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Is Mental Toughness Related with Motor Learning in Wrestling?

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Abstract

Background: In sport context learning a skill, and performing it flawlessly is of great importance. There is a unanimous consensus among sport scientists, coaches, and athletes, that along with physical, technical and tactical skills, psychological skills are also necessary for an optimal sport performance.

Objectives: The aim of the present study was to investigate the role of mental toughness in motor learning and sport performance in wrestling.

Methods: This study was semi-experimental and its population were physical education students of the University of Tehran in 2018. Using intensive sampling method, 28 student-athletes, who never had any past wrestling skill practices, were selected. Subsequently, using Mental Toughness-48 questionnaires, they were divided into two equal groups of high and low in mental toughness. After that, all participants were randomly assigned into two groups of equal size and 30 wrestling skills were taught to them twice a week for 3 months by two professional wrestling coaches. Their motor learning was assessed by three other professional coaches in the last week of training and one week after the last session. Motor learning score was obtained by calculating the mean scores of acquisition and retention stages. Then, two groups with high and low levels of mental toughness were compared regarding their motor learning scores. Tools used in this study included demographic consent form, wrestling skills test and The Mental Toughness Questionnaire-48 (MTQ 48).

Results: The results suggested that mentally tough student-athletes demonstrated significantly higher motor learning scores compared with their counterparts who had lower levels of mental toughness ($P \leq 0/05$). This advantage was persistent both in the acquisition and retention stages ($P \leq 0/05$).

Conclusions: It was concluded that mental toughness could be considered as a key factor in motor learning. Therefore, it is recommended to coaches and athletes to develop mental toughness in order to enhance motor learning and achieve successful performance.

Keywords: Mental Toughness, Motor Learning, Psychological Skills

1. Background

No one could deny the essential role of learning in human's life. Its importance is perfectly obvious throughout our life. Not only when learning a specific skill, or trying to memorize a formula, but also in our emotional growth, social interactions, or even personality development (1). Sport is another context in which learning a skill, and performing it flawlessly is of great importance. There is a unanimous consensus among sport scientists, coaches, and athletes, that along with physical, technical and tactical skills, psychological skills are also necessary for an optimal sport performance (2). There is scientific evidence which supports this notion (3, 4). Therefore, there has been a great deal of effort to hone these psychological skills in athletes.

One psychological feature, which has attracted a great amount of attention, and has been repeatedly mentioned and examined as an important factor for success in sport (4-6), is mental toughness.

Despite this extensive literature on mental toughness, there is still an ongoing controversy regarding the definition of this construct. One reason which makes defining mental toughness difficult, is the fact that our perception of the construct could change based on the socio-cultural context in which mental toughness is being studied. For instance, the concept of mental toughness in a threatening milieu could be differently comprehended compared with when examining it in a supportive one (7).

A lack of consensus over the definition of mental toughness is also obvious when looking at the previous research and theory, which could be confusing (8). Different definitions have been provided such as: "The ability to cope with or handle pressure, stress, and

adversity", "to overcome or rebound from failures", "the ability to persist or a refusal to quit", "self-belief", "insensitivity or resilience", "determination and positive cognition", or even "the possession of superior mental skills" (9, 10).

Although in most of the cases mental toughness has been conceptualized as a multi-dimensional construct and it is hypothesized that it is a combination of beliefs, attitudes, emotions, and cognitions which enables an individual to achieve his/her goals despite the obstacles and difficulties ahead (11), different models and theories point to different characteristics and features to define mental toughness. Based on Kobasa's hardiness model (1979), Clough et al. (as cited by Horsburgh et al.) provide a comprehensive definition of mental toughness. They define mentally tough individuals as: Sociable and friendly, able to stay calm, have lower levels of anxiety, more competitive, though not easily affected by troubles and competitions, have higher levels of self-confidence and always believe in themselves and their ability to determine their own future (12). In another model proposed by Jones et al., self-belief, desire and motivation, dealing with pressure and anxiety, focus, and pain and hardship related factors are considered as the main characteristics in defining mental toughness (10). Also, Gucciardi et al. refer to: Tough attitude, sport awareness, desire for achievement, and challenge as the main characteristics by which mentally tough athletes could be identified (13). However, in Clough et al. (as cited by Gerber et al.) model, challenge, control, commitment, and confidence are considered as the main defining characteristics (14). Connaughton et al. model emphasized on 3 aspects which interact with each other including: Internal motivation to succeed, sport and non-sport support networks, and effectual use of advanced psychological skills (15).

When comparing these different conceptualizations, many studies have reported features like, self-confidence, perseverance, emotional control, focus, and thriving under pressure as the most common features among different models (16). Considering all of these conceptualizations and theories, it could be asserted that personal responsibility, perseverance and resilience are the central defining characteristics of mental toughness (17).

In addition to this, a substantial portion of literature on mental toughness has already demonstrated that high achievers possess higher levels of mental toughness (11). In other words, self-actualization or fulfillment of one's potential is considered as the vital clue in understanding the concept of mental toughness (18).

Research has already proven the link between mental toughness and many positive factors and its importance in personal and professional life. Existing evidence also suggests an association between mental toughness and several other factors such as health (18), psychological well-being (19), age, gender, experience, and sport performance (9, 20), physical endurance (21), dispositional flow (16), effective coping, optimism and pessimism (22), athletes' educational progression and use of psychological strategies (23), burnout (24), problem-oriented and emotion-focused coping strategies (25), stress, pain tolerance, better sleep quality, and life satisfaction (14).

Findings have also revealed a relationship between mental toughness and big five personality traits. To be more exact, mental toughness is positively related with conscientiousness and negatively related with neuroticism. Furthermore, it has been argued that mental toughness is, to some extent, affected by genetics (12).

Recent research emphasizes on the positive role of mental toughness in sport performance and success (26). Newland et al., assert that there is a complicated relationship between mental toughness and sport performance and mental toughness is more observable in difficult circumstances. It was shown by their research that sport performance could be predicted by mental toughness (27).

The role of mental toughness in acquisition and retention of a single sport skill (basketball passing) by Moradi et al. has also been shown (28). Another study which was conducted by Ranjbar et al., showed that in acquisition and retention phase, athletes with an excellent level of wrestling skills scored higher in mental toughness than those with poor level of wrestling skills (29). Gucciardi et al. provided proof for a relationship between mental toughness and learning-related psychological experiences (30). Mattie and Munroe-Chandler proved that, along with physical exercises, mentally tough athletes use other strategies like mental imagery in order to improve their performance (31).

In addition to this, a positive relationship between psychological approaches such as goal setting and imagery has been reported (28). In fact, 82% of wrestling coaches considered mental toughness as a key psychological feature for success in this sport (32). Also Gucciardi et al. proved that in challenging tasks and activities, mental toughness has a significance role and determines the behavioral perseverance (33).

2. Objectives

Regarding the aforementioned results from previous studies, the significance of this subject, and existing challenges, this study aims to examine the role of mental toughness in motor learning and performance of sport

skills in wrestling. To the best of our knowledge, so far, a few studies have examined the role of mental toughness in comprehensive motor learning of skills in a specific sport. Since learning motor skills in wrestling requires different factors of physical fitness and also, wrestling techniques have a lot of complexity and variety and require a lot of effort, it seems that the role of personality traits such as mental toughness is a major determinant in learning these techniques. In fact, the main question this study aims to answer is whether, with the same education method and feedback, mentally tough athletes' motor learning is better compared to their peers with lower levels of mental toughness or not.

3. Methods

The present study adopted a semi experimental approach and falls into the category of applied research. Participants were selected from physical education students who were enrolled in a physical fitness course at the University of Tehran in 2018. Using intensity sampling method, 28 students, who had never had any past wrestling skill practices, were selected.

3.1. Procedure

After approving the research draft plan by several wrestling coaches and wrestling committee of the University of Tehran, informed consent forms were obtained from 48 students who later answered the Demographic and Mental Toughness-48 questionnaires. Then, those with overall scores higher than 3.5 in MT were identified as athletes with higher levels of MT (N = 14), while those with scores lower than 2.5 in MT were labeled as athletes with lower levels of MT (N = 14). These 28 selected athletes were then randomly assigned into two groups of equal size and 30 wrestling skills were taught to them twice a week for 3 months. The reason for random assignment of these athletes into two groups was to avoid the possible effects of higher levels of MT in one group on the educational atmosphere. Because, if all the participants were mentally tough, it would most probably create a more competitive and mentally tough atmosphere, which could result in better learning, compared to those who practice in the other group with lower levels of MT.

Teaching procedure involved one hour and half (including 20 minutes for warm up and cool down) practice under supervision of two coaches (one top official coach of world wrestling federation as the head coach, and one official coach of national wrestling federation as an assistant coach). During each session, first, the wrestling skills were displayed by the head coach, and then both coaches would start teaching skills to students. 10 skills were taught per month. Each month included 8 sessions, which 5 sessions were allocated to teaching and 3 sessions were allocated to reviews of learned skills, in each session 2 skills were taught with the training and practice time of almost 1 hour. Students' wrestling skills were tested during the last session and one week after the last session by three other coaches. Tested wrestling moves included 4 out of 5 main moves, which are also considered as the most frequently used ones, according to the majority of the experts and coaches (34). Although single/double leg takedown was among those main moves, it was not included, as it did not possess the necessary psychoanalytical features. The included ones were: Arm drag, gutwrench arch, hip throw, and duck-under. A median score of the scores given by three examiners was considered as the final score in each stage (acquisition and retention). The scores for both the acquisition and retention tests were given by the same examiners. The maximum performance score in each stage was 80. After this, a median score of both stages determined the learning score for each athlete. Finally, a comparison of learning scores between athletes with higher and lower levels of MT was made.

Research exclusion criterion was being absent for more than two sessions, which was not the case for any of the participants. Also, after testing the normality of the data, the one-way ANNOVA test was employed to compare the learning scores of the two different groups. The statistical software was SPSS 19 and significance level of .05 was considered.

3.2. Assessment Tools

In order to assess wrestling skills, wrestling skills test was employed, which is a reliable and valid test, devised by National Olympic Committee of Iran and designed by several wrestling coaches and experts (34). The test involves separate tests for assessment of the four main wrestling moves including: Arm drag, gutwrench arch, hip throw, and duck-under. These moves are the most frequently used ones based on the opinion of the majority of wrestling coaches and experts (34). Each separate tests consists of 10 items. Participants could receive a score between 0 - 2 for each item (2 for flawless performance, 1 for weak performance, and 0 for wrong performance of the item). In this marking system, a complete number in each skill would result in a 20 score and the sum of the scores for all 4 skills is 80. To assess MT, The Mental Toughness Questionnaire-48 (MTQ48; Clough et al. (as cited by Afsaneh Poorak and Vaez Moosavi)) was used. This questionnaire assesses 8 subscales: Challenge, commitment, control, emotional control, life control, confidence, confidence in abilities,

and interpersonal confidence. Responding on these 8 items occurs along a 5-point Likert scale ranging from 1 (absolutely disagree) to 5 (absolutely agree). Clough et al. (as cited by Afsaneh Poorak and Vaez Moosavi), employing the test retest method, reported the reliability index 0.09. Also, the reliability of this test in Iranian sample has been tested by Afsaneh Poorak and Vaez Moosavi. The overall internal reliability was 0.93, and the reliability for subscales of challenge, commitment, control, emotional control, life control, confidence, confidence in abilities, and interpersonal confidence were: 0.77, 0.80, 0.84, 0.78, 0.81, 0.86, 0.81, 0.81, respectively (35).

4. Results

4.1. Statistical Analysis

Descriptive statistics for scores in acquisition, retention, and motor learning stages are shown in Table 1. Shapiro-Wilk test was used to test the normality of scores of athletes with high and low mental toughness in all three different stages. The results are provided in Table 2. As seen in Table 2, the scores in all three stages show a normal distribution. Therefore, Levene statistical test and one-way analysis of variance (ANOVA) were employed for comparing scores between two groups.

Table 1. Descriptive Statistics for Scores in Acquisition, Retention and Motor Learning Stages

Score and Mental Toughness Group	N	Mean ± SD	Std. Error
Acquisition score			
High	14	74.4486 ± 3.56079	0.95166
Low	14	60.7121 ± 6.21136	1.66006
Total	28	67.5804 ± 8.57907	1.62129
Retention score			
High	14	73.2350 ± 3.64369	0.97382
Low	14	57.7014 ± 6.82022	1.82278
Total	28	65.4682 ± 9.55750	1.80620
Motor learning score			
High	14	73.8407 ± 3.55582	0.95033
Low	14	59.1971 ± 6.41884	1.71551
Total	28	66.5189 ± 9.02882	1.70629

Analysis of variance test results indicated that scores of mentally tough athletes in acquisition, retention, and motor learning stages are significantly higher than their peers with lower levels of mental toughness. Results of ANOVA test of acquisition, retention, and motor learning scores in the two groups are provided in Table 3. The effect size for each stage is presented by calculated eta squared in Table 4.

Table 2. Tests of Normality, Shapiro-Wilk

Stage and Group	Statistic	Sig.
Acquisition		
High	0.933	0.334
Low	0.975	0.931
Retention		
High	0.893	0.088
Low	0.954	0.618
Motor learning		
High	0.905	0.134
Low	0.963	0.771

5. Discussion

Motor learning and flawless performance are of great importance in sport. They could be affected by so many factors, such as genetic, physiological, technical, psychological, and biomechanical characteristics. Many studies in sport psychology have already shown the importance of psychological factors in fine performance and the link between personality and psychological features, and sport excellence (26). The purpose of the present study was to examine the role of mental toughness in motor learning.

Data analysis showed that mentally tough students demonstrated significantly higher motor learning scores compared with their counterparts who had lower levels of mental toughness. This advantage was persistent both in the acquisition and retention stages. results suggest that mental toughness could be a key success factor in learning wrestling skills.

Consistent with our research findings, other previous studies on mental toughness and motor learning, Jones et al. (6), Nicholls et al. (20), Moradi et al. (28), Hardy et al. (36), Jackman et al. (16), Newland et al. (27), and Mattie and Munroe-Chandler (31) all suggested mental toughness as an important factor in motor learning and excellence in performance.

With all the suggested theories and definitions in mind, it could be argued that the positive functioning term is not separated from mental toughness concept. In other words, self-actualization or fulfillment of one's own potential is a vital clue in understanding the concept of mental toughness (18). Mental toughness has been defined as an individual capability for constantly performing excellently despite the changing circumstances (16), and includes a process in which self-actualization is clearly underlined (37).

In fact, it has been demonstrated that individuals with higher levels of mental toughness are more optimistic

Table 3. ANOVA Test of Score in Different Stages in Two Different Groups

Stages and Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Acquisition					
Between groups	1320.826	1	1320.826	51.534	0.0001
Within groups	666.383	26	25.630		
Total	1987.210	27			
Retention					
Between groups	1689.043	1	1689.043	56.497	0.0001
Within groups	777.294	26	29.896		
Total	2466.336	27			
Learning					
Between groups	1501.039	1	1501.039	55.754	0.0001
Within groups	699.989	26	26.923		
Total	2201.029	27			

Table 4. The Result of Eta Squared Measures for ANOVA Test

	Eta	Eta Squared
Acquisition * group	0.815	0.665
Retention * group	0.828	0.685
Learning * group	0.826	0.682

and efficacious compared with those with lower levels of mental toughness (38). Mentally tough athletes are more industrious. They remain focused on the task they are doing, and are more tenacious when confronted with obstacles. Also, using the superior knowledge that they have gained from their performance context and their emotional experiences, mentally tough athletes are able to use the appropriate coping strategy based on the situation (37), which most probably paves the way for excellent performance achievement and maintenance.

Furthermore, it has been argued that mental toughness is a key factor in attainment of goals during the life and has a substantial role in individual development and success (30). Also, goal-directed behavior in the face of situational demands that vary in magnitude could be enhanced by mental toughness (18). Goal focused behavior is a noticeable feature of mentally tough individuals which is of great importance, especially when faced with stressful situations (11). All in all, mental toughness is expected to enhance and fulfill individual potentials and facilitate excellent performance (18).

Acquiring and demonstrating wrestling skills is a very demanding task, as it requires not only physical fitness, but also learning many complex wrestling technique (nearly 500 techniques). Because of this complexity, when teaching wrestling skills, coaches tend to break down each skill into several stages and then connect these stages altogether to facilitate learning. For instance, a beginner learner must learn how to perform arm throw technique around 8 or 9 different stages, including: Catching, twisting foot, twisting pelvis, pulling, and throwing to the ground, in order to be able to perform the skill successfully and with good coordination. This complexity and difficulty probably requires a great deal of effort and persistence for optimal performance, and also depends, at least to some extent, on non-physical factors. There is ample evidence which suggests persistence, effort, and perseverance as behavioral hallmarks of mental toughness (2, 33). In fact, it has been claimed that mentally tough individuals devote their maximum effort persistently and never quit (2) and are more determined when faced with obstacles. Studies have demonstrated a link between mental toughness and task oriented coping strategies, indicating that, when dealing with the same task, mentally tough individuals put in a greater amount of effort compared to those with lower levels of mental toughness and use logical analysis. Furthermore, mentally tough individuals always welcome challenges and are able to easily step outside of their comfort zone, due to their meticulous preparation and commitment to excellence (16). They can overcome challenges and remain proud along the difficult path of success like a brave fighter.

This could result in better performance in circumstances which require hard work, such as learning wrestling skills. In other words, it is likely that possessing personal characteristics such as self-confidence, perseverance, responsibility, resilience, control over emotions and personal life, focus and thriving under pressure (16, 17), mentally tough individuals have a better performance compared with those who demonstrate

these qualities in lower levels. Previous studies have proven the overlap between mental toughness and resiliency. Resiliency refers to the ability of confronting challenging situation, which overlaps with challenge subscale in mental toughness, and flexible response to everyday pressures, which overlaps with control subscale in mental toughness (17, 39, 40). In other words, it has been claimed that it is through resiliency, focus and determination which mental toughness facilitates learning and performance (36).

On the other hand, it has been illustrated by many studies that mental toughness is associated with many other positive features, such as effective coping, optimism (22), physical endurance (21), sleep quality (41), athletic dispositional flow (16), problem focused coping strategy, higher pain threshold and life satisfaction (14). In addition to this, Stamp et al. showed that mental toughness elements could predict health and psychological well-being in a range from medium to robust (19). Golby and Sheard asserted that mental toughness practices are helpful in sport performance improvement (5). Nicholls et al. study proved a significant positive association between mental toughness and gender, age and sport experience (20). Levy et al. demonstrated, in a part of their study, that mentally tough athletes dealt better with their pain and have a more positive attitude toward their injury, compared with their counterparts with lower levels of mental toughness (42). Furthermore, a positive association between mental toughness and application of psychological skills like, mental imagery and goal setting both in practice and competition has been illustrated. This in turn shows that mentally tough individuals search also for other methods other than exercise to improve learning and performance (27, 31). At the same time, findings also indicate the positive role of mental practice in sport skills acquisition (43).

Moreover, mental toughness has been shown to be related with the big five personality factors. This association is important, since the big five personality factors have been studied as predictors for success in many different fields. For example, in some domains, conscientiousness has been identified as a strong predictor of success (40). Prior research demonstrated a relationship between mental toughness and neuroticism and conscientiousness in genetic, as well as phenotypic and environmental levels (12). Such findings prove the importance of mental toughness in achievement of success.

Generally, individuals with a tough mindset experience less stress, regardless of the type of the stressor they encounter, and have more control over situation. They believe in themselves and their abilities and are committed to achieve their goals. In sport stressful situations use more effective coping strategies, thanks to their superior knowledge of performance contexts and their emotional experiences (37, 44). Their general health and well-being are good (2, 19).

Therefore, it is expected that mental toughness could be a suitable predictor for efficient motor learning and optimal performance of wrestling skills. Based on the findings of this study and above notions, the need for further efforts to develop this psychological characteristic could be seen in order to facilitate motor learning and improve sport performance in athletes. it is also suggested to coaches and sport psychologist to use this quality in sport talent identification.

Footnotes

Authors' Contribution: Sadegh Ranjbar: Designed the research, perform the intervention, gathered the data, and studied the concept and revised the article; Ali Akbarnejad: Perform the intervention, gathered the data; Ashkan Alizadeh: Gathered the data, analyzed the data and revised the article; Ali Fadakar: Gathered the data, revised the article.

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Informed Consent: Informed consent forms were obtained from 48 students who later answered the Demographic and Mental Toughness-48 questionnaires.

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