Scand J Med Sci Sports 2008
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DOI: 10.1111/j.1600-0838.2008.00797.x

SCANDINAVIAN JOURNAL OF
MEDICINE & SCIENCE
IN SPORTS

Self-reported psychological characteristics as risk factors for injuries in female youth football

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Accepted for publication 28 January 2008

Identifying and understanding injury risk factors are necessary to target the injury-prone athlete and develop injury prevention measurements. The influence of psychological factors on injuries in football is poorly documented. The purpose of this 8-month prospective cohort study therefore was to examine whether psychological player characteristics assessed by a self-administered questionnaire represent risk factors for injury. At baseline, female football players (14–16 years) were asked to complete a detailed questionnaire covering player history, previous injuries, perception of success and motivational climate, life stress, anxiety and coping strategies. During the 2005 season, a total of 1430 players were followed up to record injuries. A history of a previous injury [odds ratio (OR) = 1.9 (1.4; 2.5), $P < 0.001$] increased the risk of a new injury to the same region. There were significant differences in disfavor for previously injured compared with non-injured players for ego orientation ($P = 0.007$), perception of a performance climate ($P = 0.003$) and experienced stressful life events ($P < 0.001$). However, only high life stress ($P = 0.001$) and perception of a mastery climate ($P = 0.03$) were significant risk factors for new injuries. In conclusion, a perceived mastery climate and a high level of life stress were significant predictors for new injuries in a cohort of young female football players.

Background

Football (soccer) is probably the most popular sport worldwide, with a growing interest and an increasing number of female players in particular (FIFA, "big count," 2007). It is a contact sport and challenges physical fitness by requiring a variety of skills at different intensities (Cometti et al., 2001; Reilly & Gilbourne, 2003; Wisløff et al., 2004). Nevertheless, football is also associated with a large number of injuries for both genders.

As injury causation is usually complex, risk factors must be clearly established before interventions can be developed and targeted to injury-prone athletes (Bahr & Holme, 2003; Murphy et al., 2003; Emery et al., 2005). Most studies to date have addressed physical and biomechanical risk factors, e.g. abnormal joint kinetics and kinematics (Cowley et al., 2006; Krosshaug et al., 2007; Sigward & Powers, 2007), joint laxity (Östenberg & Roos, 2000; Söderman et al., 2001a), mechanical or functional instability (Östenberg & Roos, 2000; Söderman et al., 2001a), lower extremity strength (Knapik et al., 1991; Söderman et al., 2001a; Askling et al., 2003), muscular imbalances (Knapik et al., 1991), decreased range of motion (Árnason et al., 2004), previous injuries and inadequate rehabilitation (Tropp et al., 1985; Surve et al., 1994; Árnason et al., 2004; Hägglund et al., 2006).

However, successful performance in sports does not only require the athlete to be healthy and physically fit but also mentally prepared to play (Junge, 2000). Some researchers have hypothesized that certain athletes, as a result of their personality traits, have a particular predisposition toward getting injured (Taerk, 1977; Lysens et al., 1989; Junge et al., 2000).

The literature shows that measurements of sensation seeking, stress-coping strategies, competitive anxiety, behavioral traits and coping of life events seem to have an effect on the risk of sports injury in general (Andersen & Williams, 1988, 1999; Taimela et al., 1990b; Junge, 2000; Gunnoe et al., 2001; Johnson et al., 2005; Schwebel et al., 2007), but only four studies have addressed this issue in football players (Taimela et al., 1990b; Junge et al., 2000; Johnson et al., 2005; Schwebel et al., 2007). Except for one study on 11–12-year-old boys (Schwebel

et al., 2007), which did not find aggression or risk-taking behavior to increase injury risk, there is no clear evidence available on the relationship between personality characteristics and injury risk in youth football.

If a relationship between psychological factors and injury risk is established, it may be possible to identify a personality profile typical for the "injury-prone" athlete. Players at risk could then be targeted with injury prevention programs, as for example in a recent Swedish study on elite football players. In a 5-month prospective study, Johnson et al. (2005) identified players at injury risk through a screening with a questionnaire designed for psychosocial risk factors. High-risk players received an intervention that, among other factors, included relaxation and imagery training, which lowered the number of injuries in the intervention group after six sessions and two telephone contacts within 4 months of treatment.

A less studied framework to understand injury risk is a motivational perspective. A social climate that fosters a high level of competitiveness and internal rivalry, which are the characteristics of a performance-oriented climate, may result in a different injury risk compared with a climate that focuses on personal improvement and learning, such as a mastery climate (Ames, 1992). Some support for this was found by Pensgaard and Roberts (2000), who reported that levels of negative stress were significantly higher when athletes perceived a performance climate. A performance climate has also been linked to lower levels of sportpersonship (Miller et al., 2004; Kavassanu, 2006). However, to date, there are no studies that have investigated the possible relationship between motivational indices based on an achievement goal theory and injury risk.

Thus, in addition to examining more traditional stress and anxiety measures, which have revealed promising injury predictive power in the past, we wanted to investigate whether different motivational profiles could help in explaining injury occurrence among young female football players. Based on the revised Stress–Injury model developed by Williams and Andersen (1998), variables targeting both personality (i.e., goal orientations, trait anxiety and coping style) as well as situation (i.e., motivational climate and life events) may be useful to predict new injuries.

The aim of this prospective one-season cohort study involving young female football players was to examine whether psychological characteristics assessed by a pre-season self-administered questionnaire represent risk factors for new injuries. We hypothesized that there would be an increased injury risk among predominantly ego-oriented players, also among players who perceive a performance-oriented climate, and among players with low coping strategies and high levels of life stress.

Material and methods

Study population

This study is based on data from a randomized trial on young female football players examining the effect of a specific training program designed to prevent injuries. The design, the intervention program and the results of the study have been described in detail in a separate report (Steffen et al., 2008a). All teams ($n = 157$) in the southeast region of Norway that had registered to participate in the Under-17 league system in the 2005 season were invited to take part in the study. Of these, a total of 113 teams (72%) volunteered to be included. The competitive season lasted from the end of April until mid-October, interrupted by a 7-week summer break without regular league matches, but with some invitational tournaments. The teams were also followed for 2 months of the pre-season period (March/April). Throughout the season, the teams played 14–24 league matches and trained one to three times a week.

Before the start of the pre-season, the players received written and oral information about the study, and it was emphasized that participation was voluntary. The study was approved by the Regional Committee for Research Ethics, and written consent was obtained. A player was entered into the study if she was registered by the team as participating in the U17 league system, which means that she had to be 16 years or younger. Players who were injured at the start of the study were included from the time they returned to play, but this pre-existing injury was not included in the data analysis.

Risk factor questionnaire

During the 2-month pre-season period, each player was asked to complete a detailed questionnaire covering sports participation, a history of previous knee, ankle, groin or hamstring injuries, as well as present symptoms and function of the lower limbs. However, the last part of this comprehensive questionnaire included questions related to psychological player characteristics that formed the basis for the present paper.

These characteristics were assessed by five established self-evaluation questionnaires, and all questions were chosen to answer one of the given alternatives: first, the Norwegian version (Roberts & Ommundsen, 1996) of the Perception of Success Questionnaire (POSQ) (Roberts et al., 1998) was used to assess task (six items) and ego (six items) goal orientation. Further, the Norwegian version (Roberts & Ommundsen, 1996) of the Perceived Motivational Climate in Sport Questionnaire (PMCSQ) (Seifriz et al., 1992) was selected to assess perceptions of the motivational climate in their team. This instrument distinguishes the training climate in mastery (seven items) or performance climate (11 items). For the POSQ and the PMCSQ, entry was required on a five-point Likert scale. Items were scored from *strongly agree* to *strongly disagree*.

Third, psychological variables connected to a history of stressors were captured by the Life Event Scale for Collegiate Athletes (LESCA) (Petrie, 1992). The LESCA has been adapted from the Swedish version (Johnson et al., 2005). Similar to Gunnoe et al. (2001), the LESCA was modified by excluding 32 from the original 69 items to adapt the LESCA to the young cohort (modified LESCA; excluded question nos. 1–2, 8–11, 13-, 14, 18–20, 22, 27, 30, 36–38, 43, 44, 49, 53, 57, 58, 60–63, 65–69). Fourth, the recently validated Norwegian Sports Anxiety Scale (SAS-n) (Abra-

hamsen et al., 2006), a multidimensional sport performance trait anxiety inventory, provided three sub-dimensions: somatic anxiety (nine items), worry (seven items) and concentration disruption (five items), respectively.

Entry was required for one out of the two response alternatives (modified LESCA) and on a four-point Likert scale (*strongly agree* to *strongly disagree*) (SAS-n). For both questionnaires, the players were asked to indicate those items of life events (modified LESCA) and stress perceptions (SAS-n), and for each item, to rate its impact (i.e., debilitating or facilitating) at the time of occurrence (*extremely/strongly negative* to *extremely/strongly positive*).

Finally, the Norwegian version (Abrahamsen et al., 2006) of the Brief Cope (Carver, 1997) elicited information on stress coping divided into problem- (10 items), emotion- (14 items) or behavior-focused strategies (four items). Response options on a four-point scale ranged from *I have not been doing this at all* to *I have been doing this a lot*.

The full questionnaire was designed to be read optically, and data were transformed into an SPSS database (SPSS for Windows 15.0, SPSS Inc., Chicago, Illinois, USA). A questionnaire was accepted for scanning if the players had answered to each of the five sub-questionnaires. If a mark was placed outside a Likert box, the closest box was used. If two boxes were marked or a mark was placed between two boxes, that box that indicated the more negative response alternative was chosen. If no mark was placed at all, a missing value for that particular item was transformed and registered in the database. One of the standard procedures of the data program used for the optical reading allowed us and required a personal quality control of the data entry procedures.

For each of the separate sub-dimensions, a mean of the items included was calculated. Based on the maximum sum-score of perceived life stress in modified LESCA (37 points, mean 5 points), players were divided into two groups: players with a low level of perceived life stress (0–5 points) and those with a high stress level (>6 points).

The questionnaire was introduced to the players at a team meeting by staff who were carefully instructed in how the questionnaire should be completed. They were also present to answer questions while the players completed the questionnaire. It was ensured that the players had adequate privacy when answering the questions, and it took them about 60 min to complete the full questionnaire, including 15–20 min for the five psychological sub-questionnaires. Completed questionnaires were missing for players who did not attend the scheduled team meetings and for teams that, for unknown reasons, were unable to arrange team meetings.

Injury registration

To monitor all injuries throughout the 8-month study period, 18 physical therapists were recruited and assigned to the teams (typically five to seven teams each) to record injuries from March 1 through October 31. All coaches were asked to keep a continuous log of all data requested. The coach of each team was contacted by telephone and/or e-mails at least once a month to record new injuries, as well as all playing activities in training and matches. Injured players were interviewed by the injury recorders to assess aspects of the injury based on a standardized injury questionnaire. All information was registered using a web-based recording system.

An injury was registered if it caused the player unable to fully take part in match or training sessions the day following the injury *(time loss* injury) (Fuller et al., 2006). Acute injuries were defined as injuries with a sudden onset associated with a known trauma, whereas overuse injuries were those with a gradual onset without any known trauma. A previous injury was defined as an injury of the same type and the same site as an index injury and that occurred after a player had returned to full participation from the index injury. The location and type of injury were recorded. None of the injured players were examined or treated by any of the authors or the injury recorders involved in the study.

Statistics

This cohort study represents a secondary analysis of data from a randomized-controlled trial (Steffen et al., 2008a). As no differences were seen in injury rates between the intervention and control groups, the analyses did not factor in group assignment.

Descriptive data, such as anthropometrics, player history and scores for the different sub-dimensions within each questionnaire, are presented as mean values with standard deviations (SD). Intercorrelations between all psychological variables were calculated and are presented by Cronbach's α.

Groups of previously and prospectively injured and uninjured players were compared using MANOVA, with the various psychological factors as dependent variables and univariat *post-hoc* analyses when MANOVA was significant. Group differences are presented as *P*-values. In addition, using logistic regression models with new injury as a dependent variable, and the psychological variables as exposure variables, crude (cOR) and adjusted odds ratios (aOR) were calculated

We calculated relative risk (RR) with 95% confidence intervals (CI) for a one-unit increase in the exposure variable *years of organized football play* and *number of previous injuries*. All regression models were adjusted for the effects of cluster (person and team, using geographic region as a surrogate for team) using Poisson's regression models based on generalized estimating equations (GEE). Similarly, OR with 95% CI were calculated for the groups of players with previous injuries and high levels of life stress vs new injuries.

All tests were two-tailed, and *P*-values <0.05 were considered to be significant.

Results

Baseline data

A total of 1430 players (71% of the entire cohort) (Steffen et al., 2008a) completed the questionnaire on psychological player characteristics. The mean age of these players was 15.4 years (SD = 0.8, range 13–17), and they had been involved in organized football play for an average of 5 years (SD = 2; 1 to >6). Per limb, the average number of previous injuries to the ankle, knee, hamstring and groin was 1.8 (2.7; 0–16).

Analyses have been performed according to possible interactions between the different psychological variables and the intervention and control groups, respectively. However, no differences were found in the mean values between these two groups and, hence, no interaction effects were observed.

Of the 1430 players, 1003 (70.1%) reported previous injuries to the knee, ankle, hamstring or groin. There were significant between-group differences to the disadvantage of previously injured players for ego orientation ($P = 0.007$) and perception of a

performance climate ($P = 0.003$), as well as for use of emotion-focused coping strategies ($P = 0.015$). Further, players with an injury history perceived their anxiety reactions to be more debilitating for their performance than did uninjured players ($P = 0.031$) and had, in addition, experienced more stressful life events ($P < 0.001$) (Table 1).

Overall injury characteristics

A total of 296 of the 1430 players (20.7%) sustained at least one injury during the 2005 season. Of these players, 49 (3.4%), 16 (1.1%) and one (0.07%) incurred two, three and four injuries, respectively, leading to a total of 380 injuries. There were 330 acute injuries (Table 2) and 50 overuse injuries. The most common types of overuse injury were anterior lower leg pain (35% of all overuse injuries) and knee pain (21%), while an ankle sprain was the most common acute injury type (111 injuries, 34%). Of the 330 acute injuries included, 70 (21%) were re-injuries.

Risk factors for new injuries

The risk of injury was almost twice as high for players with a previous injury to the same region and site during the study period than for players without an injury history [OR = 1.9 (95% CI 1.4–2.5), $P < 0.001$]. In addition, the number of years of organized football play significantly influenced the risk of new injuries [RR = 1.12 (CI 1.04–1.22) for each additional year of play reported, $P = 0.003$]. The risk of sustaining a new injury increased with the

Table 1. Mean values and standard deviations (SD) for all scales and sub-dimensions within the five questionnaires for previously and prospectively injured and uninjured players

	Previously injured			Injured (2005 season)		
	Yes ($n = 1003$)	No ($n = 422$)	*P*-value	Yes ($n = 296$)	No ($n = 1134$)	*P*-value
1. Perception of success						
Task	4.41 (0.65)	4.37 (0.65)	0.33	4.44 (0.64)	4.39 (0.66)	0.26
Ego	2.64 (1.14)	2.47 (1.08)	0.007	2.63 (1.13)	2.58 (1.12)	0.57
2. Motivational climate						
Mastery	4.36 (0.54)	4.33 (0.52)	0.43	4.41 (0.50)	4.33 (0.54)	0.03
Performance	2.59 (0.78)	2.46 (0.74)	0.003	2.54 (0.76)	2.55 (0.77)	0.83
3. Life Event Scale						
Sum score	7.06 (5.35)	4.99 (4.75)	<0.001	7.30 (5.07)	6.21 (5.29)	0.001
Reaction	−0.53 (1.63)	−0.42 (1.88)	0.32	−0.34 (1.61)	−0.54 (1.73)	0.09
4. Sport Anxiety Scale						
Somatic	0.81 (0.54)	0.77 (0.51)	0.18	0.80 (0.53)	0.80 (0.54)	0.97
Reaction	0.16 (1.03)	0.24 (1.03)	0.21	0.22 (1.11)	0.17 (1.00)	0.50
Worry	1.11 (0.68)	1.10 (0.72)	0.76	1.11 (0.68)	1.10 (0.70)	0.89
Reaction	−0.56 (1.09)	−0.41 (1.19)	0.03	−0.50 (1.19)	−0.51 (1.10)	0.88
Concentration	0.66 (0.57)	0.66 (0.57)	0.99	0.71 (0.61)	0.65 (0.55)	0.06
Reaction	0.19 (1.23)	0.28 (1.33)	0.22	0.24 (1.31)	0.21 (1.25)	0.69
5. Brief cope						
Problem	1.41 (0.58)	1.38 (0.58)	0.43	1.41 (0.59)	1.40 (0.58)	0.68
Emotion	1.04 (0.46)	0.97 (0.45)	0.02	1.02 (0.44)	1.02 (0.46)	0.95
Behavior	0.26 (0.37)	0.24 (0.33)	0.43	0.25 (0.35)	0.26 (0.36)	0.64

Table 2. Number and proportion of acute time loss injuries in relation to injury type and location

	Contusion	Sprain	Strain	Dislocation	Fracture	Pain	Other	Total (%)
Head/neck	5	1					8	14 (4.2)
Upper body	9	5	4	1	6		2	27 (8.2)
Lower body	64	135	73	1	1	1	14	289 (87.6)
Hip	4							4 (1.2)
Groin			19					19 (5.8)
Thigh	3		46					49 (14.8)
Knee	19	20	2	1			11	53 (16.1)
Lower leg	12		4				1	17 (5.2)
Ankle	13	111					1	125 (37.9)
Foot (including toe)	13	4	2		1	1	1	22 (6.7)
Total (%)	78 (23.6)	141 (42.7)	77 (23.3)	2 (0.6)	7 (2.1)	1 (0.3)	24 (7.3)	330 (100)

number of previous injuries [RR = 1.08 (1.04–1.12) for each additional previous injury reported, $P<0.001$]. None of the anthropometric variables (age, height, weight, BMI) or weekly sports participation were significant risk factors for new injuries. The risk of an injury during the 2005 season was 70% increased for players with a high level of perceived life stress compared with those players with a presumed low level of life stress [OR = 1.7 (95% CI 1.3–2.2), $P<0.001$].

Significant differences in player characteristics for injured compared with non-injured players were observed for motivational climate and life stress (Table 1). A higher level of perceived mastery climate ($P = 0.026$) and life events ($P = 0.001$) significantly predicted new injuries among the young females (Table 3).

Intercorrelations

Descriptive statistics for predictor variables associated with injury risk and Cronbach's α for all measures are presented in Table 4. Except for behavior-related coping strategies ($\alpha = 0.57$), the intercorrelation coefficients for all sub-dimensions were acceptable, ranging from 0.70 to 0.95.

Of major interest, players with an injury history perceived the motivational climate as performance oriented, and scored positive on ego orientation. Players characterizing themselves as ego oriented scored positive on perception of a performance climate and also on task orientation. Players who perceived a performance climate reported their anxiety reactions as debilitating (somatic, worry and concentration disruption).

There was a moderate, positive association between players with new injuries during the 2005 season and perception of a mastery climate. These players (mastery) were also both task and ego oriented, and interpreted perceived, somatic anxiety as facilitating for performance. New injuries and self-reported previous injuries were strongly correlated to each other, and both new and previous injuries were associated with having experienced a high level of total life stress.

Players who rated low in coping strategies suffered from significantly more life events. However, coping resources were neither correlated to previous (except for emotion) nor new injuries.

Table 3. Logistic regression models for all scales and sub-dimensions within the five questionnaires to predict the risk for new injuries

	c OR	95% CI	*P*-value	a OR*	95% CI	*P*-value
1. Perception of success						
Task	1.12	0.92; 1.38	0.26	1.12	0.91; 1.37	0.28
Ego	1.03	0.92; 1.16	0.57	1.02	0.91; 1.14	0.78
2. Motivational climate						
Mastery	1.34	1.04; 1.72	0.03	1.34	1.04; 1.72	0.03
Performance	0.98	0.83; 1.16	0.83	0.94	0.80; 1.12	0.50
3. Life Event Scale						
Sum score	1.04	1.01; 1.06	0.001	1.03	1.01; 1.05	0.02
Reaction	1.07	0.99; 1.16	0.09	1.09	1.00; 1.18	0.05
4. Sport Anxiety Scale						
Somatic	1.00	0.78; 1.27	0.97	0.97	0.76; 1.24	0.81
Reaction	1.05	0.92; 1.19	0.50	1.06	0.93; 1.21	0.39
Worry	1.01	0.84; 1.22	0.89	1.01	0.84; 1.21	0.95
Reaction	1.00	0.90; 1.14	0.88	1.03	0.91; 1.16	0.64
Concentration	1.23	0.99; 1.54	0.06	1.23	0.99; 1.54	0.07
Reaction	1.02	0.92; 1.14	0.69	1.03	0.93; 1.15	0.57
5. Brief cope						
Problem	1.05	0.84; 1.31	0.68	1.04	0.83; 1.30	0.72
Emotion	1.01	0.76; 1.34	0.95	0.96	0.72; 1.28	0.79
Behavior	0.92	0.64; 1.32	0.64	0.89	0.62; 1.28	0.54

Data are presented as crude and adjusted OR with 95% CI.

*Adjusted for previous injuries

OR, odds ratio; CI, confidence interval.

Discussion

The aim of this prospective cohort study on young female football players was to assess self-evaluated player characteristics in relation to injuries sustained during the subsequent season. The principal finding of this investigation was that a perceived mastery climate and high level of life events were significant risk factors for new injuries.

So far, only a few studies have addressed psychosocial stressors and injury risk in different athlete groups (Petrie, 1992, 1993; Junge, 2000; Johnson et al., 2005; Schwebel et al., 2007). There is strong evidence that stressful life events can adversely affect an individual's health (Kelley, 1990), and previous findings have suggested that athletes with high life stress, poor coping skills or low social support appear to be more vulnerable to injury (Blackwell & McCullagh, 1990; Petrie 1992, 1993; Gunnoe et al., 2001). These former findings were partly supported by the present study, where self-reported high life stress was found to be associated with an increased injury risk.

Player characteristics and injuries

Longer football play in organized team activities strongly predicted the risk for new injuries. As also observed by Peterson et al. (2000), one might assume that experienced and better skilled players are protected from injury because they will have developed a greater ability to control themselves by choosing safe and skillful maneuvers on the pitch. In the present young female football teams, the technical, tactical

Table 4. Means, standard deviations (SD) and intercorrelations for all variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Previous injury	–																	
2. New injury	0.12[a]	–																
3. Task	0.03	0.03	–															
4. Ego	0.07[a]	0.02	0.41[a]	–														
5. Mastery	0.02	0.06[b]	0.34[a]	0.11[a]	–													
6. Performance	0.08[a]	−0.01	0.05	0.33[a]	−0.03	–												
7. Life event-sum	0.18[a]	0.08[a]	0.05	0.11[a]	0.05[b]	0.24[a]	–											
8. Life event-cut	0.18[a]	0.10[a]	0.07[a]	0.08[a]	0.05	0.18[a]	0.77[a]	–										
9. Life event-reaction	−0.03	0.05	0.09[a]	0.02	0.11[a]	−0.16[a]	−0.14[a]	−0.08[a]	–									
10. Somatic	0.04	0.00	−0.03	0.07[a]	0.07[b]	0.21[a]	0.29[a]	0.22[a]	0.15[a]	–								
11. Somatic-reaction	−0.04	0.02	0.13[a]	−0.05	0.08[a]	−0.20[a]	−0.12[a]	−0.07[b]	0.22[a]	−0.41[a]	–							
12. Worry	0.01	0.00	−0.02	0.09[a]	0.03	0.29[a]	0.33[a]	0.29[a]	−0.24[a]	0.71[a]	−0.39[a]	–						
13. Worry-reaction	−0.06[b]	0.00	0.05	−0.05	0.02	−0.20[a]	−0.21[a]	−0.19[a]	0.29[a]	−0.42[a]	0.69[a]	−0.63[a]	–					
14. Concentration	0.00	0.05	−0.12[a]	0.01	−0.05	0.29[a]	0.24[a]	0.18[a]	−0.18[a]	0.59[a]	−0.29[a]	0.59[a]	−0.35[a]	–				
15. Concentration-reaction	−0.04	0.01	0.12[a]	−0.02	0.12[a]	−0.19[a]	−0.12[a]	−0.08[a]	0.25[a]	−0.33[a]	0.70[a]	−0.37[a]	0.61[a]	−0.43[a]	–			
16. Problem	0.02	0.02	0.21[a]	0.08[a]	0.24[a]	−0.02	0.20[a]	0.21[a]	0.00	0.23[a]	0.04	0.22[a]	−0.02	0.10[a]	0.07[b]	–		
17. Emotion	0.06[b]	0.00	0.09[a]	0.07[a]	0.15[a]	0.14[a]	0.30[a]	0.27[a]	−0.13[a]	0.37[a]	−0.11[a]	0.41[a]	−0.20[a]	0.28[a]	−0.10[a]	0.71[a]	–	
18. Behavior	0.02	−0.01	−0.10[a]	0.05	−0.12[a]	0.21[a]	0.16[a]	−.10[a]	−0.17[a]	0.19[a]	−0.14[a]	0.24[a]	−0.17[a]	0.25[a]	−0.17[a]	0.08[a]	0.33[a]	–
Alpha	–	–	0.92	0.84	0.72	0.85	0.84	–	–*	0.89	0.86	0.88	0.88	0.82	0.70	0.84	0.80	0.57
Mean	0.70	0.21	4.40	2.59	4.35	2.55	6.43	–	−0.50	0.80	0.18	1.10	−0.51	0.66	0.21	1.40	1.02	0.26
SD	0.46	0.41	0.65	1.13	0.53	0.77	5.26	–	1.71	0.53	1.02	0.70	1.12	0.57	1.26	0.58	0.45	0.36

[a]$P<.01$; [b]$P<.05$.

*Too few cases for analysis.

and physical abilities seem to vary considerably across a team. The best skilled players may also be those most actively engaged in the game and therefore be most exposed to injuries. Unfortunately, no information about player skill level could be obtained, and this question has to remain unanswered.

Almost one-fourth of all acute injuries recorded in the present study were re-injuries, based on a previous identical injury, which may come as a surprise in such a young player population. However, the explanation seems obvious; as many as one in every five players sustains an injury every season and the injury pattern is quite consistent, with hamstring strains and ankle and knee sprains being by far the most common injuries. Similar injury distributions and high re-injury proportions have also been recorded in other studies on young (Söderman et al., 2001b; Emery et al., 2005), as well as adult female football players (Östenberg & Roos, 2000; Söderman et al., 2001a; Faude et al., 2005; Jacobson & Tegner, 2007). However, this finding may also be taken as an indication of inadequate injury rehabilitation and premature return to play.

It was hypothesized that players characterized as ego oriented and perceiving their climate to be performance involving will be at increased injury risk. These characteristics were present in players with previous injuries, indicating that they presumably felt both internal and external pressure to an early return to play after being injured. Surprisingly, having these player characteristics did not predict for new injuries. Quite the opposite, those young females who suffered from an increased injury risk in the follow-up season described the motivational climate to be mastery involving. There are no prospective studies that have addressed the possible relationship between perception of success (i.e., goal orientations) or perception of a motivational climate and injuries. It could be speculated that a mastery climate in certain team–coach relationships could create an increased perfectionism among players due to a strong emphasis on improvement and development, which may force them into injury risk situations. Hall et al. (2007), for instance, found that high task and ego goals combined with elements of neurotic perfectionism explained 27% of the variance in the obligatory exercise behavior of male college athletes.

However, in another study on Norwegian female football players, data revealed that those players who perceived the motivational climate as predominantly mastery oriented, and who had a moderately positive score on task orientation, scored negative on maladaptive perfectionism (Ommundsen et al., 2005). Thus, more studies are needed that examine the possible negative effects of having a mastery climate combined with high ego and task goals.

A stress response is triggered if an athlete perceives that his or her resources are inadequate to meet the situational demands from, e.g. a motivational climate, and an accumulation of life stress may predispose the athlete to an athletic injury (Taimela et al., 1990a; Williams & Andersen, 1998; Dunn et al., 2001). Stressful life events are one of the most frequently studied psychosocial variables in the area of injury risk, and a greater likelihood of injury was found in high-stress compared with low-stress athletes (Williams & Andersen, 1998; Andersen & Williams, 1999; Ford et al., 2000; Gunnoe et al., 2001).

Similar findings were also seen in the present study, where life stress correlated positively to previous and to new injuries. Interestingly, even though previous injuries have been shown to be a strong predictor for new injuries in this cohort (Steffen et al., 2008b), high levels of life stress significantly increased injury risk independent of an injury history. In contrast to Andersen and Williams (1999), the negative loading of life stress did not further influence injury risk. However, an increase in life stress – regardless of being perceived as positive or negative, as shown by the present results – may also contribute to disruption in concentration and for this reason be perceived negatively. A stress-produced injury is thought to be a generalized physiological arousal that increases muscle tension and reduces motor coordination (Williams & Andersen, 1998). However, there is no direct experimental evidence to support this assumption. It was, however, in some way surprising to see how high life stress can interact with new injuries in a group of such young players. One hypothesis is that these players have reached or already passed the state of puberty. It is well known that puberty can significantly influence a person's hormones and psychosocial state of mood. Moreover, half of the players, the 16 year olds, were close to change school for coming into the high school system. This fact in general, but also the pressure to get high marks, may additionally have increased the stress level.

Former experiences with coping strategies are mostly valuable to handle new stress situations more positively and to contribute to a players' general well-being. In the present study, previously injured players preferred emotion-focused strategies to cope with competition-related stress situations compared with previously uninjured players. Results from American football showed that injured players had fewer coping resources than uninjured players (Blackwell & McCullagh, 1990). Although Petrie (1993) identified coping as a predictor of the number of days absent from training or competition due to injury, varying stress-coping strategies could not predict the risk of new injuries in the present cohort.

Coping strategies continue to be challenging factors as it seems to be simplistic to analyze them as either adaptive or maladaptive (Pensgaard & Duda, 2002). In the future, a more fruitful approach might be to define coping as a positive response outcome expectancy (PROE) as in the Cognitive Activation Theory of Stress (CATS), instead of looking at coping strategies in general (Ursin & Eriksen, 2004). High levels of PROE are, e.g. associated with lower levels of work stress and sick leave in the general population, and even with high performance in a highly stressful environment such as the Olympic Games (Eriksen et al., 2005).

Among the young female players, a relationship between "worry anxiety" and previous injuries was observed, confirming the results from different prospective studies on other types of sport (Blackwell & McCullagh, 1990; Hanson et al., 1992; Petrie, 1993). Among male football players, a lower than average number of previous injuries was related to fewer worries about their performance, less competitive anxiety and peaking under pressure, a lower anger trait and less outward anger (Junge et al., 2000). However, perceived anxiety before the start of the season could not predict new injuries in our cohort of female football players.

Methodological issues

This is the first study in female football concerning the relationship between personality characteristics and injury risk. One obvious and also general limitation of research in sports psychology is the questionnaires and measurement tools available to assess characteristics of interest. Direct comparisons between the present and previous investigations using different tools should be made with caution. Research involving psychological factors and injury risk in (youth) sports is still limited.

A further limitation of the present study was the response rate. About 71% of the players completed the questionnaire, which means that there is a potential for a selection bias. For instance, players with previous injuries and symptoms from the lower limbs may be more likely to respond. However, injury proportions have been compared between responders and non-responders, and any difference in the proportion of injuries to the ankle, knee, thigh, or groin could be detected (Steffen et al., 2008b).

However, compared with most other observational investigations, the sample size is still large. Nevertheless, the observed numerical differences of specific psychological characteristics were small (<0.5 SD) and reached statistical significance only because of the large sample size. Effect sizes (partial η^2 values) were below 0.03.

Another limitation deals with the collection of exposure data. One theory is that extroverted players receive more playing time than introverted players who are low in self-esteem, and will therefore be more likely to get injured due to increased playing exposure (Kelley, 1990). Here, we were unable to record individual exposure data, as done by, e.g., Östenberg and Roos (2000), and therefore could not correct for exposure in the risk factor analyses.

Perspectives

Besides the improvement of physical performance, technical and tactical skills and injury prevention, personality traits of the players in a team will be essential for team success and should be addressed. This study supports earlier investigations by demonstrating that high life stress has an impact on new injuries. In order to attenuate this risk factor among young female football players, coaches must be aware of the total life stress situation of the player.

A positive motivational climate in a team is considered to be favorable to help those players with a high perception of life stress (Pensgaard & Roberts, 2000). However, it may be that in certain situations, a mastery climate can create a strong emphasis on individual improvement and development; a coach should avoid and, if present, buffer high levels of perfectionism among the players. Coaches will also have the responsibility to lessen life- and sports-related stress by creating a positive motivational climate, support improvement in play and playing intensity, concomitant with arranging a realistic ambition level for the team to protect the players from injuries and in the final stage from burnout (Pensgaard & Roberts, 2002; Lemyre et al., 2008). Implementation of cognitive capabilities such as stress-coping strategies may contribute to create a balance between psychological player characteristics and injury risk (Johnson et al., 2005). Further observational studies among young and older players are required to extend the present findings.

In conclusion, in a cohort of young female football players, a perceived mastery climate and high levels of experienced life stress could significantly predict the risk for new injuries.

Key words: youth, soccer, psychology, risk factor, motivational climate, life stress, coping.

Acknowledgements

We thank the physical therapists involved in the injury registration, and the coaches and players for their cooperation. This study was supported by a grant from FIFA. In addition, financial support came from the Oslo Sports Trauma

Research Center, which has been established at the Norwegian School of Sport Sciences through grants from the Eastern Norway Regional Health Authority, the Royal Norwegian Ministry of Culture and Church Affaires, the Norwegian Olympic Committee and Confederation of Sports and Norsk Tipping AS.

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