it is unfortunately not always sufficient to make accurate findings for several reasons. The primary problem is tests completed by individuals, may that the individual meets the trial, which can usually produce subjective or unrealistic results. Furthermore, the test is not conducted during a given event, but they cannot measure real mental toughness before or after it. Among the most used questionnaires is the Mental Toughness Questionnaire 48 (MTQ48), which contains 48 items scored on a five-point Likert scale, ranging from complete agreement to disagreement. The list of mental toughness (MTI; MIDDLETON et al., 2004) is also famous, a 65-item instrument that measures 12 components of mental hardness and global mental toughness. The 42-item psychological performance record (PPI) was one of the first measures to include cognitive-behavioral and self-assessment dimensions. However, PPI-A is a kind of improvement. Its potential limitation is that it does not include the degree of control. This feature has been identified several times in the literature on mental toughness (JONES et al., 2002). SMTQ is the only psychometrically acceptable mental toughness tool that includes a measure of emotional and negative energy control routinely identified in the mental toughness literature (JONES et al., 2002). Athletes and their coaches were interviewed much less frequently than the questionnaires, and in some cases, autogenic training (VMBR) and focus group comparisons were also used. The least common method was instrumental testing (Figure 2). However, if this method were more prevalent among researchers, they could produce even more valid results in measuring mental toughness, thereby maximizing the performance of athletes (SHEARD et al., 2009).

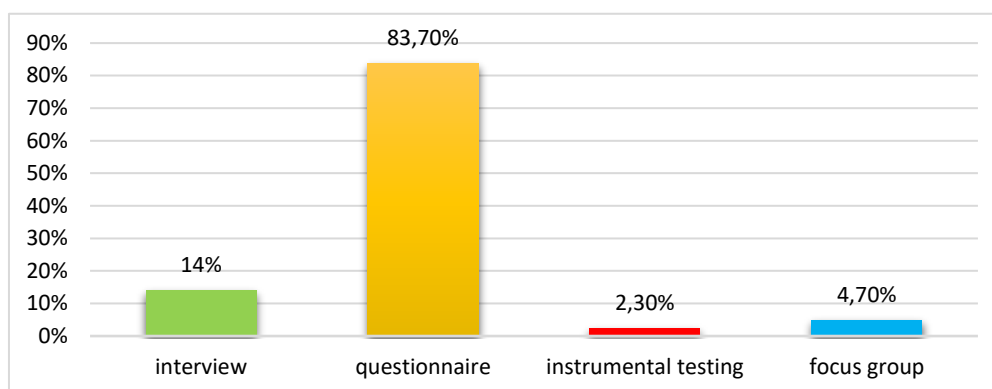


Figure 2: Testing methods of mental toughness

Although several factors (personal, social, environmental) can influence athletes' mental toughness, the relationship between coach and athlete may have one of the most significant effects on athlete motivation, mental toughness, and subsequent behavioral intention. Several authors have emphasized the importance of building an effective coach-athlete relationship due to the consequence that the quality of this relationship exercises on athletes' experience, which in turn may increase the willingness to continue a physical activity (REDDY – BERHANU, 2016)

According to Connaughton et al., (2008), mental toughness develops over three stages, and coaches play an essential role throughout the process (CONNAUGHTON et al., 2008; GUCCIARDI et al., 2009). This is not surprising, given that several studies have documented that coaches play an important role in developing and maintaining athletes' attitudes, competencies, and performance in sports.

Looking at the study of female and male athletes, it is striking that most studies have examined the non-mental hardness of both, but several studies have addressed only one of the two. In this case, a higher proportion of men were studied, and only 6% of the studies dealt only with female athletes (Figure 3). Recent research by Pausek et al., (2017) has shown no significant difference between female and male athletes through mental toughness.

There is a trend-level difference in the characteristics of the two non-mental toughness. Conversely, other researchers, such as Nicholls et al., (2009), report that male athletes

have more outstanding mental toughness than women. They are more resilient to challenges and control of emotions. Male athletes reported higher emotional power than women.

Crust (2010) supported this view, as they reported a higher level of control in men than in female competitors. Research shows that female athletes tend to use more emotion-centered and social support and less problem-focused coping in response to an event or injury.

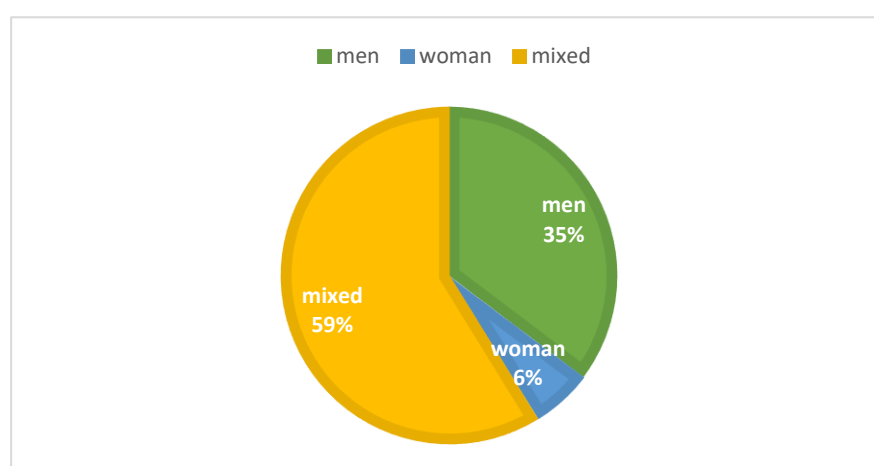


Figure 3: Proportion of gender distribution in the reviewed articles

Source: Own resource

Many athletes worldwide use psychological techniques to improve sport performance. Alternatively, mentally tough individuals can use several psychological strategies to encounter stressors. Examples are relaxation techniques, self-talk, mental images (RANA, 2009; SLIMANI et al., 2015).

Competitive experience can be an essential factor in developing mental toughness among athletes (CONNAUGHTON et al., 2008). Mental toughness (MT) has proven to be a prerequisite for success in many competitive sports (GUCCIARDI, 2017).

While researchers have shown that levels of mental toughness depend on genetic factors, research has also shown that these levels can change in adolescence and can be modified through specific interventions. Studies have also reported that coaches can improve the mental toughness of their players by intentionally working on the "mental side," such as building trust, positive expectations, and creating a positive environment

(CONNAUGHTON et al., 2008; RODAHL et al., 2015; BUTT et al., 2010). It was suggested that coaches should create an artificially developed climate in training in which athletes are exposed to stressors of competition and friendly competition. As the physical activity of male and female players is different, so should their mental training. Among elite players, this kind of method is essential, working on it with the help of a sports psychologist if possible (PIGGOTT et al., 2019).

DISCUSSION

Based on the literature review results, athletes must be treated by sports psychologists from an early age to educate as many mentally tough individuals as possible by coaches and professionals in various sports. The research results that psychological training has a positive effect on maintaining and developing athletes' mental toughness. Furthermore, coaches play an important role in developing and preserving athletes' attitudes, competencies, and performance in sports, so it would certainly be essential for coaches to learn as many ways as possible to help athletes in these areas. A key issue is developing measurement methods in research with instruments that produce immediate results and measure mental toughness during activity.

The "review" supports the hypotheses that, in many cases, the research done so far has been based on incomplete aspects. Based on these hypotheses and results, future researchers would like to use computer test systems to measure mental toughness in athletes as much as possible, which would provide more reliable and "real-time" results.

SUMMARY

Mental toughness is one of the most popular concepts these days, the maintenance and development of which is of concern to athletes, sports psychologists, and coaches alike. Research that has already been published confirms that at least 50% of success is due to psychological factors that reflect mental toughness.

Results: 1. By mental toughness, the athlete can provide a high degree of performance under changing situational factors, even under high pressure. He can process failure more easily and builds through difficulties throughout his career. A mentally tough individual is characterized by a high degree of self-confidence, self-confidence, and motivation. 2. In general, it can be said about the research so far that mental toughness was most often

measured with paper-and-pencil tests. 3. In the literature, the coach appears as a factor influencing mental toughness, and the importance of mental training is also reflected in the articles. 4. The researchers did not find a significant difference between the genders, but emotions can severely impact mental toughness in women. 5. Mental toughness can be developed through psychological techniques, various mental training, competitive simulations, and responses to different life situations.

Conclusion: There is a need for as much psychological training as possible for athletes, especially in elite sports. The work of sports psychologists is significant concerning mental training. These training are practical by gender, age group, especially in developing the mental toughness of adolescent athletes. A high level of training of coaches would also be helpful in this regard. In addition, there is a need for measuring devices that can be used during activity and convey immediate results. Computer test systems that include interactive tests and can analyze athletes under pressure based on their cognitive and psychomotor abilities may be helpful.

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APPENDIX

Author	The title of the study	The number of employees	Sex	Sport	Territorial definition	Age	Class	Methodology	Study area	Characteristics of maintaining mental toughness
Joanne Butt, Robert Weinberg, Briana Culp	Exploring Mental Toughness in NCAA Athletes	15	9 men, 6 women	team and individual (field hockey, volleyball, football, basketball, swimming, athletics)	from 8 different universities in the Midwestern region of the USA	19-22 year old	first class	interview	Properties of mental toughness, strategies used to form it.	player-coach relationship, genetics, previous career experience, encouraging practical environment, game situation simulation
Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2009)	Mental toughness in sport: Achievement level, gender, age, experience, and sport type differences	677	454 men, 223 women	team and individual	-	15-58 year old	international, national, county, university, beginner	questionnaire-MTQ48	A comparison of the level of performance, the athlete's gender, age, experience, and type of sport. Supporting mental toughness from these comparisons.	Continuously nurturing the challenge and keeping emotions in check
Marwan Ragab (2015)	The effects of mental toughness training on athletic coping skills and shooting effectiveness for national handball players	18	men	team (handball)	Zagazig University	20,76 ± 2,65 year	-	questionnaire-MTQ48, ACIS-28, shooting test, observation	Sport-specific psychological coping ability was studied.	Controlling feelings, controlling anxiety.
Thelwell, R., Weston, N., & Greenlees, I. (2005)	Defining and Understanding Mental Toughness within Soccer: 1. STUDY 1: DEFINING MENTAL TOUGHNESS AND EXAMINING THE CHARACTERISTICS FOR MENTALLY TOUGH SOCCER PLAYERS STUDY 2: CONFIRMING THE DEFINITION AND THE IMPORTANCE OF ATTRIBUTES FOR THE MENTALLY TOUGH SOCCER PLAYER	1.study: 6 people 2.study: 43 people	men	team (football)	UK	1.study: M average = 28,8 2.study: M average = 25,2 year	they play on the first team of their clubs, internationally Study 2: all 6 played internationally, but only two of them were active	Questionnaire, semi-structured interviews	Mental toughness as a definition. Examining the characteristics of a mentally tough person.	Self-confidence, insatiable desire and intrinsic motivation for success. Attention, psychological control, overcoming physical and emotional problems, accepting and overcoming competitive anxiety, the ability to turn sports focus on and off. Ignoring distractions, calm.
Nicholls, A. R., Polman, R. C. J., Levy, A. A., & Backhouse, S. H. (2008).	Mental toughness, optimism, pessimism, and coping among athletes	677	454 men, 223 women	-	UK	15-58 year old	consists of athletes competing at international (60), national (99), county (198), university (289) and beginner (31) levels	CICS10, MTQ48, LOT	The aim of the article was to explore the relationship between (a) mental toughness and coping, (b) mental toughness and optimism, and (c) coping and optimism.	Optimism is a good predictor of task-oriented coping, while pessimism is a deterrent to distraction and detachment orientation. Athletes use more approach and less avoidance strategies. A mentally tough athlete is able to solve a problem on their own, without the help of others. Challenge, commitment and emotional control are important for the athlete.
Bull, S. J., Shambrook, C. J., James, W., & Brooks, J. E. (2005).	Towards an Understanding of Mental Toughness in Elite English Cricketers	12	-	team (cricket)	UK	-	professional	interview	Developing a greater understanding of mental abilities in cricket. To determine how existing mentally tough English cricketers develop their mental toughness.	risk-taking, hard thinking, robust self-confidence, clear thinking, independence, self-reflection, belief in ben, tough attitude. Exploiting learning opportunities, independently set challenging goals, ways to think beyond achievement, opportunities to survive early failures.

Houwer, R., Kramer, T., Hartigh, R. den, Kolman, N., Elferink-Gemser, M., & Huijgen, B. (2017)	Mental Toughness in Talented Youth Tennis Players: A Comparison Between on-Court Observations and a Self-Reported Measure	6	men	individual (tennis)	North Holland Tennis Academy	10-13 year old	national junior ranking tournament-junior national championship	questionnaire - MTQ48, mental toughness positive negative taxonomy	The behavioral manifestations of tennis players' mental toughness on the court and their relationship to self-announced measures were examined.	commitment, challenge, confidence and control, interpersonal trust and life and emotional control, less stress-greater control experience, variability of positive-negative behaviors, emotional intelligence
Nithin BS and Dr. K Vaithianathan (2018)	Difference in the components of mental toughness in players of body contact games	60	-	team (20 rugby players, 20 Kabadian players, 20 handball players)	-	15-22 year old	state and national level players	Alan Goldberg [2004] "Mental Hardness Questionnaire," Scheffe post-hoc test	The mental toughness of rugby, kabaddi and handball players was also examined, and the aim of the study was also to find out the difference in mental toughness between players in sports.	Bounce ability, ability to deal with pressure, managing concentration skills, managing confidence, motivation
Patricia L. Sosa González, Juan Francisco Oliver Coronado, Rosa M^a Alfonso Rosa (2013)	Assessment of psychological skills in young elite female handball players	137	women	team (handball)	Spain	13-16 year old	Elite handball players who are the most talented. Participants in the National Sports Talent Program, which is the program of the Royal Spanish Federation, First class players.	C.P.R.D. questionnaire	Examining the resources of athletes, resp. identifying strengths and weaknesses on a psychological level as the key to the success of sport. (stress management (SC) ($\alpha = 0.88$), effect of performance appraisal (PE) ($\alpha = 0.67$) and team cohesion (TCOH) ($\alpha = 0.78$), mental skills scale (MSK) ($\alpha = 0.34$))	experience, concentration, stress control, performance appraisal, motivation
Mandeep Kaur (2017)	Analysis of mental toughness among the players of five different contact sports groups	50	-	kontakt sports (handball, football, wrestling, boxing,judo)	-	19-27 year old	college level	questionnaire	The aim of the present study was to identify the mental toughness of players in five different contact sports.	unwavering faith, concentration, confidence
Lee Crust, Martin Little-wood, Mark Nesti (2010)	Mental Toughness in Academy Football.A Cross-Sectional Analysis of Mental Toughness in a Professional Football Academy	112	men	team (handball, football)	English elite professional football academy	12-18 year old	first class	questionnaire-MTQ48, MTG18	Mental toughness was studied in academic players. Whether there is a difference between the players' experience over the years with mental toughness and whether there is a difference between the mental toughness of players released and retained at the end of the season.	higher pain tolerance threshold, concentration, commitment, emotional control, confidence and communication, self-reflection, positive feedback
Swati Choud-hary (2017)	Comparative effects of autogenic and visuo motor behavior rehearsal training on mental toughness of team games players	30	men	team (football)	Players from the Northeast Regional Center in Guwahati, Lakshimba National Institute of Physical Education	18-24 year old	college level	study of experimental groups: VMBR, autogenous training	This study was designed to examine the comparative effects of autogenic and VMBR training on the mental toughness of team players.	it is related to the player's ability to concentrate, the ability to recover from failure, the management of pressure
Piggott, B., Müller, S., Chivers, P., Burgin, M., & Hoyne, G. (2019)	Coach Rating Combined With Small-Sided Games Provides Further Insight Into Mental Toughness in Sport	31	men	team (football)	two Western Australian Amateur Football Leagues (WAAFL) clubs, semi-professional Western Australian Football League (WAFL) clubs, state championships	19-30 year old	Amateur Football League, Western Australian Football League	questionnaire-MTQ48, SMTQ, MTL, SSG	The aim of the study was to integrate methodologies to test a component of MT theory that predicts that an athlete will thrive under unlimited pressure and maintain performance.	higher level of training, despite the ability to perform the task well, focus control during the task execution
Crust L. (2009)	The relationship between mental toughness and affect intensity	112	55 men, 57 women	team and individual (basketball, association football, hockey, gymnastics, netball, badminton, golf, long distance and triathlon)	University of Northern England	18-51 year old	it covers all types of athletes from leisure to national athletes	questionnaire-MTQ48, AIM	This article was written to determine whether mentally tough athletes generally experienced more or less intense emotions.	emotional control, focus on processes, not just the result, self-talk, relaxation, positive emotions

Gucciardi, D. F., Stamatidis, A., & Ntoumanis, N. (2017)	Controlling coaching and athlete thriving in elite adolescent netballers: The buffering effect of athletes' mental toughness	232	women	team (netball)	Australia	11-17 year old	professional	questionnaire-multidimensional controlling coaching behavior scale Thriving at Work scale	The article looked at how coaches' behavior affects their athletes in terms of mental toughness.	-
Dr. RC Reddy, Theodros Berhanu (2016)	Mental toughness in sport: in case of mekelle university sport teams	37	men	team (football, volleyball, basketball)	Mekelle University	-	university level	Mental toughness Triwari and Sharma (2006) questionnaire	The aim of the study was to compare the mental toughness of basketball players, soccer players and volleyball players at Mekelle University. (self-confidence, attention control, motivation, goal, visual images and attitude control)	attention control, attitude control, concentration, maintaining motivation even in difficult situations, maintaining self-confidence, discipline and purposefulness, competitiveness
Tanja Kajtna, Dinko Vuleta, Maja Pori, Igor Justin and Primož Pori (2012)	Psychological characteristics of slovene handball goalkeepers	46	-	team (handball: goalkeeper post specialization)	Slovenia	M age = 23,13 year	first class	Buss-Durkee Aggression Questionnaire, Spielberger Anxiety Inventory, CRD (Drenovac, 1994), intelligence, concentration tests	This research focuses on handball goalkeepers, with a particular focus on aggression, anxiety, reaction time, fluid intelligence, and concentration. It compares successful and less successful goalkeepers.	positive aggression, visual attention, concentration, prognosis, anxiety management
Gloria B. Solomon (2015)	Mental Toughness among College Athletes.	174	58 men,116 women	individual and team	Universities in the southern United States	-	NCAA 1. university level	questionnaire-MTQ48	This study is intended to make exploratory efforts in the mental to determine the detection of toughness in NCAA 1. class of athletes.	trust, challenge, commitment and control, unwavering faith, self-confidence, calm,
J Golby, M Sheard, D Lavallee (2003)	A cognitive-behavioural analysis of mental toughness in national rugby league football teams	70	-	team (rugby)	-	18-35 year old	international rugby league players	Personal Views Survey III-R, Psychological Performance Inventory	The main aim of the study is to examine the mental toughness factors between the elite national teams competing in the Rugby League World Cup in 2000.	goal, mental test, self-confidence
Sheard, M., Golby, J., & van Wersch, A. (2009)	Progress Toward Construct Validation of the Sports Mental Toughness Questionnaire (SMTQ)	1142	633/427,508/351 men,633/206,509/158 women	-	UK	16-63 year old	international, national, county and provincial, as well as club and regional competitions	questionnaire-SMTQ	Two independent studies supported the three-factor model of SMTQ (trust, constancy, and control). The importance of this model is presented in the study.	optimism, toughness, stability, positive sensitivity
Cowden, R. G. (2017)	On the mental toughness of self-aware athletes: Evidence from competitive tennis players	333	175 men,158 women	individual (tennis)	south Africa	men M average: 31.99 year, women M average: 25.89 year	county club (n = 58), local county championship (n = 21), university championship (n = 147), national tournament (n = 76) and international tournament (n = 31)	questionnaire-SMTQ	The study examined the relationship between mental toughness(MT) and self-awareness.	self-confidence, encouragement
Samad Biglari , Afsaneh Sanatkara, Seyyed Molialdin Bahari , Mahshad Montazeri (2015)	The Comparison of Team and Individual Male Athletes, Mental Toughness at Different Levels of Skills	180	men	team and individual (basketball, handball, futsal, karate, wrestling, taekwondo)	Iran	-	skilled, semi-skilled, beginner level	questionnaire-SMTQ	The aim of the study was to compare male individual and team athletes at different levels of mental toughness.	reliability, stability and control, good command and coordination in stressful situations, calm, energetic
Newland, A., Newton, M., Finch, L., Harbke, C. R., & Podlog, L. (2013)	Moderating variables in the relationship between mental toughness and performance in basketball	197	92 men, 105 women	team (basketball)	American universities	-	NCAA 1. class, NCAA 3 class, NAIA	PPI-A	This study explored the relationship between mental toughness and college basketball performance, with reference to possible moderating variables (gender and baseline).	self-confidence, determination, self-confidence, positive coping
Golby, J., & Sheard, M. (2004)	Mental toughness and hardness at different levels of rugby league	115	-	team (rugby)	America	18-35 year old	International, Super League, first class	PPI,PVSIIR	The present study examined the extent of personality style and mental toughness, effectiveness in	engagement, control, challenge, negative energy control, attention control,

									predicting success for professional rugby players.	concentration, attention diversion blocking
Simon C. Middle-ton, Herb W. Marsh , Andrew J. Martin , Garry E. Richards , Clark Perry	Discovering Mental Toughness: A Qualitative Study of Mental Toughness in Elite Athletes	33 elite athlete and coach	21 men, 12 women	individual and team (athletics, swimming, boxing, hockey, rowing, archery, basketball, mountain running, mountaineering, marathon, rugby union, rugby league, australian football, baseball, cricket, cycling, water polo, squash, netball, triathlon, weightlifting and athletics for the disabled)	Australia	25- 70 year old	professional	interview, test	The primary goal of this article is to learn more about mental toughness from "expert" sources — elite athletes and coaches who know mental toughness. The primary output of the study is the definition and conceptualization of mental toughness based on reliable research methods.	coping skills, task-specific attention, perseverance, goal commitment, stress minimization and positive comparisons
Gerber, M., Best, S., Meerstetter, F., Walter, M., Ludvga, S., Brand, S., ... Gustafsson, H. (2018).	Effects of stress and mental toughness on burnout and depressive symptoms: A prospective study with young elite athletes	257	163 men, 94 women	individual and team (football, handball, volleyball, swimming, judo, athletics, tennis, hockey, karate, mountain bike, golf, others)	North-western part of Switzerland	14-22 year old	members of a regional or national team	questionnaire- SMBM, MTQ,PSS	They examined the extent to which mental toughness can affect burnout and depression in young elite athletes.	control, commitment, challenge, and confidence
Kristj-ánsdóttir, H., Erlingsdóttir, A. V., Sveins-son, G., & Saavedra, J. M. (2018)	Psychological skills, mental toughness and anxiety in elite handball players	174	84 men, 84 women	team (handball)	Iceland	18,8 +- 3,5 year	national age groups	Performance strategies test questionnaire, SMTQ and SAS-2	The association between psychological abilities, mental toughness and anxiety was studied in national handball players of different sexes and ages.	ability to concentrate, ability to recover from failure, pressure and coping with difficulties, commitment, and confidence
Katarina Paušek, Drago Paušek, Damir Sertić, Sasa Missoni, Josko Sindik (2017)	Psychological sporting talent and indicators of mental health at young male and female handball players	159	105 men, 54 women	team (handball)	Prvo plinarsko društvo, Metalac, Zamet, Samobor teams	14-16 year old	Croatian league	MSSPT, MES, MBFI, MSHS, MAES, MAIS, MPSIS, OS	The article sought to gain insight into gender differences in psychological characteristics that reflect sporting talents and some indicators of mental toughness in the best healthy young handball players.	fondness, conscience, emotional stability and openness to experience, flexibility, self-confidence and concentration
Jones, M. I., & Parker, J. K. (2013)	What is the size of the relationship between global mental toughness and youth experiences?	299	186 men, 112 women	team and individual (28 different sports (football, hockey, rugby, cricket, badminton, golf, athletics and horse riding)	American university	15-24 year old	university level	YES 2.0, SMTQ	The aim of this study is to link between mental toughness and youth experiences was an examination of the relationship.	motivational climate, external tools, development experiences, potential mechanisms
Goddard, K., Roberts, C.-M., Anderson, L., Woodford, L., & Byron-Daniel, J. (2019).	Mental Toughness and Associated Personality Characteristics of Marathon des Sables Athletes	42	33 men, 9 women	individual (ultra marathon)	America	28-57 year old	-	questionnaire- SMTQ, NEO PI-R	For ultramarathonists, mental toughness and personal character traits were examined.	lower levels of anxiety, higher impulsivity, search for excitement, positive emotions
Munish Singh Rana (2009)	Assessment of mental toughness among high and low achievers indian wrestlers: a comparative study	60	men	individual (wrestling)	India	-	national wrestlers, participants in national championships	questionnaire- PPI	The study examined mental toughness and its effect on competitive performance in Indian wrestlers.	self-confidence, negative energy control, attention control, visualization and image control, motivation, positive-energy control, attitude control
Rudvan Ekmekci, Bülent Okan Micoogullari (2018)	Examination and Comparison of Psychological Characteristics of American Football	44	men	team (handball, football)	Turkey	18-26 year old	Turkish University American Football League,	questionnaire- SMTQ, STAI	In this study, mental toughness and anxiety were chosen to compare	-

	Players and Handball Players						Turkish University Handball League		American men's soccer and handball players. The present study was designed to define and examine the psychological parameters mentioned above and has shown the importance of these concepts in sports careers.	
Andrew Levy, Adam Nicholls, Remco Polman (2012)	Cognitive Appraisals in Sport: The Direct and Moderating Role of Mental Toughness	296	200 men, 96 women	-	-	16-51 year old	beginner, university, international, county, national level	questionnaire-MTG48,SAM	We hypothesized that there was a positive relationship between mental toughness and challenge assessment and a negative relationship between mental toughness and threat assessment. Another goal of the study was to explore the mitigating role of mental toughness in assessing threats and challenges.	Mentally tough athletes can rate stressful situations as challenging and less threatening.
Stein Rodahl, Rune Giske, Derek M Peters, Rune Hoigaard (2015)	Satisfaction with the coach and mental toughness in elite male ice hockey players	154	men	team (ice hockey)	Norway	17-33 year old	Norwegian GET League, elite athletes	questionnaire-SMTQ, ASQ	First, we examined the mental toughness of elite hockey players, and second, the satisfaction of elite hockey players with the personal treatment, training and education of their coaches, utilization of their abilities, and play strategies as predictors of mental toughness.	coach-athlete relationship, flexibility, self-confidence, commitment, self-belief, concentration and coping with pressure.
Mohammad Ahsan, Arif Mohammad (2018)	Mental toughness as a determinant factor of performance in table tennis	24	-	individual (table tennis)	Delhi (India)	17-24 year old	the state level was the lowest	Goldberg's mental questionnaire	The aim of this study was to examine mental toughness effect on the performance of table tennis players as well as mental toughness to predict athlete performance.	-
Cowden, R. G., Meyer-Weitz, A., & Oppong Asante, K. (2016)	Mental Toughness in Competitive Tennis: Relationships with Resilience and Stress	351	185 men, 166 women	individual (tennis)	South Africa	18-84 year old	international, national, university team / league, local county and county club level	questionnaire-SMTQ, RSA, RESTO	-	attention control
Jones G, Hanton S, Connaughton D. (2002)	What Is This Thing Called Mental Toughness? An Investigation of Elite Sport Performers	10	7 men, 3 women	team and individual (swimming, short distance, rhythmic gymnastics, trampoline, medium distance, triathlon, golf, rugby and netball)	University of Wales	M average= 31,2 year	Participation in internationally recognized games (Olympic or Commonwealth Games). One of the participants competed in two sports internationally during his career, five retired and five were still active competitors.	interview	The aim of this research was to conduct a scientific study that identifies and defines the key characteristics that serve as the cornerstones of mental toughness.	Self-belief and its greatness ("Unwavering") mental toughness has proven to be key and fundamental in the process. Treatment of pressure, treatment of physical-emotional pain, focus and motivation are also featuring of maintaining mental toughness.
Connaughton, D., Wadey, R., Hanton,	The development and maintenance of mental toughness:	7	5 men, 2 women	team and individual (gymnastics, rhythmic	-	M average = 33 year	international level	interview	-	thorough knowledge, fraternal rivalry,

S., & Jones, G. (2008)	Perceptions of elite performers			gymnastics, swimming, trampoline, triathlon and rugby)						unyielding desire, intrinsic motivation, reflection, competitive spirit, physical and mental preparation, unshakable faith
Rubina Masum (2014)	A mixed method analysis of mental toughness in elite and sub-elite male and female tennis players in Pakistan	118	-	individual (tennis)	Pakistan	-	national and international competitions, recreational sports	PPI-A	This study studies the potential relationship between mental toughness and performance among professional and amateur Pakistani tennis players.	self-belief, focus, public image, commitment
Meggs, Jennifer Chen, Mark A. (2018)	Mental toughness and attributions of failure in high performing male and female swimmers	80	44 men, 36 women	individual (swimming)	Clubs from the North East of England	M average: 21,64 year	national and regional level	questionnaire-CSGU, MTQ48	The aim of this study is to examine how the attributable dimensions of mental toughness and the generalizability attributability of stability, globality, and universality predict manageability in response to perceived failure.	ability to manage self-awareness, self-efficacy, confidence, control, failure
O. Alvarez B. Walker I. Castillo (2018)	Examining motivational correlates of mental toughness in Spanish athletes	155	82 men, 73 woman	team (handball, volleyball, basketball, rugby and football)	Spain	18 és 36 year	international, national, state and at the local club level	SCQ, TEOSQ, MTI, future practical scale	The aim of the study is to explore the relationships between supporting athletes 'coaching autonomy and controlling interpersonal style, and the relationships between athletes' task and ego goal orientations and MT athletes.	coach-athlete relationship, motivation
Maamer Silmani, Bianca Mlarka, Walid Briki, and Foued Cheour (2015)	Comparison of Mental Toughness and Power Test Performances in High-Level Kickboxers by Competitive Success	32	men	individual (kick- box)	Tunisia	21.2 ⁺ -3.1 year	elite athletes	questionnaire-SMTQ, CMJ, MBT	The present study compared and confirmed the relationship between mental toughness (MT) and counter-movement (CMJ) and medical ball throwing (MBT) strength tests based on the results of high-level kickboxers.	process-oriented action, not victory-defeat, muscle power performance, confidence, self-esteem, emotional control, goals
Brigitta Kiss, László Balogh (2019)	A study of key cognitive skills in handball using the Vienna test system	92	54 men, 42 women	team (handball)	Hungary	14-37 year	NB1, NB1/B Hungarian Championship	instrumental testing VS (DT, COG)	Studying the adaptation of handball players to the environment and their decision-making in certain situations using the Vienna Test System.	concentration, attention

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