

Psychological predictors of sport injuries among junior soccer players

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Previous researches have established models that specify psychological factors that could predict sport injuries. One example is Williams and Andersen's stress–injury model stressing factors such as anxiety, negative life stress and few coping resources. The purpose of the current study was to find psychological factors that could lead to an increased injury risk among junior soccer players, in addition to construct an empirical model of injury risk factors for soccer players. The participants were 108 male and female soccer players ($m = 17, 6$) studying at soccer high schools in southwest Sweden. Five questionnaires were used, State Trait Anxiety Inventory, Sport Anxiety Scale, Life Events

Survey for Collegiate Athletes, Athletic Coping Skills Inventory-28 and Swedish universities Scales of Personality. Injury record was collected by athletic trainers at the schools during a period of 8 months. The result suggested four significant predictors that together could explain 23% of injury occurrence. The main factors are life event stress, somatic trait anxiety, mistrust and ineffective coping. These findings partly support Williams and Andersen's stress–injury model and are organized into an empirical model. Recommendations are given to sport medicine teams and coaches concerning issues in sport injury prevention.

Participation in competitive sports sets high demands on athletes' physical skills. As a result, injury frequency is rather high (Pargman, 2007). For instance, Hägglund (2007) found that between 65% and 95% of Swedish elite soccer players (male) reported at least one injury every year. International soccer players reported having had an injury frequency that was 9.4 injuries/1000 h of soccer practice (Waldén et al., 2005). Interest in the pathogenesis of sport injuries has led to the general conclusion that two major factors influence injury vulnerability: external factors (e.g., type of sport and weather conditions) and internal factors (e.g., physiological and psychological factors) (see Williams & Andersen, 2007). Kleinert (2007) suggests that a person's psychological state could be related to the injury occurrence. For example, a dysfunctional psychophysiological process may affect an athlete's risk of being injured. Some examples are disturbance of attention, high or low arousal and poor muscle coordination.

Well-designed sport injury etiology research focusing on psychological factors seems to have the potential to discover psychological factors that might lead to increased or decreased risk of injury among athletes. The purpose of this research was to study

psychological predictors that could increase the injury risk among soccer players.

There are at least a dozen models that try to establish a connection between psychological antecedents and the occurrence of sport injuries. One of the most well known is Williams and Andersen's (1998) "stress–injury model." Among others, Rogers and Landers's (2005) tested and found partial support for relationships in the "stress–injury model." Williams and Andersen (1998) divided risk factors into three main categories: personality, history of stressors and coping resources. Personality can affect what situations an athlete apprehends as stressful (Petrie, 1993). An example is a positive relationship between a sport injury occurrence and trait anxiety (Petrie, 1993), hardiness, locus of control, competitive trait anxiety and achievement motivation (Williams & Andersen, 1998). Moreover, Pedersen (2007) stressed a relationship between perceived injury risk and aggregate aggression. Research clearly indicates a positive connection between sport injuries and high stress levels (Patterson et al., 1998; Maddison & Prapavessis, 2005). This also includes changes in life and occurrence of sport injuries (Hardy & Riehl, 1988). More specifically, life event stress, daily elements of anxiety and past injury history seem to be

particularly related to injury outcome (Williams & Andersen, 1998). In a systematic review of 40 studies, it was found that approximately 85% of the studies found some correlation between life event stress and injury (Williams & Andersen, 2007).

Several studies have supported the link between general coping resources and athletic injury. Williams et al. (1986) report a relationship between athletes low in coping resources and prediction of injury. Hanson et al. (1992) found that coping resources were the best discriminator for both severity and number of injuries. Johnson et al. (2005) investigated the possibility of preventing sport injuries using psychological skills training among elite soccer players from 12 different teams in Sweden. A group of 36 players, labelled as being in the risk zone of becoming injured according to a psychological screening, were divided into an experiment group and a control group. Based on a brief cognitive intervention (e.g., relaxation, stress management and coping strategies), the result showed that players in the experiment group reported significantly fewer injuries after the 5-month intervention than players in the control group did. Much in the same way, Maddison and Prapavessis (2007) found it possible to prevent sport injuries by improving the athletes' coping skills, especially through stress management and self-confidence training. Perna et al. (2003) also report that athletes practicing cognitive behavioral stress management reported fewer injury days than athletes in the control group.

Rogers and Landers (2005) carried out an extensive study investigating how different psychological factors influence the injury risk. Participants were 177 soccer players between 14 and 19 years old and the result showed that factors such as coping resources (e.g., the ability to control arousal) had the potential to reduce the occurrence of sport injuries. In their discussion, they argue that a potentially stressful situation has a positive relationship leading to an increased level of state anxiety and/or peripheral narrowing. These factors also have a positive relationship with sport injuries. Moreover, findings (Rogers & Landers, 2005) also emphasize that negative life stress has positive relationships with both sport injuries and peripheral narrowing. On the other hand, a negative relationship was found between coping resources and sport injuries. In other words, athletes with a high number of coping resources are less exposed to injury risk in comparison with athletes with few coping resources. Kerr and Fowler (1988) also found that athletes with high levels of trait anxiety more frequently reported narrow concentration and attention problems. Finally, Andersen and Williams (1999) found a positive relation between sport injuries and both peripheral narrowing and state anxiety.

Previous research clearly demonstrates both positive and negative relationships between a large number of different psychological factors and the occurrence of sport injuries. For example, studies found a positive relationship between the dependent variable injury occurrence, and personality factors and life event stress, as well as negative relationships between coping resources and the occurrence of sport injuries. While many cited studies apply a cross-sectional design, often based on university-age athletes at the individual sport level, it is important for the advancement of the field to include additional longitudinal studies on younger athletes because of the potential of such studies to open up for a life-span perspective of the field. Moreover, it is essential to investigate additional psychological factors and their relation to increased injury risk, and to make recommendations to sport medicine teams and coaches for the prevention of injuries.

Accordingly, the purpose of the study is to find significant psychological factors that could lead to an increased injury risk among junior soccer players. In addition, it is necessary to investigate the relationship between specific types of personality factors, coping skills and the relationship between the athletes' history of stressors and frequency of sport injuries.

Four hypotheses are given:

1. There are a few specific personality characteristics, such as trait anxiety and trait aggression, which will be associated with an increased risk of becoming injured.
2. There is a positive relationship between negative life event stress and injury occurrence among soccer players.
3. There is a relationship between a low number of coping skills and an increased risk of becoming injured.
4. There are a few specific psychological factors, such as negative life event stress and ineffective coping strategies, which will be associated with an increased risk of becoming injured.

Materials and methods

Participants

The participants were 85 male and 23 female ($n = 108$) soccer players studying at three different soccer high schools located in southwest Sweden. Their ages were between 17 and 19 years old. Athletes below 18 years of age received parental approval to take part in the study. The selection of the high schools was made strategically and in cooperation with the Swedish Soccer Association. All participation was voluntary. The research design was authorized and approved by Halmstad University ethical committee for human studies.

Measurements

State Trait Anxiety Inventory (STAI)

STAI (Spielberger et al., 1983) is used to measure current state anxiety. The test consists of 40 items (20 state and 20 trait). The state items describe how the athletes feel just at the specific moment when the questionnaire is completed. On the other hand, the trait items describe the athletes' general anxiety level. Questions were answered on a four-graded Likert scale, ranging from 1 (not at all) to 4 (very much so). The α coefficient was 0.93 for the state items and 0.90 for the trait items. Test–retest coefficients ranged from 0.73 to 0.86 for the trait items and 0.16 to 0.62 for the state items (Spielberger et al., 1983).

Sport Anxiety Scale (SAS)

SAS (Smith et al., 1990) is used to measure an athlete's anxiety level. The test consists of 20 items, classified in three categories. The categories are somatic anxiety (nine items) (0.88), worry (seven items) (0.82) and concentration disrupters (five items) (0.74). Questions were answered on a four-graded Likert scale, ranging from 1 (not at all) to 4 (very much so). SAS has a test–retest reliability of 0.85 (Smith et al., 1990).

Athletic Coping Skills Inventory-28 (ACSI-28)

ACSI-28 (Smith et al., 1995) is used to measure an athlete's general coping skills. The test consists of 28 items, classified in seven categories. The categories are coping with adversity, peaking under pressure, goal setting, mental preparation, concentration, freedom of worry, confidence and achievement against coachability. Questions were answered on a four-graded Likert scale, ranging from 0 (not at all) to 3 (very much so). The five variables coping with adversity, peaking under pressure, goal setting, mental preparation and concentration are combined to form an effective (positive) coping skills category, and the two variables freedom of worry and confidence and achievement against coachability are combined to form an ineffective (negative) coping skills category. The authors chose to divide the coping factors into two subgroups because the five variables in the positive coping category have a positive relationship with the occurrence while the two variables in the negative coping category have a negative relationship with the injury factor (Johnson, 2007). The ACSI has a test–retest reliability of 0.87 and an internal consistency coefficient of 0.86 (Smith et al., 1995).

Life Events Survey For Collegiate Athletes (LESCA)

LESCA (Petrie, 1992) is used to measure an athlete's life history stressors. The test consists of 69 items. Athletes are asked to indicate which events have occurred in the last 12 months, and then, for each event, to rate the life event impact that they have experienced on an eight-point Likert scale, with the anchoring -4 (extremely negative) to $+4$ (extremely positive). Based on the results, the score will be divided into three categories: negative life event stress, positive life event stress and total life event stress. This procedure has been used in several other studies (e.g., Rogers & Landers, 2005). LESCA has test–retest reliabilities ranging from 0.76 to 0.84 (Petrie, 1992).

Swedish universities Scales of Personality (SSP)

SSP (Gustavsson et al., 2000) is used to measure personality factors and was developed by the Karolinska Institutet in

Sweden. SSP has been used in several studies (e.g., Magnusson et al., 2007), however, not previously in a sport context. The test consists of 91 items, classified into 13 categories. The categories, listed with α coefficients, are somatic trait anxiety (0.75), cognitive trait anxiety (0.82), mistrust (0.78), stress susceptibility, (0.74), submission (0.78), impulsiveness (0.73), adventure-loving (0.84), interpersonal distance (0.77), social conformity (0.59), bitterness (0.75), annoyance tendency (0.78), verbal trait aggression (0.74) and physical trait aggression (0.84) (Gustavsson et al., 2000). Questions were answered on a four-graded Likert scale, ranging from 1 (not at all) to 4 (very much so).

Procedure

The sampling of the data occurred from October 1, 2007 to May 1, 2008. Contact with coaches was established by phone and full information about the study was sent by letter. A test occasion was scheduled at each high school, just before soccer practice. Thus, students were informed about the purposes of the research, that they could stop their participation at any time and that all data would be confidential. During this period, the different questionnaires were completed. Injury records were collected continuously by athletic trainers at the different schools during the entire test period. The coaches were invited to register both the type of injury and the length of time the athlete was away from regular practice (i.e., days and/or weeks of missed practice). Injuries were defined as all types of injuries that occur in connection with sport participation; the severity of injuries was categorized according to the length of time the athlete was incapacitated: (a) minor (1–7 days), (b) moderate (1 week to 1 month) and (c) major injuries (>1 month) (cf. Lysens et al., 1991). The injuries had all occurred during training or a game.

Statistical analysis

One-way analysis of variance (ANOVA) was used for comparing data between injured and non-injured groups of players. Hypotheses 1–4 were tested using linear regression analysis, backward method, with the dependent variable injury in order to find injury predictors. The models (one for each hypothesis) that were developed in the linear regression analysis were later tested using logistic regression analysis. Logistic regression allows multivariate analysis of a dichotomous dependent variable into a probability statement, the so-called logic transformation. Logistic regression was used to show how a large group of players could be successfully predicted as injured or non-injured, according to the results from the linear regression.

Results

A total of 82 participants completed the five questionnaires correctly. This indicates an internal drop-out rate of 24%. Of the 108 participating players, 42 (39%) athletes missed at least 1 day of sport practice due to an injury. In this group, 67 injuries were reported.

Hypothesis 1

The result of the ANOVA analysis of somatic trait anxiety between the injured and non-injured groups

of athletes [$F(1, 99) = 4, 79, P = 0.031$] showed that injured athletes have a higher level of somatic trait anxiety than the non-injured athletes. No other significant relationship was found.

A regression analysis with backward elimination was conducted with the 13 personality variables (see SSP). This analysis showed that the two predictors somatic trait anxiety and mistrust could explain 11% of the total variance of injury occurrence [$R^2_{Adj} = 0, 11, F(2, 91) = 6, 613, P = 0.002$]. Both factors were significant, somatic trait anxiety ($\beta = 0, 32, P = 0.003$) and mistrust ($\beta = -0, 29, P = 0.006$).

A logistic regression analysis was performed using somatic trait anxiety and mistrust as predictors. Altogether, 101 cases were analyzed ($\chi^2 = 8, 57, df = 2, P = 0.014$). In this sample, 77.2% of the non-injured were successfully predicted while only 36.4% for the injured group were accurate. In total, 59.4% of predictions were accurate.

Hypothesis 2

The result of ANOVA analysis of negative life event stress (N-LES) between the injured and non-injured groups of athletes [$F(1, 97) = 5, 525, P = 0.021$] showed that injured athletes have a higher level of N-LES than the non-injured athletes. No other significant relationship was found.

A regression analysis with backward elimination was conducted with the three life stress variables (see LESCA). This analysis showed that the predictor negative life event stress could explain 7% of the total variance on the dependent variable injury [$R^2_{Adj} = 0, 070, F(1, 97) = 8.372, P = 0.005$]. The predictor negative life event stress was significant ($\beta = 0.21, P = 0.005$).

A logistic regression analysis was performed using the predictor negative life event stress and the dependent variable injury. In total, 98 cases were analyzed ($\chi^2 = 5, 14, df = 1, P = 0.023$). In this sample, 81.8% were successfully predicted non-injured while only 44.2% of the injury predictions were accurate. In total, 65.3% of predictors were accurate.

Hypothesis 3

The results of the one-way ANOVA showed no significant differences in positive or negative coping between the injured and non-injured groups, as well as the result from the linear regression analysis between the predictor's negative coping, positive coping and injury as the dependent variable.

Hypothesis 4

A regression analysis with backward elimination was conducted with 23 predictors (see SSP, LESCA,

Table 1. Regression analysis of injury predictors

Variable	M	SD	β	P
Negative life event stress	18.68	13.74	0.22	0.047
Somatic trait anxiety	1.79	0.419	0.32	0.020
Negative coping	9.62	2.93	0.24	0.019
Mistrust	1.84	0.488	-0.30	0.008
Stress sensitivity	2.03	0.419	-0.20	0.104

Dependent variable: injury

STAI, SAS, ACSI-28). This analysis showed that negative life event stress, somatic trait anxiety, negative coping, mistrust and stress susceptibility could explain 23% of the total variance [$R^2_{Adj} = 0, 23, F(5, 76) = 5, 73, P = <0.001$]. Significant predictors ($P < 0.05$) were negative life event stress ($\beta = 0.22, P = 0.047$), somatic trait anxiety ($\beta = 0.32, P = 0.020$), negative coping ($\beta = 0.24, P = 0.019$) and mistrust ($\beta = -0.30, 0.008$) (see Table 1).

Using the above-mentioned significant predictors and injury as a dependent variable, 86 cases were analyzed ($\chi^2 = 12 182, df = 4, P = 0.016$). Results showed that 78.3% of the non-injured was successfully predicted while 55% of the injury predictions were accurate. In total, 67.4% of predictions were accurate.

Discussion

The purpose was to study psychological predictors that could increase the injury risk among soccer players. The result showed that there are several psychological factors that might predict the occurrence of sport injuries. Significant factors are somatic trait anxiety, mistrust, negative life event stress and negative coping. These factors will be discussed in the following hypotheses stated, and recommendations will be provided for sports medicine teams and coaches for injury reduction.

Hypothesis 1

Williams and Andersen (1998) state in their stress-injury model that different personality variables, such as hardiness and locus of control, could increase an athlete's risk of becoming injured. The results of the first hypothesis showed that injured athletes had a significantly higher level of somatic trait anxiety than non-injured athletes, much like the research by Petrie (1993) establishing a positive relationship between competitive trait anxiety and sport injuries. According to Kerr and Fowler (1988), athletes with a high level of trait anxiety more often reported narrowing concentration and attention than other athletes. However, no significant result was reported

regarding aggressive behavior and injury occurrence. Rogers and Landers (2005) stressed that peripheral narrowing is a predictor of sport injury. These findings could explain why somatic trait anxiety is often found to be a predictor for sport injuries as high anxiety levels seem to lead to peripheral narrowing, thus higher injury vulnerability. The result from the regression analysis regarding personality factors showed that a high level of somatic trait anxiety and a low level of mistrust could explain 11% of the total variance of injury occurrence. In other words, an athlete experiencing a high level of somatic trait anxiety and a low level of mistrust are more exposed to injuries. The finding that a low level of mistrust could be one predictor of sport injury had not been previously found. A potential explanation for the findings is that athletes who are not sufficiently apprehensive of threatening stimuli could be more likely to throw themselves into situations beyond their capacity to control. In such cases, the athletes could be exposed to a high risk of injury. Still another, but related influencing factor is the coach. If an athlete who is low in mistrust places substantial decision-making responsibilities on the coach, for instance a soccer player coming into a critical one-to-one situation seeking external approval for his/her action, he or she might miss crucial cues, and thus be exposed to an elevated injury risk.

Hypothesis 2

Rogers and Landers (2005) suggest that negative life event stress is a strongest predictor for injury, which the current study result supports. One reason for this is the fact that athletes with high stress levels probably have difficulty focusing on important or relevant cues during sport participation, thus, ending up in problematic situations such as being injured. However, the present result showed that it could explain 7% of the injury occurrence. One possible reason why negative life event stress could be a significant predictor even with the modest explanation as in this study is that it influences other predictors. For example, having few coping skills or having a stress-sensitive personality could affect life event stress negatively. When discussing the effect of life event stressors, it is important to consider the fact that athletes, depending on their age, are exposed to different stressors. That is, stressors such as leaving home, pressure from their parents to perform well in school and sport and building new social networks could potentially be different from those of older athletes, for whom stressors such as building relationships and developing future careers are more prominent. Both Wylleman & Lavallee (2004) and Alferman & Stambulova (2007) emphasized that athletes are going through different psychosocial

developmental stages. For 17- or 18-year-old engaged in competitive sport, it is well established that the most important role models in the psychosocial development are the coach, peers and possibly parents. Thus, athletes at different age intervals activate different coping strategies dealing with age-related stressors.

Hypothesis 3

The third hypothesis was that injured athletes should have a lower number of coping resources than non-injured athletes. Previous research noticeably reveals a positive relationship between a lack of coping resources and the frequency of sport injuries (Hanson et al. (1992). However, no differences were found in regard to coping resources between injured and non-injured athletes. One reason could be that the different questionnaires were not sensitive enough. In particular ASCI-28 is designed to capture coping strategies that athletes generally activate during situations not associated with traumas such as being injured. Another possible explanation is that the participating players were slightly younger than athletes in most referred studies and thus have not yet developed mature coping strategies, making it problematic to compare the results with other studies. Taken together, few studies support the result of this study

Hypothesis 4

The fourth hypothesis was about specifying what psychological factors, taken together, could predict sport injuries. Both Williams and Andersen (1998) and Rogers and Landers (2005) state several predictors of injury (e.g., negative life event stress, state anxiety and few coping strategies). In the current study, the result showed that five predictors (negative life event stress, somatic trait anxiety, negative coping, mistrust and stress sensitivity) could explain 23% of the total variance of injury occurrence. Despite the fact that 23% is substantial, several factors have to be considered in exploring the result. Williams and Andersen (2007) writes about external and internal factors that could affect injury occurrence. The current result relates to the internal and psychological dimension, making it a noteworthy high predictor. Combining results of controlled studies using both external and internal predictors would most likely find even higher explanatory values. However, no such studies are to be found. Yet another challenging factor to consider is that, except for LESCA, none of the other questionnaires used are specifically constructed for measuring stressful athletic situations, because no such instruments seem to exist to date. It is the authors' opinion that

more sensitive questionnaires would likely heighten the total variance, making the results of this study even more attractive.

The significant predictors could be divided into the same main blocks as Williams and Andersen (1998) suggest. In the current study, the personality predictors are somatic trait anxiety and mistrust, the history of stressors predictor is negative life event stress and the coping predictor is ineffective coping skills. All significant predictors except mistrust have a positive relationship with sport injuries. The two personality predictors that occurred in the current study are sparsely discussed in the literature. One reason could be that the personality test (SSP) is rather new and used in only a few studies before, thus, psychological factors such as mistrust and physical trait aggression have not yet been tested methodically in a sport context. In line with Rogers and Landers's (2005) findings, one of the strongest predictors of sport injury is negative life event stress. Also, the relationship between few coping resources and an increased injury risk is well established (Hanson et al., 1992).

The five significant predictors that are presented in the text above predict 67.4% of the cases successfully. This indicates that approximately two out of three athletes were sorted correctly into either the injured or the non-injured group. Such a result allows for the creation of an empirical model of injury risk factors (see Fig. 1). Development of an empirical model has the advantage of summarizing and integrating empirical findings, allowing for a more systematic understanding of complex factors influencing risk behavior.

The empirical model of injury risk factors supports significant parts of both Williams and Andersen's (1998) stress-injury model and Rogers and Landers's (2005) findings. For example, both life stress and coping skills are discussed in the models. There are, however, some differences between the empirical model of injury risk factors and results from the two other studies. One distinct difference is that the stress-injury model contains several predictors in

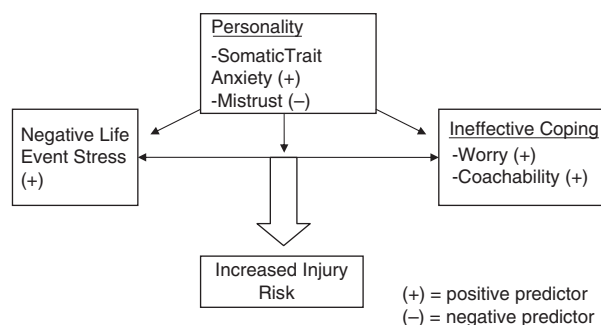


Fig. 1. Empirical model of injury risk factors.

each block (personality, history of stressors and coping) while the injury prediction model has only one or two in each block. One other difference between the models/findings is that the empirical model of injury risk factors does not highlight the stress response. There are differences also between the empirical model of injury risk factors and Rogers and Landers (2005) results regarding stress and coping. The most distinct one might be that Rogers and Landers (2005) stress both peripheral narrowing and state anxiety as predictors. These two predictors are not discussed in the empirical model of injury risk factors. Instead, the empirical model of injury risk factors highlights two personality factors. In an applied perspective, it is central for the sports medicine team and coaches to consider the joint effect of identified predictors and understand that high somatic trait anxiety as well as a low mistrust, anxiety about what the coach thinks and says and high life event stress greatly influence injury vulnerability. Clearly, previous research suggests that brief cognitive intervention, especially through stress management and self-confidence training, have the potential to significantly lessen the amount of injuries for athletes (Johnson et al., 2005; Maddison & Prapa- vassis, 2007). Hence, the empirical model of injury risk factor underline the importance of using such factors in the applied work with injured athletes. Some suggestions for actions are given below.

Methodological issues

One limitation of the study is the fact that it is problematic to measure state levels using only two test occasions during 8 months. State levels, by definition, change over time, making it hazardous to receive a general rate. Another potential limitation is the sensitiveness of the different questionnaires. In particular, SSP has not been tested on a sport-related population before. Thus, few reference points exist comparing different studies. Dividing ACSI-28 variables into two categories is also a potential limitation of the study. However, this procedure has been used successfully in other studies (e.g., Rogers & Landers, 2005). The rather low mean age of the soccer players (18 years) compared with most cited studies using senior athletes could be regarded as a limitation of the study as it is to be expected that senior athletes both experience and cope differently with age-related, stressors such as relating to new partners and coaches, as well as education (Wylleman & Lavallee, 2004).

Perspectives

Following the findings, there are well-defined psychological factors that affect the injury risk among

soccer players, which have several implications for sports medicine teams and coaches to consider. This is especially true of negative life event stress. It is recommended that medicine teams and coaches be observant if major negative life events occur for players as these could have a devastating injury impact on the athletes' behavior in terms of disrupted concentration and elevated anxiety levels. This is especially important if the negative events have occurred very recently. Thus, it is recommended that the player be allowed to miss one or more practices/games in order to restore psychological and physical focus and balance. Another recommendation, especially for coaches, is to help athletes develop coping skills. That is, to decrease the players' level of worry through increasing their self-efficacy through positive and reinforcing feedback, as well as by creating an atmosphere of trust and openness to express their feelings. Still another recommendation is to help athletes learn muscle relaxation. Somatic anxiety often leads to increased muscle tension; if athletes can control this phenomenon, injury risk

decreases. One promising area for future research is to use the empirical model of injury risk factors as a theoretical framework for studying combinations of risk predictors for minor as well as major injuries in addition to gender, age and type of sport. Developing more situation-specific and sensitive instruments would also be welcomed. Needless to say, a holistic perspective on preventive issues has the potential to significantly lessen injury occurrence in sport.

Key words: coping strategies, Life Event Stress, personality, psychological predictors, sport injury.

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