

CHAPTER 3
REVIEW OF
SCIENTIFIC LITERATURE

3.0 REVIEW OF SCIENTIFIC LITERATURE ON THE ASPECT OF *YOGA* AND MINDFULNESS FOR SPORTSPERSON

3.1 *YOGA* FOR SPORTSPERSON

One of the best lessons athletes can learn from practicing *yoga* is how to respect their body's strengths and limitations. *Yoga* is a powerful biofeedback tool that can help athletes develop better body awareness. With regard to the influence of *yoga* on injury prevention, a study on a group of Kripalu *yoga* practitioners, found that a single bout of *yoga* training significantly attenuated the symptoms of induced Delayed Onset Muscle Soreness (DOMS) (Boyle et al., 2004). Hamstring muscle injuries was managed successfully with a seven-point programme-biomechanical assessment and correction, neuro-dynamics, core stability, eccentric strengthening, an overload running programme, injection therapies and stretching/relaxation in a professional footballer (Brukner et al., 2012). Another study that examined the effects of Bikram *yoga* on strength, balance, and steadiness among a younger population found substantial improvements in one-legged balance and modest improvements in strength among their participants (Tracy, & Hart, 2013). A study on the student basketball team at the National University of bio-resources and nature utilization of Ukraine, observed the effect of *yoga* exercises on sport preparedness has revealed that the 13 players of experimental group demonstrated more preparedness in their game after nine months of *yoga* intervention. There was an increase in the level indicators, namely, vertical jump, speed endurance, speed, retention of equilibrium (balance), free throw, with the movement, three-point shots, free throws, tactical execution (Brynzak, & Burko, 2013).

Another study on the influences of *yoga* intervention on the postural skills of the Italian short track speed skating team showed improvements in eleven of the 14 angles measured when comparing pre and post postural tests. The study also suggested that *yoga* could be inserted into out-of-season training cycles (Brunelle et al., 2015). A 10 week period study on the impact of *yoga* on male college athletes demonstrated that regular practice of *yoga* improves flexibility, balance as well as whole body measures and also may enhance their athletic performances that require these characteristics (Polsgrove et al., 2015). An eight week of *yoga* training on female hockey players of age ranging from 18 to 25 years showed significant improvement in muscular strength, muscular endurance, flexibility and agility (Singh et al., 2015).

A comparative study on *yoga* versus static stretching for increasing hip and shoulder range of motion showed that in comparison to the control group, those who participated in the one-month class, both *yoga* and static stretching showed significant improvements in range of motion. The *yoga* group however, showed a greater range of motion improvement than that of the static stretching group thus indicating that *yoga* has a greater effect on range of motion at the shoulder and hip than static stretching in a healthy population (Sager, & Grenier, 2014).

Table 1: Summary of sport-related *yoga* intervention studies

Author & year of publication	Sample size (n)	Sport	Variables studied	Type of intervention	<i>Yoga</i> Intervention duration & intensity
(McClean, 2009)	N=30 Male = 30	Base Ball	Flexibility and injury incidence	<i>Yoga</i> as sport conditioning	12 weeks 45 minutes per session, twice per week
<p>Findings: Significant improvements in shoulder flexibility (SH) and Hamstring (HS). Decline in lower and upper extremity injuries (may be due to <i>yoga</i>).</p> <p>Limitations: The study was conducted only on male subjects. The results may not be generalized to individuals outside the age range, gender, or training status. No control group. The length of the study included only one pre-season period prior to the competitive period.</p>					
(Brukner et al., 2012)	N =1 Male = 1 Age – 26 years	Football	Rehabilitation for Grade 2 Femoris musculotendinous junction strain	<i>Yoga</i> as part of 7 point rehabilitation program	12 weeks 60 minutes per session, twice per week
<p>Findings: The injury was managed successfully with a seven-point programme-biomechanical assessment and correction, neurodynamics, core stability, eccentric strengthening, an overload running programme, injection therapies and stretching/relaxation.</p> <p>Limitations: The key factor among the seven-point programme that would have determined the success of this rehabilitation is impossible to conclude. There are varying levels of evidence for every individual component of this treatment regimen.</p>					

(Brunelle et al., 2015)	N=15 Female= 7; Male = 8 Age – 21 to 25 years	Skating	Postural skills in speed skating	<i>Yoga</i> as motor time-on-task	36 <i>yoga</i> session during 8 weeks
<p>Findings: The study found improvements in eleven of the 14 angles measured when comparing pre and post postural tests. During the eight weeks no skaters suffered injuries linked to the high volume of training.</p> <p>Limitations: As <i>yoga</i> is also recognized for its positive effects on psychological dispositions, the study does not address this. The study has a small sample size.</p>					
(Polsgrove et al., 2016)	N=26 Male = 26 Age – 19 to 21 years	Soccer and Basketball	Flexibility and balance in college athletes	<i>Yoga</i> with regular athlete training	10 weeks 2 times a week (intensity not specified)
<p>Findings: Significant gains were observed in the <i>yoga</i> group for flexibility and balance. Significantly, greater joint action were observed in the <i>yoga</i> group.</p> <p>Limitations: The study includes only male athletes. The <i>yoga</i> sessions were biweekly. The study does not include any psychological parameters.</p>					
(Singh et al., 2011)	Y =15 C = 15 Male = 30 Age – 18 to 24 years	Sportsmen from Department of Physical Education	Agility and muscular strength	<i>Yogāsanas</i>	6 weeks. 50 minutes of each session for 6 days a week.
<p>Findings: Significant increases in agility and muscle strength.</p> <p>Limitation: The study includes only male athletes. It is not a comprehensive <i>yoga</i> module as it included only six <i>āsana</i>s.</p>					
Singh et al., 2015)	Y =20 C = 20 Female=4 0 Age – 18 to 25 years	Female hockey players	Muscular strength, muscular endurance, flexibility and agility.	<i>Yogāsanas</i>	8 weeks. 90 minutes of each session for 6 days a week.
<p>Findings: Significantly improve muscular strength, muscular endurance, flexibility and agility among female hockey players.</p> <p>Limitation: <i>Yoga</i> module is not holistic as it includes only 13 <i>āsana</i>s given for 90 minutes. The study does not give much details on the inclusion and exclusion criteria.</p>					

3.2 ROLE OF MINDFULNESS IN SPORTS

Mindfulness techniques have been widely utilized in clinical psychology, often as an adjunct to cognitive or behavioural interventions (Cash, & Whittingham, 2010). It has become relevant in sport considering the fact that the practice inculcates a present moment awareness that is crucial in athletic performance (Birrer et al., 2010). An early study integrating mindfulness in sport was conducted by Jon Kabat-Zinn, who designed the mindfulness-based stress reduction (Zinn, 2003). Mindfulness, defined as the non-judgmental focus of one's attention on the experience that occurs in the present moment (Zinn, 1994), aids in addressing issues related to tendencies of present moment focus. Current moment awareness, a crucial component of peak sport performance, also helps in generating a state of flow, or a state of complete focus (Kee, & Wang, 2008). Mindfulness-based interventions for sports are efficient in minimizing external distractions (Gardner, & Moore, 2012). Mindfulness training allows the individual to channelize on being non-judgmental rather than restricting negative thoughts. With the present moment acceptance of internal experience, an athlete can focus on the positives and learn to cope through challenging times (Gardner, & Moore, 2004).

A study investigating the relationship between mindfulness training and flow experiences among 13 athletes of High Performance Centre, from University College Dublin, indicated that athletes who underwent mindfulness training reported increases not only in global flow scores but also on the flow dimensions of "Clear Goals" and "Sense of Control". The results from this study also suggest that mindfulness training may be beneficial to a broader range of athletes, and not just to those who report having problems with the mental aspects of their athletic performance. Thus, this study clearly suggests that mindfulness training appears to be an appropriate method to help athletes to achieve a flow state, therefore, seems likely to be an effective performance enhancement strategy as well (Briegel et. al., 2013). Mindfulness has been found to be related to improved athletic performance and propensity to achieve flow states. Another study on elite athletes showed correlations between mindfulness and flow were stronger in athletes from individual and pacing sports compared with team-based and non-pacing sports (Cathcart et. al., 2014). *Yoga* intervention on men's division 1 athletic team in the age group 17 to 20 have found that participants after 5 weeks of *yoga* practice reported greater mindfulness, greater goal-directed energy, and less perceived stress than before the intervention (Goodman et. al., 2014).

Table 2: Summary of sport-related mindfulness intervention studies:

Author & year of publication	Sample size (n)	Design	Population	Variables studied	Findings
(Gardner, & Moore, 2004)	N=2	Case Study	Elite Adult weightlifters & Division I University swimmer	Evaluate the utility of MAC I	Improved self-report of concentration and swimmer experiential acceptance (d = 1.2 to 2.0) and attained personal best competitive performances Division
Limitations: Individual case studies may not provide conclusive intervention efficacy data.					
(Hasker, 2010)	N=19	Open Trial	Division II university athletes (various sports)	Compare MAC with PST	MAC > PST in ability to describe and be nonreactive toward inner experiences, experiential acceptance, and ability to take action toward goals
Limitations: Athletes were assigned to groups based on their time availability. Due to the small sample size, the results that were obtained cannot be generalized to other populations. Sample was not particularly diverse regarding ethnicity and age. No objective performance measures (i.e. batting averages, race times, free throw percentage, etc.) were examined due to the broad range of sports being represented.					
(Aherne et al., 2011)	N =13	Randomized control trial	University athletes from various sports	Compare mindfulness intervention with control condition	Mindfulness > control (d = 1.66) with regard to Global Flow scores and on clear goals, sense of control, and unambiguous feedback subscales.
Limitations: A small sample size. Study assesses the efficacy of the intervention program (i.e., mindfulness training) rather than the degree to which participants actually adhered to the practice of mindfulness training,					
(Thompson et al., 2011)	N - 57	Open trial	Adult competitive athletes (11 archers, 21 golfers, 25	Compare mindfulness intervention with control condition	Mindfulness participants significantly increased ability to act with awareness, increased overall trait mindfulness, increased overall

			long-distance runners)		flow & decreased task-related worries & task- irrelevant thoughts. Runners exhibited significant improvement in race times
Limitations: The study has a small sample size, which led to low power to detect significant findings. Infrequent practice of mindfulness exercises by the athletes. The study did not include elite players.					
(Briegel et al., 2013)	N=21	Non-randomized control trial	21 elite youth swimmers (10 males, 11 females) Mean age = 13.24 years.	Child and adolescent mindfulness measure (CAMM) Dispositional Flow Short Scale 2 (DFS-2)	No significant changes in mindfulness and dispositional flow were identified. Qualitative data suggested that the 10-week <i>yoga</i> intervention had a positive impact on a range of physiological, cognitive, and performance parameters that included elements of mindfulness and flow.
Limitation: Relatively small sample size, coupled with absenteeism from <i>yoga</i> sessions due to unforeseen circumstances may have contributed to the nonsignificant quantitative findings. It is also possible that a longer period of <i>yoga</i> practice (i.e., an increased dose response; the current study had one session per week for 10 weeks) is required to establish statistically significant changes in mindfulness and flow when assessed quantitatively.					
(Mistretta et al., 2017)	N= 45	Randomized control trial	Collegiate student athletes	Depression, anxiety and stress scales (DASS-21), Satisfaction with life scale (SWLS), Five-facet mindfulness questionnaire (FFMQ), Acceptance and action questionnaire (AAQ II), Dispositional flow scale – 2 (DFS 2),	Participants found MSPE to be a positive experience. Evidence suggests that athletes' expectations predicted similar improvements in out measures.

				Sports anxiety scale (SAS). Program evaluation questionnaire	
Limitation: This results cannot be generalised to other ethnic groups and elite players. The intervention was only of six sessions of 75 minutes.					
(Cathcart et al., 2014)	N=92	Randomized control trial	Athletes from 12 different sports from two different sports institute in Australia.	Five-facet mindfulness questionnaire (FFMQ), Dispositional flow scale - 2 (DFS 2)	Males scored higher than females on two variables of FFMQ. Correlations between mindfulness and flow were stronger in athletes from individual and pacing sports. Relationship between mindfulness and flow possibly may vary by gender and sport type in this population.
Limitation: The results are shown for all the 12 sports in its entirety.					
(Chen et al., 2019)	N=23	Non-randomised, Single group with three time points	Baseball team	Chinese version of patient health questionnaire (PHQ-9) Beck anxiety inventory (BAI) Chinese version of eating disorder examination questionnaire (EDE-Q) Chinese pittsburg sleep quality index(CPSQI) Flow state scale (FSS -2) Revised competitive state	Mindfulness ability is associated with flow state, and MSPE is a promising training program for strengthening flow state and mental health.

				anxiety inventory -2 (CSAI-2R) Chinese mindful attention awareness scale (CMAAS)	
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Note: MAC = mindfulness-acceptance-commitment approach to performance enhancement; PST=psychological skills training (traditional approaches); ACT = acceptance and commitment therapy

With the above available evidence, *yoga* may be associated with having positive effects on a person's physical and psychological conditions, bringing in better mind-body equilibrium. Also, to date, there has been no attempt to carry out an experimental study on the effects of *yoga* on mindfulness on a large group of cricket players.

In the next section, we present the aim and objectives of the cricket injury survey, *yoga* module validation, *yoga* intervention and follow-up study.