

Injury epidemiology in a national football team of the Middle East

C. Eirale, B. Hamilton, G. Bisciotti, J. Grantham, H. Chalabi

Aspetar, Qatar Orthopedic and Sport Medicine Hospital, Sport City, Doha, Qatar

Corresponding author: Cristiano Eirale, MD, Aspetar, Qatar Orthopedic and Sport Medicine Hospital, Sport City, 29222 Doha, Qatar. Tel: +00 97 45 86 60 32, Fax: +00 97 44 13 20 40, E-mail: cristiano.eirale@aspetar.com

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Many football epidemiological studies have been performed but only two of them have investigated injury risk in a national football team. In the present study, the senior male Qatar national football team was followed prospectively for two seasons. All injuries that were incurred during training and matches were recorded, together with match and training exposure time. Principal findings were (i) a higher injury incidence during matches than during training, (65.9 vs 4.3/1000 h, $P < 0.001$), (ii) a high incidence of muscular strain

during matches (23.2/1000 h) and (iii) a greater severity of injury in games than in regular training or camp situations (19.5 vs 8.4 vs 6.7 days, $P < 0.05$). Despite the unique environmental, social and cultural setting in the Middle East, these findings are consistent with previous data from European football, suggesting that international guidelines on injury prevention and management may be applied in this region.

Collecting information from prospective epidemiological studies is the first step in the prevention of sports-related injuries. In addition to improve injury management techniques, a reduced injury rate has been noted, possibly due to enhanced injury prevention strategies utilized by athletes (Arnason et al., 2008). Several preventative strategies have been proposed to reduce the many potential risk factors associated with football injuries (Dvorak et al., 2000; Ekstrand & Karlsson, 2003; Engebretsen et al., 2008). Previous studies have investigated the incidence of football injuries in clubs in both national (Hägglund et al., 2005b; Waldén et al., 2005a; Hägglund et al., 2006) and continental competitions (Waldén et al., 2005b), in differing environmental conditions, and in amateur and professional players, (Hawkins & Fuller, 1998). Furthermore, injury recording systems have been implemented for national teams during sanctioned international competitions for many years (Junge et al., 2004b; Dvorak et al., 2007; Waldén et al., 2007).

The level of play is an important risk factor for football injuries (Inklaar, 1994; Inklaar et al., 1996; Engebretsen et al., 2008), with injury rates increasing with the level competition (Hawkins & Fuller, 1998; Hawkins & Fuller, 1999; Hägglund et al., 2005a; Waldén et al., 2005b; Hägglund et al., 2008). However, at all levels of competition the risk of injury during training is similar (Nielsen & Yde, 1989; Ekstrand et al., 1990; Inklaar et al., 1996) but is lower than the risk observed during matches

(Ekstrand et al., 1983). Despite this, research regarding injuries sustained at the national team level is limited. To the knowledge of the authors, only two studies have addressed the risk of injury when playing with senior national football teams (Wekesa, 1995; Ekstrand et al., 2004) and neither of these studies were performed in Asia. Combined with a reluctance to publicize such data, the reason for this information deficit may be that most national teams only play a few matches each year, rendering the gathering of sufficient data difficult.

The purpose of this study was to investigate both the incidence and characteristics of football injuries at the national team level in Qatar, and to evaluate injury patterns with the ultimate purpose of developing specific injury prevention programs.

Materials and methods

The Qatar senior male national football team was followed prospectively for a period of 17 months (June 2007–October 2008). During this period, 14 official and 19 friendly matches were played. All training camps and training sessions associated with official and friendly matches are included in this study, accounting for 171 training sessions. A total of 36 different players were included in the analysis, with the players mean age, weight and height upon entry to the study being 23.8 years, 72.9 kg and 176.3 cm, respectively. Ethical approval for this study was granted by the Institutional Human Research Ethics Committee and written consent was obtained from all national team squad members included in the study.

To facilitate comparison with other studies, common definitions for all injury parameters were applied (Junge &

Dvorak, 2000; Ekstrand & Karlsson, 2003). This study was performed in accordance with the international consensus on football injury epidemiology (Fuller et al., 2006). In particular, criteria from this consensus were used for the definitions of injury, recurrent injury, severity, training and match exposure, injury location, injury type, diagnosis and etiology.

When a player was first selected for the national team squad, the national team physician (C. E.) completed a baseline full medical history and examination. As only fully fit athletes were selected for the national squad, no players were injured upon entry to the study. To ensure that uniform injury assessment and classification were achieved, all subsequent injuries were examined and recorded by C. E. An injury was considered as any physical complaint sustained by a player during a match or training resulting in the inability to fully partake in present or future football training or match play (for either the national team or club team) (Fuller et al., 2006). Other kinds of complaints, such as illnesses, diseases and psychological complaints were not included. Injuries considered to have resulted from national team training or matches, but with a delayed onset of symptoms, were included in this study, as players were always examined and diagnosed by C. E. even after they returned to their respective clubs. This was possible due to the geographical proximity and intensive communication strategy in place between club physicians and C. E. Injuries sustained in club training or matches were not included, even if they resulted in a player missing national team duties.

Injuries were classified into categories according to their etiological (acute trauma or overuse) characteristic. An overuse injury was defined as “an injury caused by repeated micro trauma without a single, identifiable event responsible for the injury” (Fuller et al., 2006). Recurrent injuries were defined as “an injury of the same diagnosis and at the same site, which occurred after a player’s return to full participation from the same injury within a two month period” (Fuller et al., 2006). Injuries were further classified retrospectively into categories of severity depending on the length of absence from training sessions and matches [minimal (1–3 days absence), mild (4–7 days), moderate (8–28 days) and severe (>28 days)]. The day

of the injury was considered day 0; therefore, an injury to a player not able to participate fully on the day of injury but available for full participation on the following day, was recorded with an injury severity of zero days (Fuller et al., 2006).

Injured players were treated in the same rehabilitation center until they returned to the field following standardized protocols under the supervision of C. E. Players were only allowed to return to their clubs once they were deemed fit to return to play by C. E.

C. E. attended each training session and match over the study period, recording the duration of football exposure of each player. Match exposure was considered as the exposure during an international game, while game simulation in training was considered as training exposure. Training exposure was defined as each team based or individual physical activity under the control or guidance of the team’s coaching or fitness staff aimed at maintaining or improving players’ football skills or physical condition. Pre-match warm up and post-match cool down sessions were recorded as training exposure. Personal training or rehabilitation activities undertaken by players away from the team and not planned by the team’s coaching or fitness staff were not recorded as training exposure. No training or match exposure is included from national team players attending club games or training.

The exact number of training sessions and matches was determined at the team level. Actual exposure to football was calculated for every player for training and matches separately. Injury incidence expressed as rate per 1000 h was calculated as (number of injuries/hours of exposure) \times 1000. Data were coded and analyzed using SPSS (Version 17.0) statistics software. Results are expressed as mean \pm standard deviation for continuous variables and counts and percentages for categorical variables. χ^2 -Test was used to compare the rates of injuries in matches and training sessions (Sahai & Kurshid, 1996). Fisher’s exact test was used when the expected count was <5 . The severity of injury showed a non-normal distribution and differences were analyzed using Mann–Whitney *U*-test when comparing two groups and Kruskal–Wallis test when comparing more than two groups. When a signifi-

Table 1. Injury incidence rate per 1000 game-hours depending on player position, cause, recurrence, traumatic or for overuse

	Total	Occasion			
		Matches [†]	Regular training	Training camp	Training total
Hours	10043	561	7502	1980	9482
Total incidence	78(7.8)*	37(66.0)	31(4.1)	10(5.1)	41(4.3)
Player position					
GK	6(3.3)	4(78.4)	1(1.0)	1(1.4)	2(1.1)
MF	21(6.6)	13(63.7)	4(1.5)	4(14.8)	8(2.7)
DF	28(8.7)	7(34.3)	17(7.1)	4(6.3)	21(7.0)
FW	23(12.6)	13(127.5)	9(6.6)	1(2.8)	10(5.8)
Cause					
Contact	32(3.2)	19(33.9)	11(1.5)	2(1.0)	13(1.4)
Non-contact	46(4.6)	18(32.1)	20(2.7)	8(4.0)	28(3.0)
Recurrent					
No	59(5.9)	30(53.5)	22(2.9)	7(3.5)	29(3.1)
Yes	19(1.9)	7(12.5)	9(1.2)	3(1.5)	12(1.3)
Trauma/overuse					
Overuse	10(1.0)	1(1.8)	7(0.9)	2(1.0)	9(0.9)
Trauma	68(6.8)	36(64.2)	24(3.2)	8(4.0)	32(3.4)

*Numbers in the bracket show injury incidence rates per 1000 game-hours. When comparing injury rates between matches and training total, *P*-value was <0.001 for all comparisons (except for overuse injuries).

[†]Matches include official and friendly matches.

DF, defenders; FW, forwards; GK, goalkeepers; MF, midfielders.

Table 2. Frequency and severity of football injuries among Qatar national football team players

	n (%)	Severity of injury (days)						P-value*
		Mean ± SD	Median	1–3	4–7	8–28	> 28	
Total	78(100)	10.6 ± 14.4	6.5	26	24	23	5	
Player position								
DF	28(35.9)	8.4 ± 11.8	4.0	12	7	8	1	0.24
FW	23(29.5)	11.1 ± 12.1	7.0	4	9	9	1	
GK	6(7.7)	10.0 ± 14.8	3.5	3	2	0	1	
MF	21(26.9)	13.2 ± 19.5	7.0	7	6	6	2	
Occasion [†]								
Match official	34(43.6)	13.9 ± 18.3	7.0	8	11	11	4	0.25
Match friendly	3(3.8)	8.7 ± 7.0	8.0	1	0	2	0	
Training	31(39.7)	8.4 ± 11.4	4.0	15	7	8	1	
Training camp	10(12.8)	6.7 ± 4.5	5.5	2	6	2	0	
Cause								
Contact	32(41.0)	10.3 ± 16.8	4.0	15	8	7	2	0.13
Non-contact	46(59.0)	10.8 ± 12.6	7.0	11	16	16	3	
Side								
Left	18(23.1)	12.9 ± 14.1	9.0	5	3	9	1	0.22
Right	58(74.4)	10.1 ± 14.7	5.5	20	20	14	4	
Recurrent								
No	59(75.6)	10.9 ± 15.0	5.0	22	14	19	4	0.60
Yes	19(24.4)	9.7 ± 12.8	7.0	4	10	4	1	
Trauma/overuse								
Overuse	10(12.8)	10.2 ± 17.7	4.5	3	5	1	1	0.48
Trauma	68(87.2)	10.6 ± 14.0	7.0	23	19	22	4	
Injury type [‡]								
Contusion	12(15.4)	4.4 ± 4.3	2.5	7	4	1	0	0.04
Dislocation	3(3.8)	4.3 ± 2.3	3.0	2	1	0	0	
Fracture	4(5.1)	27.3 ± 42.3	9.0	2	0	1	1	
Sprain	10(12.8)	10.7 ± 12.0	3.0	4	2	3	1	
Strain	24(30.8)	13.2 ± 12.3 ^Δ	7.0	4	5	14	1	
Tendon injury	10(12.8)	10.9 ± 18.3	5.5	5	2	2	1	
Other type	15(19.2)	7.9 ± 6.8	9.0	2	10	2	1	

*P-values were determined using the Mann–Whitney *U*-test comparing the severity of injury (days) in two unpaired groups.

[†]P-values were determined using the Kruskal–Wallis test for variables occasion and injury type.

^ΔPost hoc analysis revealed that the severity of injury due to strain is statistically significantly different from contusion $P = 0.021$.

DF, defenders; FW, forwards; GK, goalkeepers; MF, midfielders.

cant association was found, *post hoc* analysis was completed to assess for any differences between individual pairs. Significance was set at $P < 0.05$.

Results

Exposure and incidence of injuries according to player position (DF, defenders; FW, forwards; GK, goalkeepers; MF, midfielders), etiology (contact/non-contact and trauma/overuse) and recurrence are displayed in Table 1. Data are presented for matches, regular training, training camps and total training. There was a significant difference in injury incidence between matches and training sessions ($P < 0.001$) but no difference between regular training and training camps has been recorded ($P = 0.581$). These data were confirmed when considering player position, injury etiology and recurrence ($P < 0.001$) except for overuse injuries, where no difference in injury incidence between matches and training sessions was found. GK had the lowest incidence of

injury (3.3/1000 h), while the FW (12.6/1000 h) then DF (8.7/1000 h) had the highest incidence. The incidence among FW players was higher than MF ($P = 0.028$) and GK ($P = 0.002$). The incidence was higher among DF when compared with GK ($P = 0.027$).

The most frequent injuries were muscle strains ($n = 24$, 2.4/1000 h), accounting for 34% of the total number of injuries. They occurred more often during matches than training (23.2 vs 1.2/1000 h, respectively, $P < 0.05$), but with no significant difference between regular training and training camps.

Injury incidence and severity of injuries depending on the field position, the occasion, the cause, the side of the body affected, the type of injury, the etiology and the injury type is illustrated in Table 2. These data confirm that the mean severity of injury resulting from matches was greater than from training sessions ($P = 0.05$).

The severity of injuries in accordance with injury location is shown in Table 3, with no significant

Table 3. Frequency of football injuries among Qatar national football team players and severity of injuries in days

	<i>n</i> (%)	Severity of injury (days)					
		Mean \pm SD*	Median	1–3	4–7	8–28	>28
Injury location							
Thigh	26(33.3)	11.8 \pm 12.2	8.0	6	6	11	3
Knee	13(16.7)	16.5 \pm 24.2	7.0	1	5	3	4
Leg	8(10.3)	9.4 \pm 10.4	5.5	3	3	1	1
Ankle	7(9.0)	6.0 \pm 4.9	4.0	3	2	2	0
Pelvis	5(6.4)	14.4 \pm 25.5	4.0	2	2	0	1
Hand	4(5.1)	3.5 \pm 2.5	3.0	3	1	0	0
Calf	3(3.8)	8 \pm 8.7	3.0	2	0	1	0
Face	2(2.6)	5 \pm 2.8	5.0	1	1	0	0
Foot	2(2.6)	1.5 \pm 0.7	1.5	2	0	0	0
Pubis	2(2.6)	7.5 \pm 3.5	7.5	0	1	1	0
Cranium	1(1.3)	15	15.0	0	0	1	0
Elbow	1(1.3)	2	2.0	1	0	0	0
Hip	1(1.3)	3	3.0	1	0	0	0
Low back	1(1.3)	2	2.0	1	0	0	0
Shoulder	1(1.3)	20	20.0	0	0	1	0
Spine	1(1.3)	7	7.0	0	1	0	0

*Mean \pm SD is replaced by individual values when $n = 1$.

difference observed in injury incidence according to location. The thigh was the most common location of injury (33.3% of total) with the majority of them being strains (69.9%), of which, 15 out of the 18 were posterior. While posterior thigh strains had a significantly higher incidence than anterior thigh strains (1.5 vs 0.3/1000 h, $P < 0.05$), there was no significant difference in their severity. Nearly half of posterior thigh strains (7 out of 15) were recurrent lesions and they were the most common type of recurrent injury (37%).

Discussion

The principal findings of this study were that there was (i) a higher injury incidence during matches than during training, (ii) a high incidence of muscular strain during matches and (iii) a greater severity of injury in games than in regular training or camp situations.

Importantly, we observed a total exposure of 10 043 h, which was notably higher than that recorded by previous authors over a 7-year follow-up (Ekstrand et al., 2004). This may reflect the proximity and accessibility of international players in Qatar and the number of national team camps that were coordinated.

The significantly higher incidence of injury during matches (65.9/1000 h) than during total training sessions (4.3/1000 h) confirmed the findings of previous studies (Ekstrand et al., 1983; Nielsen & Yde, 1989; Engström et al., 1990; Arnason et al., 1996; Waldén et al., 2005a). This distinction remained significant when comparing match injury incidence

separately with both training sessions (4.1/1000 h) and training camps (5.1/1000 h). Furthermore, a significant difference in injury incidence between matches and training sessions was found for players in all positions on the field, contact and non-contact injuries, primary and recurrent injuries, traumatic injuries and muscular strains. These findings illustrate the importance of focused injury prevention strategies addressing overall risk factors for all positions and situations, including general factors such as training fields, equipment, training load and training organization.

Our match injury incidence (65.9/1000 h) was higher than reported previously in the Swedish national team (30.3/1000 h) (Ekstrand et al., 2004), records from FIFA and UEFA tournaments (36–51/1000 h) (Junge et al., 2004a; Dvorak et al., 2007; Waldén et al., 2007) and elite European club football (21–28/1000 h) (Hawkins & Fuller, 1999; Häggglund et al., 2003; Häggglund et al., 2005b; Waldén et al., 2005a, b; Arnason et al., 2008; Ekstrand et al., 2010). Interestingly, our match injury incidence rate is similar to the 68.8/1000 h taken from video recording of 44 matches played at the 1994 World Cup (Hawkins & Fuller, 1996). Unfortunately, it is not possible to further compare these results due to the different criteria used for both the definition of injury and in data collection.

As observed previously at the national team level (Ekstrand et al., 2004), no difference in injury incidence was found at training camps compared with regular training. Furthermore, we observed a similar incidence of injury during training sessions (4.3/1000 h) to elite European clubs (2–12/1000 h) (Hawkins & Fuller, 1999; Häggglund et al., 2003; Häggglund et al., 2005b; Waldén et al., 2005a, b; Ekstrand et al., 2010), at European national team level (6.5 injuries/1000 h) (Ekstrand et al., 2004), and in European national teams during international competitions (2.1–2.9/1000 h) (Waldén et al., 2007).

A 24% re-injury rate was found; while the majority ($n = 12$) occurred during training, a significantly greater incidence of re-injury was observed during matches ($P < 0.001$). Many factors may be involved in this high rate of re-injury, including persistent technical errors, inadequate structure and intensity of training, misdiagnosis or under-estimation of the initial injury, incomplete or inadequate tissue healing and incomplete or aggressive rehabilitation (Woods et al., 2002). While quantifying the role of each factor for an individual is challenging and further research in this area is necessary to identify the principal risk factors, we speculate that the high number of training sessions and camps held by the Qatar national team may result in a more club-oriented injury profile when compared with other national teams. Given that posterior thigh strain was the most common

recurrent injury (37% of total), football-specific prevention programs should be implemented, focusing in particular on eccentric strength training combined with warm-up stretching (Arnason et al., 2008). Utilizing the same definition of re-injury, the present re-injury rates are comparable with previous literature that has ranged from 12% to 30% (Hägglund et al., 2003; Hägglund et al., 2005b; Waldén et al., 2005a; Hägglund et al., 2006; Ekstrand et al., 2010). Importantly, there is no evidence supporting either a higher risk of injury or re-injury in Middle East population or any risk factors peculiar to this region.

Equivocal results are present in the literature on the influence of playing position on the incidence of injuries (Nielsen & Yde, 1989; Hawkins & Fuller, 1996; Hawkins & Fuller, 1998), but our results show that FW presented with the highest incidence of injury, significantly greater than GK and MF. It remains unclear why our players have this distinct profile, but training, technical or tactical differences from the data sources above may play a role.

The thigh was the main site of injury (33.3% of all injuries), followed by the knee (16.7%) and the leg (10.3%), with the mean duration of time loss being 11.8, 16.5 and 9.4 days, respectively. These data confirm the trend of previous researchers (Hägglund et al., 2003a; Waldén et al., 2005a), although ankle injuries were not as frequent as reported previously (Arnason et al., 1996; Hawkins & Fuller, 1999; Waldén et al., 2005b; Hägglund et al., 2006; Ekstrand et al., 2010). In accordance with the literature, the most frequent thigh injury type recorded were strains (69.9%), with majority of them occurring in the hamstrings muscle group (Hawkins & Fuller, 1999). Also in line with previous studies, there was a significant difference between posterior and anterior thigh (Hawkins & Fuller, 1999). However, in contrast to previous research at the national team level (Ekstrand et al., 2004), we observed a significantly higher incidence of muscular strains during matches than in training. Moreover, our match incidence appears markedly higher than that observed previously (23.2 vs 4.0/1000 h, respectively) (Ekstrand et al., 2004), which raises concerns about match preparedness.

Several theories have been proposed to explain the cause of muscle strains including: muscle tightness, weakness or imbalances, inadequate warm-up, scar formation in the muscle tissue, biomechanics and movement patterns, lack of prevention programs, previous injury history, age, anthropometric and ethnic characteristics of players (Orchard, 2001; Goldman & Jones, 2010). In order to implement focused prevention strategies in this population, further research is required to investigate the characteristics of muscle lesions, the influence of each risk factor, particularly during high-intensity exercise,

and other potential risk factors unique to the Middle East such as vitamin D deficiency (Hamilton et al., 2010).

Overuse injuries accounted for 13% of total injury count. Previous authors report an overuse injury incidence of between 2% and 39% in footballers (Nielsen & Yde, 1989; Hawkins & Fuller, 1999; Hawkins et al., 2001; Hägglund et al., 2005b). However, the relatively low incidence of overuse injury in the present study is in line with previous research at the national team level (Ekstrand et al., 2004).

This variability can be potentially explained by different exposure to risk factors, the level of football analyzed and/or the definitions for overuse injuries. No difference in the incidence of overuse injuries was found between training and matches.

Significant differences were found in the severity of injuries that occurred during matches, regular training sessions or training camps ($P < 0.05$), with an injury during a match resulting in a greater time loss than during training sessions. A possible explanation for such results may be that during matches, unless substituted, players do not stop playing and consequently injuries may worsen with a deleterious downstream impact on prognostication. Intriguingly, while it is likely that the energy of impact between players during matches will be higher than during training sessions, no difference was found between contact and non-contact injury severity.

As anticipated, clinically and statistically significant differences were found in the mean time loss with differing injury type. While fractures resulted in the greatest time loss (mean 27.3 days) per injury, more time was lost due to muscular strains than any other injury type. Furthermore, *post hoc* analysis revealed that the severity of muscle strains is significantly higher than the severity of contusion. Of note, no difference in injury severity was found when comparing player positions, contact with non-contact injuries, side of the lesion, primary with recurrent injuries, traumatic and overuse injuries; however, these findings could have been influenced by the small study sample.

The relatively short data collection period and the rotation of players in and out of the national squad are limitations of this paper. An additional limitation was not being able to collect data on injuries sustained during club training and fixtures (which may relate to national team training and competitions considers such as overuse and fatigue based injuries). This becomes more significant, when one considers that in many countries, there is a conflict between the needs of professional football clubs and the national associations. The clubs own the players and pay their salaries, and are afraid of injuries when players attend national team gatherings. The national teams, on the other hand, want the best players to be able to

participate and to be at the peak of their performance. FIFA and UEFA have tried to resolve this by introducing international weeks during which all national teams have the right to play matches and the participation of selected players is mandatory unless they have injuries. In Qatar, however, the majority of national team players play in the Qatar National League, thereby making it possible to gather the players for more national team training sessions throughout the year. Moreover, the geographical proximity and the close contact between the clubs and the national team doctor are advantageous for the clinical management and tracking of national team players. However, further evaluation of these apparent advantages is required to determine if they translate into reduced injury rates.

Perspectives

The present study is the first injury epidemiological study performed in the Middle East and the first prospective epidemiological study at the national team level performed in Asia. This paper highlights some issues for football injury epidemiology in

Qatar, such as a higher incidence and greater severity of injuries during matches than during training and the high incidence of muscular strain during matches. Despite the unique environmental, social and cultural settings, these findings are generally consistent with previous data from European football. This suggests that in addition to addressing local issues such as vitamin D deficiency, international guidelines for prevention (such as, e.g., the FIFA 11+ warm-up program) and rehabilitation of football injuries still apply. This study highlights the need for an injury database to be kept at club level to allow integration of the club and national team data.

Key words: injury epidemiology, national team, football, soccer.

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