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1 **Psychosocial predictors and psychological prevention of soccer injuries: a**
2 **systematic review and meta-analysis of the literature**

3 **Maamer Slimani¹, Nicola Luigi Bragazzi^{2,3}, Hela Znazen^{1,4}, Armin Paravlic⁵, Fairouz**
4 **Azaiez⁶, David Tod⁷**

5 ¹*Research Laboratory “Sports Performance Optimization”, National Center of Medicine and*
6 *Science in Sports (CNMSS), Tunis, Tunisia*

7 ²*School of Public Health, Department of Health Sciences (DISSAL), Genoa University, Genoa,*
8 *Italy*

9 ³*Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child*
10 *Health (DINOEMI), Section of Psychiatry, Genoa University, Genoa, Italy*

11 ⁴*Department of Physical Education and Sport- Faculty of Education, Taif University, Saudi*
12 *Arabia*

13 ⁵*Science and Research Centre, Institute for Kinesiology Research, Garibaldijeva 1, 6000*
14 *Koper, Slovenia*

15 ⁶*High Institute of Sport and Physical Education, University of Sfax, Sfax, Tunisia*

16 ⁷*School of Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, UK*

17

18 **Corresponding author:**

19 Maamer Slimani

20 *Research Laboratory “Sports performance Optimization”, National Center of Medicine and*
21 *Science in Sports (CNMSS), Tunis, Tunisia*

22 Phone: + 216-97067695

23 E-mail: maamer2011@hotmail.fr

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30 relevant to the content of the present review.

31

32 **Abstract**

33 **Objectives:** To examine (a) the relationships between the psychosocial risk factors and injury
34 rates and (b) the effects of psychological-based prevention interventions on the injury risk of
35 soccer players.

36 **Design:** Scholarly electronic databases (PubMed/MEDLINE, Google Scholar, Scopus) were
37 searched on 1 January 2017, complemented by manual searches of bibliographies.

38 **Setting:** Systematic review and meta-analysis.

39 **Participants:** We identified 13 eligible studies, including a total of 1,149 injured soccer players
40 aged between 14 and 36 years.

41 **Main Outcome Measures:** Psychosocial risk factors, psychological-based prevention
42 interventions and injury risk in soccer players.

43 **Results:** Personality traits, such as trait anxiety and perceived mastery climate, along with a
44 history of stressors, like negative-life-event stress or high level of life stress, daily hassle, and
45 previous injury, are the main predictors of injury rates among soccer players. Also, from injury
46 prevention studies, it has been shown that psychological-based interventions reduce injury rates
47 (effect size = 0.96; 95% CI 0.34-1.58; p = 0.002) in senior soccer players.

48 **Conclusions:** Practitioners need to ensure injured soccer players are psychologically and
49 socially ready to play. They should also employ psychological-based interventions (i.e.,
50 mindfulness, imagery, self-talk, stress management, relaxation, goal setting) when designing
51 injury prevention programs.

52

53 **Key words:** psychosocial predictors; psychological prevention; injury rates; football.

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61 **Introduction**

62 Soccer is the most common sport in the world and has high mental and physical demands
63 (Slimani et al., 2016; Slimani & Nikolaidis, 2017). It is one of the most complex contact sports
64 whose frequency of practices during the season varies depending on the training phase or
65 competing level (Kirkendall, 2011; Scott & Anderson, 2013). Accordingly, as competitive level
66 rises, it is a common practice for some football teams to play one or two matches per week, and
67 take part in international tournaments, such as world championships and the Olympic Games
68 (Slimani & Nikolaidis, 2017). These heavy schedules of practice, matches, and high
69 psychophysical demands, lead to high risks and rates of injury in professional (Hawkins &
70 Fuller, 1996; Hawkins et al., 2001) and amateur players (Junge et al., 2004; Kofotolis et al.,
71 2007). Furthermore, soccer players in an overreaching phase of training or intense competition
72 would appear to be particularly vulnerable to injuries and psychophysical stress (Ekstrand,
73 Hägglund, & Walden, 2011). In other words, this intensive phase may lead to the accumulation
74 of stress, fatigue and its concomitants (i.e., non-functional overreaching or overtraining), and,
75 consequently, can increase the risk of injury and illness to the athlete (Meeusen et al., 2013).
76 For this reason, because the potential to eliminate physical stressors is limited in sport, a
77 potential avenue for decreasing injury rates is to help players cope psychologically with
78 stressors (Galambos et al., 2005). Previous studies suggest that psychosocial factors could affect
79 injury risk among athletes. To provide a theoretical framework to explain the relationship
80 between psychological variables and injury occurrence, the model of stress and athletic injury
81 was developed (Williams & Andersen, 1998). Williams and Andersen (1998) provided a
82 comprehensive, interactional model explaining the psychological antecedents (hardiness, sense
83 of coherence, achievement motivation, sensation seeking, locus of control, and trait anxiety as
84 personality traits) of sport injuries. In this model the stress response has a bidirectional
85 relationship with the athlete's cognitive appraisals of potentially stressful situations (e.g.,
86 practice, game competition). Both the magnitude of the stress response and the athlete's
87 appraisals of the situation may be influenced by the interplay between various psychosocial
88 factors, which are divided into three broad categories: personality factors, history of stressors,
89 and coping resources. Initially Andersen and Williams (1988) included hardiness, sense of
90 coherence, achievement motivation, sensation seeking, locus of control, and trait anxiety as
91 personality traits. Some authors have also included daily hassles, life events, and previous
92 injuries as history of stressors (Van Mechelen et al., 1996; Williams & Anderson, 1998).
93 Furthermore, in the model (Williams & Andersen, 1998) intervention approaches targeted to

94 influence/buffer the stress response through psychosocial, physiological, and attentional
95 pathways may reduce injury rates. A recent meta-analysis (Ivarsson et al., 2016) showed that
96 including psychological training programs into other types injury prevention programs (e.g.,
97 biomechanical, strength training) within sports has the potential to reduce the risk of sport
98 injuries and may have positive outcomes for athletes, clubs, and communities.

99
100 The aforementioned model (Williams & Andersen, 1998) and meta-analysis review
101 (Ivarsson et al., 2016) were limited by several methodological issues. First, some psychological
102 variables, not included in the model of stress and athletic injury (Williams & Andersen, 1998),
103 have been found to be related to increased injury risk, such as poor visual and verbal memory,
104 high levels of psychophysiological fatigue, behaviors related to ignorance of stressors and/or
105 neglecting recovery (Liederbach & Compagno, 2001; Richardson, 2008; Swanik et al., 2007).
106 Second, the meta-analysis review (Ivarsson et al., 2016) in this area included studies that
107 evaluated the psychosocial predictors and the effects of prevention interventions on injury rates
108 in different sports, limiting applicability to specific sporting contexts. Thus, more review is
109 required in order to single out those specific psychological risk factors targeting the many
110 different groups of athletes, such as soccer players. More specifically, for example, Johnson
111 and Ivarsson (2011) found that increased injury risk among players in junior soccer was
112 predicted by players having ineffective coping skills, such as worry.

113 In the last two decades, the effectiveness of psychological interventions on injury rate
114 reduction has also been demonstrated (Driediger et al., 2006; Edvardsson, Ivarsson, & Johnson,
115 2012). Some studies have shown that psychological preventive interventions, such as goal
116 setting, positive self-talk, imagery, relaxation, mindfulness, and cognitive-behavioral
117 biofeedback, contribute positively to the prevention of injuries, physical recovery from injury,
118 improved self-confidence levels and the decrease of cognitive and physical anxiety (Driediger
119 et al., 2006; Edvardsson, Ivarsson, & Johnson, 2012; Johnson, Ekengren, & Andersen, 2005).
120 A review of soccer-specific intervention studies will complement the focus on psychosocial
121 risk factors in this sport and together the two aims may present a broader knowledge base on
122 which to generate practice guidelines and identify future research needs. Therefore, attempting
123 to extend the previous studies, the aims of the present systematic review and meta-analysis were
124 to examine (1) the psychosocial risk factors of soccer injuries and (2) the effects of
125 psychological prevention interventions on the injury risk in soccer players.

126 **Materials and methods**

127 **Search strategy**

128 This review was conducted in accordance with the Preferred Reporting Items for Systematic
129 Reviews and Meta-analyses (PRISMA) Statement guidelines (Moher et al., 2009; Figure 1).
130 Scholarly electronic databases (PubMed/MEDLINE, Google Scholar, Scopus) were searched
131 from inception up to 1st January 2017. Moreover, we performed manual searches of relevant
132 journals and reference lists obtained from published articles. Electronic databases were
133 searched using the following keywords: “soccer” in combination with the terms “psychosocial
134 predictors”, “stress”, “anxiety”, “risk factors”, “history of stressors”, “personality traits”,
135 “coping”, “psychological prevention”, and “injuries”.

136

137 **Inclusion and exclusion criteria**

138 To be suitable for inclusion, studies had to fulfill the following selection criteria: (a) studies
139 examined either the relationships between the psychosocial risk factors (e.g., stress response,
140 history of stressors, coping, and personality traits) and injury rates among soccer players or
141 investigations studied the effects of psychological prevention interventions on injury rates; (b)
142 studies recruiting male or female soccer players and at any age category and any level as
143 participants and (c) original studies written in English. Reviews, comments, interviews, letters,
144 posters, book chapters, and books were excluded.

145

146 **Data extraction**

147 Two authors independently extracted data (participant details, intervention details, outcome
148 measures, and main conclusions), using an *ad hoc* structured form. We resolved discrepancies
149 by referring to the original papers and through discussion.

150

151 **Procedure and data analysis**

152 Once the database of papers had been finalised, we followed procedures described by Edwards
153 et al. (2014) and Sallis et al. (2000) to analyse the content. Each study was listed first by year,
154 and then alphabetically according to first author within each year. Papers meeting the inclusion
155 criteria are indicated in the reference list at the end of this manuscript with an “*”. The data
156 tables were then analysed to create summary tables presented in the results section of this
157 article, the creation of which involved a number of stages. First, the relationships the injury
158 rates had with other variables were examined. Second, the effects of psychological-based
159 prevention interventions on the injury risk in soccer players were also examined.

160 For each variable, the number of studies and observations and percentage of these observations
161 in which the variable's relationship with the injury rates was positive (+), negative (-) or
162 insignificant (0) are presented. Consistent with Sallis et al. (2000) and other systematic reviews
163 (e.g. Edwards et al., 2014), the 'summary code' column reflects the consistency with which
164 each variable related with the injury rates. A '0' indicates no consistent relationship and was
165 applied when 0–33% of the studies supported an association (and the majority of studies had
166 revealed no relationship with the injury rates). The '?' symbol indicates an indeterminate
167 relationship and signifies that 34–59% of the studies were in agreement regarding a relationship
168 (Sallis et al., 2000). A '+' or '-' symbol indicates a consistent association and was applied when
169 60% or more of the studies revealed either a significant positive or negative relationship (Sallis
170 et al., 2000). For example, researchers had examined the relationship between the injury rates
171 and history of stressors in eight studies. The summary code given was '+' (or positive) because
172 the majority of studies had revealed positive relationship with the injury rates (75% for a
173 positive relationship).

174 Meta-analysis of findings examining psychosocial predictors of injury rates among soccer
175 players was not conducted. Most studies did not contain/disclose sufficient quantitative details
176 to enable us to carry out a meta-analysis, without making too many inferences to data published
177 in other articles or relying on assumptions not stated explicitly in the texts. Also, the meta-
178 analyses would likely have been underpowered given the methodological heterogeneity within
179 the included studies, combined with the sample number of studies within each analysis
180 (Borenstein et al., 2009). A semi-quantitative synthesis, as that above-mentioned and described,
181 is a good compromise to provide readers with a summary of consistent research patterns and
182 trends.

183 However, for studies examining the effects of psychological prevention intervention on soccer
184 injuries, it was possible to perform a meta-analysis. ES were computed from the Mann-
185 Whitney's U test values, converting U figures in r coefficients (rank-biserial correlation,
186 according to Cureton) and the latter in Cohen's *d*.

187 The magnitude of the effects was interpreted as changes using the following criteria: trivial (<
188 0.20), small (0.21–0.60), moderate (0.61–1.20), large (1.21–2.00), very large (2.01–4.00) and
189 extremely large (> 4.00) (Hedges, 1981).

190 The 95% confidence interval (95%CI) for the Cohen's *d* was approximated using the formula
191 derived from Nakagawa and Cuthill (2007).

192

193 **Results**

194 **Search results**

195 The initial search yielded 102 items, which, after removing the duplicates, reduced to 67. A
196 number of studies (N = 37) were discarded and the full text of 19 studies was assessed for
197 eligibility. Finally, only 13 studies were included concerning the psychosocial predictors and
198 the effects of psychological prevention interventions of soccer injuries (Figure 1). More
199 specifically, ten investigations studied the psychosocial predictors of injury rates among soccer
200 players (Table 1). Three psychological prevention interventions were retrieved to determine its
201 effects on soccer injuries (Table 2).

202

203 ***Figure 1 here***

204 ***Table 1 here***

205 ***Table 2 here***

206

207 **Demographic characteristics**

208 The final 13 studies reported on 1,149 injured soccer players across an age range between 14-
209 36 years old. From studies where there was clarity in gender ratio the total participant figure
210 included 46.8% (n = 538) male and 32.9% (n = 378) female injured soccer players while in case
211 of 233 (20.3%) participants' gender was not specified. The players included in this review were
212 subdivided based on competitive level as follows: (a) international (6 studies: 46.1%), (b)
213 national (1 study: 7.7%) and (c) amateur (4 studies: 30.8%).

214

215 **Psychosocial predictors of injury rates in soccer players**

216 Empirical research findings indicated that personality attributes (i.e., trait anxiety, perceived
217 mastery climate [100%]) and history of stressors (i.e., negative-life-event stress or high level of
218 life stress, daily hassle, previous injury [75%]) were positively correlated with injury rates
219 among soccer players. Furthermore, there were insignificant relationships between stress
220 responses [100%], coping [100%] and injury rates (Table 3).

221 ***Table 3 here***

222

223 **Psychological prevention interventions of injuries among soccer players**

224 For injury prevention studies, only one study showed a statistically significant decreased injury
225 rate in the treatment group compared to control group (Johnson et al., 2005). The intervention
226 group involved five distinct treatments (a) somatic and cognitive relaxation, (b) stress
227 management skills, (c) goal setting skills, (d) attribution and self-confidence training, and (e)

228 identification and discussion about critical incidents related to their football participation and
229 situations in everyday life. However, although two studies reported no statistically significant
230 differences between treatment and control groups in junior soccer players (p-values were found
231 to 0.054 and 0.077, statistically borderline significant), the results were in the expected direction
232 and were interpreted as having clinical significance (Edvardsson et al., 2012; Ivarsson et al.,
233 2015). Methodological factors, such as small sample size, may account for the lack of statistical
234 significance.

235 Cohen's *d* ES for the studies ranged from 0.59 (medium effect) to 1.41 (large effect). The pooled
236 ES yielded a value of 0.96 [95% CI 0.34-1.58; $p = 0.002$] (large effect), as shown in the forest
237 plot (Figure 1). Visual inspection of the funnel plot (Figure 2) seems to indicate publication
238 bias.

239

240 ***Figure 1***

241 ***Figure 2***

242

243 **Discussion**

244 With regards to the purpose of the current review, the present data showed moderately large
245 effect of psychological prevention interventions on reducing of injury rates in soccer players.
246 Moreover, the review found that trait anxiety, perceived mastery climate, negative-life-event
247 stress or high level of life stress, previous injury, and daily hassle were the main psychosocial
248 predictor variables of injury risk among soccer players.

249 In professional soccer it has been estimated there are 11.2 injuries per 1000 match hours and
250 3.9 injuries per 1000 training hours from a 10-season study (Le Gall et al., 2006). Traditionally,
251 the treatment of injured athletes has involved only the physical aspects of injury. Moreover, the
252 sports medicine field is becoming more aware of the importance of psychological factors for
253 the treatment of sports injuries (Johnson, Ekengren, & Andersen, 2005; Heaney, 2006; Junge,
254 2000; Steffen, Pensgaard, & Bahr, 2009; te Wierike et al., 2013). In addition, by reviewing the
255 evidence, the current review revealed the association between history of stressors, personality
256 traits, and injury rates among soccer players (Devantier, 2011; Ivarsson, Johnson, & Podlog,
257 2013; Johnson & Ivarsson, 2011; Passer and Seese, 1983). Thus, in keeping with the stress-
258 injury model presented above, the associations between history of stressors and injury rates
259 could be explained by suggesting that prolonged stress can generate changes in the functions of
260 the brain's neurological networks (i.e., decreased the communication between the left and right

261 cerebral hemispheres and the information flow between the brain functions), which may then
262 decrease players' abilities in making decisions that have been related to increased injury risk
263 (Fuchs & Flugge, 2003; Gabbett et al., 2012; Ivarsson et al., 2016). Furthermore, Ivarsson et al.
264 (2016), for example, showed that the stress response ($r = 0.27$) was the predictor that had the
265 strongest associations with injury rates. Moreover, history of stressors ($r = 0.13$) and coping ($r =$
266 -0.07) had weaker relationships with injury rates, whereas, the association between personality
267 traits and injury rates was marginal ($r = 0.01$). The evidence in the current review suggests that
268 the player who can effectively manage life stress and anxiety will be less likely to be injured.
269 Future studies are needed to examine the psychosocial factors of soccer players according to
270 injury severity and type, playing positions, competitive levels and age. Such work may allow
271 the tailoring of interventions to individual athletes' needs.

272 Since psychological predictor variables have received support it could be expected that
273 interventions aimed at reducing them would reduce injury risk. Some studies have shown that
274 psychological training can be used by injured athletes as a strategy to help them cope during
275 rehabilitation (Beneka et al., 2013; Driediger, Hall, & Callow, 2006; Law et al., 2006; Slimani,
276 Tod, et al., 2016). Preliminary evidence suggests that psychological skills contribute positively
277 to the prevention of injuries, physical recovery from injury, improved self-confidence levels,
278 and decreased cognitive and physical anxiety. These psychological skills are: (a) somatic and
279 cognitive relaxation, (b) stress management skills, (c) goal setting skills, (d) attribution and self-
280 confidence training, and (e) identification and discussion about critical incidents related to their
281 football participation and situations in everyday life (Johnson, Ekengren, & Andersen, 2005).
282 For example, Johnson et al. (2005) examined the effects of a psychological skills training
283 package (i.e., relaxation, stress management, and goal setting) on the risk of injuries among 32
284 soccer players in Sweden. They showed that the treatment group sustained three injuries (0.22
285 per athlete) and the control group faced 21 injuries (1.31 per athlete), outcomes of significant
286 difference. Edvardsson et al. (2012) studied the effects of a cognitive behavioral biofeedback
287 intervention on the number of injuries among 27 Swedish soccer players from elite high
288 schools. They attributed the non-significant differences between treatment and control groups
289 as a reflection of the small sample size. In addition, Ivarsson et al. (2015) found that the
290 mindfulness practice they implemented had an effect on injury occurrence that would be
291 meaningful for soccer athletes, coaches, and sport administrators. There are many potential
292 explanations for the mindfulness group having fewer injuries, as well as more non-injured
293 players, than the control group. One possible explanation could be that mindfulness practice

294 leads to functional changes in the brain's different attention systems (Fox et al., 2006). Given
295 that previous study has found changes in perception and attention (e.g., peripheral vision
296 narrowing) to be related to sport injuries (Rogers & Landers, 2005), it is likely that if players
297 are better in directing their attention towards important stimuli, the probability of them being
298 injured will decrease. An overall hypothesis to be drawn from the present systematic review
299 and meta-analysis is that injury reduction is possible to obtain for soccer players having high
300 injury-risk profiles using combinations of psychological interventions in a brief therapy model.

301 Collectively the results from existing research shows that practitioners and football players have
302 a range of psychological interventions they can use to avoid injuries, such as goal setting,
303 attribution training relaxation, and stress management. However, this was only evident in one
304 third of studies reviewed. More specifically, only the study containing stress management and
305 relaxation components had a significant effect on injury rates (Johnson et al., 2005). Simply,
306 stress management interventions aimed at increasing athletes' stress management skills and, in
307 particular, at reducing muscle tension and attentional distractibility usually provoked by
308 stressful conditions, contributes to a reduction in the number of sport injuries youth athletes
309 sustained (Olmedilla-Zafra et al., 2017). This observation can also be explained by taking into
310 account that periods of high stress influence cortisol and oxytocin release, which may have a
311 relationship to injury risk (Miller et al., 2007) *via* immune (Hänsel et al., 2010; Maes et al.,
312 1998) and pain (Moberg, 2003) responses. Stress management interventions can have a
313 beneficial effect on these immune and pain responses (Maddison and Prapavessis, 2005; Perna
314 et al., 2005; Tranaeus et al., 2015). Reduced stress levels are also associated with amygdala
315 activation and this may, consequently, reduce injury risk by improving attention and decision-
316 making capacity (Ivarsson et al., 2015; 2017; Gabbett et al., 2012). Thus, relaxation intervention
317 may decrease injury risk among athletes by increasing the activity of the parasympathetic
318 nervous system and reducing the stress response (Davis et al., 2008). Olmedilla et al. (2015)
319 performed a systematic review of 14 preventive intervention studies aimed at reducing the risk
320 of injury in a sports setting. Only 7 studies used control groups and a sample large enough to
321 compare groups meaningfully. The review showed that for 4 out of these 7 studies significant
322 differences could be found. Therefore, it is difficult to determine the strength of the empirical
323 support in favour of a psychological intervention being useful for preventing sports injuries.
324 Some factors might lay at the root of these inconclusive results, such as the use of standardized
325 interventions regardless of the reactivity to stress of each individual, the use of short-term

326 interventions, the wide range of intervention objectives, and the lack of well-controlled study
327 designs (Olmedilla et al., 2015).

328 Furthermore, what existing research does not reveal, however, is the best way to implement
329 these interventions. Future research is needed to explore best practice. For example, there may
330 be a matching process, whereby certain interventions are best suited to particular athletes who
331 are experiencing specific stressors or have high levels of particular traits. To illustrate,
332 mindfulness may be suitable for athletes with high levels of cognitive anxiety. Future research
333 could explore which interventions are best suited to which athletes. As another avenue of
334 research, it is not known why these intervention work with injured athletes – what are the active
335 ingredients in service delivery. Research that explores the active ingredients will lead to specific
336 recommendations on how to use interventions.

337 A limitation of the present study is that we have not conducted a meta-analysis assessing the
338 different psychosocial predictors of injury rates among soccer players. This was due to most
339 studies not containing/disclosing sufficient quantitative data to enable us to perform an in-depth
340 meta-analysis. Despite the low to moderate heterogeneity between studies, direct comparison
341 among different levels of competition or playing level and its influence on experience of
342 stressor could not be performed because of the low number of retrieved and included studies.
343 Furthermore, this review excluded studies that 1) did not provide information that would allow
344 us to complete the planned statistical analyses and 2) did not involve soccer players, having
345 implications for clinical decision making on general athletic populations and not specifically
346 on soccer.

347

348 **Conclusion**

349 The present review shows that history of stressors and personality attributes are the
350 psychosocial variables with the most consistent evidence in predicting injury rates among
351 soccer players. The data also suggests that psychological prevention interventions may reduce
352 the frequency of soccer injuries. Psychological skills training, particularly somatic and
353 cognitive relaxation, stress management skills, goal setting skills, attribution and self-
354 confidence training, and identification and discussion about critical incidents related to their
355 football participation and situations in everyday life, do probably reduce the injuries rates in
356 soccer players, even though evidence of this was found only in one third of the studies reviewed.
357 Psychological-based interventions should be considered by physiotherapists and other

358 professionals when designing injury prevention programs. However, given the above-
359 mentioned limitations, further high-quality research in the field is urgently needed.

360

Highlights

- History of stressors and personality attributes are the main predictors of injury rates among soccer players.
- Psychological-based prevention interventions might have potential to reduce the frequency of soccer injuries.
- The evidence in this review suggests that the player who can effectively manage life stress and anxiety will be less likely to be injured.
- Since the effectiveness of psychological interventions was evident only in one third of studies, further research is needed.

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Table 1. Psychosocial predictors of soccer injuries.

Study	Participants characteristics (n; age; level; gender)	Study design	Predictor variables	Statistical analysis	Main findings
Brink et al. (2010)	n=53; 15-18 years (16.5±1.2 years); elite; NR	Prospective, longitudinal cohort	History of stressors, stress responses using the RESTQ-Sport and the RPE scores	Multinomial regression analysis	Stressors, namely duration (OR 1.14 [95%CI 1.06-1.23]), load (OR 1.01 [95%CI 1.00-1.02]), monotony (OR 2.53 [95%CI 1.22-5.50]) and strain (OR 1.01 [95%CI 1.00-1.01]) are statistically significant predictors of risk injury
Devantier (2011)	n=87 out of a list of n=143 subjects (regression analyses carried out on n=66); 18-34 years (24.61±4.15 years) ; elite; male	Prospective, longitudinal cohort	History of stressors, personality traits that may increase stress responses, coping, using the CTAT, the ACSI – 28, the Williams and Andersen inventory	ANOVA, Pearson’s correlation analysis, and logistic regression analysis (backward likelihood-ratio)	Coping with adversity (OR 0.731 [95%CI 0.563-0.949]) is a predictor of risk injury (considering also primary injuries; OR 0.762 [95%CI 0.598-0.971] excluding primary injuries)

Ivarsson and Johnson (2010)	n=48; 16-36 years (22 years); 3 different teams at a competitive level in Sweden (division 4 – 6, middle – low league) ; male	Prospective, longitudinal cohort	History of stressors, using the FWS, the SSP, the LESCA, the Daily Hassles Scale, the Brief COPE	ANOVA, MANOVA, linear regression analysis (backward method)	Coping variables acceptance and self-blame explain 14.6% of the variance of injuries (behavioral disengagement p=0.040 and self blame p=0.044). Personality traits like somatic trait anxiety (p=0.025), psychic trait anxiety (p=0.044), stress susceptibility (p=0.016), and trait irritability (p=0.023) predict injury risk, in particular stress susceptibility (beta=0.357, p=0.016, explaining up to the 10.7% of the total variance)
Ivarsson et al. (2013)	n=56 ; 16-36 years (25.05±5.46 years); professional; 38	Prospective, longitudinal cohort	Personality traits that may increase stress responses, history of stressors, coping, using the SSP,	MANOVA, path analysis	Trait anxiety, negative-life-event stress, and daily hassle explain 24% of the variance.of

	males and 18 females		the LESCA, the Brief COPE, the HUS		injuries. Path coefficient between daily hassle and injury frequency yielded statistical significance (0.55)
Ivarsson et al. (2014)	n=101; 15-19 years (16.7 ± 0.9 years); elite; 67 males and 34 females	Prospective, longitudinal cohort	History of stressors, using the HUS	Intraclass correlations, latent growth curve analysis	Level daily hassle and change daily hassle predict injury risk
Johnson and Ivarsson (2011)	n=82 out of a list of n=108 subjects; 17-19 years; high schools; 85 males and 23 females	Prospective, longitudinal cohort	History of stressors, personality traits that may increase stress responses, coping, using the LESCA, the ACSI – 28, the SAS, the SSP	ANOVA, linear and logistic regression analyses	Negative life event stress (p=0.047), somatic trait anxiety (p=0.02), negative coping (p=0.019) and mistrust (0.008) predict injury risk
Kontos (2004)	n=260 ; 11-14 years (12.68±0.92 years); NR; 148 males and 112 females	Prospective, longitudinal cohort	History of stressors, using the Risk of Injury in Sport Scale, the Risk-Taking Behaviors Scale, the Estimation of Ability and Overestimation of Ability	Pearson’s correlation analysis, case-control analysis, MANOVA	Perceived risk and estimation of ability represent significant psychological risk factors
Passer and Seese (1983)	n=104 out of a list of n=123 subjects; NR;	Prospective, longitudinal cohort	History of stressors, using	ANOVA	Negative life change (p=0.02)

	collegiate varsity; NR		the LES, the STAI		predicts injury risk
Steffen et al. (2009)	n=157; 14-16 years; NR; female	Randomized trial	Stress responses, using the POSQ, the PMCSQ, the LESCA	MANOVA, logistic and Poisson's regression analyses, generalized estimated equations	LES total score (OR 1.03 [95%CI 1.01- 1.05]) and motivational climate mastery (OR 1.34 [95%CI 1.04- 1.72]) predict injury risk
Wilkerson (2012)	n=76; 19.8±1.5 years; national; NR	Prospective cohort study	Stress responses	Cross- tabulation and stratified analyses, ROC analysis	Neurocognitive reaction time predicts injury risk (OR 2.94 [90%CI 1.19- 7.25]; RR 2.17 [90% 1.10-4.30])

ACSI – 28: Athletic Coping Skills Inventory – 28; ANOVA: analysis of variance; CTAT: Competitive Trait Anxiety Test; FWS: Football Worry Scale; HUS: Hassles and Uplifts Scale; LES: Life Experiences Survey; LESCA: Life Event Scale for Collegiate Athletes; MANOVA: multivariate analysis of variance; NR: not reported; OR: Odds-Ratio; PMCSQ: Perceived Motivational Climate in Sport Questionnaire; POSQ: Perception of Success Questionnaire; RESTQ-Sport: Recovery Stress Questionnaire for athletes; ROC: Receiver Operating Characteristic/Relative Operating Characteristic; RPE: Rate of Perceived Exertion; RR: Relative Risk; SAS: Sport Anxiety Scale; SSP: Swedish universities Scales of Personality; STAI: State-Trait Anxiety Inventor

Table 2. Effects of psychological prevention intervention on soccer injuries.

Study	Characteristics (age; gender; level; n; years of experience)	Intervention (length)	Measurement	Outcome
Edvardsson et al. (2012)	16–19 years; EG: (<i>n</i> =13 out of an initial list of 15 subjects) 9 males, 6 females CG: (<i>n</i> =14) 13 males, 1 female; high school	EG: self regulation technique (thought stopping, somatic relaxation, breathing) video clips and stress management (9 weeks; 7 sessions/30-60 minutes)	ACSI-28; LESCA; SAS; injuries frequency; time loss due to injuries	NSD between EG and CG in the injuries frequency (Cohen's <i>d</i> =0.89 [95%CI 0.14-1.63], <i>p</i> =0.054)
Ivarsson et al. (2015)	16-19 years ; 31 males and 10 females; EG: (<i>n</i> = 21) males and females, CG: (<i>n</i> = 20) males and females; junior elite	EG: mindfulness practice (6 months; 7 sessions/45 minutes)	Injury occurrence	NSD in injury occurrence during the study period between the EG and the CG (Cohen's <i>d</i> =-0.59 ([80%CI -0.37 to -0.74], <i>p</i> =0.077) The participants in the EG experienced fewer injuries (total 8) than the participants in the CG
Johnson et al. (2005)	Male: 22.9 years, females: 20.1 years; EG: (<i>n</i> =13 out of an initial list of 16 subjects) 4 males, 9 females, CG: (<i>n</i> =	EG: Relaxation, stress management, goal setting, attribution, self	ACSI-28; LESCA; SAS; injuries frequency	SD between EG and CG in the injuries frequency (Cohen's <i>d</i> =1.41 [95%CI 1.06-1.76])

16) 8 males, 8 confidence, critical
females; high incidence diary
competitive level, (19 weeks; 6
out of an initial list sessions/45-90
of 132 screened and minutes)
32 potentially
eligible subjects

SCS: Sports Confidence State; CAS: Competition Anxiety State; SD: significant differences between groups;
NSD: no significant differences between groups; EG: experimental group; CG: control group; ACSI-28:
Athletic Coping Skills Inventory-28; LESCA: Life Events Survey for Collegiate Athletes; SAS: Sport Anxiety
Scale.

Table 3. Relationships between injury rates and psychosocial variables.

	No. of studies	% of effects supporting presence of effect			Sum code
		+	-	0	
History of stressors	8	75		25	+
Stress responses	3			100	0
Personality traits	3	100			+
Coping	3			100	0

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) flow-chart.

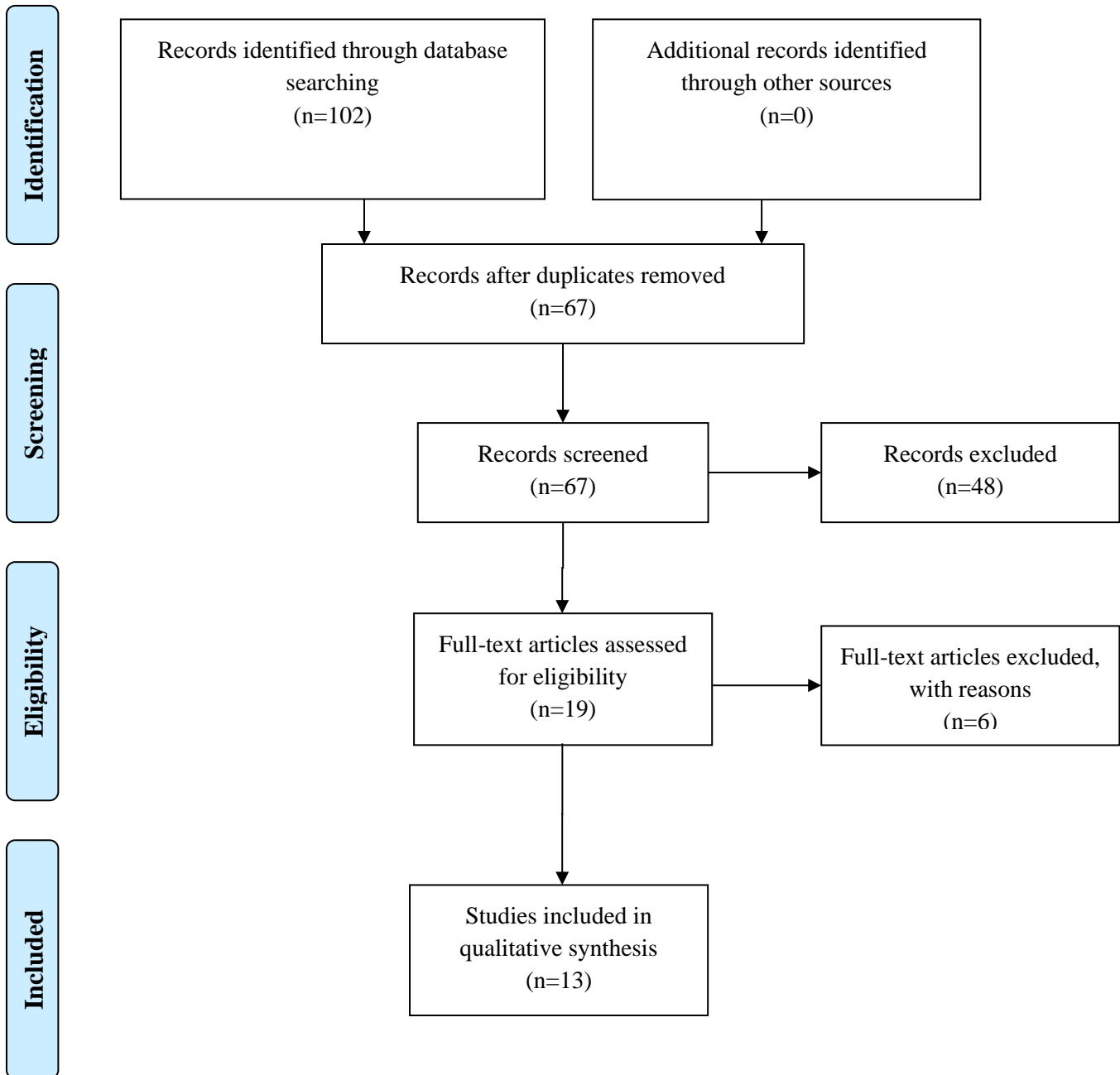


Figure 2. Forest plot of psychological prevention interventions of injuries among soccer players.

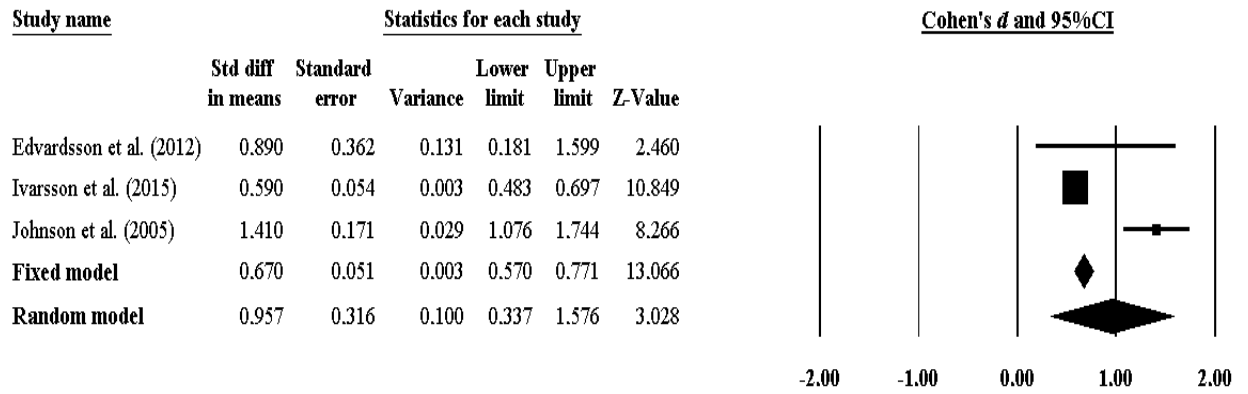


Figure 3. Funnel plot showing evidence of publication bias for the meta-analysis concerning psychological prevention interventions of injuries among soccer players.

