Mindfulness meditation training for sport (MMTS) intervention: Impact of MMTS with division I female athletes

Sporda farkındalık eğitimi (SFE) çalışması: SFE'nin I. lig kadın atletlerdeki etkisi

Amy Baltzell[1], Vanessa LoVerme Akhtar[2]

Abstract

Mindfulness training has been considered an effective mode for optimizing sport performance. The purpose of this study was to examine the impact of a twelve-session, 30-minute mindfulness meditation training session for sport (MMTS) intervention. The sample included a Division I female collegiate athletes, using quantitative comparisons based on pre- and post-test ratings on the Mindfulness Attention Awareness Scale (MAAS), the Positive Affect Negative Affect Scale (PANAS), the Psychological Well-Being Scale and the Life Satisfaction Scale. Paired sample t-tests highlight significant increases in mindfulness scores for the intervention group ($p < .01$), while the comparison group score of mindfulness remained constant. Both groups remained stable in reported positive affect however the intervention group maintained stable reports of negative affect while the comparison group experienced a significant increase in Negative Affect ($p < .001$). Results are discussed in relation to existing theories on mindfulness and meditation.

Keywords: Brief mindfulness meditation, brief meditation, sport, negative affect

Özet

Farkındalık eğitimi spordaki performansı en iyi hale getirmenin etkili bir yöntemi olarak görülmektedir. Bu çalışmanın amacı on iki seanslık eğitimin etkisini incelemektir. Bu on iki seans 30 dakikalık sporda farkındalık eğitimini (SFE) içermektedir. Örneklem I. Bölüm üniversiteli kadın atletlerden oluşmaktadır. Farkındalık Dikkat Ölçeği (FDÖ), Olumlu Duygu Olumsuz Duygu Ölçeği (ODODÖ), Psikolojik İyi Oluş Ölçeği (PİHÖ) ve Yaşam Memnuniyeti Ölçeği'nden elde edilen ön test ve son test puanları doğrultusunda nicel karşılaştırmalar yapılmıştır. Eşleştirilmiş örneklem t-testi çalışma grubundaki farkındalıkta anlamlı bir artış olduğunu ortaya koymaktadır ($p < .01$). Öte yandan, karşılaştırma grubunun farkındalık puanı aynı kalmıştır. Her iki grupça belirtilen olumlu duygu sabit kalmıştır. Diğer taraftan, çalışma grubunun olumsuz duygu raporları sabitken, karşılaştırma grubunca belirtilen olumsuz duyguda anlamlı bir artış yaşanmıştır ($p < .001$). Sonuçlar farkındalık ve meditasyona ilişkin mevcut kuramlar ışığında tartışılmıştır.

Anahtar Kelimeler: Kısa farkındalık meditasyonu, kısa meditasyon, spor, olumsuz duygu

Introduction

There has been a great interest over the last thirty years in applied sport psychology to understand what will best help athletes mentally optimize sport performance. One approach emphasizes mindfulness training for athletes (Kabat-Zinn et al., 1985). A mindfulness emphasis includes accepting psycho-emotional experience. This differs from the traditional implementation of Psychological Skills Training (PST) in sport psychology, with the main skills including goal setting, arousal regulation, visualization and self-talk. Such cognitive behavioral interventions are

[1] Boston University School of Education, USA. E-mail: baltzell@bu.edu
[2] Boston University Counseling Psychology, USA

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focused primarily on intentionally controlling one's thoughts, feelings and behaviors (Gardner & Moore, 2004; Gallucci, 2008; Moore, 2009). Recently, mindfulness training has gained traction as a viable alternate approach to prepare athletes for optimal performance (De Petrillo, Kaufman, Glass & Arnkoff, 2009; Gardner & Moore, 2004: 2006: 2007; Thompson et al., 2011). This study considers the potential benefit of investigating a brief mindfulness-based intervention for athletes. Specifically, the intervention for this study is a six-week, twelve-session mindfulness focused training program with a Division I women's soccer team.

Mindfulness is defined as, "an open-hearted, moment-to-moment non-judgmental awareness" (Kabat-Zinn, 2005, p. 24). Mindfulness contributes to both high levels of awareness and acceptance of in the moment reality (Kabat-Zinn, 1994). Aligned with the core tenant of mindfulness is the concept of acceptance, which can be conceptualized as **"**taking a stance of non-judgmental awareness and actively embracing the experience of thoughts, feelings and bodily sensations as they occur" (Hayes, Strosahl, Bunting, Twohig & Wilson, 2004, p. 7). Often, people do not attend to the present moment, and tend to think and act automatically (Kabat-Zinn, 1994). Mindfulness allows the individual to consider all internal and external information that is occurring which can ultimately allow them to experience a changed relationship to habitual reactions. For example, instead of athletes having intense fear before a competition, using avoidant thinking and not focusing on performance, athletes could notice fear and accept it. With such mindfulness attention, athletes would then be freed to focus their attention on task relevant cues (Gardner & Moore, 2007).

Mindfulness and Sport Performance

Mindfulness meditation has been demonstrated to be efficacious with a plethora of the non-sport clinical populations (Baer, 2003; Keng, Smoski & Robin, 2011). There is a growing interest in the sport realm to use mindfulness interventions to ultimately contribute to sport performance. One reason may be that performance anxiety is a chronic, core challenge for sport psychologists to address with their athlete clients (Williams, 2010). Enhanced mindfulness, through mindfulness mediation practice, has been found to reduce many symptoms associated with anxiety (Baer, 2003; Keng et al, 2011) and mindfulness practice has been associated with the ability to let go of and decreased occurrence of negative thoughts (Frewen, Evans, Maraj, Dozois & Partridge, 2008).

Empirical data to date on the impact of meditation on athletic performance directly is sparse. Solberg, Berglund, Engen, Ekeberg, and Loeb (1996) reported improvement in competitive shooters' performance one season following their meditation-based intervention. And, more recently, John, Verma, & Khanna (2011) conducted an experimental meditation study with ninety-six Indian, elite shooters. The experimental group (n=48) significantly increased shooting performance and decreased pre-competitive stress.

There also is evidence that enhanced mindfulness co-occurs with factors that have been demonstrated to be positively related to performance. For example flow has been demonstrated to correlate with enhanced sport performance (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011) and mindfulness. Bernier, Thienot, Codron, and Fournier (2009) conducted interviews with ten French national training center swimmers regarding their optimal swimming experience. In addition to the eight qualities that have been identified to align with flow (Jackson & Csikszentmihalyi, 1999), mindfulness emerged as a ninth dimension, an awareness and acceptance of somatic experience prior to performing. This finding aligns with Kee and Wang (2008) who reported a positive relationship between dispositional mindfulness and flow in sport. Kaufman et al. (2009) found strong correlations between mindfulness of athletes and most dimension of flow. Aherne, Moran, and Lonsdale (2011) also conducted an experimental mindfulness-based intervention with elite athletes, in which the intervention group experienced significantly more flow post-intervention.

Emerging in the research are new ways to cultivate mindfulness in athletes. One approach that integrates teaching mindfulness is the Mindfulness-Acceptance-Commitment (MAC) approach. The MAC approach was designed and developed specifically for sport performers to help develop mindfulness and self-regulated attention skills (Gardner & Moore, 2004, 2006, 2007), and incorporates education and practices of acceptance, commitment to values and mindfulness (See Gardner & Moore, 2007 for a detailed explanation of the MAC approach). Enhanced performance has been reported after implementing the MAC protocol with small athlete samples, including an adolescent springboard diver (Schwanhausser, 2009) a female power lifter (Gardner & Moore, 2004) and golfers (Bernier & et al, 2009).

Other mindfulness approaches in sport use meditation as the core of the intervention protocol. Meditation is defined as, "the intentional self-regulation of attention from moment to moment," (Baer, 2003, p. 125). Mindfulness can be cultivated through the practice of mindfulness meditation (Baer, 2003; Kabat-Zinn, 1994). Jon Kabat-Zinn and colleague's (1985) are the first on record to use mindfulness meditation training within sport. Rowers preparing for the Olympics independently practiced mindfulness meditation (using guided tapes once or twice per day, and for fifteen-minute sessions) for two to seven weeks prior to the Olympic Games. Once per week group meditation training sessions were also provided. Kabat-Zinn et al. (1985) reported that some of the U.S. Olympic team rowers who medaled reported the usefulness of mindfulness meditation in helping them optimize performance when racing.

More recently, another group of researchers reported initial beneficial findings from mindfulness meditation for sport intervention. Mindful Sport Performance Enhancement (MSPE) is a mindfulness meditation-training program (Kaufman et al., 2009), which is a 2.5 hour session per week, four week program. Improvements were found in constructs related to performance, but not in performance itself. Specifically, mindfulness increased and sport-related worries decreased for runners in the MSPE program (De Petrillo et al., 2009), while reduction in somatic anxiety, thought disruption and increases in sport confidence, dispositional optimism and mindfulness occurred for golfers (Kaufman et al., 2009). Thompson et al. (2011) conducted a follow up study with the participants of the MSPE interventions previously mentioned and 50% of the athletes had significantly higher mindfulness scores. In the one-year follow up, the runners' mile times were significantly faster than at pre-test assessment.

There remains a need to further explore mindfulness meditation training with athletes. The two main models in sport, MSPE and the MAC approach, both show great promise. However, they are both demanding of time and/or resources. MSPE includes four 2.5 hour training sessions for groups. It is expected that the length of the training sessions, though is efficacious on performance related measures may be too time intensive for some athletes. The MAC approach includes 7 modules, requiring up to twelve sessions, which are taught individually. The MAC approach has been demonstrated effective, however this approach with the high number of sessions paired with time demanding out of session practice may also not be readily available to large numbers of athletes.

The non-sport, general literature is rapidly offering convincing support for brief mindfulness meditation interventions, in terms of both session length and duration of program. For example Zeidan, Gordon, & Goolkasian (2009) found a reduction in participant pain and anxiety after 3 days of twenty minute mindfulness meditation (MM) sessions. And after 4 twenty-minute MM sessions, Zeidan, Johnson, Diamond, David, Goolkasian (2010) reported a reduction of participant fatigue and anxiety. Creswell, Pacilio, Lindsay, & Brown (2014) also reported a reduction in psychological stress after 3 days of twenty-five minutes of MM.

Initial precedent has also been set regarding benefit in brief MM training for athletes. John, Verma & Khanna's (2011) study, included twenty-minute daily sessions of MM training over a four week period, with no recommended independent practice. Performance in mean score of pistol shooting improved for the MM group ($p < .001$) compared the control group. The MM session in the Kabat-Zinn and colleagues' (1985) intervention included 30-minute sessions, with one or two recommended daily independent practice session of 15 minutes. Anecdotally, the athletes reported performance benefit. And finally, Aherne, Moran, & Lonsdale (2011) reported an increase in flow for participants who completed a 10-minute daily MM and a 30-minute MM exercise once a week, for six weeks.

The design of session length of MMTS was contingent on previous research and considerations of the time constraints of Division I athletes' schedules. Evidence about the requisite length of session of number of sessions for efficacious MM interventions in sport is inconclusive. Thus the length of the meditation sessions of MMTS was exploratory in nature.

The purpose of this study was to explore a new mindfulness training program (MMTS) for athletes, including brief mindfulness training. Time constraints are a factor for competitive athletes. Hence, relatively shorter formal training sessions with the team were offered with relatively less suggested practice sessions between training sessions in MMTS. Please see Table 1 that provides a comparison of session length, number of session and suggested independent practice for the MAC approach, MPSE and MMTS. It was hypothesized that the Division I female soccer team (n=19) would experience an increase in mindfulness, report less negative affect (Chambers, Yee Lo, & Allen, 2008; Frewen et. al., 2008), and report an increase in psychological well-being, compared to the comparison Division I female athletic team.

Table 1. *Comparison of mindfulness training programs in sport*

	MAC Approach	MPSE	MMTS
Number of sessions	7-12	4	12
Length of each session	1 hour	2.5 hours	30 minutes
Duration of program	7-12 weeks	4 weeks	6 weeks

Recommended Practice time out of session: No recommendation for mindfulness exercises out of session for the MAC Approach; MPSE begins with a recommended three 45 minute body scans and three 10 minute mindful breathing practices and by the end of the program athletes are encouraged to engage in 45 minute mindfulness practices 6 days per week; and the MMTS program recommends that athletes began with 5 to 10 minutes per day of independent daily practice.

Method

Participants

This study was conducted with forty-two, Division I Varsity white, college age, female athletes (n = 42) from the Northeast region of the United States. Based on convenience sampling, the participants were drawn from two interactive (sports in which performance is contingent on teammates participating concurrently and together for a shared outcome), scholarship sports teams, from the same institution, who both had spring inter-squad competitions. The women's soccer team represented the intervention group (n = 19), while the women's rowing team served as the

comparison for the study (n=23).

Procedure

Both teams completed the four measures below the week prior to and one week after the completion of the intervention period. Informed consent was gathered prior to completing the measures. The comparison group, the rowers, participated in training as normal. The only aspect of the study in which they participated was completing the four self-report measures at the start and completion of the study. Approval for the study was granted from Boston University's Institutional Review Board.

*The Psychological Well-Being Scale (PWBS)***:** The PWBS (Ryff, 1995) is a 54-item (medium form) self-report measure on a 6-point Likert scale. The Likert scale ranges from 1 to 6, with 1 indicating strong disagreement and 6 indicating strong agreement. The instrument has six subscales assessing psychological well-being: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Support for validity and reliability of the scale has been demonstrated (Ryff, 1989; Ryff & Keyes, 1995).

Mindful Attention Awareness Scale (MAAS): The 15-item MAAS (Brown & Ryan, 2003) is a self-report measure that assesses the individual's tendency of awareness and attention to every day internal and external experiences: higher scores reflect higher levels of mindfulness (Brown & Ryan, 2003). A Likert scale is used ranging from 1 – 6, with 1 indicating almost always and six indicating almost never. A sample item is, "I break or spill things because of carelessness, not paying attention, or thinking of something else." Convergent and discriminant validity of the MAAS has been demonstrated, as well as strong reliability of the measure.

The Positive Affect, Negative Affect Schedule (PANAS): The PANAS (Watson, Clark, & Tellegen, 1988) is a 20-item scale that assesses ten negative moods and ten positive moods. A Likert scale is used ranging from 1 to 5, with 1 indicating very slightly or not at all and 5 indicating extremely. A sample negative affect item is, "distressed," and a sample item for positive affect is "enthusiastic." Convergent and discriminant validity, as well as reliability for the scales have been demonstrated (Watson et al., 1988).

The Satisfaction with Life Scale (SWLS): The SWLS (Diener, Emmons, Larson, & Griffin, 1985) is a 5-item scale that assesses the individual's general satisfaction with life. A Likert scale is used ranging from 1 to 7, with 1 indicating strongly disagree and 7 indicating strongly agree. A sample includes, "So far I have gotten the important things I want in life." The scale has been demonstrated to be strong psychometrically (Deiner et al., 1985).

The intervention (MMTS): The intervention group had fourteen team meetings that were associated with the mindfulness meditation training for sport (MMTS) training. The first session was held to explain the purpose of the program for the team, to gather informed consent, and to administer the MAAS, the PANAS, PWBS and the SWLS. Sessions two through thirteen were dedicated to MMTS education and practice, which was lead by an expert meditation teacher. The twelve meetings dedicated to MMTS practice were held after afternoon practice for thirty minutes, two days per week, for six weeks. Participants were encouraged to practice meditation five to ten minutes each day, in addition to the MMTS program. The fourteenth session was for the Primary Investigator to de-brief the MMTS training and to administer and gather the same four inventories. The head coach required all team participation in MMTS. The athletes retained the option to opt out of participating in the data gathering aspect of the study.

Mindfulness Meditation Training for Sport (MMTS)

An expert insight meditation teacher led the mindfulness meditation program. The program was introduced to athletes and coaches as "mental training through meditation." The athletes were told that the training was designed to help with performance on the field, though no measures of performance were taken. The primary goals of the sessions were to train participants to increase their mindfulness, in general, and then to learn to integrate mindfulness skills when practicing and competing. The training was similar to that of Jon Kabat-Zinn and colleagues (1985), in that the training with the meditation leader was focused on mindfulness meditation practice and participants were encouraged to practice daily. In addition, athletes were guided to alternate points of focus, while practicing acceptance and non-judgment of related emotions and thoughts.

Twenty minutes of each session were devoted to the facilitator educating the participants on various aspects of mindfulness, mindfulness meditation practice of each session and the debrief after practicing meditation. The facilitator allowed time in each session for the participants (both athletes and coaches) to ask questions. Ten minutes of each session were devoted to meditation practice. There were four main areas to the training:

1. Open awareness capacity. Traditional mindfulness meditation training was introduced in the first four sessions. Participants began with directing their awareness to their breathing. The mindfulness meditation training was also focused on having the participants practice being aware of what was occurring, in terms of the senses that they experienced, including sounds, body sensations, and thoughts. Participants were concurrently instructed to practice observing their experiences in a passive, non-judgmental, interested way (Siegel, 2010).

2. Caring thoughts for self and teammates. Participants were guided in some sessions to an alternative focus (rather than the breath, sounds, body sensations, and thoughts). Participants were directed to an alternate focus of wishing themselves and their teammates well, within the performance realm. This exercise began with each participant internally wishing herself well (i.e., warmth and kindness toward herself as an athlete). Participants would then be prompted to think about sending wishes (and the warm feelings associated with these) to individual teammates and the team as a whole. This portion of the training was based on Compassion Focused Therapy's compassionate mind training (Gilbert, 2010, 2011) and Loving Kindness Meditation, which involves wishing positive affirmations for one's self and others (Fredrickson, Cohn, Coffey, Pek & Finkel, 2008).

3. Concentration exercises. A variety of concentration exercises were introduced throughout the training, which served as other alternative points of focus, while practicing awareness and non-judgmental acceptance of all that was occurring. Concentration exercises were integrated given that concentration skills are essential for optimal sport performance (Cox, 2002; Williams, 2010).

*4. Practicing acceptance of negative mind-states***.** Participants were prompted to think about past performance events that included aversive emotions. Specifically, they were asked to replay an event or scene in their minds that involved a negative feeling, such as frustration, embarrassment or anger. Once participants had recalled such an events or scenes, they were directed to re-experience the emotions associated with what they were recalling. Next, participants were asked to *label* that state of mind (Baer, 2003) and concurrently practice acceptance and non-judgment. Such exercises were intended to help participants change their relationship to negative mind and emotional states, an essential element of mindfulness practice. Research indicates that practicing mindfulness is associated with "decreases in both frequency and perceptions of difficulty in letting-go of negative automatic thought" (Frewen et al., 2008, p. 758).

After each session concluded with discussion about how the skills learned in the meditation training could be directly transferred to on the field practice and/or competition. The full script

and intervention plan is available for researchers to use[3].

Results

The results are divided into two separate sections. The first section utilizes paired-sample t-tests in order to examine in-group differences among the intervention group and the control group. These statistics highlight natural changes in the control group, in comparison to changes in the intervention group following exposure to the MMTS training. The second section utilizes independent sample t-tests, comparing change scores for the intervention group to change scores of the control group. Using t-tests to compare change scores is an appropriate procedure for comparing pre- and post-test differences for two samples with $n \leq 30$ (McClave & Sincich, 2009). T-tests were used, rather than multiple analysis of variance (MANOVA), due to the small sample size, as the power of a MANOVA is greatly decreased with a small sample size, making it difficult to identify significant differences even if they do exist (D'Amico, Neilands & Zambarano, 2001). In order to account for the increased potential of a Type I error, a strict *p*-value of .01 was used over the standard *p*-value of .05. This section highlights some significant differences between changes in scores on various measures from Time 1 to Time 2. Independent samples t-tests revealed no significant differences between the intervention group and control group on any of the scales, including all subscales, at Time 1, indicating that the two groups were similar on all measures prior to the MMTS intervention.

In-Group Comparisons from Time 1 to Time 2

Tables 2 and 3 provide descriptive statistics for the intervention group and control group, respectively, on the MAAS and the PANAS, for both the pre-test and post-test. Table 4 displays the results for this data analysis. In order to account for the increased potential of a Type I error due to multiple testing, a strict alpha level of $p < .01$ was chosen, as opposed to the conventional $p < .05$, for all analyses. The intervention group had significant increases in mindfulness scores ($t = 2.953$, $p < .01$), and did not have significant changes on any of the PANAS scales. The control group had significant increases in overall PANAS Negative Affect scores ($t = 4.539$, $p < .001$) as well as in several of the PANAS subscales from Time 1 to Time 2, including upset ($t = 3.976$, $p < .001$), scared ($t = 3.432$, $p < .01$), hostile ($t = 9.953$, $p < .001$), alert ($t = 3.796$, $p < .001$), ashamed ($t = 3.449$, $p < .01$), and jittery ($t = 9.677$, $p < .001$). In addition, the control group had significant decreases in PANAS subscale scores from Time 1 to Time 2 for nervous ($t = -3.432$, $p < .01$), determined ($t = -4.555$, $p < .001$), and active ($t = -2.915$, $p < .01$). These scores suggest a wide range of natural fluctuations on PANAS scores from Time 1 to Time 2. There were no significant in-group differences from Time 1 to Time 2 for the Psychological Well-Being Scale or SWLS.

Table 2. *Descriptive statistics pre-test and post-test intervention group*

Measure	Pre-Test (*M*,*SD*)	Post-Test (*M*,*SD)*
MAAS	3.684, .670	4.043, .620
Positive Affect	34.620, 9.744	32.210, 7.473
Negative Affect	20.580, 5.975	20.740, 6.244

[3] For full intervention script please contact Amy Baltzell via e-mail at baltzell@bu.edu

Table 3. *Descriptive statistics pre-test and pos-test control group*

Measure	Pre-Test *(M,SD)*	Post-Test *(M,SD)*
MAAS	4.060, .638	3.707, .898
Positive Affect	35.833, 6.793	33.560, 6.051
Negative Affect	18.500, 3.823	25.170, 3.823

Table 4. *Paired sample t-tests*

Measures	*t*-score Intervention	*t*-score Control
MAAS	2.953**	-1.967
Positive Affect	-1.343	-1.182
Interested	.000	-.212
Alert	.000	3.796***
Attentive	.000	-.461
Excited	-1.714	-2.204*
Enthusiastic	-2.111*	.776
Inspired	-1.291	1.000
Proud	-1.439	-.458
Determined	-1.143	-4.555***
Strong	-.846	.511
Active	-1.064	-2.915**
Negative Affect	.095	4.539***
Distressed	-2.024	-.195
Upset	-.839	3.976***
Guilty	.000	.000
Ashamed	.000	3.449**
Hostile	1.407	9.953***
Irritable	-.188	-2.600*
Nervous	.579	-3.432**
Jittery	.000	9.677***
Scared	1.000	3.432**

Afraid	.567	1.882

*Note: *p < .05, **p < .01, ***p < .001*

Positive T-Scores indicate an increased rating from pre-test to post-test.

Change Score Comparisons Between Intervention and Control

Change scores from Time 1 to Time 2 were calculated on all subscales for each participant. Mean change scores for each group were then compared using independent samples t-tests (McClave & Sincich, 2009). Table 5 shows all significant findings from these analyses. The intervention group had significantly greater increases in scores from Time 1 to Time 2 on overall mindfulness score (t = 3.316, p < .01), and PANAS subscale for determined (t = 2.904, p < .01).

In contrast the comparison group had no significant change from Time 1 to Time 2 on the overall mindfulness score. The comparison group though had significantly greater increases in scores on the PANAS subscales for upset (t = -3.430, p < .01), hostile (t = -4.674, p < .001), ashamed (t = -2.874, p < .01), and jittery (t = -6.496, p < .001), and overall Negative Affect scores (t = -2.923, p < .01). No significant differences were found for change scores on any of the Psychological Well-Being subscales or the Satisfaction with Life Scale.

Table 5. *Independent samples t-test for change scores*

Measures	Intervention Change (*M, SD*)	Control Change (*M, SD*)	*t*-Score
MAAS	.359, .529	-.353, .761	3.316**
Negative Affect	.160, 7.244	6.670, 6.231	-2.923**
Upset	-.260, 1.368	1.280, 1.364	-3.430**
Scared	.210, .918	1.060, 1.305	-2.289*
Hostile	.420, 1.305	2.170, .924	-4.674***
Ashamed	.000, .816	.940, 1.162	-2.874**
Nervous	.210, 1.584	-1.060, 1.30	2.645*
Determined	-.320, 1.204	1.610, 1.501	2.904**
Jittery	.000, 1.291	2.610, 1.145	-6.496***
PANAS Alert	.000, 1.155	.940, 1.056	-2.592*
Environmental Mastery	-2.677, 4.907	.715, 4.354	-2.219*
Environmental Mastery	-.375, 3.918	-4.167, 5.985	2.292*

*Note: *p < .05, **p < .01, ***p < .001*

Negative mean scores indicate a decreased score from pre-test to post-test; Positive mean scores indicate an increased score from pre-test to post-test.

Positive T-Scores indicate that the intervention group had a greater increase in ratings on that scale from pre-test to post-test. Negative T-Scores indicate that the control group had a greater increase in ratings on that scale from pre-test to post-test.

Discussion

The purpose of this study was to assess the impact of the MMTS program on positive and negative emotions, mindfulness, psychological well-being and life satisfaction of the athlete participants. The main findings indicated that MMTS positively enhanced mindfulness of the soccer players, the intervention group. In addition, MMTS may have served as a steadying influence given that the intervention group experienced no change in mean scores of positive and negative emotions. This is quite different than what happened with the team that continued to train as usual, with no intervention. The rowing team experienced no change in mindfulness and, at once, reported higher levels of negative emotions as assessed by the PANAS.

The study was not designed to consider performance outcomes. To date, there is little data that indicates a direct relationship between mindfulness meditation training and enhanced performance. However, mindfulness meditation practice is expected to enhance mindfulness, which has been demonstrated to help the individual reduce the experience of negative thinking (Frewen et al., 2008), to reduce the aversive impact of stress (Baear, 2003), which can lead to enhanced athletic performance (John et al., 2011; Solberg et al., 1996).

While this study also does not focus on improved performance directly, consistent with the goal of mindfulness meditation interventions, the MMTS intervention significantly increased the intervention groups' mindfulness. These findings are consistent with previous research using mindfulness meditation training with a general non-clinical population (Chambers et al., 2008) and with competitive athletes (De Petrilloet al., 2009; Kabat-Zinn et al., 1985; Kaufman et al., 2009; Thompson et al., 2011). The current study indicates that a combination of shorter sessions (30 minutes) of MM can enhance mindfulness, which supports new findings in the MM in the general (Creswell et al, 2014; Zeidan at al, 2009) ands sport performance literature (Aherne et al., 2011; John et al., 2011).

The emotional experience of the soccer players, including both negative and positive emotions, remained stable when comparing pre- and post-program data. In contrast, the comparison group experienced significant increases in negative emotions. The explanation for the differences may be due to one of the benefits of the MMTS intervention: there is empirical evidence suggesting that practicing meditation results in a reduction of the experience of negativity over time (Chambers et al., 2008; Frewen et al., 2008). Thus, the practice of meditation may have mitigated the normal elevation of negative emotion in the face of increasing academic and competitive demands for the intervention group.

There has been a suggestion that mindfulness meditation training is distinct from psychological skills training (PST) in sport (De Petrillo et al., 2009; Gardner & Moore, 2004, 2006, 2007; Thompson et al., 2011). And indeed, the traditional use of mindfulness training is distinct from PST. However, it may be of value to use traditional PST cues as alternative points of focus in mindfulness training in sport, such as Kabat-Zinn and colleagues (1985) integrating imagery in their mindfulness meditation intervention. In the current study, MMTS included using imagery (of aversive moments in sport that cause negative emotions) and guided self-talk cue words (i.e. positive affirmations were used; labeling emotions when they occurred, such as "*there is fear*".) Though these cues were used differently than traditional PST, using such alternative cues (compared to traditional mindfulness mediation practice) paired with acceptance and non-judgment may be of use to sport psychology practitioners using mindfulness-based interventions.

Future Research

The modes of mindfulness training, number of training sessions and duration of each session, though sparse, has widely ranged in sport. Kabat-Zinn et al.'s (1985) ground breaking mindfulness mediation interventions ranged from two weeks to seven weeks, with each group session running 30 minutes weekly, as well as 15 minutes daily of individual practice encouraged. MSPSE includes only four sessions once per week for 2.5 to 3 hour sessions with individual daily practice of meditation also encouraged (De Petrillo et al., 2009; Kaufman et al., 2009; Thompson et al., 2011). The MAC approach (Gardner & Moore, 2007) includes an 8 module, up to 12 one-hour individual sessions. MMTS included twelve sessions, over six weeks, which lasted 30 minutes total, with ten minutes of mediation practice. Both Kabat-Zinn et al. (1985) and the MSPE interventions recommended daily practice with the aid of an audio guide. And Aherne et al. (2011) exclusively used an individualized audio CD for daily practice, with no in-person live sessions. In contrast, MMTS recommended daily practice with no audio guide.

Future research will also need to consider who can deliver a mindfulness meditation program in sport in order to be most effective. Specifically, must the program leader be a mindfulness meditation practitioner or can the instructor be a novice meditation teacher? Can audio-files (or tapes) be used exclusively, without a weekly or twice per week guided group meditation, and the programs remain effective? Though all sport based interventions have been reported to have some benefit to the participants, it will be important in future research to determine the number of sessions, duration per training session and the daily independent training design that most benefits the participants. Variability in findings to date of mindfulness meditation training programs in sport may be attributed to differences in the program facilitator, curriculum design and the number of sessions and length of sessions. And perhaps the most important, but challenging related task for future researchers, is to consider how to best assess the impact of mindfulness based interventions on performance. Very few studies to date have conducted quasi-experimental interventions that directly assess changes in performance (e.g. John et al., 2011). It will be important to design interventions that athletes will voluntarily participate in which can, concurrently, assess the impact of the program on performance.

Limitations

The soccer team was made to participate in the MMTS training. This study was the first to report mandatory participation in a meditation-training program in the United States. International examples of mandatory participation in sport meditation training have been reported (John et al., 2011). However, it will be necessary to better understand the athlete's experience of mandatory participation prior to replicating this aspect of the design. It was expected that the intervention would have had less of an impact on mindfulness and the other measures, given the athletes did not choose to participate and could have chosen not to engage in the sessions though physically present. Also, there was no true control group. Rather, data analysis was based on a convenience sample of a comparison team. However, there were strong similarities between teams: the teams were from the same university, both compete in Division I, both all female, both teams were assessed through the start of a competitive season (spring ball and spring racing season) and both are co-active sports. A trained meditation teacher administered MMTS, which could be costly to replicate. In addition, only pre- and post-intervention measures were taken. A follow up could have demonstrated whether or not gains in mindfulness were lasting, as demonstrated by Thompson et al. (2011). The changes in mindfulness could also be attributable the Hawthorne Effect, in that the intervention group received more attention and support than the comparison

group. Changes in mindfulness could also be attributable to demand characteristics: the athletes were practicing mindfulness meditation and may have expected of themselves to increase mindfulness. However, neither the researches nor meditation instructor overtly stated that it was expected that mindfulness scores were expected to increase over the course of the intervention.

Conclusion

MMTS was effective in increasing mindfulness and was related to dampening reported negative emotions experienced by the MM intervention group compared to the control group. MM training has preliminarily been shown to provide benefits for athletes including factors related to enhanced performance. Group practice was shortened, compared to other established sport interventions (e.g. the MAC approach). MMTS offers brief MM, with sessions lasting thirty minutes. Mindfulness meditation based interventions that are brief and effective may be most appealing to greater numbers of athletes. The brief MM offered within MMTS suggests that we can re-think how mindfulness mediation training can be adapted and more widely adopted in sport.

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