

Injuries of football referees: a representative survey of Swiss referees officiating at all levels of play

M. Bizzini^{1,2}, A. Junge^{1,2}, R. Bahr³, J. Dvorak^{1,2,4}

¹Schulthess Clinic, Zurich, Switzerland, ²FIFA – Medical Assessment and Research Centre (F-MARC), Zurich, Switzerland, ³Oslo Sports Trauma Research Centre (OSTRC), Oslo, Norway, ⁴Fédération Internationale de Football Association (FIFA), Zurich, Switzerland

Corresponding author: Mario Bizzini, MSc, Schulthess Clinic, Lengghalde 2, 8008 Zurich, Switzerland. E-mail: mario.bizzini@kws.ch

Accepted for publication 17 June 2009

The purpose of this study was to investigate the frequency and characteristics of injury and musculo-skeletal complaints in Swiss football referees of all levels. A representative sample of 489 Swiss referees was interviewed regarding their socio-demographic characteristics, refereeing qualifications, time spent in training and in matches, history of injuries and musculo-skeletal complaints caused by training or refereeing, and other medical problems. A total of 110 referees (22.5%) reported having suffered at least one injury related to officiating, and 126 referees (25.8%) at least one refereeing-related musculo-skeletal complaint. Thigh strains and ankle sprains were the most frequent injuries,

with the most frequent locations of complaints being the knee and lower back. The incidence of match injuries in the last 12 months was on average 2.06 per 1000 match hours; the incidence of training injuries was substantially lower (0.09 per 1000 training hours). The injury rates were similar for referees officiating at an adult level, but lower at a junior level. In comparison with elite football referees, the incidence of training injuries and the prevalence of musculo-skeletal complaints were lower in amateur referees. Nevertheless, preventive programs are indicated for referees at all levels, especially when considering the length of a referee's career.

The referee, with his two assistant referees, plays an important role in the game of football. The “big count” of the Fédération Internationale de Football Association (FIFA) revealed over 840 000 registered referees and assistant referees in 2006 (FIFA, 2007).

Some studies reporting the injury profile of football referees have been published recently, but they have focused exclusively on elite referees at the international level (Bizzini et al., 2008a, b) or at the national level (Bizzini et al., 2009). A complete survey of all 71 officials of the two top divisions of the Swiss Football League revealed an incidence of match injuries of 3.5 per 1000 match hours, and almost 90% of the referees reported musculo-skeletal complaints in the last year (Bizzini et al., 2009). In a retrospective study of male ($n = 123$) and female ($n = 81$) referees selected for the FIFA World Cups™ 2006 and 2007, a lower injury rate and fewer complaints were reported; however, the data collected prospectively during the competitions showed a substantially higher incidence of match injuries (20.8 and 34.7 per 1000 match hours, respectively) (Bizzini et al., 2008a, b).

Similar to the case for players, the number of elite referees is small when compared with the number involved in amateur football. In Switzerland, the 71

referees officiating in the two top divisions represented 1.6% of 4452 registered referees (including 105 female referees) of the Swiss Football Association (SFA) during the season 2005/2006. Moreover, the 204 male and female referees selected for the recent FIFA World Cups™ represented only 0.02% of all registered referees in the 208 National Member Association of FIFA worldwide.

In view of the lack of research in amateur football referees, the aim of the present study was to investigate the incidence of injury and musculo-skeletal complaints in a representative sample of all amateur football referees in one country.

Method

A total of 4452 referees were licensed to officiate in the different leagues of the SFA in the season 2005/2006. Based on the leagues, they were classified into four groups: “professional/semi-professional” level, defined as the two elite leagues (called “Super” and “Challenge”) leagues, “high-amateur” as the first and second leagues, “low-amateur” as the third–fifth leagues, and “junior” level as all leagues with players up to 20 years of age. There is no age limit for referees, with the exception of the two top leagues, where the referees' retirement age is set at 45 years. For none of them, was refereeing the primary paid work.

The SFA provided a complete list of all 4452 referees and informed the regional Swiss Referee Federations about the impending survey 2 months in advance. A random sample of 608 referees was selected, but 86 referees had to be withdrawn from the survey (invalid phone numbers, unwilling to participate, language problems) and 33 were excluded because they were no longer active as referees.

A total of 489 active Swiss referees officiating at all levels were interviewed by telephone with regard to their personal characteristics, such as socio-demographics, refereeing qualifications and time spent in training and in matches, history of injuries and musculo-skeletal complaints caused by training or refereeing, and other medical problems.

The structured interviews were based on a questionnaire that had been implemented in previous studies on referees (Bizzini et al., 2008a, b, 2009), but specially adapted for the needs of a telephone survey. The questionnaire had separate sections for (acute) injuries and musculo-skeletal complaints. First, the referee was asked: "Have you suffered any injury caused by refereeing a football match or the training for officiating?" The question was repeated for three time periods (the last match, the last 12 months, and the entire career), and if the referee answered in the affirmative, he/she was requested to give further details about the injury(ies), such as location, type, and duration of absence. The section on musculo-skeletal complaints was introduced with a short explanation as to how one distinguished "injuries" from "complaints" and some examples of complaints were given (low back pain, pain in the Achilles tendon, etc.). If the referee stated that he/she "had any pain, discomfort or complaints caused by refereeing a football match or the training for officiating," he/she was asked to give further details (such as location, intensity, cause, and consequences with respect to training and officiating). The interviews (average duration, 10 min) were conducted in German and French in order to cover the two languages most commonly spoken in Switzerland. The phone survey was carried out by a specialized institute (LINK Institut, Lamprecht & Stamm, Zürich) in May 2006.

The University of Zürich, University Human Subjects Ethics Committee, granted ethical approval for this study.

Calculation of exposure time and statistical analysis

Exposure time in match and training was calculated based on the information provided in the survey (number of matches in the last 12 months, average training hours per week during the pre-season and during the season). Match exposure during the last 12 months was calculated as the total sum of matches officiated by all referees in the last year times 1.5 h (the minimum duration of a match).

Statistical analyses were carried out using SPSS (version 11; SPSS Institute, Chicago, Illinois, USA). The statistical methods applied were frequencies, means, and cross-tabulations. Results are reported as the mean and standard deviation (SD) and/or range, unless otherwise noted. For incidence rates, 95% confidence intervals (CI) were calculated as the incidence ± 1.96 times the incidence divided by the square root of the number of injuries.

Results

Characteristics of referees

The 489 referees (481 men, eight women) had a mean age of 36.6 years (range 15–73, SD 14.9 years). Their mean height was 177.1 cm (range 150–201, SD 7.2), body weight, 78.2 kg (range 43–120, SD 11.6), and

body mass index (BMI), 24.9 kg/m² (range 13.0–37.2, SD 3.4).

The referees had received their official license from the SFA on average 12 years (range 1–20, SD 8.1) ago, but approximately 40% ($n = 197$) of the referees had received it within the last 5 years. Thirteen (2.6%) referees officiated matches in the (semi-) professional league; for 123 (25.2%) referees, their highest level was upper amateurs, and for 215 (44.0%), lower amateurs. One hundred and thirty-eight (28.2%) referees officiated in the junior league. The referees had officiated on average 24.4 matches per year (range 1–90, SD 13.8) during their career, and 21.8 matches during the last 12 months (range 0–96, SD 14.4). They trained on average 4.8 h a week (range 0–20, SD 11.1), with no difference between in-season training and before/after season training. About 10% of the referees stated that they performed no specific training at all. About one-third ($n = 141$, 30.9%) of the referees played football in an amateur club at the time of the survey. While only 6.8% of the referees ($n = 33$) had never played football, 90.2% ($n = 435$) had played at an amateur level and 2.9% ($n = 14$) in semi-professional and professional leagues.

One in five referees ($n = 97$, 19.8%) reported general medical problems, mainly allergies (8.1%), high blood pressure (5.9%), and asthma (3.2%). Sixty-six referees (13.3%) stated that they regularly took medication because of their health problems. Every third referee ($n = 167$; 34.2%) had undergone surgery for a musculo-skeletal problem, 33 (6.8%) of them more than once. The most common locations for their surgical interventions were the knee (20%), the ankle (4.5%), and the Achilles tendon (2%).

Injuries during career

A total of 155 career injuries were reported, with more injuries during matches ($n = 114$; 73.5%) than during training (Table 1). The top five injured body parts were the ankle, thigh, lower leg, knee, and Achilles tendon (Table 1). Muscle lesions mostly occurred in the thigh and lower leg. Ligament lesions were prevalent at the ankle and knee joints. Meniscal and chondral lesions were documented for the knee joint. Tendon problems (i.e. acute tendonitis) occurred almost exclusively in the Achilles tendon. Thigh muscle strain (26.3%) was the most common match injury, followed by ankle sprain (14.9%) and calf strain (14.0%). Ankle sprain was the most frequent training injury (11.4%).

In the majority of injuries ($n = 91$, 79.8%), the injured referee was able to finish the match. In almost a quarter of the match injuries ($n = 24$, 23.5%), the match was interrupted, and in most of these cases ($n = 23$; 20.2%), the referee could not finish the match and had to be substituted by the fourth

Table 1. Diagnosis of career injuries, given separately for match and training

Localization and type	Number of injuries		
	Total	Match	Training
Head/neck	1		
Concussion	1	1	
Trunk	5		
Strain	1	1	1
Contusion	1	1	
Other	3	2	
Upper extremity	1		
Strain	1	1	
Hip/groin	3		
Strain	3	2	1
Thigh	39		
Strain	37	30	7
Other	2	2	
Knee	22		
Lesion of the meniscus	10	4	6
Sprain	9	5	4
Other	3	3	
Lower leg	24		
Strain	19	16	3
Other	5	5	
Achilles tendon	13		
Acute tendonitis	9	7	2
Lesion of the tendon	2	2	
Other	2	2	
Ankle	41		
Sprain	31	18	13
Fracture	2	1	1
Other	8	6	2
Foot/toe	6		
Contusion	4	3	1
Other	2	2	
Total	155	114	41

official. In 96 (61.9%) cases of injury, the referee sought a medical examination, and in 53 (34.2%) cases, sick-leave was granted.

The vast majority of injured referees were not able to officiate ($n = 141$; 91%) or train ($n = 137$; 88.4%) the day after the reported injury. Absence from matches was up to 1 week in 23 (14.8%) cases, from 8 to 14 days in 38 (24.5%) cases, from 15 to 30 days in 35 (22.6%) cases, from 31 to 60 days in 17 (11%) cases, from 61 to 120 days in 12 (7.7%) cases, and >4 months in 12 (7.7%) cases.

A total of 110 referees (22.5%) reported having suffered at least one refereeing-related injury during their career. The majority ($n = 75$; 68.2%) of them reported a single injury, while 35 (31.8%) referees had incurred two or more injuries. The proportion of referees reporting injuries during their career increased with age up to 50 years, after which it remained relatively stable (Fig. 1).

Musculo-skeletal complaints during career

A total of 158 musculo-skeletal complaints during the career were reported by 126 referees (25.8%). The

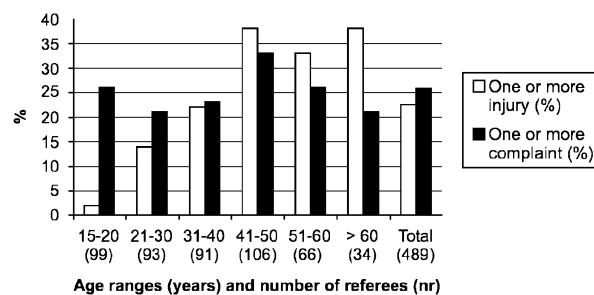


Fig. 1. Percentage of Swiss football referees by age group, reporting at least one career injury and at least one musculo-skeletal complaint.

percentage of referees reporting complaints ranged between 21% and 33% in the different age groups, with no specific trend (Fig. 1). The most frequent localizations were the knee ($n = 35$; 22.2%), low back ($n = 34$; 21.5%), Achilles tendon ($n = 18$; 11.4%), and groin ($n = 12$; 7.6%). All other body locations accounted for <7% of all complaints, i.e. they were declared by <1% of the referees.

The intensity of the complaint was rated as “very severe” in 21 cases (13.3%), “severe” in 37 cases (23.4%), “moderate” in 67 cases (42.4%), and “minor” in 33 (20.9%) cases. In seven cases (4.8%), the referee was not able to finish the match because of the severity of the physical symptoms. In 64 cases (40.5%), the referee visited a physician for the complaint.

The majority of complaints ($n = 115$, 71.9%) did not impede the referees from (potentially) officiating a match the next day, but 40.6% of the complaints ($n = 64$) affected the ability to train. Absence from training was between 1 and 3 days in 13 cases (8.2%), between 4 and 7 days in 14 cases (8.9%), between 8 and 21 days in 25 cases (15.8%), between 22 and 56 days in seven cases (4.4%), and for >8 weeks in three cases (1.9%).

Relationship between injuries and musculo-skeletal complaints

Thirty referees (6.1%) reported having suffered both injuries and complaints related to refereeing during their career. In only one case was the body part that was injured the same as that for which the complaints were reported (thigh/hamstring); in four other cases, an association between injury and complaint could have been suspected (foot and Achilles Tendon (two cases), knee and quadriceps (one case), thigh and knee (one case), respectively). In all other cases, the referees reported only injuries ($n = 80$) or complaints ($n = 96$), or neither of them ($n = 308$).

Table 2. Characteristics of referees, exposure, injuries, and complaints in the last 12 months with respect to the officiating level

	Junior (<i>n</i> = 138)	Low-level amateur (<i>n</i> = 215)	High-level amateur (<i>n</i> = 123)	Semi- Professional and professional (<i>n</i> = 13)	Total (<i>n</i> = 489)
Age (mean ± SD)	25.7 ± 12.6	40.7 ± 13.8	41.2 ± 12.9	51.1 ± 10.1	36.6 ± 14.9
Years of license (mean ± SD)	5.9 ± 5	13.2 ± 7.7	16.1 ± 7.9	23 ± 4.6	12 ± 8.1
Average number of matches (mean ± SD)	16.2 ± 11.6	24.1 ± 14.1	24.8 ± 16.9	18.5 ± 11.3	21.8 ± 14.4
Average number of training hours (mean ± SD)	6.1 ± 14.7	4.8 ± 13.2	4.7 ± 4.2	4.7 ± 2.8	4.8 ± 11.1
Number of match injuries (<i>n</i>)	2	20	9	2	33
Training injuries (<i>n</i>)	1	7	3	0	11
Incidence of match injuries (injuries per 1000 match hours, and 95% CI)	0.59 (95% CI: 0.23 to 1.33)	2.57 (95% CI: 1.44 to 3.7)	1.97 (95% CI: 0.67 to 3.27)	5.54 (95% CI: 2.16 to 13.24)	2.06 (95% CI: 1.36 to 2.76)
Incidence of training injuries (injuries per 1000 training hours, and 95% CI)	0.02 (95% CI: 0.02 to 0.06)	0.11 (95% CI: 0.03 to 0.19)	0.11 (95% CI: 0.01 to 0.23)	0	0.09 (95% CI: 0.04 to 0.23)
Number of referees with complaints related to match (<i>n</i> [%])	15 (10.9)	26 (12.1)	18 (14.6)	1 (7.7)	60 (12.3)
Number of referees with complaints related to training (<i>n</i> [%])	1 (0.7)	2 (0.9)	1 (0.8)	2 (15.4)	6 (1.2)

CI, confidence interval.

Injuries and musculo-skeletal complaints in the preceding year

The exposure times, as well the number and incidence of injuries in the last 12 months are presented in Table 2. A higher incidence of match injuries was observed in referees officiating the matches of adult players than in those refereeing junior league matches. However, referees officiating junior matches were significantly younger than referees of adult leagues. Compared with the incidence of match injuries, the incidence of training injuries was low in all categories (Table 2). Sixty (12.3%) referees reported musculo-skeletal complaints in connection with officiating, but only six (1.2%) in association with training.

Five injuries were incurred during the last match by five referees (two low-level amateur, two high-level amateur, one junior level), yielding an injury incidence rate of 6.82 injuries per 1000 match hours (95% CI: 0.85–12.79). One referee was not able to finish the match and had to be substituted because of the severity of his calf strain. Musculo-skeletal complaints related to the last match were reported by 7.8% of all referees (*n* = 38), and two of them (0.4% of all referees) were not able to finish the last match because of the severity of their Achilles tendon symptoms.

Discussion

This study is a retrospective phone survey of the injuries and musculo-skeletal complaints of a representative sample of 489 football referees officiating in

all Swiss leagues. The study followed the methodology of previous studies (Bizzini et al., 2008a, b, 2009); the limitations of the retrospective design, especially the associated recall bias for career data, have been discussed in these publications. The referees included in the present study were similar in age, height, weight, years of experience, and weekly training hours to the 91 referees involved in an international youth football 5-day tournament (Fauno et al., 1993). They also had a similar average age to the 71 referees of the two top divisions of the Swiss Football League, but a slightly higher BMI and on average a shorter experience in refereeing compared with that group (Bizzini et al., 2009). They were, however, on average younger and less experienced than referees pre-selected for FIFA World Cups™ (Bizzini et al., 2008a, b).

The reporting of medical problems (such as asthma) and the use of medication in the representative group of Swiss referees showed almost the same prevalence (20% and 10%, respectively) as in Swiss elite referees (Bizzini et al., 2009) and FIFA World Cup™ pre-selected referees (Bizzini et al., 2008a, b). Knee surgery was the most frequently reported surgical intervention, similar to the findings for the Swiss elite group, but the incidence was higher than in the FIFA pre-selected referees (Bizzini et al., 2008a, b, 2009). The fact that >30% of the amateur referees were also playing club football may have accounted for the larger number of reported knee injuries.

In the present study, a quarter of the referees reported having suffered one or more refereeing-related injuries during their career. This is approxi-

mately half as many as those at the elite level (Swiss elite: 44%, selection for the 2006 FIFA World Cup™: 40%; selection for the FIFA Women's World Cup™ 2007: 50%) (Bizzini et al., 2008a, b, 2009). In the representative sample of the present study, fewer training injuries (21%) than match injuries (79%) were reported, which contrasts with the situation for the elite referees (Swiss elite: 62% training injuries; FIFA selection: 82% training injuries). This may be explained by the greater number of hours spent in training by the elite referees compared with the amateur referees of the present study.

The incidence of match injuries in the preceding 12 months reported by the referees in the present study (2.06 per 1000 match hours; 95% CI: 1.36–2.76) was similar to that previously reported for Swiss elite referees (3.45 per 1000 match hours; 95% CI: 1.20–5.7) and the pre-selected referees for the FIFA Women's World Cup™ 2007 (2.8 per 1000 match hours; 95% CI: 1.3–4.3) (Bizzini et al., 2008a, b, 2009). In the present study, the referees involved at the junior level showed a lower incidence of match injury than the other referee groups. However, because this group was significantly younger than the other groups, it is not possible to ascertain whether this is an effect of league or age. Previous studies have shown that increasing age is associated with a higher incidence of match injuries in football players (Arnason et al., 2004). Interestingly, the incidence of match injuries in the small group of referees officiating at a semi-professional or a professional level was similar to that reported for Swiss elite referees (Bizzini et al., 2009) and for a group of international referees (Fauno et al., 1993). The incidence of injury in the last match (6.8 per 1000 match hours; 95% CI: 0.85–12.75) was similar to that reported for the pre-selected referees for the FIFA Women's World Cup™ 2007 (8.2 per 1000 match hours; 95% CI: 2.6–13.9) (Bizzini et al., 2008a) and the international youth football tournament (4.6 per 1000 match hours, 95% CI not provided) (Fauno et al., 1993). In contrast, the referees selected for the FIFA World Cup™ 2006 had a reported incidence of 0.7 match injuries per 1000 match hours (95% CI: 0.1–1.3) in the last 12 months, and no injury in the last match (Bizzini et al., 2008b).

In the present study, the incidence of training injuries in the last 12 months was substantially lower than that in all previous studies (Swiss elite referees: 0.42 per 1000 training hours; 95% CI: 0.13–0.71, selection for the FIFA World Cup™ 2006: 0.41 per 1000 training hours; 95% CI: 0.21–0.61, selection for the FIFA Women's World Cup™ 2007: 0.63 per 1000 training hours; 95% CI: 0.22–0.64) (Bizzini et al., 2008a, b, 2009). This might be explained by the higher number of training hours (on average, over 6 h/week), combined with the higher intensity and

quality of training in the Swiss elite referees and the selected referees for the two FIFA World Cups™. The most common types of injury (strains of the hamstring and calf, and sprains of the ankle and knee) were, however, the same in the present survey as in previous studies on elite referees (Bizzini et al., 2008a, b, 2009).

In this survey, about a quarter of the referees reported at least one musculo-skeletal complaint during their career. The prevalence of complaints was substantially lower than reported previously for groups of elite referees, where it ranged from 60% to 90% (Bizzini et al., 2008a, b, 2009). One possible explanation for this difference concerns the different methodological approaches used to register complaints. While in the previous studies on high-level referees a list of complaints was provided, in the present study, the referees were asked an open question and the responses were then categorized into the different locations. The difference might also be partly explained by the high demands of matches and training at the national and the international level (Castagna et al., 2007; MacMahon et al., 2007). The most prevalent localizations of musculo-skeletal complaints (knee, low back, Achilles tendon, and calf) were, however, similar in amateur and elite referees (Bizzini et al., 2008a, b, 2009). These findings confirm the specific musculo-skeletal complaints' profile of the football referee at all levels.

Perspectives

The incidence of match injuries is similar for referees officiating matches for adult players, regardless of the level of play. Referees of junior leagues are on average younger and have a lower injury rate. The rate of training injuries is substantially lower in amateur than professional referees. However, the career of a referee officiating at all levels may continue beyond the limit of 45 years of age (the limit set for the international career of elite referees), so that they experience longer exposure to matches and training. The implementation of prevention programs within the training routine may help all referees in minimizing musculo-skeletal problems over the years.

Key words: soccer, amateur level, referees, injuries, musculo-skeletal complaints.

Acknowledgements

The authors gratefully acknowledge Fédération Internationale de Football Association (FIFA) for the funding of this study. We appreciate the support and collaboration of Mr. F. Bianchi and Mr. V. Coppo of the Swiss Referee Committee

of the Swiss Football Association, Lamprecht and Stamm Zürich, and Link Institute Zürich for carrying out the phone survey. The authors are grateful to PD Dr. Anne Mannion for her careful language editing of the manuscript. The Oslo Sports Trauma Research Center has been established at the

Norwegian University of Sport and Physical Education through generous grants from the Eastern Norway Regional Health Authority, the Royal Norwegian Ministry of Culture and Church Affairs, the Norwegian Olympic Committee and Confederation of Sport, and Norsk Tipping AS.

References

- Arnason A, Sigurdsson SB, Gudmundsson A, Holme I, Engebretsen L, Bahr R. Risk factors for injuries in football. *Am J Sports Med* 2004; 32: 5S–16S.
- Bizzini M, Junge A, Bahr R, Dvorak J. Female soccer referees selected for the FIFA women's world cup 2007 – a survey of injuries and musculoskeletal complaints. *Br J Sports Med* 2008a (October 16, Epub ahead of print).
- Bizzini M, Junge A, Bahr R, Dvorak J. Injuries and musculoskeletal complaints of referees - a complete survey in the top divisions of the swiss football league. *Clin J Sports Med* 2009; 19: 95–100.
- Bizzini M, Junge A, Bahr R, Helsen W, Dvorak J. Injuries and musculoskeletal complaints in referees and assistant referees selected for the 2006 FIFA world cup™ – retrospective and prospective survey. *Br J Sports Med* 2008b; 43: 490–497.
- Castagna C, Abt G, D'Ottavio S. Physiological aspects of soccer refereeing performance and training. *Sports Med* 2007; 37: 625–646.
- Fauno P, Kalund S, Andreasen I, Jorgensen U. Soreness in lower extremities and back is reduced by use of shock absorbing heel inserts. *Int J Sports Med* 1993; 14: 288–290.
- MacMahon C, Helsen W, Starkes JL, Weston M. Decision-making skills and deliberate practice in elite association football referees. *J Sports Sci* 2007; 25(1): 65–78.
- FIFA. The FIFA big count 2006: 230 million active in football, 2007. Available at <http://www.fifa.com/search/index.htm?q=big+count> (accessed May 31, 2007)