

1 Running head: Mental toughness research

2 Title: A review and conceptual re-examination of mental toughness: Implications for  
3 future researchers

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## Abstract

1  
2 This paper provides a review of mental toughness research and examines the major  
3 conceptual concerns that are evident in current mental toughness literature. Despite  
4 more rigorous scientific approaches to the study of mental toughness, a number of  
5 limitations are apparent: These include the assumption that elite or super elite  
6 performers are mentally tough (failure to provide objective measures), focusing research  
7 solely on elite or super elite performers, appearing to conceptualise mental toughness in  
8 absolute rather than relative terms, and ignoring contextual differences. Comparisons  
9 are made with research developments in the related concept of hardiness. It is argued  
10 that more innovative approaches to research are required to further develop knowledge.  
11 This should include more experimental studies, longitudinal research,  
12 psychophysiological approaches, and testing the influence of mental toughness in  
13 contexts outside sport performance. Further efforts to understand how mental toughness  
14 develops are encouraged. With recent advances in instruments to measure mental  
15 toughness, further quantitative research is deemed appropriate. The efficacy of proposed  
16 methods of enhancing mental toughness such as environmental manipulations, and  
17 mental skills training approaches need to be evaluated if the gap between theoretical  
18 research and practice is to be bridged.

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## 1 Introduction

2 Although the concept of mental toughness in sport is not new, and applied texts  
3 devoted to the development of mental toughness have existed for some time (i.e. Bull,  
4 Albinson, & Shambrook, 1996; Goldberg, 1998; Loehr, 1986, 1995), it was not until  
5 relatively recently that more rigorous scientific approaches to the study of this important  
6 construct have been evident (Jones, Hanton, & Connaughton, 2002, 2007). The surge in  
7 research interest clearly indicates the importance which sport psychologists, coaches  
8 and athletes attach to the concept of mental toughness because of the potential  
9 relationship with successful performance (cf. Crust, 2007).

10 In the past decade, scientific evidence has ostensibly led to a greater  
11 understanding of mental toughness, although agreement concerning the  
12 conceptualisation, definition, and development of mental toughness has been slow to  
13 emerge. Bull, Shambrook, James, and Brooks (2005, p211) take a pragmatic stance by  
14 accepting the conceptual ambiguities which are, 'bound to exist when trying to establish  
15 all encompassing definitions of mental toughness in sport'. As research interest appears  
16 to be increasing there is a need to evaluate progress and to focus research efforts to  
17 enable efficient acquisition of new knowledge.

18 This paper aims to review mental toughness research, re-examine some of the  
19 underlying conceptual and methodological issues, identify gaps in the knowledge  
20 domain and provide appropriate direction for future researchers. With apparent  
21 increased knowledge of what mental toughness is (Clough, Earle, & Sewell, 2002;  
22 Jones et al., 2007), the associated attributes of mentally tough performers (Fourie &  
23 Potgieter, 2001; Jones et al., 2002) and emerging evidence of how mental toughness is  
24 developed and maintained (Bull et al., 2005; Connaughton, Wadey, Hanton, & Jones,  
25 2008), there is a need to carefully consider how research should proceed.

### 1 *Replication or Innovation?*

2 In relation to the study of anxiety in sport, Nesti (2004) suggested future researchers  
3 faced an important decision: to continue using the same methods and asking the same  
4 questions, thereby essentially replicating past research; or choose new approaches in an  
5 attempt to advance knowledge. With a plethora of research studies using qualitative  
6 methods and elite athletes from either generic athletic samples or mainstream sports to  
7 identify the attributes of mentally tough athletes (Bull et al., 2005; Fawcett, 2005;  
8 Fourie & Potgieter, 2001; Gordon, Gucciardi, & Chambers, 2007; Jones et al., 2002,  
9 2007; Thelwell, Weston, & Greenlees, 2005) it is reasonable to consider the value of  
10 pursuing this particular line of enquiry. It will be presently argued that researchers need  
11 to adopt more innovative approaches to the study of mental toughness. Just as mentally  
12 tough athletes seek challenges and are focused on personal growth, mental toughness  
13 researchers need to embrace the challenge to be innovative, rather than continue to  
14 replicate past research; or as Maddi (2004) might suggest, have the courage to choose  
15 the future rather than the past.

### 16 *Dominant Perspectives*

17 The work of Jones et al. (2002; 2007) has undoubtedly made a significant  
18 contribution to the current understanding of mental toughness in sport. In contrast to  
19 previous investigations, these studies demonstrated a more rigorous, scientific approach.  
20 Jones et al. (2002, 2007) studied mental toughness within the guiding framework of  
21 personal construct theory (Kelly, 1955) and employed qualitative methods using elite,  
22 and super elite performers (Olympic gold medallists and world champions) from a  
23 variety of sports. To their credit, these researchers also included coaches and sport  
24 psychologists within their sample in order to gain a broader perspective. A three-stage  
25 procedure was adopted in both studies which progressed from a small focus group

1 (three participants), to individual interviews and follow-up interviews to confirm the  
2 definitions of mental toughness and the attributes of mentally tough performers that  
3 emerged during the initial stages of the research. Jones et al. (2007, p. 247) defined  
4 mental toughness as:

5       Having the natural or developed psychological edge that enables you to,  
6       generally, cope better than your opponents with the many demands  
7       (competition, training, lifestyle) that sport places on a performer and,  
8       specifically, be more consistent and better than your opponents in remaining  
9       determined, focused, confident, and in control under pressure.

10       Jones et al. (2007) reported thirty attributes of mental toughness which were  
11       presented within four separate dimensions. These four dimensions consisted of Attitude  
12       / mindset (belief, focus), Training (using long-term goals as the source of motivation,  
13       controlling the environment, pushing yourself to the limit), Competition (handling  
14       pressure, belief, regulating performance, staying focused, awareness and control of  
15       thoughts and feelings, controlling the environment) and Post-competition (handling  
16       failure, handling success).

17       The definition and conceptualisation of mental toughness proposed by Jones et  
18       al. appears to have achieved significant support from other researchers who have  
19       adopted similar qualitative approaches, and studied elite, mainstream sports participants  
20       (Bull et al., 2005; Thelwell et al., 2005). However, it is necessary to be cognisant of  
21       findings that offer alternative perspectives on mental toughness, as previous research  
22       has not universally supported the findings of Jones et al. Despite advances, a number of  
23       theoretical and methodological issues require greater clarification.

24       *Limitations and Theoretical Problems*

1 While the work of Jones et al. clearly moves towards a more thorough,  
2 multidimensional understanding and conceptualisation of mental toughness, criticisms  
3 remain. Crust (2007) highlighted concerns with using small numbers in the initial focus  
4 group stage of the research, since researchers and theorists have consistently  
5 recommended between 6 and 8 participants in focus group research (Bloor, Frankland,  
6 Thomas, & Robson, 2001). Such group sizes enable individuals to sufficiently challenge  
7 one another, as well as re-consider and re-evaluate their own positions in order to move  
8 beyond individual interpretations (Kitzinger, 1995). While it could be argued that the  
9 comprehensive nature of the second and third stages of the Jones et al. (2002; 2007)  
10 research negates such concerns, the focus group itself does appear rather limited, given  
11 that it is the foundation of the research.

12 Furthermore, it could be argued that the emerging attributes of mental toughness  
13 are little different to those found previously (Loehr, 1995; Fourie & Potgieter, 2001).  
14 Another concern, highlighted by Middleton et al. (2004a) is that the definition of mental  
15 toughness presented by Jones et al. does not represent what mental toughness is, but  
16 rather what mental toughness can allow athletes to do. There is also an underlying  
17 assumption that elite and super elite participants will be mentally tough, with no  
18 objective measure of mental toughness attempted to verify this. Jones et al. (2007)  
19 justify their approach on the basis that mental toughness should be related to successful  
20 outcomes, and interestingly because 'there is no validated measure of mental toughness'  
21 (p.244). Given that a number of instruments have been developed to measure mental  
22 toughness, and have been found to be valid and reliable (MT48 – Clough et al., 2002),  
23 and possess adequate psychometric properties (PPI-A – Golby, Sheard, & van Wersch,  
24 2007) this statement is inaccurate and misleading. Finally, despite the research being

1 guided by personal construct theory, the work is not underpinned by any extant theories  
2 of personality or development.

3 While the work of Jones et al. (2002; 2007) has sought to address the conceptual  
4 weaknesses of previous studies, and thus reduce the conceptual confusion, ambiguity  
5 and contradictions of previous work, there is an alternative view that has been  
6 overlooked: such problems in previous research might, in part, have been a reflection of  
7 individual difference and the fact that the term 'mental toughness' may have various  
8 idiosyncratic meanings to different athletes in different sports (cf. Fawcett, 2005).

9 While numerous attributes have been found to consistently represent mental toughness  
10 (cf. Crust, 2007) in a variety of settings, other attributes are less frequently reported and  
11 are not consistent with the findings of Jones et al. (i.e. mental self-concept, religious  
12 convictions, task familiarity, ethics, self-knowledge, patience, flexibility, and  
13 sociability).

14 Little attention appears to have been given to the proposal of Bull et al. (2005),  
15 who suggested different forms of mental toughness, and differentiated between 'final  
16 putt' or pressure mental toughness; 'endurance' mental toughness or mental toughness  
17 in relation to heavy training schedules; and mental toughness in circumstances of  
18 extreme physical danger. While an over-arching framework of mental toughness, with  
19 central attributes has recently been presented (Jones et al., 2007), in practical terms, the  
20 mental toughness required of a snooker player is not likely to be congruent to that of a  
21 rower, or a mountaineer. If the ultimate outcome is to intervene and help athletes to  
22 develop higher levels of mental toughness, it would appear that ignoring such  
23 differences is to the detriment of knowledge development, and this is dangerous as it  
24 might lead researchers down a metaphoric 'blind alley'.

1           Another problem with the dominant conceptualisation of mental toughness is the  
2 predominant focus on elite and super elite sports participants and coaches (i.e. Bull et  
3 al., 2005; Fourie & Potgieter, 2001; Jones et al., 2002; 2007; Thelwell et al., 2005). The  
4 implicit assumption seems to be that successful athletes must be mentally tough without  
5 any attempt to objectively evaluate the mental toughness of participants. It is quite  
6 conceivable that for many of the participants, that physical characteristics, abilities, or  
7 physiological factors were more influential in relation to success. Jones et al. (2007, p.  
8 244) are quick to acknowledge that because their own definition of mental toughness  
9 ‘contains a dimension that relates to successful outcomes, mental toughness should be  
10 investigated in a sample of athletes who have achieved ultimate success in their  
11 respective sports’. While it is easy to agree that mental toughness includes an outcome  
12 dimension, it is difficult to conceive why mental toughness should only be studied with  
13 elite or super elite participants. This approach would appear restrictive given that  
14 successful outcomes are perhaps more appropriately conceived in relative, rather than  
15 absolute terms, reflecting what Bull et al. (2005) revealed as a ‘determination to make  
16 the most of ability’. Similarly, Loehr (1995) defined mental toughness in relative terms,  
17 describing the ability to consistently perform toward the upper range of ones talent and  
18 skill, regardless of competitive circumstances. Since athletes all have differing levels of  
19 ability, conceiving mental toughness in absolute, rather than relative terms appears to be  
20 problematic.

21           Furthermore, the definition of mental toughness presented by Jones et al. (2002;  
22 2007) is not consistent with concepts such as self-efficacy, which emphasise the need  
23 for other non-psychological prerequisites when considering the relationship with  
24 successful outcomes (Bandura, 1986). Previous mental toughness researchers have also  
25 stressed the importance of both psychological and physical prerequisites (Fourie &

1 Potgieter, 2001). Although using elite and super elite performers to study mental  
2 toughness has intuitive appeal, there is a danger that mental toughness erroneously  
3 becomes a concept only attributable to such athletes.

#### 4 *Qualitative and Quantitative Research*

5 In moving towards a clearer understanding of mental toughness it is important to  
6 consider the future role of qualitative and quantitative investigations. Undoubtedly,  
7 qualitative research methods have a significant role to play in acquiring knowledge of  
8 how mental toughness develops. However, while qualitative research has been  
9 instrumental in providing rich, descriptive interpretations, and have revealed mental  
10 toughness to be multidimensional, future researchers should also be encouraged to  
11 employ quantitative approaches to examine perceptual, affective, cognitive, and  
12 behavioural differences between athletes with differing levels of mental toughness.  
13 Experimental research investigating aspects of the conceptualisation of mental  
14 toughness such as decision-making under pressure, performance consistency, or risk  
15 taking are becoming increasingly necessary. Indeed, in viewing the progress of related  
16 research from health psychology, the importance of quantitative research is evident in  
17 establishing relationships between hardiness and variables such as, blood pressure, self-  
18 care, coping, and performance (cf. Maddi, 2004).

19         Research by Clough and colleagues (Clough et al., 2002; Crust & Clough, 2005;  
20 Levy, Polman, Clough, Marchant, & Earle, 2006) using the MT48 and MT18  
21 questionnaires has already established various perceptual and behavioural differences  
22 between participants with self-reported varying levels of mental toughness (cf. Crust,  
23 2007). Furthermore, other researchers such as Golby and colleagues (Golby, Sheard, &  
24 Levallee, 2003; Golby & Sheard, 2004), and Gucciardi, Gordon, and Dimmock (2007)  
25 have also begun to move the study of mental toughness forwards by employing

1 quantitative methods. However, given that the predominant approach appears to be the  
2 use of self-report questionnaires, future researchers should look to use multi-source  
3 measures of mental toughness to help reduce the likelihood of socially desirable  
4 responding. Encouragingly, recent research in Australian football, comparing self-  
5 reported mental toughness to coach and parent evaluations using the authors own  
6 Australian Football Mental Toughness Inventory, found no evidence that football  
7 players were giving socially desirable responses (Gucciardi et al., 2007). While future  
8 refinements to existing measurement instruments are necessary (Crust, 2007), the recent  
9 advancements in this area appear promising and likely to encourage more objective  
10 testing.

### 11 *Transferability*

12 From a theoretical perspective, one of the most important aspects of mental toughness  
13 which researchers urgently need to establish is the concept of transference. Given that  
14 mental toughness is most often proposed to be a personality disposition (cf. Crust,  
15 2007), it would seem reasonable to expect that high mental toughness would be  
16 demonstrated in various aspects of athletes lives, and not just in their main sports.  
17 Indeed, it is difficult to conceive mental toughness as only applicable to sport, as many  
18 other competitive and pressured environments exist beyond sport (performing arts,  
19 business etc.). There is some evidence of broadening out the study of mental toughness  
20 already, with relationships found with effective lifestyle management and dealing with  
21 organisational stress (Fawcett, 2005).

22         Studies such as Jones et al. (2002, 2007) have used samples of athletes from a  
23 variety of different sports to better understand the concept of mental toughness. This  
24 approach appears to assume that mental toughness is a generic, multidimensional  
25 concept that is best understood by piecing together common perceptions of elite

1 athletes. However, participants in such investigations are primarily considered mentally  
2 tough through being elite or super elite performers in respect of their own sport. To  
3 advance knowledge of mental toughness, there needs to be attempts to consider how far  
4 the concept impacts on perceptions, cognitions, affect, and behaviour, beyond the  
5 individual's primary sport performance. Does a professional soccer player, who has  
6 high mental toughness, demonstrate mental toughness when faced with other life  
7 challenges such as dealing with difficult inter-personal relationship issues, needing to  
8 take action in an emergency situation, problem-solving, parenting, or even competing in  
9 a charity endurance challenge? The key question is how do mentally tough individuals  
10 cope with pressure and adversity outside of their own sport?

11           With the related concept of hardiness, a personality disposition discovered by  
12 health psychologists to be an influential resistance resource when confronting stress  
13 (Kobasa, 1979; Kobasa, Maddi, & Kahn, 1982; Maddi, 2004), it has been found that  
14 hardy individuals are not just particularly effective at managing their work related  
15 stress, but rather in managing all aspects of their lives (cf. Maddi, 2004). Kobasa et al.  
16 (1982) emphasised the relationship between personality dispositions and coping,  
17 suggesting that hardiness might influence coping, and this mechanism might be  
18 responsible for buffering stress. More recently Maddi (2004) has described the positive  
19 relationship between transformational coping and hardiness, with hardy individuals  
20 more likely to diminish (rather than avoid) the threat of a potential stressor by  
21 addressing not only the problem but also the emotions that it arouses. On this basis, and  
22 as others have already pointed out (Crust, 2007; Nicholls & Polman, 2007), there is a  
23 need to understand the relationship between mental toughness and coping, including the  
24 evaluation of both cognitive appraisal, and action aspects. Are the same coping process  
25 used by athletes in their particular sport, also employed when confronting stresses in

1 other contexts? Furthermore, understanding the influence of mental toughness beyond  
2 specific sports contexts has important implications for practitioners and researchers  
3 considering the best approach to developing mental toughness. If mental toughness is a  
4 broader personality disposition, then consistent with Gould, Dieffenbach, & Moffett  
5 (2002), cultural and environmental influences from both inside and outside of sport, and  
6 more general life based skills would likely be important in developing mental  
7 toughness.

#### 8 *Bridging the Gap between Theory and Practice*

9 While it is important to establish a clear conceptualisation of mental toughness, and to  
10 understand how mental toughness develops, from an applied perspective, practitioners  
11 are most likely to be concerned with developing mental toughness in their athletes. One  
12 key question concerns the degree to which mental toughness is *caught* via  
13 environmental influences, or *taught* through training (Gordon et al., 2007). For some  
14 time, numerous texts have existed concerning what might broadly be called ‘mental  
15 toughness training’ (Bull et al., 1996; Goldberg, 1998, Loehr, 1995), although these  
16 texts appear to lack sufficient theoretical underpinning. Recently, some initial progress  
17 has been made in understanding how mental toughness develops through interviewing  
18 elite athletes, with evidence appearing to suggest a pivotal role for environmental  
19 factors (Bull et al., 2005; Connaughton et al., 2008; Gould et al., 2002). In their mental  
20 toughness pyramid, which was developed through the study of elite English cricketers,  
21 Bull et al. (2005) propose environmental influences provide the foundation of mental  
22 toughness development on the two key levels of upbringing and transition. In terms of  
23 upbringing, participants reported the importance of parental influence and childhood  
24 background. In relation to transition, the early part of a junior playing career was found

1 to be important because of exposure to tough environments (playing abroad, as an  
2 outsider) and providing opportunities to survive early setbacks (learning from failure).

3 Connaughton et al. (2008) studied the development of mental toughness in elite  
4 athletes in relation to Bloom's (1985) subdivision of career phases (early, middle, later).  
5 Findings provide further evidence of the importance of environmental influences, with  
6 various individuals (parents, coaches, siblings, senior athletes, sport psychologists etc.)  
7 contributing to development, and to social support networks, that extended beyond sport  
8 contexts. These researchers also suggested the importance of an appropriate  
9 motivational climate (enjoyment and mastery), which is likely to have important  
10 implications for transition periods as junior players develop, and attend training  
11 academies. Given the highly competitive nature of elite sport, research is needed to  
12 establish what type of climate is best suited to developing mental toughness in aspiring  
13 junior athletes. While the work of Connaughton et al. (2008) and much research in  
14 physical education contexts suggests the importance of promoting a mastery based  
15 climate, it is clear that elite sport is far more oriented towards outcomes and winning. It  
16 is therefore legitimate to consider what constitutes the most appropriate environment to  
17 enable the development of mental toughness. On the basis of 'toughening-up', the  
18 application of stress inoculation training, a widely used method in applied sport  
19 psychology (Clough et al. 2002), assumes that gradual exposure to stress (rather than  
20 avoidance) would be most appropriate. Research into physiological toughness also  
21 appears to support the notion that stress tolerance can be increased with intermittent  
22 exposure to stressors (cf. Dienstbier, 1989). Research focusing on the relationship  
23 between motivational climate and mental toughness would appear to be vital to evaluate  
24 whether the promotion of mastery climates in sports academies is the best preparation  
25 for the psychological demands of professional sport.

1 Future researchers should be encouraged to study the development of mental  
2 toughness in respect of established theories of development, such as Erikson's  
3 Psychosocial Theory (1963). This theory might be particularly suited to the study of  
4 mental toughness given that Erikson's most important contribution was considering the  
5 individual in context of both family and society, and by identifying the essential  
6 concerns of adulthood, including trust, identity, and competence (Wade & Tavis,  
7 1996). The use of longitudinal research methods is needed to determine how mental  
8 toughness changes over time and to establish the crucial developmental periods.

9 While the influence of environmental factors on the development of mental  
10 toughness appears to have initial support, the role of traditional sport psychology  
11 interventions (mental skills training) is less clear. Bull et al. (2005, p.226) suggests that  
12 it 'is also interesting to note that very little of the output relates directly to mental skills  
13 training', and propose the integration of mental skills training into the appropriate  
14 environment rather than focusing on such techniques in isolation. Interestingly, there is  
15 evidence that interventions can be successfully used to develop hardiness (cf. Maddi,  
16 2004), although as Crust (2007) highlights, the prototypical form of hardiness training  
17 used was clearly more holistic than most sport-based mental skills training approaches.  
18 Other evidence appears to show that such skills as goal-setting and self-talk have an  
19 important role in the development of mental toughness (Connaughton et al., 2008). With  
20 the emergence of instruments to measure mental toughness, there is scope for testing the  
21 impact of psychological interventions on mental toughness and this would certainly  
22 advance the knowledge base. Questionnaires such as the MT48 (Clough et al., 2002),  
23 which not only measure overall mental toughness, but also include measures of various  
24 subscales (Commitment, Challenge, Control – emotional and life, and Confidence – in  
25 abilities, and interpersonal) allow specific components of mental toughness to be

1 targeted, rather than applying more generic interventions. As such, case study research,  
2 focusing on the needs and developments of individuals, might be an ideal starting point  
3 in relation to advancing knowledge in this area.

4         Another important future direction of mental toughness research that might be  
5 used to bridge the gap between theory and practice is the identification of observable  
6 behaviours that are associated with mentally tough performers. Such behaviours are  
7 likely to be observed in both the approach of participants to practice and training  
8 sessions, and in competitive contexts. This work appears to have begun with Davis and  
9 Zaichkowsky's (1998) study of mental toughness in ice-hockey. These researchers  
10 asked coaches, scouts and managers to rate players mental toughness in respect to: (1)  
11 adversity response (i.e. increased work rate), (2) over-achievement (exceeds usual  
12 performance under stress), (3) effort (consistency), (4) enthusiasm (encourages team-  
13 mates), and (5) skill (subjective assessment of demonstrated ability). However, the  
14 results remained equivocal since no justification for the five listed categories was given,  
15 and no standardised performance / behavioural checklists were produced to allow  
16 quantifiable analysis. Despite this, if behavioural checklists could be established in  
17 specific sports, then coaches and psychologists might be able to work with players to  
18 promote such behaviours, and in team sports, use mentally tough players to cultivate  
19 such behaviour in others (perhaps most influentially in relation to younger, developing  
20 players). This is consistent with the findings of Connaughton et al. (2008) which  
21 identified the importance of vicarious experience and role models.

22         In related research involving social interactions, hardiness has been found to be  
23 associated with both giving and receiving encouragement, and various leadership  
24 behaviours (cf. Maddi, 2004). Further research into the related behaviours associated  
25 with mental toughness might also allow coaches to become more able to identify mental

1 toughness in relation to team recruitment, although such approaches must be cautiously  
2 developed given past misuse of personality measures. A further additional benefit from  
3 the development of behavioural checklists is the potential to add to multi-modal  
4 measures of mental toughness and potentially establish more accurate and trustworthy  
5 measurements.

### 6 *Physiological Toughness*

7 Another line of research that has important implications for the study of mental  
8 toughness is provided by Dienstbier (1989) in his review of arousal and physiological  
9 toughness. It would seem important to consider physiological toughness given that  
10 researchers have considered physical toughness as a component of mental toughness  
11 (Gucciardi et al., 2007) and other researchers have noted a relationship between mental  
12 toughness and physical endurance / pain tolerance (Crust & Clough, 2005). Dienstbier  
13 considered literature concerning human and non-human confrontations with stress  
14 (defined by appraisals of threat or harm rather than of challenge). The observations that  
15 Dienstbier made in regards to the interrelationship between arousal, performance and  
16 personality would appear to be particularly pertinent to the concept of mental toughness.

17       Dienstbier (1989) reviewed a number of studies that reported relationships  
18 between task performance and hormonal levels. Evidence from both non-human and  
19 human studies showed that better performances across a variety of tasks appeared to be  
20 associated with increased catecholamine levels and quicker return to baseline rates  
21 following stressful manipulations. In turn, those participants who experienced greater  
22 increases in catecholamine were also shown to be more socially adjusted, and to have  
23 greater emotional stability (Johansson, Frankenhaeuser, & Magnusson, 1973), lower  
24 levels of anxiety (Rauste-von Wright, von Wright, & Frankenhaeuser, 1981) and greater  
25 adaptive capacity or stress tolerance (Roessler, Burch, & Mefferd, 1967). These same

1 characteristics appear in definitions and as attributes of mentally tough performers.  
2 Dienstbier summarised these finding by stating that ‘the same manipulations that  
3 increase emotional stability and stress tolerance, also increase central and peripheral  
4 catecholamine availability’ (p. 86).

5 Another important aspect of Dienstbier’s (1989) work is the distinction he made  
6 in regards to different kinds of arousal; that is Sympathetic Nervous System-adrenal-  
7 medullary arousal (stimulates the release of the catecholamines adrenaline and nor-  
8 adrenaline) and pituitary-adrenal-cortical arousal (stimulates the release of cortisol).  
9 High levels of cortisol, an important biomarker of stress reactivity (Clow, 2004) appears  
10 to be related to poor performance and defensiveness (Ursin, Baade, & Levine, 1978;  
11 Vaernes, Ursin, Darragh & Lambe, 1982). Evidence from both human and non-human  
12 studies suggest that high levels of cortisol are maintained by a lack of appropriate  
13 responses (Dienstbier, 1989). Increasing participant control and enabling participants to  
14 define the situation as ‘challenging’ prevents high levels of cortisol and depletion of  
15 catecholamines (Miller, 1980). Indeed, children who were found to cope more  
16 effectively with hospitalisation were shown to have lower cortisol levels (Knight,  
17 Atkins, Eagle, et al., 1979).

18 In relation to personality correlates, high cortisol levels have been found to be  
19 associated with anxiety, depression and neuroticism (Anisman & La Pierre, 1982) and  
20 with low self-esteem (Pruessner, Hellhammer, & Kirschbaum, 1999). Coping more  
21 effectively with stress appears to require an ability to suppress the cortisol response and  
22 to resist catecholamine depletion (Dienstbier, 1989). Evidence suggests the cortisol  
23 response to standardised stressors can be attenuated by cognitive behavioural  
24 interventions (cf. Clow, 2004). This finding could have important implications for

1 researchers wishing to evaluate the role of mental skills training on the development of  
2 mental toughness.

3         The sum of Dienstbier's (1989) work was the proposal of four toughening  
4 manipulations that affect physiological mediators, which are consequently reflected in  
5 performance and temperament characteristics. These four manipulation are (1) early  
6 experience (early life exposure to stress), (2) passive toughening (intermittent exposure  
7 to stress that is equivalent to stress inoculation training), (3) active toughening (such as  
8 exercise) and (4) ageing (opposite effects than other three manipulations, reduces  
9 toughening). The second and third of these four proposed manipulations certainly  
10 suggests that appropriate interventions could result in 'toughening up'.

11         On the basis of psychophysiological research, it might be hypothesised that a  
12 mentally tough individual would exhibit different patterns of reactivity to standardised  
13 stressors, than would a less tough individual. Specifically, it could be hypothesised that  
14 high levels of mental toughness would be characterised by increased arousal to meet the  
15 challenge (larger adrenaline increases) and the ability to cope with stressors more  
16 effectively (lower cortisol rates). Assessing the impact of mental toughness training on  
17 bio-markers of stress (i.e. cortisol) would also help to understand exactly how mental  
18 toughness operates. Moreover, the establishment of links between multi-source  
19 measures of mental toughness would help to establish more accurate measurement of  
20 mental toughness.

### 21 *Potential Drawbacks of being Mentally Tough*

22 The vast majority of research thus far, has considered mental toughness as a positive  
23 psychological construct, linked to successful outcomes. However, recent research does  
24 suggest some possible drawbacks to being mentally tough, especially in relation to  
25 recovery from injury. Levy et al. (2006) found support for previous research that

1 suggested mental toughness was associated with greater pain tolerance (Crust &  
2 Clough, 2005), but reported that participants with low mental toughness showed better  
3 adherence to clinic based rehabilitation activity. These researchers suggest this finding  
4 might be due to 'high mentally tough individuals appraising their injury to be less  
5 severe and less susceptible to reoccur and thereby perceive compliance to clinic based  
6 activity to be less important' (Levy et al., 2006, p. 252). On this basis, future researchers  
7 might consider testing whether mental toughness is associated with playing on while  
8 injured, and injury reoccurrence. There are fascinating arguments that pertain to the  
9 relationship between mental toughness and injury that will probably be more  
10 appropriately approached as research evidence develops. In essence, is mental  
11 toughness about playing on while injured, risking long-term damage, and potentially  
12 reducing team efficiency; or is it taking the difficult decision to stop training and  
13 competing, seeking medical support, focusing on adhering to a program of  
14 rehabilitation, and returning to action as soon as possible? With the 'no pain, no gain'  
15 philosophy that apparently pervades elite sport, this would appear to be an important  
16 question for future researchers.

## 17 Conclusion

18 While the study of mental toughness has clearly advanced through more rigorous recent  
19 studies (Bull et al., 2005; Jones et al., 2002; 2007) a number of research limitations and  
20 theoretical problems are evident. In the present paper it is proposed that the narrow  
21 focus on elite and super elite athletes is somewhat restrictive and that mental toughness  
22 should more appropriately be considered in relation to an individuals potential.  
23 Furthermore, it is argued that research which has assumed that elite and super elite  
24 athletes are mentally toughness with no objective measures sets a dangerous precedent.  
25 While qualitative research has undoubtedly facilitated greater understanding of what

1 mental toughness is, and how mental toughness develops, with advancements in  
2 appropriate psychometric measurement instruments, more quantitative studies are to be  
3 encouraged. Such research will help mental toughness research expand and avoid  
4 replication. The challenge that faces future researchers is to be innovative in regards to  
5 research methods, and explore mental toughness in broader contexts. It is unlikely that  
6 mental toughness is only relevant in the sport domain, so attention is needed to  
7 determine how mentally tough individuals behave in other areas of their lives. Since  
8 cognitive and physiological functioning are not discrete entities, researchers should be  
9 encouraged to explore the physiological correlates of mental toughness. In relation to  
10 the development of mental toughness, much more work is needed to determine the  
11 effects of environmental manipulations and skills training approaches to developing this  
12 important construct.

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