

Examining the Effects of the Mindfulness-Acceptance-Commitment (MAC) Programme on Sport-Specific Dispositional Mindfulness, Sport Anxiety, and Experiential Acceptance in Martial Arts

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Abstract

The aim of the study was to examine effects of the Mindfulness-Acceptance-Commitment (MAC) programme on sport-specific dispositional mindfulness, sport anxiety, and experiential acceptance, compared to an inactive control group, in a population of Martial Arts (MA) athletes. Twenty-three MA athletes were subjected to the MAC intervention, and 22 MA athletes comprised the control group. To analyse potential differences in the outcome variables between the two groups, Bayesian repeated measures analysis of variance (RM-ANOVA) was used. Findings showed that the MAC-group had greater increases over time in the sport-specific mindfulness subscales awareness and acceptance and acceptance, compared to the control group. In contrast, no interaction effects were found for present moment attention (AMQ), experiential acceptance (BEAQ), and sport anxiety (SAS-2). Overall, the present study adds further information and understanding about the effectiveness and implementation of the MAC programme.

Keywords: *Acceptance, Experiential acceptance, Martial Arts, Mindfulness, Sport anxiety*

Professional Mixed Martial Arts (MMA) athlete Darren Till was interviewed after his win over Kelvin Gastelum at the UFC 244, 2019, where he open-heartedly confessed that he was terrified before the fight began: "I didn't even wanna go out there tonight. I was thinking of ways to fake an injury. It was so hard, man. I was so terrified. I was scared" (Catterall, 2019, 1:12). Anxiety and fear are emotions that most competitive athletes in all sports sometimes experience; these kinds of emotions may arguably be more severe in violent combat sports where the risk of getting badly physically injured by an aggressive opponent is ever present (Andrade et al., 2020; Cooper & Lochbaum, 2022; Jensen et al., 2013; Vaccaro et al., 2011). Moreover, in a population of competitive MMA fighters, Jensen et al. (2013) found that the participants generally attributed poor performance to failure of managing pre-competition anxiety and high levels of adrenaline, indicating a need for this population of athletes to learn psychological strategies in order to handle common

strong affects and emotions, such as fear of getting injured, that occur under such stressful and demanding conditions as combat sport matches (Andrade et al., 2020; Cooper & Lochbaum, 2022).

Inspired by Acceptance and Commitment Therapy (ACT; Hayes, Stroschal, & Wilson, 1999), Gardner and Moore (2004) developed the seven-module programme Mindfulness-Acceptance-Commitment (MAC) that specifically targets athletic performance enhancement and overall psychosocial well-being among athletes, suggesting that techniques practiced in MAC may also be useful in dealing with challenges outside of the sports domain. Gardner (2009) emphasizes that it is not sufficient to only study whether an intervention leads to performance enhancement; it is equally important to understand how and why an intervention works and what specific mechanisms are responsible for changes in performance-related outcomes. According to the Monitor and Acceptance Theory (MAT; Lindsay & Creswell, 2017), the two overall

mindfulness mechanisms are enhanced *attention* capacity that results in increased awareness of present-moment stimuli, and a general attitude of *acceptance* towards all kinds of internal and external experiences. Acceptance in this theoretical framework is a broad term that refers to several aspects of acceptance behaviours (i.e., nonavoidance, nonjudging, nonattachment, and nonevaluation) (Lindsay & Creswell, 2017). Lindsay and Creswell (2017) postulate that enhanced awareness and attention skills together with increases in acceptance comprise the main processes that cause positive changes in Mindfulness and Acceptance Based Interventions (MABI) outcome variables (e.g., mental health, stress).

Experiential Acceptance, Experiential Avoidance, and Dispositional Mindfulness

Experiential acceptance is often described as the willingness to remain in contact with unwanted and distressing emotions, thoughts, memories, and bodily sensations, in order to pursue personal values and goals (see Block-Lerner, Wulfert, & Moses, 2009, for an in-depth review of experiential acceptance). Experiential avoidance on the other hand is characterized by attempts to escape, avoid or modify unpleasant experiences by altering their form and/or frequency (Hayes et al., 1996; Hayes et al., 1999). Whilst experiential acceptance reflects healthy psychological flexibility, experiential avoidance can be seen as psychological inflexibility (Bond et al., 2011). Further, Zhang and colleagues (2016) found that MAC participants scored higher than an attention control group on general (not sport-specific) experiential acceptance on both post-test and follow-up. Even if Gross et al. (2016) found statistically significant increases in general experiential acceptance for MAC participants, no differences between the MAC group and a PST control group were found. Similarly, Hasker (2010) found increases in general experiential acceptance in MAC participants but no differences were found between the MAC-group and a traditional Mental Training group. Moreover, Goodman et al. (2014) found no statistically significant differences between a combined MAC + yoga intervention and an inactive control group in experiential acceptance.

A few MAC studies have found statistically significant between-group post-test differences in general dispositional mindfulness in favour of MAC compared to control groups (i.e., Goodman, Kashdan, Mallard, & Schumann, 2014; Zhang et al., 2016). However, Gross et al. (2017) found no statistically significant interaction effects on general dispositional mindfulness when comparing a MAC group with a PST control group. Using a sport-specific dispositional mindfulness measure (Zhang et al., 2015), Josefsson et al. (2019) found that the MAC group attained greater improvements in athletic mindfulness skills compared to the PST control group.

Anxiety

Despite the fact that meta-analytic results show large effect sizes in favor of MABIs compared to control conditions on reductions of anxiety in both clinical and non-clinical populations (see Khoury et al., 2013, for an overview), very few studies have examined MABI-related effects on sport competition anxiety in athlete populations, and the results so far have been mixed. To our knowledge, no studies have specifically examined effects of MAC on sport competition anxiety. However, Thompson et al. (2011) found a decrease in overall competition anxiety from post-test to follow-up in a multiple-sport population after a Mindful Sport Performance Enhancement (MSPE; Kaufman et al., 2009) intervention. On the other hand, no statistically significant differences were found across the

three assessments when the anxiety subscales (somatic anxiety, worry, cognitive disruption) were analyzed (Thompson et al., 2011). In another study, effects of a mindfulness intervention on total sport anxiety were examined in a population of elite cyclists (Scott-Hamilton, Schutte, & Brown, 2016). The results showed no statistically significant differences between the mindfulness group and an inactive control group in sport anxiety but a significant anxiety reduction, of a moderate effect size magnitude, was found for the mindfulness intervention group from pre- to post-test (Scott-Hamilton et al., 2016).

Present Study

In general, previous research indicates that MABIs are associated with improvements in a number of sport performance-relevant variables (Bühlmayer et al., 2017). However, there is a lack of research on standardized MABIs on performance-related outcomes in competitive athlete populations. Several effect trials have also developed their own mindfulness intervention in which the intervention length, session length, and the intervention content often vary significantly, making it difficult to draw any firm overall conclusions about the effectiveness of mindfulness- and acceptance-based techniques and exercises on performance-related outcomes. Arguably, the most established of all these sport MABIs that have been developed in the last two decades is the MAC programme. Nonetheless, studies that have examined MAC-related effects on performance-relevant variables such as experiential acceptance and anxiety are scarce, and the results so far are somewhat inconsistent. To our knowledge, no MABIs so far have specifically studied MA athletes. Considering that combat sport athletes themselves relate poor performance to unsuccessful attempts to reduce pre-competition fear and anxiety (Andrade et al., 2020), teaching these athletes mindfulness and acceptance-based skills and exercises may help them to improve their ability to stay focused on the current task at hand in matches despite experiencing such strong affects and emotions, something that potentially may contribute to overall performance enhancement. Hence, the aim of the present study was to examine the effectiveness of the MAC-intervention, in a population that experience particularly strong affects and pre-competition anxiety (Andrade et al., 2020; Jensen et al., 2013), compared to an inactive control group, on psychological performance-related variables (i.e., sport-specific dispositional mindfulness, experiential acceptance, and sport competition anxiety).

Method

Participants

A total of forty-five adult competitive MA athletes (30 men and 15 women, Mean age = 29.56, SD = 5.98) were recruited from ten martial arts clubs in the regions of two major cities in Sweden. Participants were excluded if they (i) were younger than 18 years old, (ii) had no competition experience, and (iii) if they had quit competing in MA matches. The population contained people ranging from those with relatively little competitive experience to those that had competed and taken medals at the Swedish Championships and/or the World Championships.

Participants who were available during the scheduled MAC sessions constituted the experimental group whereas the remaining participants, who had accepted to take part in the study but could not attend the MAC sessions because of other commitments, functioned as inactive controls. Twenty-three MA athletes (13 men and 10 women, Mean age = 27.83, SD = 4.98) were subjected

to the MAC training modules, either in Gothenburg ($n = 8$) or Stockholm ($n = 15$), and 22 MA athletes (17 men and 5 women, Mean age = 31.36, SD = 6.50) comprised the control group. The majority of participants were MMA-athletes ($n = 19$) and Thai boxers ($n = 14$), (see Table 1 for more information). In Sweden, the total population of MMA-athletes is approximately 2 200, and the total number of competing Thai boxers is around 8 400. Two participants (one from the experiment group and one from the control group) failed to complete the post-test survey. Means and standard deviations for attendance rates (maximum six sessions) were 4.87 (SD = 1.07) for the MAC group (see Table 2 for frequencies of adherence in each MAC session).

Table 1: Background variables for the MAC-group (n=23) and the control group (n=22)

	MAC		Controls	
	M	SD	M	SD
Years in MA	8.61	5.19	9.27	5.38
Physical training/week	11.39	3.35	11.23	6.16
MA training/week	7.61	2.06	6.91	4.85
Number of MA matches	20.22	15.28	24.18	17.33
MMA	12		7	
Thai boxing	10		4	
Kickboxing	1		2	
Brazilian Jiu-Jitsu			4	
Boxing			1	
Submission wrestling			1	
Other			3	

Table 2: Frequencies for adherence in each MAC session (n=22)

Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
19	21	16	20	15	16

Measures

Athlete Mindfulness Questionnaire. The AMQ (Zhang, Chung and Si, 2015) comprises 16 items aimed at measuring an individual's level of dispositional sports mindfulness, including three subscales: Present-moment attention ("I can easily sustain my attention on the competition"), Awareness ("I am aware that my emotions during training and competition can influence my thinking and behaviour"), and Acceptance ("During training and competition, it doesn't matter if my thoughts and feelings are comfortable or not, I put up with all of them"). The items are scored using a 5-point scale ranging from (1) *strongly disagree* to (5) *strongly agree*. Higher average score on this scale indicate a higher level of dispositional sports mindfulness. The Swedish version of the AMQ has previously shown similar reliability properties as the original version (Josefsson et al., 2019). In the present study, the reliability scores for the subscales were: Present-moment attention (T1; $H = 0.75$) (T2; $H = 0.85$), Awareness (T1; $H = 0.70$) (T2; $H = 0.83$), Acceptance (T1; $H = 0.86$) (T2; $H = 0.91$).

Brief Experiential Avoidance Questionnaire. As recommended by Rochefort, Baldwin and Chmielewski (2018), the BEAQ (Gamez, Kotov, Chmielewski, Ruggero, Suzuki & Watson, 2014) was used to assess experiential acceptance/experiential avoidance. The BEAQ has six subscales (Behavioural avoidance, Distress aversion,

Repression/denial, Distraction/Suppression, Procrastination, Distress endurance) and the total questionnaire consists of 15 items.

The items are scored using a 6-point scale ranging from (1) *strongly disagree* to (6) *strongly agree*. The higher the average score on this scale entails subsequently a higher level of experiential avoidance (and therefore a lower level of experiential acceptance). The BEAQ has been widely used to assess experiential avoidance and has shown good psychometric properties in previous validation studies (i.e., Rochefort et al., 2018). For the present study, analyses have only been performed on the total BEAQ scale. In the present study, the coefficient H reliability score for the scale were 0.85 (T1) and 0.83 (T2).

Sport Anxiety Scale-2. The SAS-2 (Smith, Smoll, Cumming, & Grossbard, 2006) was used to assess somatic and cognitive trait anxiety in a sport context. The modified SAS-2 has shown good psychometric properties and the factorial validity is stronger compared to the previous version of the scale. The SAS-2 is frequently used to assess pre-competition anxiety in sport. A particular advantage with the SAS-2 scale is that it has shown to be sensitive to anxiety reductions after interventions that are designed to decrease anxiety (Smith et al., 2006). SAS-2 is a three-dimensional measure (Somatic anxiety, Worry, Concentration disruption) that includes 15 items, and uses a 4-point likert scale that ranges from (1) *not at all* to (4) *very much*. The higher the score on the scale would entail a higher experienced level of anxiety. In the present study, the reliability scores for the subscales were: Somatic anxiety (T1; $H = 0.90$) (T2; $H = 0.88$), Worry (T1; $H = 0.94$) (T2; $H = 0.94$), Concentration disruption (T1; $H = 0.82$) (T2; $H = 0.92$).

Procedure

Recruitment was done by advertising the study through coaches at martial arts clubs and posting flyers at those clubs in the Stockholm and Gothenburg regions. The study was also advertised through Instagram. Participants were given a letter that provided information about the purpose of the study, that data from the study would be analysed at the group level, thus guaranteeing confidentiality, and that they were free to withdraw from the program at any time. Measures were administered to all participants electronically prior to the first MAC session as well as after the last session.

MAC Intervention

In total, the MAC-intervention consisted of six one-hour sessions where the MAC-group met once a week during September and October 2019. MAC was delivered in a seven-module program, with one module being presented in one session for the first five sessions and then combining modules six and seven to one final module for the sixth and last session. The presentation material for the sessions was strictly based on the MAC-programme, created by Gardner & Moore (2007). As recommended by Josefsson et al. (2019), we mainly used sport-specific examples and illustrations, specifically relevant to a martial arts environment (e.g., fear, anxiety, sense of panic), in explanations and discussions of MAC concepts and exercises. The same MAC material, in the form of presentation and exercise forms to fill in, was used for both MAC-groups (the Stockholm group and the Gothenburg group), in order to ensure a consistent approach to presentation with the use of similar examples and analogies. Two locations were booked to hold the training sessions (one in Gothenburg and one in Stockholm), and the sessions were held in training facilities at martial art clubs. In both places the sessions were held in the evening.

Two MAC-instructors were employed, one supplying the MAC protocol in Gothenburg and the other in Stockholm. The MAC-instructors are both former professional athletes on an international elite-level, and they have previous experiences in working with mindfulness- and acceptance based techniques for athlete populations.

The six module MAC program covered the following topics:

1. *Introduction to MAC*: Preparing the client with psychoeducation: information about theoretical and practical aspects of the intervention and an introduction to the structure and the content of the full MAC programme. In particular, the role of attentional control/regulation in relation to athletic performance is introduced. Participants' own experiences of cognitive and emotional content in good versus bad sport performance are discussed. Home exercise: Waking-up and breathing meditation (five minutes), five times a week.

2. *Introducing mindfulness and cognitive defusion*: the meaning of these concepts is defined and explained, and how they can be applied in a sport competition context. Cognitive schemes and meta-cognition are presented and discussed. Mindfulness exercises are introduced. Home exercises: Waking-up and breathing meditation as well as a "traditional" mindful breathing meditation exercise (five minutes), five times a week for each exercise.

3. *Introducing values and values-driven behaviour*: the relation between goals, values and behaviours is presented. Differences between values-driven behaviour versus emotion-driven behaviour are discussed. Moreover, participants reflect on how they want to be viewed and remembered and how they want to live their lives. The difference between acting in the service of personal values and behaviours that are driven by emotions are discussed. The concept of short-term emotional gratification versus long-term benefit is also introduced and what impact it can have on sporting performance and development. Home exercises: Continuing with previous meditation exercises and filling in the "Given up for Emotions" form" (Gardner & Moore, 2007).

4. *Introducing acceptance*: The meaning of acceptance is defined and explained. The primary purpose of this module is to develop an understanding of the consequences associated with experiential avoidance, and the potential benefits with applying experiential acceptance when striving for improved performance. Further, in this module the ability to focus on relevant stimuli and perform at a high level whilst having uncomfortable thoughts and emotions is discussed. The negative consequences of avoiding behaviours related to the valued direction are looked at and what opportunities that become available in a person's behaviour and development when being more accepting of all thoughts and emotions. A particular exercise that was designed to practice the understanding of mindfulness and acceptance was the so called "holding-your-breath-exercise". In this exercise, the participants were asked to hold their breath for as long as they could and clock the time. Then they were asked to reflect and discuss what it felt like; what thoughts, emotions and bodily sensations they experienced during the exercise. The exercise was repeated with the difference that the second time the participants were specifically asked to be aware of thoughts, emotions, and physical sensations, and also to try to accept whatever it was that they were currently experiencing. After the second trial, they all noticed that they had held their breath for a longer period of time. Finally, the participants discussed the internal processes they experienced during these simple breathing exercises

and compared them to certain thoughts and feelings that can be experienced during an MA match, and additionally, how mindful awareness and acceptance can be applied for handling unpleasant thoughts and emotions during a fight. Home exercises: Continuing with previous meditation exercises and filling in the "Emotion and Performance Interference Form" (Gardner & Moore, 2007).

5. *Enhancing commitment*: Presentation of the concepts motivation and commitment, and how they differ from one another, and also how they are linked to performance-related values and behaviours. An overall aim of this module is to increase the understanding of what it takes to be committed to the long-term valued direction and being prepared to do what is necessary to follow that path. The connection is made between short and long-term goals and the valued direction. Home exercises: Practicing mindfulness in daily activities (e.g., during stretching, brushing teeth, sport practice, warming up).

6. *Life after MAC - Combining, maintaining and enhancing mindfulness, acceptance, and commitment*: Discussion about the athletes' experiences so far in integrating the topics presented in previous sessions. Thus, all the different aspects in the program were brought together so the connections were fully understood; how self-awareness allows experiential acceptance, which allows behavioural acceptance and being committed to following identified values regardless of thoughts and emotions. This module also included discussions about how to maintain and deepen the skills learned in previous sessions after the intervention has been completed. Particularly, problems and difficult situations were identified and explored. Finally, an individual action plan was made for each participant, setting out which acquired MAC-skills each individual would focus on and continue to practice in the following weeks and months.

During each session, the same meditation exercise, Brief Centering Exercise (see Gardner & Moore, 2007, for more information), was performed.

In cases where a MAC-participant could not attend a session, an audio recording of the session was made and sent electronically to that person.

Data Analyses

Based on previous recommendations Coefficient H was calculated to evaluate reliability for the scales (McNeish, 2018). To analyse potential differences in baseline values for the outcome variables, we performed Bayesian t-tests. To analyse the potential differences in the outcome variables between the two groups we used Bayesian repeated measures analysis of variance (RM-ANOVA; Rouder et al., 2012), using JASP (version 0.14.1.0, 2021). In comparison to the more commonly used frequentist approach the Bayesian approach has several advantages (for more information see, for example, Ivarsson, et al., 2015). Within the RM-ANOVA the main effect of time (T1 to T2), group (intervention vs. control) as well as the time x group interaction were tested. The Bayes Factor was used to determine support for the alternative hypothesis over the null hypothesis (Ivarsson et al., 2015). More specifically, the Bayes Factor (BF) quantifies the evidence, provided by the observed data, of one statistical hypothesis over the other (H₀ vs. H_A). A BF larger than 1 indicates stronger evidence for H_A in comparison to H₀, in accordance with recommendations from Lee and Wagenmakers (2014), we considered a BF >3 to indicate moderate support for the alternative hypothesis and a BF >10 to indicate strong evidence.

Results

The results from the Bayesian t-tests showed no support for baseline differences between the two groups in any of the outcome variables (see means and standard deviations in Table 3).

The results showed that there was strong support for an interaction effect in awareness (BF = 13.32). More specifically, the participants in the experimental group had, in comparison to the participants in the control group, greater increase in awareness over time. Also, the results showed moderate support for an interaction effect in acceptance (BF = 6.52), indicating support for a greater increase in the experimental group over time. There was no support for interaction effects for attention (BF = 1.27), sport anxiety (BF = 0.13), or experiential acceptance (BF = 0.81).

Overall, the results showed that there was strong support for within-group effects in acceptance (BF = 21.44) and awareness (BF = 60.95), illustrating increase in both these variables over time. There was no support for any within-group effects for attention (BF = 0.55), sport anxiety (BF = 0.18), or experiential acceptance (BF = 1.01). There was moderate support for a between group effect in awareness (BF = 5.07), but not in attention (BF = 1.21), acceptance (BF = 1.97), sport anxiety (BF = 0.34), or experiential acceptance (BF = 0.64).

Table 3: Means and standard deviations on both measurement points for attention, awareness, acceptance, sport anxiety, and experiential acceptance

	MAC (N=22)		Controls (N= 21)	
	M	SD	M	SD
AMQ-Attention 1	3.96	0.58	3.87	0.58
AMQ-Attention 2	4.21	0.44	3.79	0.54
AMQ-Awareness 1	3.66	0.55	3.68	0.58
AMQ-Awareness 2	4.17	0.46	3.72	0.53
AMQ-Acceptance 1	3.28	0.80	3.74	0.78
AMQ-Acceptance 2	3.88	0.72	3.80	0.70
Sport anxiety 1	2.41	0.54	2.28	0.47
Sport anxiety 2	2.34	0.65	2.36	0.53
Experiential acceptance 1	2.78	0.74	2.44	0.64
Experiential acceptance 2	2.48	0.60	2.42	0.60

Note. AMQ = Athletic Mindfulness Questionnaire. Sport anxiety = Sport Anxiety Scale (SAS-2). Experiential acceptance = Brief Experiential Avoidance Questionnaire (BEAQ)

Discussion

The current study aimed to examine effects of the MAC approach in comparison to an inactive control group, on dispositional athletic mindfulness, experiential acceptance, and sport anxiety, in a population of MA athletes. As hypothesized, MAC participants showed greater increases over time in the mindfulness subscales awareness and acceptance (AMQ) than the control group. In contrast to our initial predictions, there were no statistically significant interaction effects on present moment attention (AMQ), experiential acceptance (BEAQ), and sport anxiety (SAS-2).

Dispositional Mindfulness

The results concerning dispositional mindfulness are partly in line with previous research that also found

statistically significant MAC-related effects on dispositional athletic mindfulness compared to control conditions (Josefsson et al., 2019). However, MAC participants in the Josefsson et al. (2019) study improved on all three athletic mindfulness subscales compared to the control group whereas our findings only showed group differences on awareness and acceptance. This result is somewhat surprising considering that awareness and attention are theoretically closely linked with one another (Lindsay & Creswell, 2017). Thus, it is unclear why the MAC participants increased their awareness whilst their attention skills remained unaffected. A potential explanation may be that athletes in full-contact combat sports have been “forced” to early develop great present-moment attention skills, both in training and especially in matches where just one tiny lapse of attention may quickly result in a sudden fight-ending loss. In team sports (e.g., football/soccer, ice hockey, handball) the responsibility is shared by several team members and even if a brief attention lapse by a team member may lead to a situation where the opposing team score a goal, the consequences of an occasional attention lapse for a defender in soccer who is currently not involved in an attack on the opposing team’s half of the field may in many situations go largely unnoticed. In contrast, an MA fighter who briefly loses focus may risk being knocked out and end up not only losing the fight but also being severely injured. There are few opportunities, if any, to “hide” in an MA match. In other words, MA fighters may already be fairly skilled in present-moment attention on current sport tasks and MAC does not appear to add anything extra to that particular skill. The idea that MA athletes are skilled at being focused on present sport tasks is to some extent supported by the results that showed that present-moment attention had the highest mean score on the pre-test (3.93) of the three AMQ subscales.

As expected, the MAC training has led to enhanced contextual awareness, suggesting that MAC participants are more aware of their emotions, thoughts, ideas and physical reactions during matches and training. Furthermore, enhanced awareness combined with increases in acceptance of unpleasant thoughts and feelings during training and matches may help MA athletes to perform optimally in matches. The improvement in acceptance for the MAC group compared to the control group is consistent with the theoretical model proposed by Birrer et al. (2012) as well as the MAT theory in which acceptance is seen as a key mechanism in regulation of difficult emotions and thoughts (Lindsay & Creswell, 2017). Thus, the present study’s results confirm that sport-specific mindful acceptance and contextual awareness are facilitated by the MAC programme.

Experiential Acceptance

In line with the majority of findings in previous studies that have investigated MAC-related effects on general experiential acceptance compared to control conditions (i.e., Goodman et al., 2014; Gross et al., 2016; Hasker, 2010), no statistically significant group differences were found on experiential acceptance/experiential avoidance in the present study. This result is not compatible with the theoretical model Birrer et al. proposed (2012) where dispositional mindfulness was hypothesized to lead to several specific mindfulness impact mechanisms, related to experiential acceptance (i.e., attitude, flexibility) as well as experiential avoidance (i.e., exposure, flexibility), indicating that MAC does not have an effect on experiential acceptance/avoidance outside of the sport context. Put differently, MAC may be efficacious in reducing avoidance behaviours and increasing the willingness to face

aversive experiences in challenging matches and hard training situations but these effects may not extend to situations in daily life. Even if the MAC programme aims at teaching athletes tools that are applicable in various life situations, MAC primarily aims to help athletes deal with sport-specific challenges, such as unwanted thoughts and feelings related to athletic performance. Previous findings support the idea that MAC has a limited effect on psychological health indicators outside of the sport context. For example, Gross et al. (2016) examined nine non-sport health outcomes (e.g., depression, anxiety, distress, eating concerns) and only two of these (hostility, substance use) showed any statistically significant group differences between MAC and PST over time. Another possible explanation for the lack of effect may be that "general" experiential acceptance may require practice of MAC exercises over a longer period of time until greater tolerance for challenging and distressing life events may emerge.

Sport Anxiety

The lack of group differences in sport anxiety due to MABIs is consistent with previous trials that found similar results (i.e., Scott-Hamilton et al., 2016; Thompson et al., 2011), suggesting that MAC (as well as other MABIs) does not have an immediate post-intervention effect on sport-specific anxiety. Moreover, the aforementioned Gross et al. (2016) study found no statistically significant reductions in either general anxiety or social anxiety for MAC participants compared to a PST-group (Gross et al., 2016). Similarly, Goodman et al. (2014) found no statistically significant differences between MAC and an inactive control group in general anxiety. However, it is also possible that MAC leads to reductions in sport-specific anxiety exclusively for athletes who experience severe anxiety problems in competitions. Further, the SAS scale attempts to assess level of anxiety during as well as prior to a competition/match. Considering that most participants did not have any matches during the intervention (Mean for matches during the intervention = 0.59), they did not get any opportunities to actually practice MAC principals and exercises (e.g., anxiety tolerance and exposure), in such a highly demanding situation as an MA match in which anxiety levels are maximally raised. A plausible explanation for the low number of matches among MAC participants may be that in some MA sports (e.g., MMA), the number of matches during a year may not be more than one or two (Jensen et al., 2013). Exposure therapy is the treatment of choice for anxiety disorders (Abramowitz, 2013) and athletes need to face the feared stimuli for an anxiety-reducing effect to occur (Gustafsson & Lundqvist, 2020), which may not have been the case for all participants in the current study. In addition, within-person variations in anxiety levels may vary over time and we do not have any information about each participant's average anxiety level. However, it has been documented that anxiety levels for MA athletes peak just before a match (Andrade et al., 2020; Jensen et al., 2013).

In general, we would argue that it is important to not view mindfulness- and acceptance-based tools as quick fixes. Even athletes from other sports who frequently have competitions and matches may need time to regularly practice MAC exercises as well as internalize MAC principals, and thereafter apply them in training and competitions/matches. In accordance with the MABI approach, athletes are taught that it is possible (and even required) to learn how to perform optimally in matches despite experiencing unpleasant, strong affects and emotions. Thus, it may not be necessary to reduce anxious feelings to be able to perform. It is more a question of

accepting whatever unwanted thoughts and emotions that arise during a competition or a match, which may facilitate the ability to stay focused on the current sport task at hand (Gardner & Moore, 2004).

Methodological Concerns

There are several limitations of the present study that need to be recognized. First, the sample size was rather small, limiting the possibility to generalize the results to the entire MA population. Second, the participants were not randomly assigned to experimental- and control group. This is a major limitation in the present study because randomization is an important tool for reducing selection bias as well as balancing out confounding variables (Suresh, 2011). Third, there was heterogeneity of type of MA sports that were represented in the groups; the experimental group consisted mainly of MMA fighters and Thai boxers whereas the control group contained seven different MA sports (see Table 1). Unfortunately, matching was not possible for practical motives. There was also a large heterogeneity in competitive level among participants, ranging from novices to athletes who have participated in major international competitions, which we have not controlled for in the analyses. Experience may be a crucial factor in how to manage pre-competition anxiety and fear. For example, MMA fighters in Jensen et al's (2013) study argued that the only way to learn how to cope with fear prior to a match is through experience. Fourth, another limitation was that we only used an inactive control group. For practical reasons it was not feasible to use an active control group. However, advantages with inactive control groups have also been identified. For instance, inactive control groups are less costly and may be suitable for studies for early evaluations of novel interventions that have not been extensively studied in previous trials (Mohr et al., 2009). Fifth, considering that MAC participants were divided in two groups that were led by different instructors, it is possible that non-specific factors related to leadership style and/or leader competence may have influenced participants' understanding of key MAC concepts as well as engagement in the intervention, which in turn could have had an impact on the results. Finally, we did not collect data of home practice for the MAC participants. Hence, the amount of time participants engaged in home exercises is not known. Similarly, no data was collected on previous mindfulness- and meditation experiences.

Future Research

The findings of the current study further strengthen the support for the MAC approach in cultivating sport-specific mindfulness skills. MAC-specific exercises, techniques and principals may need to be regularly practiced and then gradually implemented during training and in matches. Pressurised training sessions (i.e., full-contact fights), in which high anxiety and strong emotions are particularly present in MA-athletes, are likely to be more effective when testing the usefulness of MAC methods than merely practicing them separately from training and matches (see Low et al., 2021, for an extended review on pressurised training).

Furthermore, the investigation of potential mediators and moderators should also be prioritized in future MAC-studies. By doing so, it would be possible to understand how, why, for whom, and under what conditions an intervention such as MAC works, which would provide valuable information for how to best modify intervention modules as well as giving practitioners guidance in carrying out the intervention. In addition, longitudinal case studies would be helpful in understanding the applicability and effectiveness of mindfulness- and

acceptance based interventions for this particular population who often experiences high levels of stress and anxiety prior to matches. In general, we recommend using an RCT design, follow-up measures, and using sport specific homework assignments that should be evaluated after the intervention. Homework assignments are crucial features for the overall effectiveness of an intervention (Kazantzis et al., 2016) and they should be delivered on a difficulty level that is closely matched with the athlete's current capacity. For athletes to stay motivated in doing homework assignments, they should be able to succeed in performing the tasks by themselves (Gustafsson & Lundqvist, 2020). Continuous improvements and adaptations of intervention content and appropriate homework assignments are vital in order to provide athletes with effective interventions and sufficient psychological support.

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Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. The study was reviewed and approved by the regional ethical review board of Lund University (no. 2016/153).

Conflict of Interest

The authors declare that they have no conflict of interest.

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