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RISK FOR INJURY WHEN PLAYING IN A NATIONAL FOOTBALL TEAM

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Abstract

The Swedish male senior national football team was followed prospectively between 1991 and 1997. During these 6 years the team played 73 official matches and had 3 training camps. The senior author (JE) attended 57 of these matches and the 3 training camps and these matches and training camps are included in the present study. Exposure to football was recorded individually for each player. The team physician examined all injuries. Total exposure was 7245 hours (6235 training and 1010 match hours) and there were 71 injuries (40 training and 31 match injuries). Five (16%) of the match injuries were major with more than four weeks absence from football. The injury incidence during training was 6.5/1000 hours and the injury risk during matchplay was 30.3/1000 hours. A significantly higher injury incidence was found for matches lost compared to matches won or drawn (52.5 vs. 22.7/1000 hours, $p=0.026$). No statistically significant difference for injury was found between competitive matches and friendly matches. No difference was found between home and away matches or matches on neutral ground. The risk for injury when playing in a national team compares with previously reported figures for professional football at a high level.

Introduction

Several studies have investigated the risk for injury in football. In order to be able to compare results from these studies, the injuries must have a comparable definition. In most recent studies, an injury has been defined as any injury occurring during scheduled match or training session and causing the player to miss at least one training session or match (Ekstrand & Gillquist, 1983a, 1983b; Ekstrand et al., 1983a; Ekstrand et al., 1983b; Keller et al., 1988; Nielsen & Yde, 1989; Ekstrand & Tropp, 1990; Engström et al., 1990; Poulsen et al., 1991; van Mechelen et al., 1992; Árnason et al., 1996; Lühje et al., 1996; Putukian et al., 1996; Hawkins & Fuller, 1998a, 1998b, 1999). These studies provide us with some idea of the risk for injury to individual players and the consequence for the team, since they take into consideration the exposure to football and record injuries per 1000 hours of football activity.

The level of play is an important factor when studying the exposure factor and injury risk in football (Inklaar, 1994; Inklaar, 1995; Inklaar et al., 1996; Ekstrand et al., 2003). Ekstrand & Tropp (1990) studied the difference in exposure between divisions in Swedish male senior football. The authors found that exposure to football increases with an increase in the level of play. The numbers of matches and training sessions as well as attendance are higher in the higher divisions.

The level of play also influences the risk for injury in football. Ekstrand et al. (2003) collected results of studies where similar definitions and data collection had been used to record the risk for injury. These results indicate that the risk for injury during training is approximately the same regardless of the level of play and that the risk for injury increases while at training camps compared to regular training.

The risk for injury during a match has been reported to be greater than during training (Ekstrand et al., 1983b; Nielsen & Yde, 1989; Ekstrand & Tropp, 1990; Engström et al., 1990; Poulsen et al., 1991; Árnason et al., 1996; Lühje et al., 1996) and the risk for being injured during a match is reported to be greater the higher the level of play (Nielsen & Yde, 1989; Ekstrand & Tropp, 1990; Inklaar et al., 1996).

To our knowledge there is only one published study reporting the risk for injury for a national team (Wekesa, 1995). Football at national team level has also been analysed by Hawkins & Fuller (1996), who studied risk for injury and injury mechanisms during the

World Cup tournament of 1994 in the US by analysing video recordings of 44 of the total 52 matches during the tournament.

The purpose of this study was to investigate the incidence of injury in football at national team level and to examine any connections between the number of injuries in the team, the results obtained by the team, whether the team played competitive or friendly matches and whether the team played at home or away.

Materials and methods

During the six years between 1991 and 1997, the Swedish senior male football national team played 73 official matches and had 3 training camps. The period included seven World Cup matches (USA, 1994), four European Championship matches (Sweden, 1992), twenty-one World Cup or European Championship qualification matches, forty-one friendly matches and three training camps.

The present study covers all the matches and associated training sessions and the training camps where the senior author (JE) participated as team physician (57 matches including all the World-cup and European cup matches, all qualification matches except one, 26 friendly games and all 3 training camps).

Attendance records were kept for all training sessions and matches. The exposure time to football was registered for each individual player. All injuries during national team exposure (training sessions and matches) were recorded. An injury was defined as any injury occurring during a match or training session causing the player to miss the next match or training session (in the national team or in his ordinary team). An overuse injury was defined according to Orava (1980) as “a pain syndrome of the musculoskeletal system appearing during physical exercise without any known trauma, disease, deformity or anomaly that might have given previous symptoms”. A player who could not fully participate in team training or matches, or trained with a modified exercise programme, was considered as injured. The senior author (JE) examined all injuries. Injuries were classified into three categories of severity according to the length of absence from training sessions and matches including the day of injury: minor (1-7 days); moderate (8-28 days); and major (>28 days). The injury incidence was based on real exposure time to football, i.e. the number of new injuries per 1000 hours of exposure. Incidence was calculated per 1000 hours of training session or matchplay as: “(the total number of injuries during training or matchplay/hours of exposure) x 1000”. Due to a non-normal distribution of data, differences between groups were examined by the Mann-Whitney U test or the Kruskal-Wallis test (Armitage & Berry, 1994). The significance level was set at 5% ($p \leq 0.05$).

Results

The total exposure was 7245 hours. The exposures to matches and training sessions were 1010 and 6235 hours, respectively. A total of 71 injuries occurred, 40 of them during training and 31 during matches. The majority of injuries were minor resulting in absence of less than one week. Five (16%) of the match injuries caused absence from football of more than four weeks (one fracture of the ribs in combination with a pneumothorax, one fracture of os zygomaticus in combination with concussion, one ankle fracture, one meniscus injury with postoperative arthritis and one ankle sprain with cartilage injury). Eighty per cent of the injuries were due to trauma and 20% were overuse injuries. Seventy-eight per cent of the overuse injuries developed after training sessions and the rest after matchplay.

Twelve of the injuries were muscle ruptures affecting the lower extremity. Eight of these muscle ruptures occurred during training and 4 during matches. The incidence of muscle rupture was 1.7/1000 hours of exposure (1.3/1000 hours of training and 4.0/1000 hours of matchplay, $p=0.25$).

Six players sustained 11 ankle sprains, five during training and six during matchplay. The total incidence of ankle sprain was 1.5/1000 hours of exposure (0.8/1000 hours of training vs. 5.0/1000 hours of matchplay, $p=0.09$).

Five fractures were seen, one during training (metatarsal fracture) and four during matchplay (one fracture of the os zygomaticus, one of the os mandibulum, one ankle fracture and one rib fracture):

The incidence of injury figures are summarised in Table 1. The injury incidence during training was 6.5/1000 training hours. The risk for injury increased at training camps compared to regular training, although not statistically significant (16.4 vs. 6.0 injuries/1000 hours, $p=0.061$). The incidence of injury during matchplay was 30.3/1000 match hours. There was no difference in injury incidence during competitive matches compared to friendly matches (35.2 vs. 24.8/1000, $p=0.38$) or World Cup matches compared to non-World Cup matches (43.3 vs. 28.5/1000, $p=0.42$). The incidence of injury was higher during matches lost than during matches won or drawn (55.5 vs. 22.7/1000 hours, $p=0.026$). No difference in the risk for injury was noted between home and away matches or matches on neutral ground.

Table 1. Injury incidence during training and matchplay for Swedish national football players. Means with standard deviations (SD) and 95% confidence interval (95% CI).

	Mean (SD)	(95% CI)
Injuries per 1000 hours of football (training + matches)	10.0 (10.3)	(7.3, 12.7)
Injuries per 1000 hours of training	6.5 (9.3)	(4.1, 8.9)
-Training camps	16.4 (9.9)	(-8.2, 40.9)
-Regular training	6.0 (9.1)	(3.6, 8.4)
Injuries per 1000 hours of matchplay	30.3 (45.4)	(18.4, 42.1)
-World Cup matches	43.3 (29.6)	(15.9, 70.6)
-Non-World Cup matches	28.5 (47.0)	(15.4, 41.6)
-Friendly matches	24.8 (50.2)	(5.3, 44.3)
-Competitive matches	35.2 (40.7)	(20.3, 50.1)
-Matches lost	52.5 (86.2)	(14.8, 90.3)
-Matches won or drawn	22.7 (32.1)	(12.9, 32.4)

Discussion

Risk for injury during training and at training camps

In the present study the incidence of injury during training was 6.5/1000 training hours. We also found a tendency towards a higher injury incidence at training camps compared to regular training (16.4 vs. 6.0 injuries/1000 hours) although this was not statistically significant. A significantly higher risk for injury at training camps has previously been reported in a study on male amateurs (Ekstrand et al., 1983b). The sample size in this study is, however, considerably lower. The risk for injury during training is essentially constant regardless of the level of play (Ekstrand & Tropp, 1990; Ekstrand et al., 2003).

Risk for injury during matchplay

In this study the risk for being injured during a match was greater than during training. Several other studies, using the same injury definition as the present study, have also

found a higher risk for injury during matchplay (Ekstrand et al., 1983b; Nielsen & Yde, 1989; Ekstrand & Tropp, 1990; Engström et al., 1990; Poulsen et al., 1991; Árnason et al., 1996).

A few studies have also analysed the injury risk at different levels of play (Nielsen & Yde, 1989; Ekstrand & Tropp, 1990; Poulsen et al., 1991). The results from these studies are somewhat conflicting. Two studies found an increasing risk for injury with increasing level of play (Nielsen & Yde, 1989; Ekstrand & Tropp, 1990) whereas another study found no difference in injury incidence at different levels of play (Poulsen et al., 1991). The incidence of injury during matchplay in the present study was 30.3/1000 hours of play. This is higher than previously published data from Swedish male football. Ekstrand et al. (1983a) reported a match injury incidence of 16.9/1000 hours for male amateur players, Ekstrand & Tropp (1990) and Engström et al. (1990) found incidences of 21.8/1000 hours and 13/1000 hours, respectively, for male semi-professional elite players. All these studies used the same methodological design. However, it must be kept in mind that these studies were carried out at amateur and semi-professional levels. Reports from recent or on-going studies at top level professional football have shown the injury incidence at matches to be similar to this study. Hawkins & Fuller (1999) reported an injury frequency rate of 26/1000 hours of matchplay in a study of four English professional football clubs. Injury incidences between 25 and 35/1000 match-hours have also been reported in ongoing studies on top level professional football in Norway (Tor Einar Andersen, personal communication), Denmark (Martin Hägglund, to be published) and Sweden (Markus Waldén, to be published). Thus, it appears that the risk for injury during matchplay is higher at professional level than at amateur level but the difference between top professional club and national team levels is slight.

One previous study reported the injury pattern from 18 matches with the Kenyan national team during the 1992-1993 season (Wekesa, 1995). However, the injury definition was different and no exposure data was reported resulting in an unknown injury incidence. Furthermore, Hawkins & Fuller (1996) analysed video recordings from 44 of the total 52 matches in the 1994 World Cup. The authors reported an injury incidence during matches of 68.8/1000 hours. In the present study we found an injury incidence of 43.3/1000 hours during seven World Cup matches involving Sweden at the same tournament. One possible reason for this difference lies in the injury definition used. Hawkins & Fuller (1996) defined an injury as that leading to the player receiving

treatment on the field of play, or otherwise identified as having been injured. No consideration to absence from training or matches was taken in this definition although this was taken when classifying injury severity. Some injuries might have required acute medical treatment on the field of play but the players were able to complete the rest of the match without any subsequent absence from training or matches. This definition is similar to the concept of tissue injury recently applied by Junge & Dvorak (2000). The number of injuries recorded using this definition is predicted to be higher than when using the time lost definition as in the present study. However, when using video recordings there is a possibility of underestimating the true number of injuries since injuries that become apparent after the match will not be included in the statistics. Furthermore, in the present study the same orthopaedic surgeon diagnosed all injuries, whereas in the study by Hawkins & Fuller (1996) no clinical examination was performed at all.

However, one weakness of a study on national team players, like the present one, is that follow-up after matches is more difficult. There may be times when the national team physician does not appreciate an injury but when the player returns to his professional team in another country, his team physician discovers an injury which might therefore not be recorded in the database of the national team physician. In other words, the numbers we see in this study are probably the lowest possible and some minor injuries may have been missed because of this.

Why is the risk for injury greater during a match lost?

This study has shown that the risk for injury is twice as high when the team loses a match. There could be several reasons for this:

- Injuries have a direct impact on the match result

The best team is selected to play. The team is weakened if anyone is injured.

- Injuries have an indirect impact on the result because of change in match strategy

The best team plays and the tactics are planned according to the initial line-up. If anyone in the initial line-up is substituted, match strategy is disrupted and the tactical pattern as well as the rhythm of the team may be disturbed.

- The result and importance of the game influence the injury profile

Teams that need to win or draw a match often play more intensely and thereby increase the risk for injury. Furthermore, players who suffer minor symptoms (such as pain or stiffness) could be more liable to feel these when facing defeat.

Definition of injury

A fundamental problem associated with an epidemiological assessment of data on football injuries is the inconsistent manner in which injury is defined and data collected and recorded (Ekstrand, 1982; Noyes et al., 1988; van Mechelen et al., 1992; Inklaar, 1995; Dvorak & Junge, 2000). There is no consensus about the definition of injury and it is, therefore, difficult to compare injury rates between different studies. There is probably no ideal definition and every known definition of injury has advantages as well as disadvantages depending on the purpose of the study.

In recent years an injury has been defined as an injury a player has sustained in any football- related activity that has caused absence from training or from a match. These studies provide us with an idea of the risk for injury to the individual player and it's consequence for the team, since they take exposure to football into consideration.

Furthermore, these studies have expressed incidence in terms of injuries per 1000 hours of football activity, which also supplies valuable background information for preventive measures.

A definition of injury based on time lost from the sport, as used in this study, has been recommended for studies on football injury since it directs attention to those injuries most likely to have an important effect on the player's health and performance (Keller et al., 1988). However, most injuries are minor in studies using this definition. The duration of restriction from athletic performance should, therefore, also be reported. In the present study we found only 16% severe injuries with absence from football more than four weeks.

The "time –lost" sport injury definition has certain weaknesses (Noyes et al., 1988; Inklaar, 1994; Junge & Dvorak, 2000). Defining injury by the time lost from play criterion is sport-specific. A certain injury could mean inability to participate in one sport but not another. This means that comparison between different sports is difficult using this definition. Furthermore, there is a subjective bias. Different players respond to an injury in different ways, i.e. a certain injury may cause one player to stop

participating while another will experience no restriction. The “time- lost” injury definition also depends on the frequency of training sessions and games, which may interfere with comparison between different levels of play.

Comparison between studies is also simplified if inclusion and exclusion criteria are clearly stated. In football, the rehabilitation aspect has to be clarified. In the present study we used the criteria suggested by Lewin (1989) that a player was defined injured if he could not fully participate in training sessions or matches. Since training with the team using a modified programme is commonly encouraged for social and psychological reasons it might be reasonable to define that participation in a training session (marked as non-injury in the protocol) means full participation in all parts of the session. If any part of the training programme is modified for a player the training session should be marked “injured” in the protocol and considered part of the rehabilitation programme for the player.

In this study we defined overuse injuries according to Orava (1980). The low percentage of overuse injuries found in this study (20%) could be explained by the fact that only healthy players free of symptoms were selected to the national team. However, using the same definition of an overuse injury as the present study, Lüthje et al. (1996) reported only 6% overuse injuries amongst Finnish elite football players. The reason for the difference between studies might be that players representing their national teams are the best players in the country and these players are often professionals in European clubs where they are exposed to more matches than a domestic elite player. This frequent match exposure might lead to an increased risk for overuse injuries.

Conclusions

- The risk for injury during training with the national team is approximately the same as during training with club teams regardless of the level of play
- The risk for injury is greater at training camps compared to regular training
- The risk for injury during matchplay is greater than during training
- The risk for injury is greater during matches lost

Perspective

Several epidemiological studies on football injury have been conducted over the last twenty-five years. However, no methodological consensus exists and agreement on a preferable golden standard method would facilitate comparison between studies. The present study is the first prospective study on national team players. The risk for injury during training was approximately the same as in previous studies and seems to be constant regardless of the level of play. The risk for injury during international matchplay is at least as high as in elite football in Sweden. On the basis of the results of the present study, we recommend that future epidemiological studies on elite football should include exposure and injuries incurred by players who participate at national team level.

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