

Injuries and Musculoskeletal Complaints in Referees—A Complete Survey in the Top Divisions of the Swiss Football League

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Objective: To analyze the extent and characteristics of injuries and musculoskeletal complaints in elite football referees and to analyze differences between match and assistant referees.

Design: Retrospective cohort study.

Setting: Training camp organized by the Swiss Referees Association.

Participants: All 71 referees of the 2 top divisions of the Swiss Football League (2005–2006 season).

Interventions: The referees (66 males and 5 females) completed a questionnaire on their personal characteristics, referee qualifications, time spent in training and matches, career history of injuries, and musculoskeletal complaints caused by training or refereeing and were subsequently interviewed about the location, type, circumstances, and consequences of reported injuries.

Main Outcome Measures: Incidence of injuries, frequency of musculoskeletal complaints, type of injuries, and complaints.

Results: A total of 41 injuries during the career were reported by 31 of 71 referees (44%). Injuries were incurred more frequently in training than during matches, and all injuries reported resulted in at least 2 weeks of absence from sport. About a quarter of the referees reported an injury, and almost 90% of the referees reported musculoskeletal complaints caused by refereeing during the preceding 12 months. In male referees, hamstring strains and ankle sprains were the most common injuries, and the hamstrings, knee, Achilles tendon, and calf were the most prevalent locations of musculoskeletal complaints. No significant difference in the incidence of injury or in the frequency of complaints was observed between match and assistant referees.

Conclusions: Future studies should be designed prospectively and should include a larger group of female referees. Regarding the incidence of injuries and frequency of musculoskeletal complaints

related to refereeing, prevention programs for football referees should be developed, evaluated, and implemented.

Key Words: soccer, referee, injury, musculoskeletal complaints, incidence

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INTRODUCTION

Football (soccer) is one of the most popular sports worldwide. An official survey (“Big Count 2006”) by the Fédération Internationale de Football Association (FIFA) revealed that in 2006 there were, worldwide, more than 840,000 registered referees and assistant referees (ARs).¹ The anthropometric profiles of referees and their movement patterns and physiological demands during match play have been examined in a number of studies.^{2–13} In a recent review, Castagna et al² summarized the current literature describing the physical and mental demands on the referee. Similar to players, referees show a mixed walking and running profile during the game. However, there are substantial differences in the characteristics of referees and their actions during the game: football referees are rarely full-time professionals, are older than players,³ and, more importantly, are not meant to have any physical contact with the players. Therefore, it can be expected that referees have a different injury profile from football players, with less risk of acute injuries and a higher proportion of overuse problems.

In reviewing the scientific literature, there are very few peer-reviewed publications on injuries in referees.^{14,15} Brukner et al¹⁴ describe a comparison of injuries in Australian rules football players and referees. Although the match demands for football players differ from Australian rules football players, they are similar for referees. All time-loss injuries were recorded during the 22 matches of the 1989 season. A total of 13 injuries were recorded in 50 umpires. The study of Fauno et al¹⁵ investigated the effects of shock absorbing heel inserts on soreness in the lower extremity and back in 91 referees during a 5-day tournament. In the control group, between 16% and 93% of the referees reported soreness, whereas the prevalence was lower in the intervention group. Additionally, 6 acute injuries were reported, resulting in an incidence rate of 4.6 injuries per 1000 referee hours.

Given the paucity of research on injuries of football referees, the aim of the present study was to investigate the injuries and musculoskeletal complaints of all referees

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officiating in the 2 top divisions of the Swiss Football League and to analyze possible differences between match referees and ARs.

METHODS

Design and Procedure

The study was designed as a retrospective survey including all referees officiating in the Swiss Super and Challenge League (first and second national divisions; 2005–2006 season). During a training camp organized by the Swiss Referees Association (mid-season break; January 2006), all match referees (MRs) and ARs were asked to complete a specially developed questionnaire and were subsequently interviewed to gain more detailed information about each injury reported.

The 5-page questionnaire covered the following areas: personal characteristics, such as sociodemographics, refereeing qualifications, and experience; career history of injuries and musculoskeletal complaints caused by training or refereeing; and other medical problems and time spent in training and in matches.

The interview was based on the injury documentation form published in the recent consensus article.¹⁶ The questions, with predefined answers, focused on the location (body part and side), type (overuse injury, trauma, and diagnosis), circumstances (training, match, and type of activity), and duration of absence from sport for each injury mentioned. Furthermore, the referees were asked about the details of the stated musculoskeletal complaints to classify only acute trauma as injury and all overuse injuries as complaints. All interviews were conducted in either German or French by the first author of the study (MB) and each had an average duration of 10–15 minutes.

All participants gave their signed informed consent to participate. The study was approved by The University of Zürich, University Human Subjects Ethics Committee.

Development of the Assessment Methods

The assessment methods were developed based on a recent consensus statement on injury definition and data collection procedures in studies on football injuries.¹⁶ In this consensus statement, an injury was defined as: “Any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for medical attention or time loss from football activities.”¹⁶ Theoretically, this definition applies to both traumatic and overuse injuries. However, there are some practical problems in the assessment of overuse injuries due to their nature (gradual onset, recurrent symptoms, and severity fluctuation¹⁷). Overuse injuries may be assessed by inquiring about musculoskeletal complaints in the given body area.

Based on these considerations, the questionnaire had separate sections for injuries and musculoskeletal complaints. The referees were first asked, “Have you suffered any injury caused by refereeing a football match or the training for officiating?” and then “Have you had any pain, discomfort or complaints caused by refereeing a football match or the training for officiating?” These questions were repeated for

3 different periods (during the last match, in the last 12 months, and in your entire career). The response options for the injury question were “yes/no,” and, if the referee ticked “yes,” further details on the injuries were inquired about during a personal interview. The question concerning complaints was followed by a list of the most common musculoskeletal symptoms (complete list in Table 3). The referees were asked, “Please indicate the extent to which you suffered from any of the following symptoms,” with answers being given on a 5-point Likert scale (not at all, a little, moderately, severely, and very severely). This method was adopted because the wording of a question has a major impact on the answers of the respondent; if asked “Have you sustained an injury?” the respondent would be more likely to recall the most serious and acute injuries but might forget to report minor injuries or complaints that he does not immediately consider as injuries. The additional question about “pain, discomfort or complaints” was included to remind the referee of any physical symptoms that he may have experienced during training or a match. We developed the list of symptoms to capture overuse injuries. The questionnaire was available in German and French to cover the main languages spoken in Switzerland.

Calculation of Exposure Time and Statistical Analysis

Exposure time in match and training was calculated based on the information provided in the questionnaire (average matches per year, matches in the last 12 months, and average training hours per week in preseason and during season). Match exposure in the last 12 months was calculated as the total sum of matches officiated by all referees in the last year times 1.5 hours (the minimum duration of a match). Match exposure over the career was calculated by multiplying the number of referees, the average years in refereeing, and the average number of officiated games per year, and 1.5 hours.

The statistical analyses were carried out using SPSS version 11 (SPSS Inc, Chicago, Illinois). Statistical methods applied were frequencies, means, and cross-tabulations. Group differences between MRs and ARs were analyzed by χ^2 (categorical data) or unpaired *t* tests (continuous variables). Female referees were analyzed separately to account for potential gender differences. Results are reported as the mean and SD and/or range, unless otherwise noted. For incidence rates, 95% confidence intervals (CIs) were calculated as the incidence \pm 1.96 times the incidence divided by the square root of the number of injuries. *P* values of less than 0.05 were regarded as significant.

RESULTS

All 71 referees (27 MRs and 44 ARs) of the 2 top divisions of the Swiss Football League participated in the study. Because almost all referees were male (*n* = 66), the results of the 5 female referees (2 MRs and 3 ARs) are reported in a separate section.

Characteristics of Male MRs and ARs

The average age of the 66 male referees was 36 years (SD, 5.3; range, 25–45 years), and they reported a height of

180 cm (SD, 6 cm) and a weight of 76 kg (SD, 6 kg), resulting in an average body mass index (BMI) of 23.6 (SD, 1.7; range, 19.9–27.7) kg/m². Before their refereeing career, the majority (n = 60; 91%) had played football on average for 9.3 years (SD, 4.5 years). For the majority, low-level amateurs were the highest league level in which they had played football (n = 48; 80%), although 11 referees had been high-level football players (17%) and one a semiprofessional. They received their first official license for refereeing on average 16 years ago (range, 7–25 years) and had been officiating in the top 2 divisions of the Swiss Football League for an average of 7.5 years (range, 1–20 years). Seventeen referees (26%) also possessed a FIFA license. No differences between MRs and ARs were observed in their level of experience as players or referees.

During the last 12 months, the MRs had officiated fewer national matches than ARs [22 (SD, 6.8) vs 26 (SD, 7.2); *P* < 0.05]. Seven MRs (28%) and 16 ARs (39%) had also participated in international matches, on average 5.1 matches (SD, 2.9). MRs had spent significantly more hours per week in training than had ARs; 6.4 hours (SD, 2.9) versus 4.7 hours (SD, 2.3; *P* < 0.05), respectively, in the preseason and 5.1 hours (SD, 3.0) versus 3.6 hours (SD, 1.7; *P* < 0.05), respectively, during the season (Table 1).

Injuries Among Male MRs and ARs

A total of 39 injuries throughout their career were reported by 13 MRs (52% of all MRs) and 16 ARs (39%) (not significant) (for details, see Table 2). Four MRs (16%) and 6 ARs (15%) reported 2 injuries but to different body parts. Nine MRs (36%) and 8 ARs (20%) reported an injury during the last 12 months. Hamstring strains (26%) and ankle sprains (26%) were the most common diagnoses in both groups; in ARs, knee cartilage lesions were also frequent.

All referees reported being unable to train the day after their injury; no injuries were reported that resulted in less than 2-week absence from sport. Most injuries resulted in a time loss of either 2–4 weeks (n = 17; 44%) or 5–8 weeks (n = 14;

36%), whereas 8 injuries (21%) resulted in an absence of more than 12 weeks.

Fourteen injuries (36%) (of 5 MRs and 9 ARs) were incurred during matches, whereas 24 (62%; 11 MRs and 13 ARs) occurred during training or warm-up. All 6 match injuries reported by MRs were incurred in the last 12 months, resulting in an incidence of 6.8 match injuries per 1000 match hours (95% CI, 1.4–12.3). For ARs (3 match injuries), the incidence of match injuries in the last 12 months was 1.7 per 1000 match hours (95% CI, 0.2–3.7).

Musculoskeletal Complaints of Male MRs and ARs

A summary of the musculoskeletal complaints reported by male MRs and ARs is provided in Table 3. No referees reported having incurred an injury during the last match, but almost half of the MRs (n = 12; 48%) and 39% of the ARs (n = 16) stated that they had had at least 1 musculoskeletal complaint. In relation to the last 12 months, 23 MRs (92%) and 34 ARs (83%) reported having had some sort of complaint caused by refereeing. Twenty-four referees (96%) and 36 ARs (88%) reported having experienced musculoskeletal complaints at some stage during their entire career. The most prevalent locations were the hamstrings, knee, and Achilles tendon. No significant difference in the frequency of complaints was observed between MRs and ARs.

Characteristics, Injuries, and Musculoskeletal Complaints of Female Referees

Two female MRs and 3 female ARs were officiating in the 2 top divisions of the Swiss Football League. Similar to their male counterparts, their age ranged from 23 to 39 years (mean, 31 years; SD, 6 years); their average height (167 cm; SD, 0 cm), weight (57 kg; SD, 2 kg), and BMI (20.4 kg/m²; SD, 0.87 kg/m²) were all substantially lower than those of the male referees. They had received their first official license for refereeing on average 9 years ago (range, 4–22 years), and all also had a FIFA license. The female referees officiated between 20 and 32 national matches per year and between

TABLE 1. Exposure Time, Number and Incidence of Injuries and Frequency of Complaints of 66 Swiss Male Elite Referees

	Match Referees (n = 25)			Assistant Referees (n = 41)		
	Last Match	Last 12 Months	Entire Career	Last Match	Last 12 Months	Entire Career
Exposure time, h						
Match	37.5	877.5	14 040	61.5	1719	27 500*
Training	—	8640*	138 240*	—	10 400*	166 400*
Injuries, No.						
Match	0	5 + 1†	0	0	3	6
Training	—	3	8	—	5	8
Incidence, injuries/1000 h						
Match	0	6.84	0	0	1.74	0.22
Training	—	0.35	0.06	—	0.48	0.05
Complaints, No. (%)						
At least 1	12 (48)	23 (92)	24 (96)	16 (39)	34 (83)	36 (88)

*Estimated.

†One injury occurred after the match.

TABLE 2. Injuries During Their Career of 66 Swiss Male Elite Referees

Injury	Match Referees (n = 25)		Assistant Referees (n = 41)		Total
	Match	Training	Match	Training	
Hamstring strains	2	4	2	2	10
Ankle sprains	2	3	3	2	10
Calf strains	—	1	1	1	3
Meniscus lesions	—	1	1	1	3
Knee cartilage lesions	—	—	—	3	3
Anterior cruciate ligament ruptures	—	—	1	1	2
Achilles tendon partial ruptures	1	—	1	—	2
Rib fractures	1*	1	—	—	2
Clavicle fracture	—	—	—	1	1
Groin strain	—	—	—	1	1
Quadriceps strain	—	—	—	1	1
Knee sprain	—	1	—	—	1
Total	6*	11	9	13	39

*One rib fracture was caused by the referee being attacked after a match and falling.

0 and 6 international matches per year. Similar to their male colleagues, the female referees spent on average 6 h/wk (range, 4–10 h/wk) in training during the preseason period and 5 h/wk (range, 3–6 h/wk) during the season.

One MR (50%) and 1 AR (33%) reported an injury in the last 12 months; both incurred a hamstring strain while sprinting during training. The most prevalent complaint was headache (for details, see Table 4).

DISCUSSION

The present study investigates the characteristics and incidence of injuries and the frequency of musculoskeletal complaints in the entire cohort of all 71 male and female referees of the 2 top divisions of the Swiss Football League.

The Swiss top-level referees included in the present study were similar in age to Italian,^{4–8} English,^{9,18} Greek,¹⁰ Belgian,¹¹ and Danish^{12,13} elite referees officiating at the national level. Their average BMI was similar to Italian^{4–8} and Danish^{12,13} referees but was lower than that of English⁹ and Greek¹⁰ referees. A BMI value of less than 25 kg/m² (average in the Swiss group, 23.6 kg/m²) is considered to be favorable for refereeing performance² and for good health. The Swiss top-level referees were also similar to the Italian⁸ and Belgian¹¹ referees concerning the average number of years officiating at the national level.

Of all male Swiss top-level referees, 29 (44%) reported having incurred at least 1 injury during their career. Almost half of the injuries reported (17 of 39) were incurred in the last 12 months, resulting in an incidence of 6.8 match injuries per 1000 match hours for MRs and 1.7 for ARs. However, when interpreting these data, it must be borne in mind that no injury with a time loss of less than 2 weeks was reported. Thus, the true incidence of injuries may have been underestimated.

Nevertheless, the percentage of referees who reported an injury in the preceding year (23%) was similar to that stated by Brukner et al,¹⁴ and the exposure-related incidence of match injuries in the last year (3.45/1000 match hours; 95% CI, 1.20–5.7) was similar to that reported by Fauno et al.¹⁵ For a comparison of the injury profile of referees and football players, only episodes of noncontact injuries with a minimum of 2-week time loss should be regarded. In the data that Junge et al¹⁹ reported from the 2002 FIFA World Cup, the incidence of noncontact injuries with an absence of more than 1 week (2 weeks was not available as a cutoff) was 4.7 per 1000 match hours.

The most frequent types of injury were hamstring strains and ankle sprains (each 26%), with other types of injury each accounting for less than 8% of all injuries. Muscle strains and ligament sprains are also the injuries most commonly documented for football players.^{20,21} It is important to note that, in players, about half of all acute injuries (especially knee and ankle sprains) are caused by physical contact with another player.^{22,19–24} The most common noncontact injuries of players—the muscle strains (especially of the posterior thigh)—are also frequent in referees.

The Swiss elite referees incurred more injuries during training (62%) than during the match (39%), which might be explained by the greater exposure time in training than in matches (Table 1). In general, slightly more MRs (52%) than ARs (39%) reported an injury during their career. The incidence of match injuries showed a similar trend, but the difference was not significant due to the smaller numbers. Statistical comparisons between male and female referees were not possible due to the low number of female referees; however, there seemed to be no substantial gender differences in the overall rates or types of injury.

Although no acute injuries were reported in relation to the last match, 28 male (42%) referees and 1 female (20%) referee reported having had at least 1 musculoskeletal complaint. In relation to the last 12 months, 86% of the male referees and all female referees reported musculoskeletal complaints caused by refereeing. These figures closely related to the prevalence of soreness in the lower extremity and back pain observed by Fauno et al¹⁵ during a 5-day tournament. The most prevalent locations of these complaints were, in the male referees, the hamstrings, knee, Achilles tendon, and calf; in the 5 female referees, headache was a common symptom. In general, more MRs than ARs reported complaints; however, calf and groin problems were more frequent in ARs. Complaints in the hamstrings reflect the most frequent diagnosis of injuries (hamstring strains); however, for the other locations, there was no association between complaints and injuries. It can therefore be assumed that complaints in the knee and Achilles tendon might rather reflect symptoms of overuse injury. In addition, the diagnoses for the reported injuries did not include typical overuse injuries; thus, the separate assessment of injuries and musculoskeletal complaints provided complementary information.

In the present study, stretching was indicated as the main injury prevention measure by about 40% of the referees. Although the preventive value of stretching is controversial,²⁵ most athletes consider it important in injury prevention. It was interesting to note that none of the referees mentioned any

TABLE 3. Number and Percentage of Male Referees Reporting Musculoskeletal Complaints

Complaint	Match Referees (n = 25)			Assistant Referees (n = 41)		
	Last Match, No. (%)	Last 12 Months, No. (%)	Entire Career, No. (%)	Last Match, No. (%)	Last 12 Months, No. (%)	Entire Career, No. (%)
Headache	1 (4)	3 (12)	3 (12)	2 (4.9)	4 (9.8)	5 (12.2)
Neck pain	—	2 (8)	4 (16)	—	4 (9.8)	4 (9.8)
Low back pain	2 (8)	11 (46)	11 (46)	4 (9.8)	11 (26.8)	11 (26.8)
Pain in the hip joints	—	4 (16)	5 (20)	1 (2.4)	2 (4.8)	3 (7.3)
Pain in the groin regions	1 (4)	2 (8)	2 (8)	3 (7.3)	9 (22)	9 (22)
Pain in the front thigh muscles (musculus quadriceps femoris)	2 (8)	4 (16)	5 (20)	2 (4.9)	8 (19.5)	10 (24.4)
Pain in the back thigh muscles (hamstrings)	—	3 (12)	4 (16)	1 (2.4)	3 (7.3)	6 (14.6)
Pain in the inner thigh muscles (musculi adductores femoris)	2 (8)	12 (48)	12 (48)	1 (2.4)	11 (26.9)	13 (31.8)
Pain in the patellar tendons	2 (8)	11 (44)	14 (56)	4 (9.8)	17 (41.5)	17 (41.5)
Pain in the knee joints	—	3 (12)	3 (12)	1 (2.4)	2 (4.9)	2 (4.9)
Pain in the Achilles tendons	2 (8)	6 (24)	8 (32)	2 (4.9)	14 (34.1)	15 (36.6)
Pain in the calf muscles	3 (12)	7 (28)	12 (48)	4 (9.8)	12 (29.3)	16 (39.0)
Pain in the ankle joints	1 (4)	3 (12)	5 (20)	—	1 (2.4)	6 (14.6)
Others*	—	—	—	1 (2.4)	2 (4.9)	2 (4.9)

*Others includes shin splints and heel pain.

specific preventive exercises or prevention programs that they engaged in to try to reduce their likelihood of injury. For the most common injuries in referees (hamstring strains and ankle sprain), there is evidence for the effectiveness of preventive programs. Eccentric strengthening has been shown to reduce the incidence of hamstring strains in football players.^{26,27} Ankle sprains can be prevented by external ankle supports and balance board training, especially in athletes with previous ankle sprains.²⁸

Limitations of the Study and Future Research

The major limitation of the present study is its retrospective design and the associated recall bias. Twellaar et al²⁹ showed that students, when asked to recall all injuries sustained in the preceding 3 years, had forgotten 54% of their injuries. In comparing prospective and retrospective evaluations of injuries over a 12-month period, Junge and Dvorak³⁰

found that only “every third moderate injury and less than 10% of mild injuries were reported in a retrospective questionnaire” and concluded that “the shorter the period of symptoms and the longer ago the injury occurred, the more frequently it was forgotten.” This seems to explain the results of the present study, in that only injuries with at least 2-week duration were reported, and the exposure-related incidence of injuries was substantially higher for the preceding 12 months than for the entire career. In fact, the size of the discrepancy when comparing the estimated career incidence with the reported 12-month incidence suggests that as many as 90% of injuries occurring more than 12 months ago may have gone unreported. As such, the incidence of injury clearly represents a minimum estimate, and the reported total number of complaints during a career is probably unreliable and should be interpreted with caution. Therefore, future studies should further investigate the injury profile in referees using a prospective design.

In the present study, injuries and musculoskeletal complaints were assessed and analyzed separately because it was expected that the chronic/recurrent symptoms of overuse injuries would not be reported when asked for injury. Furthermore, due to the gradual onset and fluctuation of severity of the symptoms, musculoskeletal complaints might be better expressed as a prevalence than incidence. The results showed that the referees’ answers to the injury and musculoskeletal complaints question were complementary (eg, 2 referees reported an injury of the Achilles tendon, but 28 referees reported pain in the Achilles tendon). This approach may be of interest for future studies focusing on athletes who suffer more overuse than acute injuries.

Female referees were included in the present study to describe the entire group of referees of the 2 top divisions of the Swiss Football League, but their number was too small to draw conclusions. Future research should also focus on this population. Finally, prevention programs targeting the special

TABLE 4. Musculoskeletal Complaints Among Swiss Female Elite Referees

No.	Referee	Time Period and Related Complaints
1	MR	Last 12 months: pain in the calf muscles and in the Achilles tendon
2	MR	Last 12 months: headache, and pain in the hamstring and in the foot Entire career: headache, pain in the hamstring and in the foot
3	AR	Last 12 months: pain in the hamstring, calf muscle and ankle Entire career: headache, low back pain, and pain in the hamstring, calf muscles and ankle
4	AR	Last 12 months: headache, neck pain and low back pain Entire career: headache, neck pain and low back pain
5	AR	Last match: headache Last 12 months: headache Entire career: headache

MR, match referee; AR, assistant referee.

needs of referees should be developed, implemented, and evaluated.

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