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Effects of Mindfulness on Sport, Exercise and Physical Activity: A Systematic Review.

Oswaldo Rivera, Miguel Quintana, and M^a Esther Rincón

Abstract— Several studies have shown that mindfulness-based interventions in clinical settings can elicit positive outcome such as: reducing anxiety or increasing psychological well-being, which could be beneficial to the sport experience too. Evidence of mindfulness applied to the sport and physical activity context has not been yet systematically reviewed. A literature research was undertaken using PsycInfo, Medline, Science direct, ISI web of Knowledge & Ovid databases, reviewing afterwards the references of the retrieved articles. Seven out of the 52 studies, dated between 2000 and 2010 and related to mindfulness and sport, exercise or physical activity, were analyzed. Research outcomes included high correlations between mindfulness and flow state, suggesting that the more mindful individuals are, the more likely to experience flow states. Mindfulness-based interventions and mindfulness high score measures had no effect on sport performance improvement. However, they may be effective in enhancing psychological well-being, directly related to the sport performance.

Keywords— Mindfulness, psychological well-being, sport performance, systematic review.

I. INTRODUCTION

DURING competitive sport activities, athletes must be mentally ready to perform under stressful circumstances. The construct of mindfulness has been considered, in the sport psychology field, in order to understand the mental states during sport practice and to develop effective tools to enhance performance. Mindfulness, defined as the non-judgmental focus of one's attention on the experience that occurs at the present moment [1], could help address issues related to the tendencies of focusing on the present moment in sport activities, like the flow state construct does [2], [3]. Mindfulness has been suggested to represent the non-judgmental observation of the ongoing stream of internal and external stimuli [4]. Brown and Ryan [5] have shown that mindfulness is a distinct form of awareness and attention, which could be considered a predisposition for well-being enhancement.

Several studies have shown that mindfulness-based interventions in clinical context could benefit people suffering from chronic pain, fibromyalgia, cancer, heart disease and anxiety [6]. These interventions could also afford positive outcomes as acceptance of negative thoughts, reduce worrying, and increase enjoyment, concentration and persistence [7].

Mindfulness-based interventions are, thus, presented as effective elements to overcome stressful stimuli.

Therefore they could facilitate peak sport performance. With a heightened self-regulation of attention, those who are mindful are more likely to be conscious of their goals when executing moves and will be better at detecting threats and emotional events [4]. Siegel [8] found out that cultivating mindful awareness seemed to increase the capacity to regulate emotions, combat emotional dysfunction, improve thinking patterns, and reduce negative mindsets, as well as to enhance bodily functioning and strengthen interpersonal relationships.

Mindfulness encourages awareness of inner states, including cognitive and somatic phenomena [5]. It should therefore be a strong mediator of exercise-related variables and peak performance experiences; although currently there are little supportive data and a dearth of research involving mindfulness and attention allocation in the sport context.

II. OBJETIVE

No review has yet covered all available evidence of mindfulness applied to the sport and physical activity context. The aim of the present paper is to systematically summarize the evidence of the presumed benefits of mindfulness in sports. Main research outcomes are discussed in order to establish whether mindfulness is a viable new research approach in sport psychology.

III. METHODOLOGY

A. Literature Research

A literature research was undertaken using PsycInfo, Medline, Science direct, ISI web of Knowledge & Ovid databases and references of retrieved articles. This search included papers published in English from January 2000 to December 2010. The search terms were combined as follows: a) mindfulness-sport, b) mindfulness-exercise and c) mindfulness-physical activity.

B. Selection of Trials

Full text articles, short communications and congress abstracts indexed by the consulted databases that focused on the relationship of mindfulness construct and psychological, physical or performance outcomes in participants of sport, exercise and physical activity were screened by the reviewers in order to be considered for inclusion. Included studies had to: (1) target sports, exercise or physical activity population,

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(2) with or without mindfulness intervention program, (3) provide quantitative data supported by statistical methodology. Reasons for exclusion were: (1) theoretical studies.

C. Outcome Measures

The main outcome measures considered were: (1) mindfulness and sport performance, (2) mindfulness and other psychological measures (e.g. flow, cognitive anxiety), (3) post intervention mindfulness outcomes.

IV. RESULTS

A. Search Results

The original search retrieved 4576 papers. Of these, 4524 papers were excluded because their primary focus was not the research of mindfulness in the sport, exercise or physical activity context (Fig. 1). A total of 52 papers remained after the first screening; and 36 were excluded using the duplication criteria. The inclusion and the exclusion criteria were applied to the remaining 16 papers, resulting in nine being excluded and seven included in the present review.

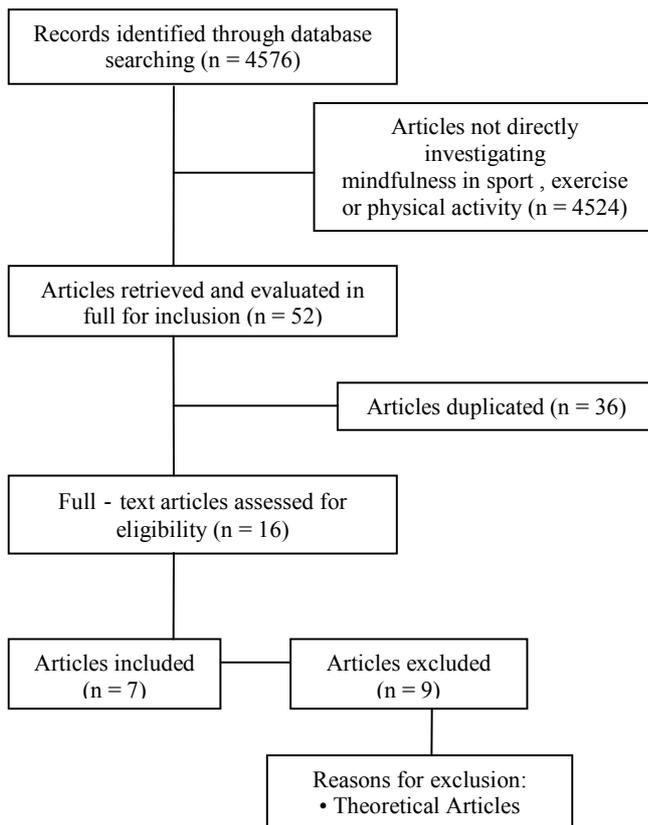


Fig.1. Flow diagram of the review process.

A summary of the included studies with their significant results is illustrated in Table 1.

Research interventions were carried out through the Mindfulness Based Cognitive Therapy MBCT [9] and the Mindfulness Sport Performance Enhancement MSPE [10].

The sports studied were varied and included individual and team disciplines. Besides, mindfulness was mainly measured with the Mindful Attention and Awareness Scale MAAS [5], Kentucky Inventory of Mindfulness Skills KIMS [11], Toronto Mindfulness Scale TMS [12] and Mindfulness/Mindlessness Scale MMS [13]. Following the results of the reviewed studies, mindfulness intervention programs and high score measures had no effect on sport performance improvement. In most of them, mindfulness interacted with other psychological measures, mainly with the flow state.

V. DISCUSSION

The aim of the present work was to systematically review current evidence on mindfulness applied to the sports, exercise or physical activity context. The sport activities covered in this review included both team and individual disciplines. Results showed that individual participants were mostly golf and archery, suggesting that mindfulness could be present mainly in disciplines whose performance requirements include: self-paced, closed skill, a high degree of mental focus and fine motor movement [10]. Furthermore, in team sports mindfulness and performance were measured during individual game situations, such as the free throw in basketball [26]. It has been suggested that endurance and cyclical sports as long distance running, where anxiety and worries affect performance, could also benefit from the mental attitude mindfulness provide with [27], [28].

A. Mindfulness & Flow

Mindfulness state has been related specially with the flow construct [10], [30], [29]. Qualitatively, a lack of self-consciousness appears in both states [24], [31] and quantitatively, there is a high scores correlation. Flow state experience could be present in those athletes prone to be mindful and that state could be promoted during the mindfulness training. Despite the similarities and correlations between mindfulness and flow, researches have failed to prove causality relations.

B. Mindfulness-based Interventions

The Mindfulness Sport Performance Enhancement (MSPE) intervention has offered mixed results, as a performance enhancement program has not been effective; however, it has proved to be a promise as an intervention to enhance flow and mindfulness: disposition and state [10], [27]. On the contrary, a Mindfulness-Based Stress Reduction [1] intervention, which served as a basis for development of MSPE, has shown efficacy for many psychiatric and physical conditions [6]. In the sport context, performance enhancement was not reached after the four week MSPE intervention. In comparison, the effective MBSR interventions have a length of eight weeks. Kaufman et al. [10] considered that mindfulness was such a new skill in sport that it might be difficult for athletes to

TABLE I
SUMMARY OF THE MINDFULNESS IN SPORT, EXERCISE AND PHYSICAL ACTIVITY STUDIES (2000-2010).

Study	Target Sport	Intervention	Total Sample Size (N)	Mindfulness Intervention	Mindfulness Measure Questionnaires	Psychological Measures	Evaluation	Results
Ulmer et al. 2010	Adult community exercisers	No	226		FMI; MAAS			Higher levels of mindfulness and acceptance and lower suppression were related to fewer missed exercise sessions. $p < .01$
Bernier et al. 2009	Golf	Yes	7	MBCT 4 sessions		Behavioral Indicators OMSAT-3*	During a Season	The golfers who followed the program had increased their scores related to activation. $p < .05$
De Pettillo et al. 2009	Running	Yes	25	MSPE 4 sessions Control Group N = 13	KIMS; TMS	TOQS; MPS; CEM	Pre-Post	No significant differences between the groups on sport performance. $p > .05$
Denny et al. 2009	Hockey, Volleyball, Soccer Basketball	No	140		MMS	Rotter's Locus of Control; FAY; WAI		Internal measures like mindfulness will be a better estimator of overall satisfaction than measures of success. $p < .05$

TABLE I
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Study	Target Sport	Intervention	Total Sample Size (N)	Mindfulness Intervention	Mindfulness Measure Questionnaires	Psychological Measures	Evaluation	Results
Gooding et al. 2009	Basketball	No	17		MAAS	SCAT	All basketball season	Increase in mindfulness scores would result in a 5.75 percentage point increase in game free throw percentage. p < .05
Kaufman et al. 2009	Archery; Golf	Yes	32	MSPE 4 sessions	KIMS; TMS	MPS; CSCI; TOQS; CEM; SAS; FSS-2; DFS-2	Pre-Post	The level of flow state achieved by the athletes during their weekly performances changed significantly over the course of the training. p < .001
Kee et al. 2008	Malay martial arts Bowling Archery Soccer Rugby Dragon	No	182		MMS	DFS-2 TOPS		The findings suggest that those with the propensity to be more mindful are also more likely to experience the flow states. p < .01

Note. MBCT = Mindfulness based Cognitive Therapy [9]; MSPE = Mindful Sport Performance Enhancement [10]; FMI = Frieberg Mindfulness Inventory [14]; MAAS = Mindful Attention and Awareness Scale [5]; KIMS = Kentucky Inventory of Mindfulness Skills [11]; TMS = Toronto Mindfulness Scale [12]; MMS = Mindfulness/Mindlessness Scale [13]; OMSAT-3* = Ottawa Mental Skills Assessment Tool-3* [15]; TOQS = Thought Occurrence Questionnaire for Sport [16]; MPS = Multidimensional Perfectionism Scale [17]; CEM = Credibility and Expectations Measure. The CEM (Kaufman et al., in press); Rotter's Locus of Control [18]; FAY = Facts About You [19]; WAI = Weinberger Adjustment Inventory [20]; SCAT = The Sport Competition Anxiety Test [21]; SAS = Sport Anxiety Scale [22]; CSCI = Carolina Sport Confidence Inventory [23]; FSS-2 = Flow State Scale-2 [24]; DFS-2 = Dispositional Flow Scale-2 [24]; TOPS = Test of Performance Strategies [25].

improve their performance just with the MSPE length.

Considering that the development of mindfulness ability is gradual and systematic, requiring regular practice, a 4 week program might not be enough neither to enhance sport performance nor to improve mindfulness skills. Nonetheless, it is not clear the way in which the flow state, which is directly related to sport performance, improves with MSPE. In general there is not a clear theoretical explanation about how mindfulness could improve sport performance; although it has been assumed that the self-regulation of attention related to mindfulness is an inherent and important quality of peak performance [26], [31], [33]. If the mindfulness construct is treated as an inherent state of consciousness, it is suggested that individuals may differ in the frequency with which they deploy attention and awareness, and also in the fact that there are intra individual variations in mindfulness [5]. Mindfulness may present different advantages for different sports, depending on the main performance subcomponents (i.e. physical, technical, and tactical) [29].

C. Mindfulness & other Psychological Processes

The non-judgmentally & fully aware acceptance of cognitions, emotions and sensations at the present moment includes several psychological processes. For Bernier et al. [29] flow, mindfulness and acceptance present a positive link. These authors suggested that the concept of awareness is some way close to mindfulness; because in both of them there is a consideration of the athlete's necessity to be lucid and aware of their internal states and external cues. A high mindfulness experience could be also accompanied by attentional control, emotional control, goal setting and self-talk strategies [30].

Mindfulness could operate as a protection resource or coping strategy against mental introjections and promoting the use of other coping strategies by the full aware detection process. Mindful athletes may be better able to attain the present moment task, not allowing their internal experiences (e.g. cognitions, emotions, anxiety) affect them [26], [27], and so, facilitating the athlete's ability to respond instead of reacting to them [28], accepting them instead of fighting against negative thoughts and unpleasant emotions [29]. Moreover, mindfulness as an internal process is presented as a strong indicator of happiness in athletes [32]. Nevertheless, mindfulness experience appears to be a compendium of psychological processes which occur simultaneously and synchronously. Nonetheless, the studies reviewed do not provide a conclusive explanation about the psychological abilities related to mindfulness state. It must be added that the difficulty to measure a mindful state as it happens -asking athletes in action whether they are focusing on the present moment- will inevitably disrupt their attention toward the task at hand [30]. Theoretically, mindfulness has yet to be satisfactorily operationalized, being largely limited at the present time to questionnaire-based assessment instruments [34]. Furthermore, taking into consideration that there is not a unified mindfulness concept definition.

VI. CONCLUSION AND RECOMMENDATIONS

The main research outcomes discussed in this review suggest that mindfulness state would happen during sport practice. High mindfulness scores are related to increasing the opportunities athletes have to experience flow state. However, correlation scores do not offer a clear explanation. Despite the fact that both constructs may be similar (qualitatively), they are not equivalent. Contrary to mindfulness state, flow is not voluntary controlled. Actual evidence does not allow establishing clearly the mindfulness construct effectiveness as a new psychology approach to sport performance. However, the mindfulness construct may provide a suitable psychological framework to understand the effects of self-regulation of attention with a passive, non-reactive and non-judgmental attitude that can promote a better psychological state during sport performance. Mindfulness in sport may facilitate self-regulation processes of attention and increase awareness to better manage intrusive thoughts, disturbing feelings or negative mood states; although this self-regulation skill may not have any impact in sport performance. In this sense, mindfulness, as a psychological construct in sport, may have possibilities under the scope of enhancing psychological well-being, not directly related to performance but to other psychological factors like self stem, arousal level, cognitive and physical information processing or goal settings; that could mediate sport performance at last. Further empirical research is needed, especially by using other measures of psychological skills to better understand the relationship of mindfulness with other mental skills in sport (e.g. appraisal, coping, self stem, attention, self-talk strategies). Incorporating physiological and neurobiological assessment procedures, already used in clinical mindfulness-based interventions can provide valuable data.

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