

Mindfulness with Collegiate Gymnasts: Effects on Flow, Stress and Overall Mindfulness Levels

Received 02 June 2019
Accepted 20 August 2019

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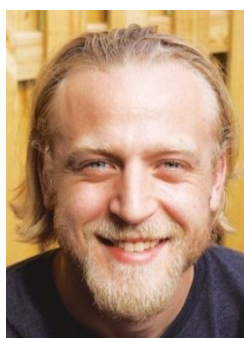
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Abstract: The physical and psychological demands of sports can place an athlete under a variety of stressors. Subsequently, the way in which athletes deal with such stressors can positively or negatively affect their performance. Flow is defined as a type of experience where one is completely engaged in an activity and optimally functioning. Recently, an increase in mindfulness and acceptance based approaches have been utilized as a means to augment negative emotions in sport and many have suggested a link between mindfulness and flow. Thus, if mindfulness can positively influence flow, perhaps performance can also be positively affected. There has also been a need to determine optimal intervention lengths to successfully teach mindfulness practices within sports teams. The purpose of the current study was to examine the effects of a mindfulness training program on mindfulness scores, dispositional flow scores, and perceived stress scores within a population of Division I female collegiate gymnasts. Results from a repeated measures ANOVA indicated that athletes who participated in the mindfulness training demonstrated a statistically significant difference in the dispositional flow dimensions of loss of self-consciousness and the autotelic experience. These results suggest that mindfulness may influence factors associated with athletic performance.

Key Words: Mindfulness, Flow, Stress, Intervention, Gymnastics



Nicholas P. Cherup, MS, is a second-year doctoral student in the Kinesiology and Sports Science department at the University of Miami. As a research assistant in the Laboratory of Neuromuscular Research and Active Aging, Nicholas's research line is focused on the therapeutic effects of yoga in the elderly and individuals diagnosed with Parkinson's disease. More specifically, he is interested in how yoga can be used to improve functional movement and enhance cognition within these populations. He has also conducted research examining the impact of mindfulness training to mitigate stress perception with college students and student athletes. Nicholas is a registered yoga instructor (RYT-200) who holds weekly community classes funded by the Parkinson's foundation. His academic and career goals are to contribute meaningful research to the field of Kinesiology and to further legitimate the efficacy of yoga as a therapeutic modality across a variety of clinical populations.

1. Introduction

An elite athlete has been described as one who possesses great physical skills and can perform under extremely demanding conditions [1]. Optimal performance necessitates the integration of not only physical components, but also psychological skills throughout training and the competitive season.

Successful athletes often describe their best performances as a state of being in the zone [2].

Typically, this feeling comprises the fusion of the mind and body where the individual responds to challenges fluidly and with poise, unencumbered by performance anxiety or distraction. An analogous

construct known as flow describes experiences where individuals are completely immersed in an activity, perceive a match between their goals and skills, and are optimally functioning [3-5]. Past literature has examined dispositional characteristics of peak performance in sport, and it has been suggested that for an athlete to reach their fullest potential during competition, an underlying flow state must concomitantly occur [6].

Athletes also experience a wide range of stressors during their career and failure to successfully navigate emotions and other obstacles may be antithetical to overall performance and flow attainment [7]. In the past, sports psychologists have approached mitigating stress and other barriers to performance using techniques that encourage the suppression of negative emotions while emphasizing more “ideal” mental states [8-9]. Although literature has shown this method to be indirectly beneficial, few studies have shown clear performance effects [9-11]. Alternatively, over the last two decades mindfulness based approaches in sport have gained popularity as a means to augment negative emotions and bolster cognitions associated with enhanced well-being and optimal performance [10-12]. The method behind such practices differs from previous approaches insofar as mindfulness techniques utilize acceptance of unwanted mind states or stressors instead of trying to avoid or suppress negative thoughts. Consequently, navigating negative emotions through mindfulness practices is still not fully understood and necessitates additional studies [13-15].

Determining optimal intervention lengths (i.e., dosage effects) has also been a point of interest for sport researchers, as past approaches often require a substantial time commitment which may not be practical for the demanding and dynamic schedule of sports teams. Though previous studies have manipulated overall program lengths, ideal combinations to achieve benefits have yet to be determined [16,17]. In addition, given that sports teams are placed under demanding schedules (i.e. out of state competition, practice, etc.) there is a need to find ways to teach mindfulness to athletes in a time frame that is amenable to their schedule.

Therefore, the current study used a training protocol containing twelve 1-hour sessions spanning the course of eighteen weeks. The current protocol was adapted from previous mindfulness interventions in sport [10, 12] with the additional component of being flexible in the meeting requirements. Ultimately, this framework allowed mindfulness to be taught in a timeframe that coincided with the demanding schedule of a Division I female gymnastics team starting in the preseason and continuing into the competitive season.

2. Mindfulness

Mindfulness is a deeply rooted concept embedded in many eastern philosophies. The central theme of this contemplative practice is maintaining non-judgmental and open awareness of the present moment. The operational definition of mindfulness as a theoretical construct was initially presented by Bishop and colleagues (2004) and serves as a foundation for subsequent research. The definition is broken down into two components. The first element focuses on the regulation of internal attention at any given time, and the second element is concerned with a specific orientation toward the subjective experience in question. This quality of awareness primarily emphasizes curiosity and an open and accepting view of the present moment free of expectations. It is important to distinguish that the practice and overarching goal of mindfulness is not concerned with suppressing thoughts and feelings, but acknowledging and accepting reality and all its contents as a matter of conscious experience [18]. As a mechanism, research has indicated that mindfulness practices may help an individual to change their perception of emergent thoughts (i.e., see them as just thoughts) as opposed to identifying with or attaching to those thoughts [19]. In line with this view, it is understood that the content of thoughts and emotions remains the same but the relationship between the subject and those thoughts is altered. Researchers have also indicated that this change in perception can lead to increased calmness in the presence of external factors [15]. Ultimately, this frame of reference may provide positive outcomes when considering the potential stressors

an athlete is faced with during the competitive season.

3. Mindfulness in Sports

Traditionally, professionals have approached psychological impediments to athletic performance using cognitive behavioral therapy [1, 20, 21]. Often referred to as psychological skills training (PST), techniques which include imagery, mental rehearsal, arousal management, goal setting, and self-talk are practiced to help athletes foster a sense of self control [22, 23]. The goal of PST is to focus attention on ideal performance skills while suppressing or discarding negative emotions or bodily states [8]. Though many professionals find this approach helpful, current information regarding its utility remains limited [10, 11, 15]. Mindfulness based practices offer a different approach to such problems insofar as they discourage the control or circumvention of internal experiences and suggest that the individual accept them as natural events that emerge in consciousness. Further, it may be that an athlete's ability to disengage from negative cognitions through acceptance mechanisms could allow them to move forward and perform more optimally in the future.

Although Kabat-Zinn and colleagues (1985) were the first to implement mindfulness training in collegiate and Olympic athletes, a recent increase in published research has surfaced with the use of mindfulness to increase sport performance. Past studies have scrutinized the effects of mindfulness training in a variety of sports including; archery, golf [12], long distance running [24], swimming, [10, 25] basketball [26], and soccer [27-28] and have generally found a positive impact on factors related to performance. Specifically, it has been proposed that mindfulness may alter elements such as attentional resource allocation, self-regulation, flexibility in thought, and less rumination, through the of reframing of stress or negative emotions [15]. Additionally, mindfulness interventions have been shown to decrease worrying, increase self-confidence, increase enjoyment of participation in a specific sport, increase adherence to training regimens (Gardner & Moore, 2004) [10], lessen

perceived stress, (De Petrillo, Kaufman, Glass, & Arnkoff, 2009; Goodman et al., 2014)[27-29], and decrease the risk of injury among athletes (Ivarsson, Johnson, Anderson, Fallby, & Altemyer, 2015) [30] .

3.1 Types of Mindfulness Interventions in Sports

Interventions such as the Mindfulness-Acceptance-Commitment (MAC) based approach to athletic achievement (Garner & Moore, 2004, 2007) [10,31], the Mindful Sport Performance Enhancement (MSPE) program (Kaufman et al., 2009) [12], and the Mindful Meditation Training for Sport (MMTS) program (Baltzell & Akhtar, 2014) [17] all use techniques that encourage an athlete to stay in the present moment with the intent of canceling out external stressors that may inhibit their success during competition (i.e., draw on cognitive resources that may otherwise tax the athlete during competition). As previously indicated, the efficacy of such interventions has been examined in a wide variety of sports (Kaufman et al., 2009; Thompson et al., 2011; Schwanhausser, 2009; Gardner & Moore, 2004; Gooding & Gardner, 2009; Goodman et al., 2014; De Petrillo et al., 2009) [10, 12, 24-27, 29] and generally it has been found that such approaches have been effective for enhancing psychological traits associated with optimal performance. Specifically, decreased worrying, increased optimism, and increased enjoyment of sport participation underscore such factors. However, these interventions require a substantial time commitment that can place constraints on the dynamic nature and demanding schedule of collegiate athletics. For example, the MSPE approach is four weeks in length with each session lasting from 2.5-3 hours whereas the MAC approach contains seven modules that can be taught over twelve weeks. Though both interventions have produced fruitful outcomes within a performance enhancement context, researchers (Moore & Gardner, 2014; Baltzell & Akhtar, 2014) [16, 17] have suggested further studies on the determination of optimal intervention lengths. Specifically, there is a need to develop shorter and more flexible individual sessions in an effort to export mindfulness concepts in a more

efficient manner. Moreover, to our knowledge, there is a minimal amount of research examining the use of mindfulness training within a population of gymnasts [32].

3.2 Flow and Performance

The concept of flow was developed in the mid-seventies through the pioneering research of Csikszentmihalyi (1990, 1992) [3, 4]. He interviewed individuals participating in challenging activities ranging from rock climbing to surgical procedures and distilled commonly reported experiences into nine interrelated dimensions: 1) attainment of challenge skill balance, 2) merging of action and awareness, 3) clear goal realization, 4) unambiguous feedback, 5) increased concentration, 6) paradox of control, 7) loss of self-consciousness, 8) transformation of time, and the 9) “autotelic experience” [3, 4]. Ultimately, the subjective experience of complete emersion in the specific activity, accompanied by implicit focus and joy, embodies the flow state. It has also been suggested that athletes who are completely immersed in their given sport and perceive a match between their skills and objectives find more intrinsic enjoyment of the task at hand [5]. Moreover, it has also been proposed that flow and optimal or peak performance are interrelated constructs [33], and that athletes perceive themselves as performing at their best during states of flow [6]. Subsequently, finding ways in which to enhance such experiences or decrease the threshold at which they occur, may help an athlete’s overall success and allow them to perform at their fullest potential during the competitive season.

3.3 Flow and Mindfulness in Sport

It has been suggested that increased attentional resources dedicated to proprioceptive cues can help an athlete to become more absorbed in a task, and thus predispose them to experience flow [34]. Consequently, similarities between the key tenants of mindfulness and multiple dimensions of flow have led researchers to believe that mindfulness may influence the occurrence of such states [10-11, 14]. For example, it has been shown that those who

participated in the MSPE and MAC programs have reported increases in flow measures [11-12, 25]. Similarly, Aherne and colleagues (2011) found that athletes who participated in a 6-week mindfulness intervention showed increases in global flow scores as well as increases in the flow dimensions of clear goals and sense of control. When considering the trait of mindfulness in the absence of an intervention, Kee and Wang (2008) used a cluster analysis to study the relationship between mindfulness and flow in recreational athletes. Ultimately their results indicated that those who were more mindful, scored higher in the flow dimensions of challenge skill balance, clear goals, concentration, sense of control, and loss of self-consciousness. Together these findings support the notion that being more mindful may augment an individual’s propensity to experience flow, however, further research is needed to examine this potential relationship across a broader range of sports, including gymnastics.

3.4 Stress as a Barrier to Optimal Performance

In direct opposition to the positive mental states associated with the construct of flow, athletes often experience a range of stressors that may have a negative impact on performance [15, 35]. Past literature has defined competitive stress as “an ongoing transaction between the individual and the environmental demands associated primarily and directly with competitive performance” [36]. Subsequently, these demands can influence cognitive anxiety, self-confidence [37], evaluations of athletic ability [35] and organizational stress perception (i.e coaches and coaching styles [38-40], and may tax the athlete in such a way as to draw from resources that can otherwise be used to meet the demands of their sport [15]. Further, the way in which an individual appraises these stressors can positively or negatively affect their emotional response under pressure and effect how well they perform during competition [35]. It is also pertinent to consider that collegiate athletes are faced with many additional stressors such as academic, physical, and social components, that may also negatively impact overall stress perception [41]. While past research has found that

mindfulness based approaches positively impact acceptance of emotional experiences [17] and perceived stress among athletes [27], there is a paucity of research looking at the effects of mindfulness training and overall stress in collegiate athletes. Therefore, the purpose of this study was to examine the effect of mindfulness training on mindfulness scores, dispositional flow state scores, and stress perception scores in a population of Division I female collegiate gymnasts. The primary hypothesis was that those who participated in the mindfulness training would report increased mindfulness scores, increased dispositional flow scores, and decreased stress scores over the twelve sessions.

4. Materials and Methods

4.1 Participants

This study was conducted with seventeen Division I female gymnasts from a university in the Midwestern United States. The participants range in age varied from 18-21 ($M = 19.59$ years old, $SD = 1.09$). Sixteen (94%) of these participants were Caucasian and one (0.06%) participant identified as Asian or Pacific Islander. The participants varied in academic class and fifteen reported that they were not actively practicing mindfulness techniques prior to the start of the program. This study was approved by the university's institutional review board for human subject research.

4.2 Procedure

During the first session athletes were invited to participate in the study and it was also explained that participation in the data collection portion of the mindfulness training was completely voluntary. The athletes were also informed that they could withdraw from the research portion of the training at any time without penalty. In addition, all athletes were informed that their answers to the questionnaire data would be kept completely confidential and all scores would be analyzed as an aggregate. Informed consent was obtained from all participants and all gymnasts agreed to complete the

questionnaires at pre- (session 1), mid-(session 7), and post-test (session 12). The mindfulness program used for the present study was adapted from Garner and Moore's MAC program (2007) and Kaufman et al.'s MSPE program (2009) and was led by a sport psychologist and graduate student. Specifically, the current protocol incorporated several group discussions about values, goals, and acceptance from the MAC program, along with additional mindfulness techniques from the MSPE program. One important modification from the previous approaches was that the current program utilized a flexible protocol which allowed for non-consecutive sessions to better accommodate the schedule of the team. Each session lasted approximately one hour and the total program consisted of twelve nonconsecutive sessions over an eighteen-week period that started in the preseason and continued into the competitive season. Each session was broken into two components which included psychoeducation and group discussions about concepts related to mindfulness and performance. In addition, a formal meditation practice (10-20 minutes) with and without the practice of relaxation techniques was introduced throughout the program (body scan, progressive muscle relaxation, breathing exercises, walking meditation, imagery, yoga type stretching, and Qi Gong; see Table 1). Formal or informal mindfulness exercises were encouraged outside of the sessions, but not required. See table 1 below.

4.3 Measures

4.3.1 The Five Facet Mindfulness Questionnaire (FFMQ)

The FFMQ was developed by Bear, Smith, Hopkins, Krietemeyer, & Toney (2006) [42]. The FFMQ is 39-item questionnaire that measures five facets of mindfulness including: Observing, Describing, Acting with Awareness, Nonjudging, and Nonreactivity. The instrument is scored by summing the items in each category (facet), and calculating the mean totals. A total mindfulness score can also be obtained by summing the individual category score means.

Table 1. Intervention protocol

Session	Discussion Topic	Relaxation Exercise	Mediation time
1	Introduction to Mindfulness	Formal Meditation	10 min
2	Introduction to Flow	Progressive Muscle Relaxation	10 min
3	Attentional Resources in Sport, Cognitive Diffusion, serial sevens exercise	Breathing Techniques	12 min
4	Anger, Controllable vs Uncontrollable Factors, Creating space between thoughts	Introduction to Qi Gong	14 min
5	Perfectionism, Resiliency, Self-Efficacy	Guided Imagery Exercise	16 min
6	Review of mindfulness practices in sport, use thus far	Raisin Exercise/ Mindful Walking	18 min
7	Values and Goals, distinction between value driven behavior and goal driven behavior	Formal Meditation	14 min
8	Self-Care through season, Fear and skillful vs unskillful ways of addressing fear	Mindful Stretching	16 min
9	Emotions toward injury, team vs individual injury, framing injury as a positive	Progressive Muscle relaxation/ Brief imagery exercise	18 min
10	Growth vs Fixed Mindset, grounding	Formal Meditation	20 min
11	Process vs Outcome	Mindful Stretching	20 min
12	Integration of mindfulness into practice and competition scenarios	Candle Exercise	20 min

The FFMQ has shown good internal consistency across populations and has been shown to be a valid measure of mindfulness with Cronbach alpha coefficients ranging from .72-.92 (43).

4.3.2 The Long Dispositional Flow Scale (DFS-2) – Physical

The DFS-2 was developed by Jackson and Eklund (2002) and is grounded in the theoretical framework of Csikszentmihalyi's flow theory (1990) [3, 4]. The DFS-2 instrument was developed to assess all nine dimension of flow during a specific physical activity and include: 1) challenge skill balance,

2) action and awareness merging, 3) clear goals, 4) unambiguous feedback, 5) concentration on the task at hand, 6) sense of control, 7) loss of self-consciousness, 8) transformation of time, and the 9) autotelic experience. The scale consists of 36 items that are rated on a five point Likert scale ranging from 1(never) to 5 (always). The participants were asked to rate the frequency of their experience of any of the nine dimensions of flow during their last practice or competition. An example question is; "I do things spontaneously and automatically without thinking too much." The instrument is scored by summing the items in each category and finding the mean totals. A total score can also be determined by

summing the item averages across all categories. All nine subscales have been shown to be a reliable measure of dimensions associated with flow with Cronbach alpha measures ranging from .78-.90 [44].

4.3.3 The Perceived Stress Scale (PSS).

The PSS was developed by Cohen, Kamarck, and Mermelstein (1983) [5]. The PSS instrument measures the degree in which an individual appraises their life as stressful over the previous month. The scale consists of 10 items and all answers are based on a 5 point Likert scale ranging from 0 (never) to 4 (very often), with four of the items reversed scored. An example question is; "In the last month, how often have you been angered because of things that are out of your control?" The instrument is scored by summing the ten items. The scale has been shown to be a reliable measure of stress perception with Cronbach alpha measures of .75-.91 [45].

4.3.4 Statistical Analysis

To examine the effects of the current mindfulness intervention on mindfulness scores, dispositional flow scores, and perceived stress scores, descriptive statistics were analyzed along with a repeated measure ANOVA. A post hoc t-test with a Bonferroni adjustment was also used to examine the mean differences between the pre-, mid-, and post-test scores. All data was analyzed using SPSS software.

5. Results

5.1 Five Facet Mindfulness Questionnaire

Results from the repeated measures ANOVA indicated no statistically significant differences in the overall mean mindfulness scores at pre- ($M = 115.24$; $SD = 12.63$), mid- ($M = 116.65$; $SD = 11.65$), and post-test ($M = 115.82$; $SD = 15.75$; $F(2,17.098) = 0.222$, $p = 0.80$). In addition, the results revealed no statistically significant difference in the individual FFMQ subscales including: observing, describing, acting

with awareness, nonjudging, and nonreactivity (see Table 2).

5.2 Long Dispositional Flow Scale

Results from the repeated measures ANOVA indicated no statistically significant difference in the overall DFS-2 mean scores for participants at pre- ($M = 13.96$; $SD = 1.05$), mid- ($M = 14.54$; $SD = 1.42$), and post-test ($M = 14.11$; $SD = 1.12$; $F(2, 32) = 1.745$, $p = 0.19$). However, results indicated a statistically significant effect for time on two DFS-2 subscales including; loss of self-consciousness ($F(2, 32) = 4.592$, $p = 0.02$) and the autotelic experience ($F(2, 32) = 5.175$, $p = 0.01$). Specifically, a Bonferroni post hoc analysis indicated that there was a statistically significant difference between pre- ($M = 9.76$, $SD = 3.01$) and mid-test ($M = 11.88$, $SD = 2.45$) loss of self-consciousness scores with a p value below 0.05. Additionally, the post hoc analysis indicated a statistically significant difference between pre- ($M = 15.76$, $SD = 2.19$) and post-test ($M = 14.18$, $SD = 2.13$) autotelic experience scores with a p value below 0.05 (see Table 2).

5.3 Perceived Stress Scale

Results from the repeated measures ANOVA indicated that total PSS scores did not display a statistically significant difference for participants from pre- ($M = 20.88$; $SD = 4.38$), mid- ($M = 20.75$; $SD = 4.78$), or post-test ($M = 20.37$; $SD = 5.12$; $F(2,30) = 0.075$, $p = 0.93$; see Table 2).

6. Discussion

The present study sought to determine the impact of a mindfulness intervention consisting of twelve 1-hour non-consecutive sessions on athletes' mindfulness scores, dispositional flow scores, and perceived stress scores. Results indicated that a statistically significant difference was found in the individual flow subscales of the loss of self-consciousness and the autotelic experience. These findings indicate that mindfulness practices may augment factors related to sport performance.

Table 2 Repeated measures results with means and standard deviations

Measure:	Mean Pre	SD	Mean Mid	SD	Mean Post	SD	P-Value
Five Facet Mindfulness Questionnaire Total	115.24	12.63	116.65	11.65	115.82	15.75	0.80
FFMQ Subscales							
Observing	20.53	3.76	21.94	4.62	20.94	4.56	0.28
Describing	25.06	5.70	26.18	4.95	25.06	6.65	0.37
Acting with Awareness	24.94	6.05	23.82	5.10	24.76	5.31	0.38
Nonjudging	24.65	5.24	25.82	6.42	26.11	5.17	0.46
Nonreactivity	17.88	3.08	18.88	2.39	18.94	3.44	0.13
Long Dispositional Flow Scale 2 Total	13.96	1.05	14.54	1.42	14.12	1.12	0.19
Flow Subscales							
Challenge Skill Balance	15.24	1.52	15.82	1.94	15.82	1.98	0.39
Merging of Action and Awareness	12.47	1.87	13.24	1.60	13.0	2.18	0.42
Clear Goals	17.18	2.16	17.94	2.22	17.41	2.67	0.42
Unambiguous Feedback	15.24	2.61	16.41	2.67	16.41	2.35	0.08
Concentration on the Task at Hand	13.88	3.14	14.53	2.18	13.71	2.17	0.37
Sense of Control	14.29	1.93	14.88	1.93	14.76	2.05	0.43
Loss of Self Consciousness	9.76	3.01	11.88	2.46	11.59	3.31	0.02
Transformation of Time	11.82	2.01	10.65	3.82	10.18	3.57	0.12
Autotelic Experience	15.76	2.19	15.47	2.10	14.18	2.13	0.01

Note. * indicates significance with a p value below 0.05 as a main effect for time.

6.1 Five Facet Mindfulness Questionnaire

It was hypothesized that mindfulness scores would increase between pre-(session 1, i.e. preseason), mid-(session 7, i.e. preseason), and post-test (session 12, i.e. competitive season). The findings from the current study indicated that total mindfulness scores did not differ significantly over time. Surprisingly, these results differ from previous research insofar as mindfulness interventions have

been shown to produce increased measures of trait mindfulness [17, 25], acting with awareness, and decreased task related worries (Thompson et al., 2011) [24] within athletic populations. When considering the results of the current study, it is important to note that while the researchers taught mindfulness exercises and other relaxation techniques during group sessions, twelve 1-hour meetings may have not been sufficient to instill a

base of practice with the athletes. Subsequently, future research should continue to examine optimal intervention lengths in order to determine the appropriate time requirement for such practices. While the non-consecutive nature of the current intervention was adaptable to the dynamic schedule of the athletic environment, unexpected cancelations as well as a 3-week hiatus due to the winter break may have had an influence on mindfulness scores. Thus, this discontinuity in the intervention sessions could have resulted in the athletes practicing less mindfulness than they would have if the meeting times were consecutive. Furthermore, while the athletes were encouraged to utilize these exercises in their daily lives, no measure was directly employed to track this progress (i.e. home meditation logs). Anecdotally, participants occasionally mentioned using mindfulness practices before bed, however in general, the majority of the athletes reported no other outside mindfulness practices. Following this line, Bishop and colleagues (2004) suggested that mindfulness is a skill that requires repetition, and that the continuation of these types of exercises (formal or informal), may help individuals to choose mindful states more frequently [18]. Future studies should consider the use of take home logs to continually reinforce mindfulness techniques and potentially obtain more encouraging results.

6.2 Long Dispositional Flow Scale

It was hypothesized that total dispositional flow scores would increase over the course of the intervention. Results from the current study revealed that total dispositional flow scores did not differ significantly over time. However, statistically significant findings were found in the DFS-2 subscales, loss of self-consciousness and the autotelic experience.

When considering total DFS-2 scores, the current results differ from the majority of previous findings that have shown increased flow scores following mindfulness based interventions [12, 25]. Interestingly, the current results are similar to those reported by Thompson and colleagues (2011), who observed no change in dispositional flow measures after a one year follow up in athletes who

participated in the MSPE program [24]. Thompson et al. (2011) postulated that lack of mindfulness practices over the twelve-month period could have resulted in decreased flow scores. Additionally, though many have articulated a potential relationship between mindfulness and flow [10, 12, 25] further research is needed to determine if and how these constructs influence one another. Though the current results did not indicate any significant changes in total flow disposition scores over the course of the mindfulness intervention, lack of findings may also be explained by the somewhat obscure concept of flow itself. Given the elusive nature of these types of optimal experiences, self-reported measures can make it difficult to capture this phenomenon in close to real time. Moreover, the controllability of such experiences remains to be a point of interest for sports psychologists, with many indicating that specific situational factors such as lacking motivation, non-optimal concentration, and low perceived ability may make an individual more or less likely to experience and maintain flow [7, 46, 47]. In the current study, it may be that the way in which athletes dealt with perceived stress, increased pressure of the competitive season, as well as inconsistent attention during the meditation exercises translated into decreased flow results at the post-test.

Increases in loss of self-consciousness scores are consistent with past results, which indicate that individuals who display higher dispositional mindfulness are more likely to experience this flow dimension [48, 49]. Based on the current results, the loss of self-consciousness measure was found to significantly increase from the baseline to the mid-test, however, this increase was not significantly different from mid- to post-test. An important factor to consider is that the post-test was administered well into the competitive season. Consequently, it may be postulated that academic demands were greater at this time and these additional burdens compounded with an increase in competitive stress may have resulted in decreased self-consciousness scores. Highlighting the potential effect of stress on psychological well-being, Brown and Ryan (2003) [50] proposed that individuals who are more mindful are potentially less perturbed by outside influences.

In this context, it may be that lack of mindfulness practice, coupled with an increase in perceived academic and performance pressures, could have predisposed the gymnasts to feel concerned about competitive factors that were out of their control (i.e. judge scores, overall team progress, crowd views). Ultimately, these cognitions may have led to a decrease in the sense of self variable at the post-test.

When considering the results of the autotelic experience, it was found that this measure displayed a statistically significant decrease from pre- to post-test. This unexpected finding may also be illustrated by the competitive stressors placed on the gymnasts throughout the intervention. It is also important to emphasize that the final data collection occurred following two consecutive losses, and the autotelic experience is a measure of an individual's perception of an activity as intrinsically rewarding and deeply enjoyable. Therefore, consecutive losses prior to the post-test may have negatively affected these views. According to Jackson (1995) [46], several features such as performance going poorly, non-optimal environmental or situational conditions, inappropriate focus and negative team play interaction, may prevent the experience of flow. Subsequently, the researchers of the current investigation noted a decrease in the team's energy during the post-test session (i.e., team expressed frustration about performance and progress) and this deflated sense of team success may also have contributed to the decreased autotelic experience scores following the intervention.

6.3 Perceived Stress Scale

It was hypothesized that PSS scores would decrease between pre-, mid-, and post-test. Results indicated that perceived stress scores did not decrease significantly over the course of the intervention. These findings contradict previous research insofar as mindfulness training has been shown to lower perceived stress, decrease worry, and decreased perception of organizational stressors within athletic populations [7, 10, 29]. One potential explanation for this disparity in results may also be attributed to the timing of the post-test data collection. Considering that the final questionnaires

were distributed well into the competitive season and after two losses, the athletes may have harbored some frustrations over past performances. In addition, post-test measurements were collected in the middle of semester when academic and competitive demands were likely increasing. Therefore, it is possible that increased academic and athletic pressure could have influenced subjective performance appraisals and global stress scores. Correspondingly, it has been suggested that additional academic and social pressures can impact stress levels within collegiate [41]. Lack of statistically significant changes in stress scores may also be the result of athletes not participating in mindfulness exercises on their own time. As previously mentioned, mindfulness is a skill that requires practice, and failure to commit to these techniques regularly, may hinder the emergence of more mindful states in the future.

7. Conclusion

The current study failed to detect any statistically significant change in mindfulness, total dispositional flow, and perceived stress scores following the 18-week mindfulness intervention. There were statistically significant changes in the loss of self-consciousness and autotelic experience subscales. Some researchers support the claim that there is a clear association between mindfulness and flow, however no study has provided a clear mechanism for how this occurs. Several factors may have impacted the current results including: the frequency of home practice, the timing of data collection and the order in which mindfulness exercises were presented. Indeed, many different mindfulness techniques were incorporated into this intervention, and exercises may have resonated differently within each athlete. It seems more likely that repetition of mindfulness practice is a more salient factor for the cultivation of mindful states than overall time or variety of exercises. Future research should continue to examine the impact of frequency, intervention length and teaching order in similar populations. Finally, though performance aspects were not directly measured in this study, it is worth noting that five of the seventeen gymnasts

finished the season with career high scores in their respective events. In addition, the team went on to break their all-time team score and set a school record during their final meet. Moreover, the coach expressed that the team enjoyed the group sessions and felt that the program was an important aspect of their success. Anecdotally, these reports lend credence to the application of mindfulness-based approaches in sport.

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Funding

This study was not funded by any grant

Acknowledgements

I would like to acknowledge **Dr. Timothy Michael** and **Dr. Carol Weideman** for their assistance in the completion of this manuscript. Their expertise and suggestions were integral in the writing process.

Conflict of interest

None of the authors have any conflicts of interest to declare.

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