

Influence of Stress and Anxiety on Sports Injuries in Athletes

SAJJAN PAL¹, SHEETAL KALRA², SUPRIYA AWASTHI³

ABSTRACT

An athlete does not only require to be fit physically but also requires to be fit psychologically for their successful performance in sports activities. Hence, it is essential to understand the psychological risk factors which contribute to sport injuries in athletes. For this review, literature search in the international databases of PubMed, MEDLINE and Google Scholar was done by using following keywords: 'sports injury', 'stress', 'anxiety', 'athletic injury', 'psychology', 'predictors' and 'athletes'. The studies published from 1992 to March 2020 and in the English language were included in this review. Of 120 articles obtained by the end of this search process, 18 full text articles were finally selected. Most of the study designs were cross-sectional studies or surveys, cohort studies and descriptive studies. The results indicated that stress and anxiety are two notable psychological variables which are associated with predicting injury in different sports and found to be significant with the incidence of sports injuries among athletes of different sports. It was found that stress and anxiety can influence the risk of injuries, injury frequency, and injury severity in athletes.

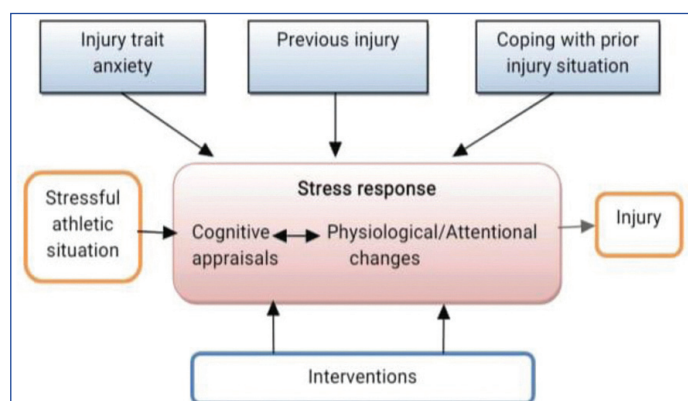
Keywords: Competitive anxiety, Predictors, Psychological risk factors, Sport related injury, Stressor

INTRODUCTION

In modern world, sports injury is a common concern among athletes [1]. Many researches have been done to find out the predictors and risk factors for injury occurrence in sports. Now-a-days researchers have been primarily interested in determining the role of certain psychosocial variables which can predict vulnerability or resiliency to injury. There has been a growing realisation that psychological factors, especially stress and anxiety play a major role in determining the frequency, severity and extent of the injury [2-5]. A study stated that high risk of an injury is a consequence not only because of physical or environmental problems but also due to psychosocial or personality constellations within the individual [6]. In order to prevent injuries in sports, it is important for athletes and trainers, to identify the psychological factors that causes athletic injury. Andersen MB and Williams JM proposed a model [Table/Fig-1] [7] to understand the relationship between psychological variables and injury occurrence. The model suggested that when an athlete faces a potentially stressful athletic situation or environment, there is a resultant stress response to that environment. The body always responds to potentially injurious situation. Body responses by the following processes- cognitive appraisal of the demands, resources and consequences followed by physiologic and attentional changes in the body. The Anderson and William's model highlighted the effect of anxiety, depression, anger, total negative mood state and competitive anxiety on frequency and severity of injury. It can be interpreted by the model that there has been an increase in the frequency and severity of injuries due to these factors [7]. A stressful situation always generate a stress response that will be influenced by the interplay between various psychosocial factors and are divided into three categories:

- Personality factors or psychosocial factors for example, anxiety, Type-A behaviour and attentional style
- History of stressors for example, life event stress, hassle and
- Coping strategies for example, social support, acceptance and positive reappraisal [7].

The stressful nature of sport and the competitive environment predispose an athlete to an injury. Life stress is found to be an important antecedent of injury occurrence in athletes [8,9]. In competition, both anxiety and stress are associated with performance of an athlete and identified as key predictors of injury



[Table/Fig-1]: Stress injury model proposed by Andersen and Williams, 1988 [7].

and is responsible for discontinuation of sport participation [10,11]. There is lack of such reviews regarding the psychological variables which contribute to a sport injury of elite athletes. Thus, the aim of this review was to synthesise the growing evidence base regarding the relationship of stress and anxiety to the occurrence of injury in athletes.

MATERIALS AND METHODS

Literature Search Strategy

Databases like Google Scholar, PubMed and MEDLINE were searched using combinations of the keywords: 'sports injury', 'stress', 'anxiety', 'athletic injury', 'psychology', 'predictors' and 'athletes'. This literature search was conducted from April 2020 to August 2020.

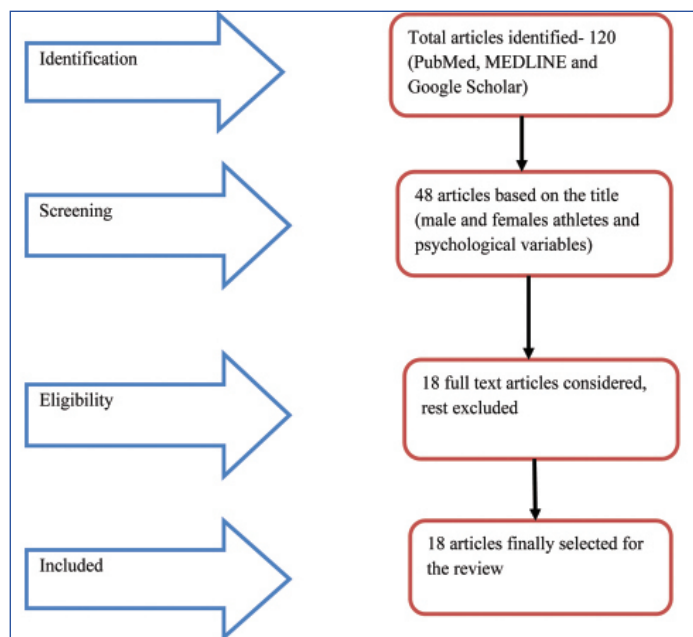
Inclusion and Exclusion Criteria

The inclusion criteria of present study were: (a) Studies conducted on male athletes or female athletes or both that included psychological variables; (b) Articles published in English language; (c) Articles published after the year 1992 till the month of March 2020. Studies were excluded on the basis of the following criteria: (a) Reviews and studies with only abstract were excluded.

Data Extraction and Analysis

In the first phase, eligibility of each retrieved record was assessed on the basis of the title and abstract. Then, the full-text articles were screened. In the second phase, all included studies were

subsequently re-screened by reading the full text articles. After double screening, a total of 18 studies were included in this review [Table/Fig-2]. Most of the study designs were cross-sectional studies or surveys.



[Table/Fig-2]: The process of selection of studies.

Description of Included Studies

After double screening of full text articles 18 studies were included in the review as summary of included articles which is showed in [Table/Fig-3] [12-28]. Studies included in this review examined

athletes from individual sports like swimming, gymnastics, runners and rodeo (horse riding) etc., and team-based sports like soccer, football and rugby. There were also studies on elite athletes from a range of sporting disciplines that is mixed (rugby, athletics, swimming, cycling, basketball, volleyball, canoeing, golf, cricket, hockey, netball, gymnastics, soccer, tennis, softball, water polo and triathlon).

The sample size ranged from lowest 10 to highest 2164. The age range of the athletes was 15 to 36 years. Included studies had maximum numbers of cross-sectional or survey study design which were 10 in number followed by four prospective studies, two correlational studies and only one comparative and one cohort study. There were maximum studies on football sport which were four in numbers that is two survey design [14,26] and two prospective cohort studies [16,22]. The sports gymnasts [12,23,27] and soccer [13,15,17] consisted of three studies in each field, these studies reported that anxiety and life stress have found to be common predictors of sport injury. Furthermore, there were three studies which was conducted in mixed sports [6,20,24] players which showed that competitive anxiety was found to be a predisposing factor of athletic injury. There were only two studies where sport was not specified but the athletes had competed in Olympics or World championships [19,21]. Only one prospective study specifically in rugby sport which showed that psychosocial variables like personality, competitive anxiety, history of stressors, previous injury were identified as being at risk of injury and predicted vulnerability in athletes [18]. Moreover, one study by Marthinus JR and Potgieter JR conducted a survey on runners and another study by Meyers MC et al., conducted on rodeo athletes, a correlational study which reported the

Authors (year)	Study design	Aim	Subjects	Sport	Overall findings
De Pero R et al., [12] (2013)	A cross-sectional study	Investigated the relationship between state anxiety, self-efficacy and fear of injury in national and European Team Gym competitions.	14 Italian Team Gym athletes- both male and female (age 26±3 years)	Gymnastics	It showed that self-efficacy dampened the anxiety level of athletes and mediated the effects of fear of injury on anxiety prior to their competition. It has been found that athletes who have experienced less fear of being injured and were more confident in their technical abilities showed a lesser degree of pre-competitive anxiety.
Ivarsson A et al., [13] (2013)	Prospective study	Studied whether personality, stress and coping predicted injury occurrence in an elite soccer players.	56 soccer players- both male and female (16 to 36 year)	Soccer	It concluded that trait anxiety, negative-life-event stress and daily hassle were significant predictors of injury among professional soccer players which accounted for 24% of the variance.
Alizadeh MH et al., [14] (2012)	Survey design	Examined the psychological factors that could increase the injury risk among football players.	81 junior male football players (16-20 years)	Football	It can be concluded that cognitive and somatic anxiety may increase the injury occurrence due to physiological changes and poor concentration in the game. It has been found that psychological factors can be used to predict injury occurrence and anxiety was the main predictor of injuries in junior football players.
Ivarsson A and Johnson U [15] (2010)	Survey design	Examined the relationship between personality factors, coping variables and stress and injury risk.	48 male soccer players (16 to 36 years)	Soccer	The results of this study suggested that injury was significantly predicted by 4 personality trait predictors: somatic trait anxiety, psychic trait anxiety, stress susceptibility and trait irritability. All predictors could explain 14.6% of injury occurrence. It also showed that more injuries were reported among players who scored high in daily hassles.
Steffen K et al., [16] (2009)	Cohort study	Identified and understand injury risk factors those are necessary to target the injury prone athlete and develop injury prevention measurements.	1430 female football players (mean age 15.4)	Football	It concluded that a perceived mastery climate and high levels of experienced life stress could significantly predict the risk for new injuries in young female football players. It also reported that history of a previous injury increased the risk of a new injury to the same region.
Ivarsson A [17] (2008)	Survey design	To find out the psychological factors that could increase the risk of injury among soccer athletes.	152 (both male and female) soccer players (17 to 19 years of age)	Soccer	It can be concluded from this study that occurrence of sports injuries could be due to personality factors. The results suggested that 23% of the sports injuries are due to four main personality factors- mistrust, negative coping, somatic trait anxiety and life event stress. These were the four main factors that increased the risk of injury in athletes.
Maddison R and Prapavessis H [18] (2005)	Prospective study	Examined the role of psychological factors in the prediction of injuries.	470 male rugby players (16 to 34 years)	Rugby	It showed that psychosocial variables (personality, competitive anxiety, history of stressors, previous injury) identified as being at risk of injury and predict vulnerability. Results showed that social support, the type of coping, previous injury and competitive anxiety interacted together to maximise the relationship between life stress and injury.

Hanton S et al., [19] (2005)	A comparative study	Compared the content and quantity of competitive and organisational stressors in elite athletes.	Ten international performers (aged 18–36 years)	Not specified (Olympic Games, World Championships)	It revealed that the participants mentioned the competitive stressors less than the organisational stressors. It meant that organisational stress predicted more injury than competitive stress. The findings indicated that elite athletes experience and recall more demands associated primarily and directly with the sport organisation than with competitive performance.
Galambos SA et al., [20] (2005)	Survey	Hypothesised that psychological variables are the predictors of physical injuries in sports, and to find out the relations between mood, perceived life stress and physical injury to ameliorate the injury problem in athletes.	845 players (433 female and 412 male athletes)	Mixed	It was found out by the study that 50% stress scores predicted due to depression, tension and vigour. Both scores mood score and stress score were the significant factors for injury. Anger, confusion, depression, tension and fatigue (with each mood dimension 6-7% of the variance) are the five dimensions of mood which played significant role in orthopedic injuries over the preceding one year in injured players.
Nigorikawa T et al., [21] (2003)	Survey	Investigated the relationships between the tendencies toward Type A Behaviour Pattern (TABP) and sports injuries.	2164 (1631 males and 533 females), 18 to 24 years	Not specified	It revealed that Type A (more competitive, aggressive and impatient athletes) individuals showed higher occurrences of sports injury than Type B (relaxed and non-competitive personalities) individuals. It has been shown that the injury group showed higher TABP tendency than the non-injury group and the higher TABP score group showed higher occurrence of injury experiences than those of low score group.
Kleinert J [6] (2002)	Prospective study	The study examined relationships between sport injury anxiety, injury history and the occurrence of injuries.	114 male and 92 female sport students (mean age 21.4 years)	Mixed (swimming, track and field, or gymnastics)	Findings revealed that high injury anxious subjects were more likely to sustain a less severe injury (16.3%) than low injury anxious subjects (7.6%). There was an inverse relationship concerning severe injuries. It showed that subjects with high sport injury anxiety were at lower risk of a severe injury (9.7%) than those with low Sport Injury Trait Anxiety Scale (SITAS) scores (22%). It has also found that high injury group with low injury anxiety experienced more severe injuries (28%) than the other groups and the high injury group with high injury anxiety sustained less severe injuries significantly more frequently (22%) than the other groups.
Gunnoe AJ et al., [22] (2001)	Prospective study	Investigated the potential relationship between life events and injury among high school football players.	331 high school football players	Football	It was found that total and negative life change measured significantly affected injury status and frequency of injury. Results showed that high school football players who experienced high degrees of total and negative change were at greater risk of becoming injured and of sustaining multiple injuries.
Kolt G and Kirkby R [23] (1996)	Survey	Assessed the role of psychological variables in injury.	162 female gymnasts	Gymnasts	It had found that life stress was a significant predictor of injury for the non-elite gymnasts. For the elite gymnasts, a more internal locus of control significantly predicted injury.
Lavallee L and Flint F [24] (1996)	Correlational study	Examined the role of stress, competitive anxiety, mood state and social support in athletic injury.	55 male athletes (19-28 years)	Mixed (42 football, 81% of the football team, and 13 rugby, 74% of the rugby team),	It revealed that competitive anxiety and tension/anxiety mood states were related to injury frequency and that tension/anxiety, anger/hostility, and total negative mood were related to injury severity. These findings were useful for athletic trainers in identifying athletes who may possess psychological factors in predisposing them to athletic injury.
Marthinus JR and Potgieter JR [25] (1995)	Survey	Found out the relationships between illness or injury and selected psychological factors.	44 athletes (Mean age 24.4 years)	Runners	This study showed no significant relationships was found between illness/injury and the psychological variables of locus of control, extroversion, neuroticism and life events. But showed a significant relationship between competitive anxiety, daily hassles and illness/injury in the runners.
Thompson NJ and Morris RD [26] (1994)	Survey	Explored the relationship of anger/aggression, attention, and stressful life events to injury.	120 players (14 to 18 years)	Football	It indicated that high anger directed outward and low focused attention increased injury risk, while stressful life events and vigilant attention interacted. It reported that injury risk elevated in presence of recent stress ($p < 0.05$) and also increased as vigilance decreased. It suggested that stressful life events elevate injury risk by reducing vigilance in the football players.
Petrie TA [27] (1992)	Survey	Hypothesised that life stress (as measured by the LESCA's (Life Events Survey Collegiate Athletes)) was the strongest predictor of injury.	103 female collegiate gymnasts (17 to 23 years)	Gymnasts	Social support is an important variable in life stress injury relationship. The findings showed that gymnasts who reported high level of social support showed increased variance by the LESCA's positive score (14% for moderate injuries and 12% for total days missed).
Meyers MC et al., [28] (1992)	Correlational study	Addressed the relationship between psychological mood state patterns and the incidence of injury in what many perceive to be a high-risk athletic group, the collegiate rodeo performer.	99 male collegiate rodeo athletes	Rodeo	It concluded that a relationship may exist between incidence of athletic injury and vigour arousal state of athletes involved in high collision, nontraditional sports. No significant association was found between tensions, depression, anxiety, vigour, fatigue or confusion levels prior to competition and subsequent incidence of total injuries among the collegiate rodeo athletes.

[Table/Fig-3]: Summary of included studies in the present review [6,12-28].

significant relationship between competitive anxiety and sport injury [25,28].

DISCUSSION

This review has synthesised data from the existing knowledge base with the goal of identifying and understanding the relationship of stress and anxiety with occurrence of sport injury in athletes. Regardless of limitations of existing literature, a number of key observations and conclusions can be drawn from data synthesis. Previous injury-prediction model highlighted the role of stress and coping in injury onset. The relationship between the psychological stress and injury heightens because of increase physiologic responses of the body to stress and anxiety, for eg- increase in the muscle tension while playing also increases muscle fatigue after it [7]. The Williams and Andersen's stress injury model is strongly supported by the present study as it indicated the role of psychological variables (stress and anxiety) in prediction of occurrence of sports injuries. Also, there is a major role of personality variables and state level stress in injury occurrence. Many previous studies stated that trait anxiety and negative life event stress or daily hassle played a significant role in prediction of injury in sports person [13-15,25]. One of the main finding of the present study was that stressful life events increased the risk of injury in athletes. Life event stress is one of the predictor of injury [17]. According to the area of risk of injury, one of the main psychosocial variables is stressful life events. High stress in athletes are found to be at greater risk of injury as compared to low stress athletes [22,29,30]. Similarly, Steffen K et al., reported that high levels of experienced life stress could significantly predict the risk for new injuries in football players [16]. This finding was inconsistent with another study [26] which revealed that stressful life events are found to increase the risk of injury. Mood and increase level of stress collectively had significant utility in predicting injury characteristics [20].

Next important finding of the present study was that anxiety was also found to be an important predictor of sport injury. Marthinus JR and Potgieter JR suggested that competitive anxiety has a relationship with the occurrence of injury [25]. Lavallee L and Flint F also reported that competitive anxiety and tension/anxiety mood states were related to injury frequency [24]. In contrast to this, a study reported that anxious subjects with high injury are more likely to sustain a less severe injury than anxious subjects with low injury [6]. There was an inverse relationship as concerning severe injuries. Furthermore, Alizadeh MH et al., found that cognitive and somatic anxiety may increase the injury occurrence due to poor concentration and physiological changes [14]. Anxiety is an important predictor of injury in football players. De Pero R et al., investigated the relationship between state anxiety [12], self-efficacy and fear of injury in national gymnasts and found that self-efficacy dampened the anxiety level of gymnastics and mediated the effects of fear of injury on anxiety prior to their competition [31]. Although there was a different study on gymnasts by Kolt G and Krikby R which reported that for the non-elite gymnasts, life stress was a significant predictor of injury [23]. Ivarsson A et al., indicated that negative-life-event stress had an indirect effect on injury occurrence through daily hassle among soccer players [13].

Furthermore, a previous study found that there were four personality traits (stress susceptibility, somatic trait anxiety, psychic trait anxiety and trait irritability) which predicted injury significantly in soccer players and could explain 14.6% of injury occurrence [15]. In regard to this, another study found four significant predictors that cause injury were life event stress, somatic trait anxiety, mistrust and negative coping [17]. A good confidence in their high levels of technical executions provides elite athletes with a perception of behavioural control, which contributes to coping with fearful and anxious competitive situations [32,33]. There was a different study

that showed the relationship of Type A Behaviour Pattern (TABP) of athlete and sport injury as also explained by the Anderson and William model. Nigorikawa T et al., investigated the relationships between the tendencies toward TABP and sports injuries which reported that high occurrence of sports injury was correlated with Type A individuals [21]. One of important risk factor of Coronary Heart Disease (CHD) was found to be TABP. As reported by a previous study, Type A individuals were found to be at greater risk of developing CHD than Type B individuals [34]. Similarly, Gunnoe AJ et al., correlated the life event scores with the chance of becoming injured and sustaining multiple injuries but life event scores were not related to severity of injury [22].

The overall finding of present study found to be significant and reported that sport injury trait anxiety/anxiety and stress as widely stable and indefinite concern or worry to sustain an injury in athletes of different sports. There is a raising concern to implement preventive interventions based on psychological training programs. There is a need for a responsive crisis intervention framework specific to athletes according to Anderson and William model. Development of specific models of psychiatric intervention [35,36] for elite athletes appears to be warranted. This may include incorporation and implementation of psychological health screening programmes along with physical health or fitness screening and education of athletes and coaches [13,37].

Limitation(s)

Firstly, this review highlighted the influence of psychological variables on sports injuries in male and female athletes but it had not included athletes with disabilities- a population in which little is known about these predictors of injury. Secondly, this review only focused on stress and anxiety variables only, as there are relatively many psychological predictors of injury as well.

CONCLUSION(S)

It has been concluded that stress and anxiety were the two major psychological variables or predictors of injury in athletes of different sports. Both variables can influence the risk, frequency and severity of injury. By the findings of the present study it can be concluded that stress and anxiety played a major role in injury occurrence in athletes. These are the main two intrinsic risk factors that predispose an athlete for the injury risk as suggested by comprehensive model of injury causation. Hence, it is essential to focus on these predictors of injury while designing an injury prevention protocol. There is a need to investigate specific sports individually to determine the moderating effects of psychosocial variables on athletic injury. Other biopsychological variables that are related to sports injury risk in athletes should be studied further.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Physiotherapy, SGT University, Gurugram, Haryana, India.
2. Associate Professor, Department of Physiotherapy, DIPSRU, Delhi, India.
3. Associate Professor, Department of Physiotherapy, Sharda University, Noida, Uttar Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sajjan Pal,
Assistant Professor, Department of Physiotherapy, SGT University, Gurugram,
Haryana, India.
E-mail: palsajjan14@gmail.com

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