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What a Difference a Mentally-Toughening Off-Season Makes: A Case of NCAA DI Rowers

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Abstract Non-contact injuries in US collegiate athletics during offseason have increased. Despite the widespread acceptance of mental toughness (MT) training in the strength and conditioning world, coaches do not tend to measure the effectiveness of their regimens. Strength and conditioning coaches (SCC) tend to design mostly physical and not psychological protocols to increase MT. **Purpose:** Triggered by current incidents in Big 12, in Pac-12, and most recently, in Big Ten -in which SCCs were purportedly involved, researchers attempted to investigate the effectiveness of an offseason physical training protocol on the MT levels of Division I rowers. **Methods:** Fourteen student-athletes and their strength and conditioning coach (multi-rating) assessed, via Qualtrics, the players' levels of MT using the Mental Toughness Index (MTI). **Results:** No statistically-significant effect was found between pre- and post-offseason intervention [F (1, 54) = 0.13, p = 0.71] nor between the perception of that effect between players and coach [F (1, 54) = 1.23, p = 0.27]. **Conclusions:** The levels of athletes' MT between the pre- and post-intervention measurements did not increase significantly and the perceptions of the assessors were not significantly different either. Therefore, the results suggest that the intervention did not work in regard to increasing the MT levels of the team. Furthermore, the MTI scores indicate coach-athlete compatibility in recognizing this theoretical construct. In an effort to support the student-athletes' well-being and avoid similar media backlash, more similar research projects are crucial so as to move from anecdotally-based to evidence-based strength and conditioning MT training protocols. However, during that attempt, coaches need to share their protocols for reasons of evaluation and replication.

Keywords Multi-rating, Mentally tough, Rowing, Collegiate athletics, Female student-athlete, Mental toughness, Applied sport psychology, Strength and conditioning

1. Introduction

"The CSCCa extends its deepest sympathy to the family of University of Maryland offensive lineman Jordan McNair. Furthermore, we are extremely distressed by the media reports regarding the culture of the Maryland Football Program, especially the alleged involvement of the strength and conditioning program. Every athlete deserves a positive, constructive environment in which to work and train to develop his/her full athletic potential safely and effectively…" [10]

The popularity of the term *mental toughness* (MT) in scholarly but also in non-scholarly (i.e., practice) sport settings in the past two decades is well recognized [16]. In addition, even if there is no consensus on its exact definition (e.g., [3, 16, 25]), MT's worldwide cultural relevance, even in non-English-speaking countries, has started being uncovered (e.g., [21, 29]).

However, incidents, such as the ones in Big 12 [5], in Pac-12 [23], and most recently, in Big Ten [34] have once again raised concerns in the U.S. strength and conditioning community (see example of statement above). These concerns focus on the safety and effectiveness of anecdotally-based, military-style, strength and conditioning protocols usually occurring in the offseason and designed to challenge student-athletes' psychological attributes, such as MT.

A review of the literature uncovers that the majority of MT research is mainly correlational [42]. For example, MT has been correlated with positive mental health outcomes (e.g., stress, depression; sleep quality; [9, 14, 30]), as well as recognized predictors of performance (e.g., motivation, self-efficacy; [15, 35]). Moreover, in the limited interventional MT research, the prescribed protocols are mainly psychological and not physical (e.g., [1, 6, 7, 17, 18, 27, 36, 38, 40]). Nevertheless, SCCs prescribe mainly physical training protocols [33].

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Preliminary data have indicated that collegiate SCCs are not aware of the existence of specific psychometric tools and/or do not use any to measure the effect of their interventions on the MT levels of their athletes (e.g., [43]). So, how do SCCs know if they prescribe safe and effective offseason MT training protocols (*dose-response relationship;* [2])? This study focuses on the effectiveness of such an offseason training regimen in a National Collegiate Athletics Association (NCAA) Division I (DI) rowing team.

Among other groups, female athletes remain underrepresented in applied Sport Psychology research [45]. Rowing is the oldest intercollegiate sport in the United States [46]. However, NCAA sanctions women's rowing, but not men's. Rowing, along with softball, bowling, and beach volleyball is played by female student-athletes only in DI NCAA. Rowing is a spring sport, which –as shown in Table 1– has presented noteworthy progress [32]. Nonetheless, it has not been researched as much.

Table 1. NCAA Division I Rowing Participation Rates

	Year	
Participation	1981-1982	2016-2017
Number of student-athletes	862	5,600
Number of teams	28	89

Based on the information presented above, the purpose of the study was dual: to measure the effectiveness of the offseason physical training protocol on the MT levels of a NCAA DI rowing team, while investigating possible differences in the perception of that effect between athletes and strength coach.

Therefore, there are two hypotheses:

1. Compared to pre-intervention, the post-intervention levels of athletes' MT will increase and
2. The perceptions of the SCC and student-athletes on the effect of the intervention (over time) will be significantly different.

2. Method

2.1. Experimental Approach to the Problem

The study followed a quasi-experimental, one-group pretest-posttest model. The research problem was suited for this kind of design, since the intervention was performed to all active athletes (i.e., no control group). Data were collected using an instrument (i.e., MTI). However, multi-rating was performed (i.e., player, strength coach).

2.2. Participants

The rowers of a DI NCAA institution were the target population (i.e., inclusion criteria). All participants were part of the same team (criterion-based purposive sample). All players were contacted. Thus, there was no random selection of participants. Fourteen rowers agreed to participate (M_{age}=20.36, *SD*=1.01).

2.3. Instrument

Data collection was performed though the Mental Toughness Index (MTI; [32]). MTI is a self-report MT measure and includes eight items (see Appendix). MTI's scores were found to be reliable and the inferences of those scores valid [11, 20, 24].

Gucciardi et al. conceptualize MT[1] as one-dimensional and as a caravan of personal resources [20]. Based on that, each item (i.e., question) of MTI is designed to correspond to each one of those resources. In more detail, item 1 measures *generalized self-efficacy*, item 2 *emotion regulation*, item 3 *attention regulation*, item 4 *success mindset*, item 5 *buoyancy*, item 6 *overcoming adversity*, item 7 *context knowledge*, and item 8 *optimistic style*.

2.4. Procedures

After the Institutional Review Board (IRB) approval, the survey was uploaded on Qualtrics (www.qualtrics.com). After the Athletic Department shared the players' email addresses, all rowers received individualized links. The participants were then able to go online and complete the survey. The procedure was performed twice, before and after offseason. This specific phase of periodization was chosen since it is the only period of the year, when DI SCCs are almost fully in charge of the training. Consequently, in that phase of training the researchers could control for more extraneous variables.

Due to established (a) limitations of self-reporting (e.g., under/overstimation of perception; [13]) and (b) implications of perception (*perception-action coupling*; [22]), the players were rated by their SCC, as well. Multi-rating was chosen in order to promote triangulation of the scores. Although triangulation enhances the validation of the data through cross-verification from multiple sources, a very limited number of MT researchers have used it and/or have looked for discrepancies in perceptions of different assessors (e.g., [12, 17, 18, 40, 47]).

2.5. Statistical Analyses

The researchers were interested in examining (a) the effect of MT training protocols on DI rowers and (b) possible differences in the perception of that intervention effect between athletes and coach. Total MT scores were calculated by adding the scores per item (range of scores per item: from one to seven). As mentioned before, MTI consists of eight items. As a result, total MT scores could range from eight to 56. A one-way ANOVA was used to examine pre-intervention and post-intervention levels of athletes' MT. A one-way factorial ANOVA design was used to assess the coach's and student-athletes' responses on MTI between pre- and post-intervention. All statistical analyses were performed using JMP (Pro 14.0) [37].

[1] *"…a personal capacity to produce consistently high levels of subjective (e.g., personal goals or strivings) or objective performance (e.g., sales, race time, GPA) despite everyday challenges and stressors as well as significant adversities."* (20, p. 31).

3. Results

The summary statistics are presented in Table 2 (M_{score}=40.30, *SD*=5.43). The results represent both the two self-assessments from the 14 athletes (*n*=28) and the two assessments of the athletes from the SCC (*n*=28). Therefore, the total number of measurements considered is 56.

Table 2. Summary Statistics for MT Scores (n=56)

Statistic	Count
Mean	40.30
Standard Deviation	5.43
Standard Error Mean	0.73
Upper 95% Mean	47.76
Lower 95% Mean	44.85
Minimum	26
Maximum	55

Below, the results are going to be presented in two phases. First, the authors are going to present those concerning the effectiveness of the MT training protocol and check whether the first hypothesis is accepted. Then, they will move to the second hypothesis by presenting the results in regard to the perceptions of athletes and SCC. Unless otherwise stated, $p < .05$.

It is noteworthy that ANOVA assumptions for MT scores were checked. In more detail, using the normal quantile plot, MT scores were found to be normally distributed and equality of variance was checked with Levene test: F (1, 54) =1.8, p = 0.19.

3.1. Did the Intervention Work?

As shown in Table 3 and Figure 1, on average, MT levels increased post intervention. However, no statistical significance was found between pre- and post-values: F (1, 54) = 0.13, p = 0.71. Therefore, the first hypothesis is rejected.

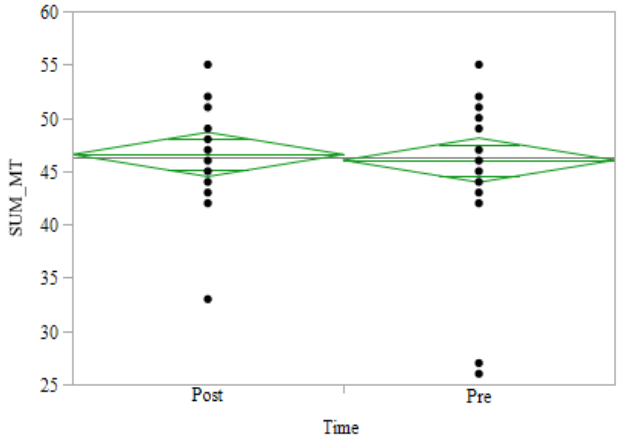

Figure 1. One-way ANOVA means for pre- and post-intervention athletes' MT levels

Table 3. MT Mean Scores by Time (*n*=28)

Level	Mean	Standard Error	Lower 95%	Upper 95%
Post	46.5714	1.0344	44.498	48.645
Pre	46.0357	1.0344	43.962	48.110

3.2. Did Athletes and Coach have Different Perceptions on the Effect of the Intervention (over time)?

As shown in Table 4 and Figure 2, there is a pattern of student-athletes perceiving the effect of the intervention as more substantial compared to the SCC. However, no statistical difference was observed: F (1, 54) = 1.23, p = 0.27. Therefore, the second hypothesis is rejected.

Table 4. MT Mean Scores by Assessor (n=28)

Level	Mean	Standard Error	Lower 95%	Upper 95%
Athlete	47.1071	1.0241	45.054	49.160
Coach	45.5000	1.0241	43.447	47.553

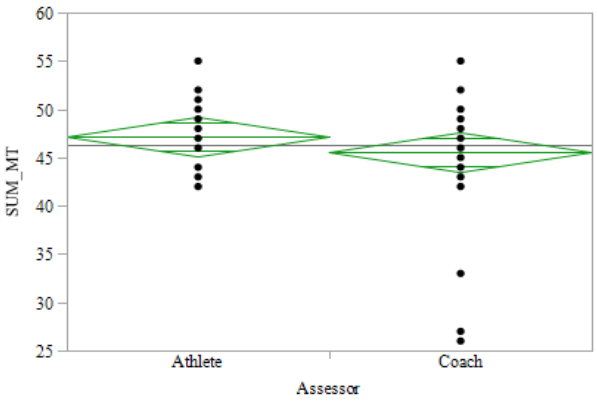

Figure 2. One-way ANOVA means for athletes' and coach's perceptions on effect of offseason intervention on athletes' MT levels

In addition, a one-way ANOVA factorial design was used to examine potential interaction between assessor and time. The analysis, displayed in Figure 3, revealed that there is no interaction between assessor and time: F (1,1) = 0.57, p = 0.45.

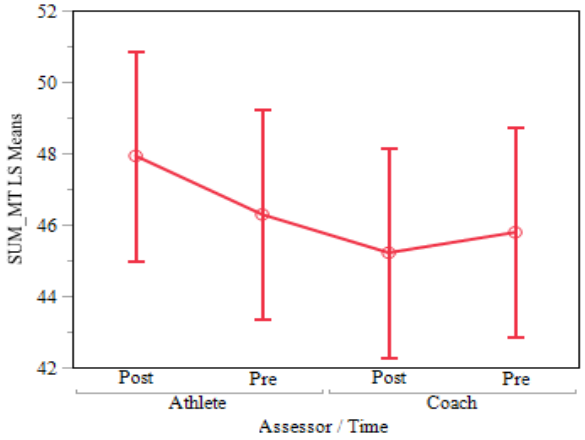

Figure 3. Least square means plot for athlete/coach and pre/post perceptions on effect of offseason intervention on athletes' MT levels

4. Conclusions

The purpose of this study was to investigate, using a quasi-experimental design, the effect of an offseason physical strength and conditioning training protocol on the levels of MT of a team of NCAA DI rowers, while examining possible differences in the perception of that effect between athletes and coach. Data were collected from 14 student-athletes and their SCC through an inventory, MTI.

The levels of athletes' MT between the pre- and post-intervention measurements did not increase significantly and the perceptions of the assessors were not significantly different either. Therefore, both hypotheses were rejected.

In other words, despite the initial prediction of the SCC, in our case, the intervention did not work in regard to increasing the MT levels of the team. Unexpectedly, too, the results may indicate coach-athlete compatibility in recognizing this theoretical construct.

4.1. Limitations and Delimitations

This research is not immune to limitations or delimitations. Therefore, the inferences of the results should be interpreted and generalized with caution. In more detail:

(A) Although the inclusion and exclusion criteria were well established and there were no missing data, not all eligible participants were enrolled. That affects the extrapolation of the inferences of the results negatively;

(B) The coach indicated that the same intervention was consistently applied to the participants. He did not agree to clearly describe it though. Therefore, sufficient details to allow the work to be reproduced by an independent researcher cannot be provided;

(C) The outcome measure was clearly defined, MTI is a psychometrically-sound instrument, and assessment from the coach was included to increase validity of the inferences of the results. Nevertheless, the person prescribing and applying the intervention (i.e., the strength coach) was the same person conducting the outcome assessment. No blinding of outcome assessors raises questions about possible bias; and

(D) While the reported study results documented the (lack of) statistical significance for the changes in MT levels, the dependent variable was not measured more than once before and after offseason. The absence of multiple measurements with the same result decreases the confidence on the inferences of the results of this study.

4.2. Future Research

While this research project focused on DI rowing, more research is recommended in the other two NCAA divisions as well in other DI rowing programs. Most importantly, although the authors tried to enhance the validation of the data including the SCC as an assessor, due to possible bias, another source could lead towards a more efficient triangulation. For instance, Cowden, Anshel, and Fuller (2014) chose to use the sport coach. However, during offseason and due to NCAA regulations and restrictions, the sport coach may not be able to accurately assess their players. A possible better choice could be the head SCC who could design the protocol, but that protocol would be implemented by somebody else, such as an assistant SCC.

Furthermore, based on the needs of coach, the analysis of the data can be performed by: (a) athlete (i.e., "Who has the highest/lowest total MT score"), (b) by question (e.g., "Which MT resource is the team's strength or weakness?"), (c) years in the program (e.g., "On average, how much time does it take for the 'MT culture' of the program to significantly affect the athlete's MT levels?"), and (c) other demographics (e.g., position, race, gender).

4.3. Practical Implications

The National Strength and Conditioning Association (NSCA) and the Collegiate Strength and Conditioning Coaches association (CSCCa), the two leading authorities in the US collegiate strength and conditioning field, have both endorsed *"The Inter-Association Task force for Preventing Sudden Death in Collegiate Conditioning Sessions: Best-Practices Recommendations"* [39, 44]. In addition, the majority of National Collegiate Athletic Association Autonomous 5 Division I (A5DI) institutions have implemented more rigorous cardiovascular screening than just history and physical [28].

The exact cause of the University of Maryland event is likely multifactorial. Unfortunately though, analogous incidents will most likely happen again, since there are factors, such as primordial, which are difficult to detect or avert [2].

4.3.1. What can SCCs do to Prescribe Safe and Effective Protocols?

There are 6,000 teams and 170,000 student-athletes in DI programs [31]. How can the SCC, who spends the most "countable hours" with student-athletes compared to other coaches (i.e., NCAA Bylaw 17), ensure that their protocols are safer and more effective?

Although it may not always be practical to conduct research with control groups in DI institutions and metric arbitrariness is usually a concern when using inventories [4, 8], just "body language" should not be enough anymore [43], if the profession wants to attack the lack of empirically-based practices [19].

As shown above, MT has been consistently correlated with performance predictors. The method to develop it though through safe and effective physical protocols remains vague. At the same time, there are (a) official positions from the professional organizations of the field to move towards evidence-based practices (e.g., [26]) and (b) preliminary evidence through published [43] and unpublished data [41] that verify that SCCs ask for research that measures the effectiveness of their training protocols. Therefore, there has

to be an intentional and collective effort from the practitioners themselves to not only keep participating in similar research projects, but also to share their protocols. By sharing, other professionals could draw conclusions, evaluate and adjust their regiments, and in the end, the field of strength and conditioning could shift away from anecdotally-based practices and the negative issues related to them.

Appendix

Mental Toughness Index

INSTRUCTIONS: Using the scale below, please indicate how true each of the following statements is an indication of how you typically think, feel, and behave as an athlete.

Remember: There are no right or wrong answers. So, be as honest as possible.

1	2	3	4	5	6	7
False, 100% of the time						*True, 100% of the time*

1	I believe in my ability to achieve my goals	1	2	3	4	5	6	7
2	I am able to regulate my focus when performing tasks	1	2	3	4	5	6	7
3	I am able to use my emotions to perform the way I want to	1	2	3	4	5	6	7
4	I strive for continued success	1	2	3	4	5	6	7
5	I execute my knowledge of what is required to achieve my goals	1	2	3	4	5	6	7
6	I consistently overcome adversity	1	2	3	4	5	6	7
7	I am able to execute appropriate skills or knowledge when challenged	1	2	3	4	5	6	7
8	I can find a positive in most situations	1	2	3	4	5	6	7

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