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Chapter 4

PREDICTING AND PREVENTING SPORT INJURIES: THE ROLE OF STRESS

Aurelio Olmedilla^{1,}, Víctor J. Rubio²
and Enrique Ortega¹*

¹University of Murcia, Murcia, Spain

²University Autonoma Madrid, Madrid, Spain

ABSTRACT

Hardly any sport practitioner would have finished his/her career without suffering at least one sport injury. Sport injury is a broadly spread out morbidity condition sustained as a result of an energy transfer when the specific tissue or organ is no longer able to resist the biomechanical forces that stress it. Traditionally, athlete has been viewed as a mere injury container and the injury itself as a broken piece that should be fixed up. Despite of such outlook, psychological research has shown athletes play an active role on the process of becoming injured and several psychosocial variables might influence on such. According to the seminal Andersen and Williams (1988, Williams and Andersen, 1998) model, the key psychological factor related to sport injury occurrence is the stress response. The present paper focuses on the preinjury phase, reviewing the concept of stress and analyzing the mechanisms involved in

* Corresponding author: Ass. Prof. Aurelio Olmedilla. Dpt. Personality, Assessment and Psychological Treatments. University of Murcia. 30100 Murcia (Spain). E-mail: olmedilla@um.es.

sport injury occurrence. It also reviews the experiences of interventions aimed to cope with stress and the empirical evidence of such interventions preventing sport injuries.

THE BEGINNINGS OF THE STUDY OF THE STRESS-SPORT INJURY RELATIONSHIPS

The interest in psychological factors affecting sport injuries dates back to the 1970's when several authors tried to find relationships between personality traits and injury vulnerability (see, for instance, Williams and Andersen, 2007). However, such attempts, some of which found differences between injured and non-injured athletes, while others did not (see Andersen and Williams, 1988), brought about a more interactional approach (see Fischer, 1984, for a claim of a Person x Situation outlook instead of the static trait approach) where the concept of stress caught the attention of researchers.

By the seventies, stress had already been shown to play a role in disease promotion (see Krantz, Glass, Contrada and Miller, 1981) and accident occurrence in the work setting (see Burham's 2009 review). In this way, Holmes, in 1970 (cited in Andersen and Williams, 1988), having recently developed the Social Readjustment Rating Scale for assessing stressful life events with his colleague Rahe (Holmes and Rahe, 1967), found that there was a greater likelihood for football players to become injured when they had experienced important life events. This was the first of a series of studies that, in many cases, found greater incidence of sport injuries when athletes were exposed to high stress levels (Bramwell, Masuda, Wagner, and Holmes, 1975; Coddington and Troxell, 1980; Cryan and Alles, 1983; Lysens, Auweele, and Ostin, 1986; Passer and Seese, 1983). These and some other results led Andersen and Williams (1988) to propose a model that aimed to provide a theoretical framework for explaining the relationship between stress and other psychosocial factors and injury outcome.

THE ANDERSEN AND WILLIAMS'S STRESS AND INJURY MODEL

The Andersen and Williams's (1988) model, slightly revised years later (Williams and Andersen, 1998), is centered on the stress response,

bidirectionally related to the athlete's cognitive appraisal of a potentially stressful situation and the physiological and cognitive aspects of the stress response. As Williams and Andersen (1998, 2007) pointed out, the athlete makes an appraisal of the sport demands, the adequacy of his/hers resources for coping with the demands, and the consequences of meeting or failing to meet them. Cognitive appraisal triggers the physiological and attentional aspects of the stress response. Likewise, such changes influence cognitive appraisal in a bidirectional way.

In turn, stress response is influenced by three major factors: personality, history of stressors, and coping resources. According to the authors, the athlete's history of stressors (previous injuries, life events, daily hassles) influences the stress response by means of the cognitive appraisal of the situation and/or the physiological and attentional changes that are provoked.

In the same way, personality factors such as locus of control, sense of coherence, hardiness, trait anxiety and achievement motivation can directly affect to the stress response, or either a) moderate the influence of the history of stressors or b) are shaped by such previous stressors in the idiosyncratic way the individual cope with them. Finally, coping resources (sleep patterns, nutritional habits, social support network, stress management skills, etc.) act on the stress response either directly or by moderating the influence of previous stressors (Williams and Andersen, 1998; 2007). Furthermore, the revised version of the model also included a bidirectional relationship between coping resources and personality, highlighting the complex influences between the variables involved and the injury outcomes.

In the end, the model also includes the implementation of interventions aimed at reducing the stress response by both changing cognitive appraisals of potentially stressful events and modifying the physiological and attentional facets of the stress response involved in the sport injury.

MECHANISMS UNDERLYING THE STRESS-INJURY RELATIONSHIPS

Rather than establishing a mere path of relationships between different psychosocial factors and injury outcomes, more or less based on empirical correlational studies, Andersen and Williams (1988, Williams and Andersen, 1998) hypothesized specific mechanisms involved in the stress-injury relationship. According to their model, on the one hand, stress response

increases generalized muscle tension that can lead to a motor coordination disturbance as well as a reduction in flexibility and an increase in fatigue. On the other hand, stress response might affect the attention narrowing of the visual field, responsible for the lack of noticing relevant peripheral information and increased distractibility.

Muscle Tension

There are a broad number of studies that have shown the role of stress in increasing muscle tension, leading to diseases such as headaches or musculoskeletal disorders (Lundberg et al., 1999). Nevertheless, no one from the sport psychology field has directly explored the relationships between stress reactivity in terms of muscle tension and injury outcomes. There is just indirect evidence concerning such a relationship. For instance, Hicks, Inman, Deharo, and Hicks (1999) found that the consistency of hand use, considered as a measure of motor coordination, was related to sport injuries. More specifically, Arnason, Andersen, Holme, Engebretsen and Bahr (2008) showed that eccentric strength training with Nordic hamstring lowers, combined with warm-up stretching (but not solely flexibility training), appears to reduce the risk of hamstring strains.

Attention Deficit

Stress has been shown to affect the central nervous system in different ways. As early as 1970, Kopell, Wittner, Lunde, Warrick, and Edwards, (1970) found a significant decrease in individuals' event-related potentials (ERP) amplitudes to visual stimuli when injecting glucocorticoids, the hormones secreted under stress conditions. This ERP amplitude decrease, which has been further confirmed (see Lupien, Maheu, Tu, Fiocco, and Schramek, 2007, for a review), reflects a state of hypovigilance and is coherent with Andersen and Williams (1988) hypothesis.

There are just a bunch of studies from the field of sport psychology focused on attentional narrowing as a result of stress condition and injury outcome. Williams and Andersen (1997) found that athletes with high injury risk profile and higher negative life events scores, presented slower central vision reaction time when faced with a stressful lab test consisting of detecting cues in the central and peripheral fields of vision when performing a Stroop

test. This reduced reaction time when facing a stressful condition was interpreted as a demonstration of distractibility and vigilance decrease when suffering more major life events. Moreover, Williams and Andersen (1997) also found the characteristic “visual tunnelling” effect (Dirkin, 1983) under stress: the group of participants with high life event scores showed significant higher peripheral narrowing compared to the group with low life event scores. These results were in line with findings previously obtained by the same group (Williams, Tonymon and Andersen, 1990, 1991) who also used a stressful lab task condition and found that high negative life events were related to greater peripheral narrowing during the stress condition, supporting the Andersen and Williams (1988) hypothesis about mechanisms involved in the stress-injury outcome relationship. However, some other mechanisms might also be involved.

Other Mechanisms

Athletes are active subjects in the injury process, committing or omitting actions that can lead to an injury (Almeida, Olmedilla, Rubio and Palou, 2014). In fact, anyone could intuitively assume that the more risk-taking behaviors showed (such as competing when experiencing muscle aches, diving to head the ball among the defense or playing aggressively against the opponents), the greater the risk of becoming injured (Rubio, Pujals, de la Vega, Aguado, Henández, 2014). The same could be said regarding omitting behaviors such as avoiding a correct warm-up prior to the sport activity or not wearing the required protection.

Does the stress response and/or its moderating factors affect the risk-taking behaviors shown by the athletes? Petrie (1993) found that athletes who reported high levels of social support were at a higher risk of experiencing an injury, contrary to what would be expected. The author hypothesized that, under lower stress, high social support may provide a sense of confidence, which might provoke an athlete’s risk-taking behaviors.

Stress has shown to negatively affect decision making, increasing riskier behaviour (for instance, altering reward-punishing sensitivity, see Starcke and Brand, 2012). Moreover, experimental studies have shown that elevated levels of stress-evoked glucocorticoid concentrations (typically related to chronic stress) increase riskier behaviors, the opposite effect of that experienced when a moderate increase in catecholamines occurs (usually in cases of

acute/moderate stress) thereby enhancing decision-making performance (Pabst, Brand, and Wolf, 2013).

Furthermore, even though there are no specific studies from the sport psychology field, the literature regarding the role of emotions in decision making and inducing riskier behaviors could shed light on the stress-injury relationship and the role of other mechanisms beyond attentional and coordination-flexibility factors. For instance, social stress has been related to risk-prone activities such as aggression and novelty seeking in response to impulsive decision-making (Reynolds, Schreiber, Geisel, MacPherson, Ernst and Lejuez, 2013), and the potentially stressful athletic situation involved in the Andersen and Williams's model has many connotations of a social stress. Likewise, negative affective states such as fear, disgust or anger directly influence risk-taking behavior (Bodenhausen, 1993). It is assumed that such an influence is due to the fact that when under stress either a) cognitive resources are used for emotion regulation and are thereby distracted from inhibitory processes that might control risky behaviors (Baumeister, Vohs and Tice, 2007), or b) risk engagement reduces distress (Baker, Piper, McCarthy, Majeskie and Fiore, 2004).

Regardless of the explanation, scientific literature has shown that people under stress conditions have difficulty in regulating the focus of their attention, memory and psychomotor processes (McEwan, 2006) as well as in making decisions, and show an increase in risk-taking behaviors (Reynolds et al., 2013) that could result in sport injury.

PREVENTING SPORT INJURIES THROUGH STRESS CONTROL STRATEGIES

According to the Andersen and Williams's model (1988) and its further review (Williams and Andersen, 1998), the stress is a key factor in the pathogenesis of a sport injury (Dunn, Smith, and Smoll, 2001; Galambos, Terry, Moyle, and Locke, 2005; Hanton, Fletcher, and Coughlan, 2005; Johnson and Ivarsson, 2011). Thus, from a psychological perspective, stress control might be a basic strategy for a sport injury prevention program. Nevertheless, there are just a few studies that have attempted to test the effectiveness of psychological programs in preventing sport injuries. Moreover, the empirical data shows controversial results. Such discrepancies have been attributed to different factors, such as the use of very reduced

(Tranaeus, Johnson, Engstrom, Skillgate, and Werner, 2014) or heterogeneous samples (for instance, combining male and females, see Edvardsson, Ivarsson, and Johnson, 2012) without considering the stress reactivity differences.

Additionally, there is a lack of clinical assay control and isolation of the components of the programs, using different techniques for training stress control management, as well as other psychological intervention strategies (see Johnson, Tranaeus, and Ivarsson, 2014).

The next section provides a review of the characteristics and results of studies that have tested the effectiveness of psychological intervention programs for reducing sport injury.

PSYCHOLOGICAL INTERVENTION PROGRAMS FOR REDUCTION OF INJURY: AN OVERVIEW

A literature review revealed that just only 14 studies have tested the effectiveness of psychological interventions in reducing sport injuries. Three out of these 14 are not focused on sport injury prevention but are general mental training programs that have also tested their effect on in sport injury incidence (DeWitt, 1980; Fenker and Lambiotte, 1987; Murphy, 1988). Eleven of them are specifically aimed to prevent sport injuries based on stress management.

As can be seen in Table 1, the systematic testing of the effectiveness of psychological programs for preventing injuries started during the 1980's, though there has only been a clear increment in its number since the beginning of the present century.

Presented in a chronological order, a study by DeWitt (1980) showed a substantial decrease in reported injuries in varsity basketball and soccer players after a combination of cognitive techniques (mental rehearsal exercises aimed to control tension), muscle relaxation and physiological feedback training. Fenker and Lambiotte (1987) carried out a psychological intervention program aimed at controlling competitive and training stress with an American college football team though not specifically oriented to reduce injuries. The program included imagery-training techniques combined with a process-oriented approach to performance. They found an over 33% reduction in the number of injuries during the following two seasons compared to the previous one (from 18 to 12 and 13, respectively). Murphy (1988), refers the first time a

sport psychologist was recruited by the US Olympic Committee for providing psychological services to the 1987 US Olympic Festival.

Table 1. Injury prevention intervention studies

Study	Population	N	Intervention	Intervention effects
DeWitt (1980)	Basketball, football players	18	Biofeedback	Reduced injuries
Fenker and Lambiotte (1987)	Major college football team	30	Relaxation/Imagery	33% reduction
Murphy (1988)	Team athletes	12	Relaxation/Pain control	Reduced injuries
May and Brown (1989)	Olympic alpine skiers	18	Relaxation/Imagery	Reduced injuries, increased self-confidence
Schomer (1990)	Marathon runners	10	Attentional strategies	Facilitated heavy training with injury
Davis (1991)	Collegiate swimmers and football players	21	Stress management	52% reduction in swimming injuries, 33% reduction in football injuries
Kerr y Goss (1996)	Elite gymnasts	24	Stress management	Reduced injuries and stress level
Perna et al. (1998)	Collegiate rowers	34	Cognitive behavioral Stress management	Reduced injuries and illness. Robust association but non-significant
Perna et al. (2003)	Collegiate rowers	40	Cognitive behavioral Stress management	Reduced injuries and illness
Kolt et al. (2004)	Elite gymnasts	20	Stress management	Reduced injuries, No statistically significant differences

Study	Population	N	Intervention	Intervention effects
Johnson et al. (2005)	Competitive soccer players	32	Stress management, critical incidence	Reduced injuries and stress level
Maddison and Prapavessis (2005)	Competitive male rugby players	38	Stress management, CMSM	Reduced injuries and stress level
Noh et al. (2007)	Female ballet dancers	45	Autogenic Training, Broad-based Coping Skills	Reduced injuries, frequency and time lost
Edvarsson et al. (2012)	Junior soccer players	29	Cognitive behavioral Biofeedback	No significant difference between the control and experimental group
Tranaeus et al. (2014)	Elite floorball players	401	Stress management	Reduced injuries, No statistically significant differences
Olmedilla et al. (in preparation)	Junior soccer players	112	Relaxation/Imaginery/ Setting Goals	No significant difference between the control and experimental group

He reported the results of the work with one of the teams that had 7 of 12 players injured (2 seriously), leaving not even enough healthy players to hold a game. He carried out relaxation training with the athletes and pain control techniques with some of them. After the psychological training, all of the athletes exhibited pain reduction and the 12 were able to compete. Still in the eighties, May and Brown (1989) used a multifaceted program including attentional shift, visualization, mental skills training, team building and communication skills training with the US Olympic skiing team prior to and during the Calgary Olympic Games. The authors found a decrease in injuries, as well as an increase in self-confidence and self-control. Schomer (1990) also found a relationship between associative thinking strategies in marathon runners and a decline in overload injuries, facilitating athletes' heavy training even when injured.

During the nineties, there were three studies aimed at investigating the effectiveness of psychological interventions in sport injury prevention. Davis

(1991), for instance, used a psychological intervention consisting of visualization and relaxation for stress management with collegiate swimmers and soccer players.

He found injuries had a remarkable decrease of 52% in swimmers and 33% in soccer players. Nevertheless, Kerr and Goss (1996) applied Meichenbaum's stress inoculation training during eight months to a group of 24 male and female elite gymnasts and even though findings indicate the stress management program did reduce athletes' stress levels and enabled them to cope with the frustration of minor injuries, there were no significant findings for the effect of stress management on injury prevention. Perna, Antoni, and Schneiderman (1998) founded a quite robust ($d = .67$), albeit non-significant, effect on injury reduction when they used a stress management program with a very small sample of collegiate rowers. To the contrary, the same group of researchers (Perna, Antoni, Baum, Gordon and Schneiderman, 2003), working in this case with a larger sample of varsity rowers found a statistically significant drop of injuries and illnesses of the group receiving a behavioral-cognitive stress management program compared to the group which did not received the intervention. Nevertheless, Kolt, Hume, Smith, and Williams (2004) failed to find significant differences between treatment and placebo groups when they used a stress-management program consisting of 12 one-hour sessions with 20 New Zealand elite gymnasts (half of them assigned to the treatment and half to the placebo group). Even though they recorded less injuries in the treatment group compared to the group that received only the anthropometric measures and lectures on nutrition during the 9 month period following the intervention, these differences were not statistically significant.

Johnson, Ekengren and Andersen (2005), working with soccer players, carried out a study in which they took 32 athletes, previously identified to be at risk of injury according to their stress levels and other psychosocial factors involved, and assigned them to either a control or a intervention group consisted of training in six mental skills (somatic and cognitive relaxation, stress management skills, goal-setting skills, attribution and self-confidence training, and identification and discussion about critical incident related to sport and everyday life situations). Results showed a significant drop in both stress level and injury occurrence during the intervention period compared to the control group. Using the same paradigm, in this case with a sample of 470 rugby players, Maddison and Prapavessis (2005) carried out two related studies. In the first one they assessed history of stressors, coping strategies and social support in order to identify athletes at risk for suffering sport injuries, according to Andersen and Williams's model (1988, Williams and Andersen,

1998). Once they identified 48 players at risk, the second study consisted of a testing whether a cognitive behavioral stress management intervention program could be useful for reducing sport injuries. Their results showed athletes at risk showed a reduction in time missed due to injuries as well as stress levels compared to non-intervention counterparts.

Noh, Morris and Andersen (2007), in this case with 45 Korean dancers, tested the efficacy of an autogenic training program, a broad-based coping skills training program including autogenic training, imagery and self-talk, and a control group which did not received any specific psychological intervention. Authors found that dancers at the broad-based coping skills condition significantly shortened the average time elapsed since injury to dancer return compared to the control group.

However, other studies did not find significant differences. Edvarsson, et al. (2012) used a combined intervention including biofeedback training, somatic relaxation, thought stopping, emotions/problems focused coping, goal setting and keeping a critical incident diary in a sample of 29 junior soccer players and they could not find significant differences between control and treatment groups. Tranaeus et al. (2014) also failed to find statistically significant differences between a treatment group consisting of 11 soccer teams receiving a 6-session stress management program and a control group (12 soccer teams which did not received any specific psychological intervention). Finally, Olmedilla, Rubio, Ortega and Boladeras (in preparation) also did not find significant differences when 6 junior soccer teams receiving an intervention including relaxation, goal-setting, stress management, and visualization, were compared to a control group consisted of 2 other junior soccer teams.

PROPOSALS FOR FUTURE RESEARCH

As was previously mentioned, the empirical evidence on the effectiveness of psychological interventions focused on stress management, with or without some other facets, is far from being established. If there is no statistically significant reduction in sport injuries compared to some other group or regarding the previous history of injuries, does it refute the Andersen and Williams's model? Does it mean intervention programs are not properly designed or applied? Are there non-controlled variables affecting the results obtained? Is this a matter of inadequacy of experimental designs or assessment procedures?

Firstly, it should be stated that Andersen and Williams's model itself pointed out the multidetermined nature of the phenomenon. Moreover, the implementation of programs such as those reviewed should include many aspects, such as the number of effective sessions the athletes receive, the character of standardized interventions regardless the reactivity to stress of each individual and his/her idiosyncratic factors, etc. Moreover, the length of the interventions and the preservation of the achievements are another issue that should be taken into account. Most of the studies have been designed to be applied short term and almost no one has continued research for more than one season to show how long the gains are preserved and how they influence sport injuries (Finch, 2006). For that reason, further research should be carried out in order to test the effectiveness of psychological intervention programs on the prevention of sport injuries.

In this line, Almeida et al. (2014), based on the *Global Psychological Approach to Sport Injuries* and its three proposal axes (causal, temporal, and conceptual, see Olmedilla and García-Mas, 2009), highlight the need for integrating the different collections of empirical data, as well as to agree on what a sport injury is, to what extent it is measured though the outcomes typically used and how the relationships between psychological factors and sport injury should be methodologically studied.

Likewise, Johnson (2007) emphasizes the need for clarification and agreement regarding two basic aspects: theoretical background and research designs, assessment instruments and statistical tests. Concerning the theoretical issues, Andersen and Williams's (1988) model is useful for pointing out the role of several psychological factors and the sport injury. However, some other approaches could contribute to a more comprehensive perspective, such as the Hanin's (2000) Individual Zones of Optimal Functioning (IZOF) model. Several studies have shown that it can be used as a theoretical background for detecting emotional antecedents which have shown to be related to sport injuries (Devonport, Lane, and Hall, 2003; Mårtensson, 2004; Olmedilla, Ortega and Gómez, 2014).

Regarding research, assessment and statistical analyses, future research should insist on controlled trials with larger samples, comparing treatments, as well as using non-treatment groups. Moreover, although not devoid of difficulties (Johnson, 2007), longitudinal studies are necessary in order to test the dynamic aspects involved, and prospective, instead of retrospective, gathering might protect against several biases the quality of the data (Almeida et al., 2014; Johnson et al., 2014). In this line, there are several concerns about the near to exclusive use of self-reports for assessing the relevant dimensions

and collecting information. Effort should be made towards the introduction of task-based assessment, observational techniques, physiological and biochemical outcomes, as well as the promotion of new IT-based technologies in order to provide more accurate and multiplist data collection (Almeida et al., 2014). Likewise, statistical models based on general linear modelling would probably leave out relevant data (Johnson et al., 2014). Therefore, analyses based on latent growth curves, Bayesian analysis and structural equation modelling for testing changes might contribute to a more precise examination of the complex interactions between the independent variables (García-Mas, Pujals, Fuster-Parra, Nuñez, and Rubio, 2014; Johnson et al., 2014). Likewise, qualitative studies can also contribute to a better comprehension of the role of psychological factors in sport injury and its prediction and prevention, as a few studies have shown (Georgiadis, Biddle and Auweele, 2001; Johnson, 2011).

Furthermore, as Johnson and colleagues have pointed out (Johnson et al., 2014; Tranaeus et al., 2014) several aspects should be considered when testing the preventive efficacy of psychological interventions: a clear definition of the type of injury (overload vs. traumatic injuries; self-produced vs. sustained by opponent collision), age, gender, competitive level and position, as well as cultural issues that could be involved. Finally, staff participation and engagement can make the difference between successful and unsuccessful interventions in terms of reaching the preventive goal (Tranaeus et al., 2014).

REFERENCES

- Almeida, P., Olmedilla, A., Rubio, V. J., and Palou, P. (2014). Psychology in the realm of sport injury: What it is all about. *Revista de Psicología del Deporte*, 23(2), 395-400.
- Andersen, M. B. and Williams, J. M. (1988). A model of stress and athletic injury: Prediction and prevention. *Journal of Sport and Exercise Psychology*, 10(3), 294-306.
- Arnason, A., Andersen, T. E., Holme, I., Engebretsen, L., and Bahr, R. (2008). Prevention of hamstring strains in elite soccer: an intervention study. *Scandinavian Journal of Medicine and Science in Sports*, 18(1), 40-48.
- Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., and Fiore, M. C. (2004). Addiction motivation reformulated: an affective processing model of negative reinforcement. *Psychological Review*, 111(1), 33-51.

- Baumeister, R. F., Vohs, K. D. and Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science*, 16(6), 351-355.
- Bodenhausen, G. V. (1993). Emotions, arousal, and stereotypic judgments: A heuristic model of affect and stereotyping. In: D. M. Mackie and D. L. Hamilton (Eds.), *Affect, cognition, and stereotyping: Interactive processes in group perception* (pp. 13-37). San Diego, CA: Academic Press.
- Bramwell, S. T., Masuda, M., Wagner, N. N., and Holmes, T. H. (1975). Psychological factors in athletic injuries: Development and application of the Social and Athletic Readjustment Rating Scale (SAARS). *Journal of Human Stress*, 1(1), 6-20.
- Burnham, J. C., 2009. *Accident Prone: A History of Technology, Psychology, and Misfits of the Machine Age*. Chicago: The University of Chicago Press.
- Coddington, R. D. and Troxell, J. R. (1980). The effect of emotional factors on football injury rates: A pilot study. *Journal of Human Stress*, 6(1), 3-5.
- Cryan, P. O. and Alles, E. F. (1983). The relationships between stress and football injuries. *Journal of Sports Medicine and Physical Illness*, 23(1), 52-58.
- Davis, J. O. (1991). Sport injuries and stress management. An opportunity for research. *The Sport Psychologist*, 5(2), 175-182.
- Devonport, T. J., Lane, A. M. and Hall, R. J. (2003, July). Affective state profile of athletes prior to best, worst and injured performance. *Paper presented at 8th Annual Congress of the European College of Sport Science*, Salzburg, Austria.
- DeWitt, D. J. (1980). Cognitive and biofeedback training for stress reduction with university athletes. *Journal of Sport Psychology*, 2, 288-294.
- Dirkin, G. R. (1983). Cognitive tunnelling: Use of visual information under stress. *Perceptual and Motor Skills*, 56(1), 191-198.
- Dunn, E., Smith, R. and Smoll, F. (2001). Do sport-specific stressors predict athletic injury?. *Journal of Science and Medicine in Sport*, 4(3), 283-291.
- Edvardsson, A., Ivarsson, A. and Johnson, U. (2012). Is a cognitive-behavioural biofeedback intervention useful to reduce injury risk in junior football players?. *Journal of Sports Science and Medicine*, 11(2), 331-338.
- Fenker, R. and Lambiotte, J. (1987). A performance enhancement program for a college football team: One incredible season. *The Sport Psychologist*, 1(3), 224-236.
- Finch, C. (2006). A new framework for research leading to sports injury prevention. *Journal of Science and Medicine in Sport*, 9(1-2), 3-9.

- Fischer, A. C. (1984). New directions in sport personality research. In: J. M. Silva and R. S. Weinberg (Eds.). *Psychological foundations of sport* (pp. 70-80). Champaign, IL: Human Kinetics.
- Galambos, S., Terry, P., Moyle, G., and Locke, S. (2005). Psychological predictors of injury among elite athletes. *British Journal of Sports Medicine*, 39(6), 351-354.
- García-Mas, A., Pujals, C., Fuster,-Parra, P., Núñez, A., and Rubio, V. (2014). Determinación de las variables psicológicas y deportivas relevantes a las lesiones deportivas: Un análisis bayesiano [Determination of the psychological and sportive variables related to sports injuries: a bayesian analysis]. *Revista de Psicología del Deporte*, 23(2), 423-429.
- Georgiadis, M., Biddle, S. J. H. and Auweele, Y. V. (2001). Cognitive, emotional, and behavioral connotations of task and ego goal orientation profiles: An ideographic approach using hierarchical class analysis. *International Journal of Sport Psychology*, 32 (1), 1-20.
- Hanin, Y. L. (2000). *Emotions in Sport*. Human Kinetics, Champaign.
- Hanton, S., Fletcher, D. and Coughlan, G. (2005). Stress in elite sport performers: a comparative study of competitive and organizational stressors. *Journal of Sports Sciences*, 23(10), 1129-1141.
- Hicks, R. A., Inman, G., Deharo, D., and Hicks, G. J. (1999). Consistency of hand use, exercise, and sports-related injuries. *Perceptual and Motor Skills*, 88(3), 1359-1360.
- Holmes, T. H. and Rahe, R. H. (1967). The Social Readjustment Rating Scale. *Journal of Psychosomatic Research*, 11(2), 213-218.
- Johnson, U. (2007). Psychosocial antecedents of sport injury, prevention, and intervention: an overview of theoretical approaches and empirical findings. *International Journal of Sport and Exercise Psychology*, 5(4), 352-369.
- Johnson, U. (2011). Athletes' experiences of psychosocial risk factors preceding injury. *Qualitative Research in Sport, Exercise and Health*, 3(1), 99-115.
- Johnson, U., Ekengren, J. and Andersen, M. B. (2005). Injury prevention in Sweden: Helping soccer player at risk. *Journal of Sport and Exercise Psychology*, 27(1), 32-38.
- Johnson, U. and Ivarsson, A. (2011) Psychological predictors of sport injuries among junior soccer players. *Scandinavian Journal of Medicine and Science in Sports*, 21(1), 129-136.
- Johnson, U., Tranaeus, U. and Ivarsson, A. (2014). Current status and future challenges in psychological research of sport injury prediction and

- prevention: A methodological perspective. *Revista de Psicología del Deporte*, 23(2), 401-409.
- Kerr, G. and Goss, J. (1996). The effects and stress management program on injuries and stress level. *Journal of Applied Sport Psychology*, 8(1), 109-117.
- Kolt, G., Hume, P. A., Smith, P., and Williams, M. (2004). Effects of a stress-management program on injury and stress of competitive gymnasts. *Perceptual and Motor Skills*, 99 (1), 195-207.
- Kopell, B. S., Wittner, W. K., Lunde, D., Warrick, G., and Edwards, D. (1970). Cortisol effects on averaged evoked potentials, alpha-rhythm, time estimation, and two-flash fusion threshold. *Psychosomatic Medicine*, 32(1), 39-49.
- Krantz, D. S., Glass, D. C., Contrada, R. J., and Miller, N. E. (1981). Behavior and Health. *The National Science Foundation: Five year outlook on science and technology: 1981 Source materials* (Vol. 2, pp. 561-588). Washington, D.C.; Government Printing Office.
- Lundberg, U., Dohns, I. E., Melin, B., Sandsjö, L., Palmerud, G., Kadefors, R., Ekstrom, M., and Parr, D. (1999). Psychophysiological stress responses, muscle tension, and neck and shoulder pain among supermarket cashiers. *Journal of Occupational Health Psychology*, 4(3), 245-255.
- Lupien, S. J., Maheu, F., Tu, M., Fiocco, A., and Schramek, T. E. (2007). The effects of stress and stress hormones on human cognition: Implications for the field of brain and cognition. *Brain and Cognition*, 65(3), 209-237.
- Lysens, R., Auweele, Y. V. and Ostyn, M. (1986). The relationships between psychosocial factors and sport injuries. *Journal of Sports Medicine and Physical Fitness*, 26(1), 77-84.
- Maddison, R. and Prapavessis, H. (2005). A psychological approach to the prediction and prevention of athletic injury. *Journal of Sport and Exercise Psychology*, 27(3), 289-310.
- Mårtensson, C. M. (2004). *A study about the relationship between performance related emotional state and the risk of sustaining athletic injuries of speedway drivers at elite level*. Unpublished Master's dissertation, School of Social and Health Science, Halmstad University, Sweden.
- May, J. R. and Brown, L. (1989). Delivery of psychological service to the US Alpine ski team prior to and during the Olympics in Calgary. *The Sport Psychologist*, 3(4), 320-329.

- McEwen, B. S. (2006). Protective and damaging effects of stress mediators: central role of the brain. *Dialogues in Clinical Neuroscience*, 8(4), 367-382.
- Murphy, S. M. (1988). The on-site provision of sport psychology service at the US Olympic Festival. *The Sport Psychologist*, 2(4), 337-350.
- Noh, Y. E., Morris, T. and Andersen, M. B. (2007). Psychological intervention for reduction of injury in ballet dancers. *Research in Sports Medicine*, 15(1), 13-32.
- Olmedilla, A. and García-Mas, A. (2009). El Modelo Global Psicológico de las Lesiones Deportivas. *Acción Psicológica*, 6(2), 77-91.
- Olmedilla, A., Ortega, E. and Gómez, J. M. (2014). Influencia de la lesión deportiva en los cambios del estado de ánimo y de la ansiedad precompetitiva en futbolistas [Influence of sport injury on mood states and competitive anxiety in soccer players]. *Cuadernos de Psicología del Deporte*, 14(1), 9-10.
- Olmedilla, A., Rubio, V., Ortega, E., and Boladeras, A. (in preparation). *Preventing sport injuries: A psychological intervention over Spanish soccer youth players*.
- Pabst, S., Brand, M. and Wolf, O. T. (2013). Stress and decision making: A few minutes make all the difference. *Behavioural Brain Research*, 250, 39-45.
- Passer, M. W. and Seese, M. D. (1983). Life stress and athletic injury: Examination of positive versus negative events and three moderator variables. *Journal of Human Stress*, 9(1), 11-16.
- Perna, F. M., Antoni, M. and Schneiderman, N. (1998). Psychological intervention prevents injury/illness among athletes [Abstract]. *Journal of Applied Sport Psychology*, 10 (Suppl.), 53-54.
- Perna, F. M., Antoni, M. H., Baum, A., Gordon, P., and Schneiderman, N. (2003). Cognitive behavioral stress management effects on injury and illness among competitive athletes: a randomized clinical trial. *Annals of Behavioral Medicine*, 25(1), 66-73.
- Petrie, T. A. (1993). The moderating effects of social support and playing status on the life stress-injury relationship. *Journal of Applied Sport Psychology*, 5(1), 1-16.
- Reynolds, E. K., Schreiber, W. M., Geisel, K., MacPherson, L., Ernst, M., and Lejuez, C. W. (2013). Influence of social stress on risk-taking behavior in adolescents. *Journal of Anxiety Disorders*, 27(3), 272-277.
- Rubio, V. J., Pujals, C., de la Vega, R., Aguado, D., and Hernández, J. M. (2014). Autoeficacia y lesiones deportivas: ¿factor protector o de riesgo?

- [Self-efficacy and sport injuries: Is this a risk or a protective factor?]. *Revista de Psicología del Deporte*, 23(2), 439-444.
- Schomer, H. H. (1990). A cognitive strategy training program for marathon runners: Ten case studies. *South African Journal of Research in Sport, Physical Education and Recreation*, 13, 47-78.
- Starcke, K. and Brand, M. (2012). Decision making under stress: a selective review. *Neuroscience and Biobehavioral Reviews*, 36(4), 1228-1248.
- Tranaeus, U., Johnson, U., Engstrom, B., Skillgate, E., and Werner, S. (2014). A psychological injury prevention group intervention in Swedish floorball. *Knee Surgery, Sports Traumatology, Arthroscopy*. doi: 10.1007/s00167-014-3133-z.
- Williams, J. M. and Andersen, M. B. (1997). Psychosocial Influences on Central and Peripheral vision and reaction time during demandin tasks. *Behavioral Medicine*, 22(4), 160-167.
- Williams, J. M. and Andersen, M. B. (1998). Psychosocial antecedents of sport injury: Review and critique of the stress and injury model. *Journal of Applied Sport Psychology*, 10(1), 5-25.
- Williams, J. M. and Andersen, M. B. (2007). Psychosocial antecedents of sport injury and interventions for risk reduction. In: G. Tenenbaum and R. C. Eklund (Eds.), *Handbook of sport psychology* (pp. 379-403). New York: John Willey.
- Williams, J. M., Tonymon, P. and Andersen, M. B. (1990). Effects of life event stress on anxiety and peripheral narrowing. *Behavioral Medicine*, 16(4), 174-181.
- Williams, J. M., Tonymon, P. and Andersen, M. B. (1991). Effects of stressors and coping resources on anxiety and preripheral narrowing in recreational athletes. *Journal of Applied Sport Psychology*, 3(2), 126-141.