

Injury incidence in Brazilian football referees

Mario Cesar de Oliveira¹, Luiza Naujorks Reis², Alberto Inácio da Silva³

¹Faculdades Metropolitanas Unidas – FMU – Brasil. ²Universidade Santa Cruz do Sul – UNISC – Brasil. ³Departamento de Educación Física de la Universidad Estadual de Ponta Grossa – Paraná – Brasil.

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Summary

Sports injuries have had notoriety in soccer studies. It has long been argued that soccer referees would be susceptible to the same injuries that the players. However, recent studies have shown that lesions that affect the referees are in situations and different sites that affect the players. Therefore, the aim of this study was to analyze the situations and places where the professional soccer referee in the south and southeast of Brazil are injured. The study sample consisted of 36 male referees accredited by the Paulista Football Federation (FPF) and Gaucha Football Federation (FGF). The sample consisted of 17 referees of FPF, mean age 35 ± 4.7 years, height 1.82 ± 0.07 m weight 83 ± 7.5 kg. We evaluated 19 referees from FGF, mean age 31 ± 5.9 years, height of 1.82 ± 0.06 m and weight 86 ± 7.1 kg. Three situations were established in the referee once injured this injury would be considered sports injury: during physical evaluation, training, and during the match. When considering all the referees, 19 referees say they have suffered some kind of sports injury in one of the situations described above. Of these ten (10) by referees of FPF and 9 by FGF referees. Of the 22 injuries identified, 59% ($n = 13$) occurred during training, 23% ($n = 5$) during the physical test and 18% ($n = 4$) during the game. The injury types were 45% ($n = 10$) strains, 45% ($n = 10$) sprains and 10% ($n = 2$) fracture. For these data, we can conclude that soccer referees suffering low injuries during a soccer match, with more incidence of injury during training or physical test.

Key words:
Referee. Soccer. Injury.

Incidencia lesional en árbitro de fútbol en Brasil

Resumen

Las lesiones deportivas han ganado importancia en los estudios involucrados en el fútbol. Ha sido durante mucho tiempo estudiado que el árbitro de fútbol sería susceptible a los mismos tipos de lesiones que los jugadores. Sin embargo, estudios recientes han demostrado que las lesiones que afectan a los árbitros están en situaciones y diferentes sitios que afectan a los jugadores. Por lo tanto, el objetivo de este estudio fue analizar las situaciones de aparición de lesiones y su tipología en árbitros de fútbol profesional de las regiones sur y sureste de Brasil.

La población de estudio consistió en 36 árbitros varones acreditados por la Federación Paulista de Fútbol (FPF) y Federación Gaucha de Fútbol (FGF). La muestra está conformada por 17 árbitros de la FPF, edad promedio de $35 \pm 4,7$ años, altura de $1,82 \pm 0,07$ m y peso de $83 \pm 7,5$ kg. Se han evaluado también, 19 árbitros gauchos de la FGF, con edad promedio de $31 \pm 5,9$ años, altura $1,82 \pm 0,06$ m y peso de $86 \pm 7,1$ kg. Fueron establecidas tres situaciones de ocurrencia de lesión del árbitro: durante la evaluación física, durante el entrenamiento y el curso de un partido de fútbol. De la población total encuestada, 19 árbitros manifestaron haber sufrido algún tipo de lesión deportiva en una de las situaciones descritas anteriormente. De estos, 10 ocurrió con árbitros de FPF y 9 con árbitros FGF. De las 22 lesiones identificadas 59% ($n = 13$) ocurrido durante el entrenamiento, 23% ($n = 5$) durante la prueba física y 18% ($n = 4$) durante el juego. Los tipos de lesiones fueron 45% ($n = 10$) distensiones musculares, 45% ($n = 10$) esguinces y 10% ($n = 2$) de fracturas. Para estos datos, se puede concluir que los árbitros de fútbol se lesionan poco durante el arbitraje de un partido de fútbol, con una incidencia más frecuente de lesión durante el entrenamiento o la prueba física.

Palabras clave:
Árbitro. Fútbol. Lesión.

Correspondence: Alberto Inacio da Silva
E-mail: albertoinacio@bol.com.br

Introduction

The movements without ball during the game are prolonged and predominately aerobics, meanwhile the activities with ball are of high intensity and anaerobic, thus, the football is a team sports that requires a considerable aerobic capacity and a great ability to perform repeatedly maximum efforts¹. The no ball exercises include more activity during a game and are mostly aerobic, while the activity directly involved in the game is highly anaerobic².

As high-level sport, soccer has been the target of numerous changes in recent years, mainly due to the adoption of different training methodologies and constant increasing of physical demands. This in turn forces the athletes to work near their maximum effort, culminating with greater predisposition to injury³.

The physical stress of the referee during the match is significant, since during the 90 minutes it performs on average in 1268 different activities⁴. From 4 to 6 seconds the referee changes its motor action during the game^{4,5}. In terms of perceptual-cognitive demands, an elite referee takes about 137 decisions observable per game⁶. Furthermore, according to these authors, given the effective time of the game, a high level of referee takes 3-4 decisions per minute. Thus the physical activity of the referees is characterized by a high physical demand with variations of aerobic and anaerobic metabolism, determined by high-intensity movements with changes of direction, acceleration, turns and sprint, which makes the sport has a high incidence of injuries⁷.

After a review of the literature related to injuries in soccer referees, it was found that the incidence is poorly investigated. There are few studies reporting on referees' sports injuries, and the studies found were recently published. Two of these were developed with Swiss referees^{8,9}, international referees FIFA¹⁰ and Brazilian referees¹¹. The first three authors conducted an analysis of the incidence of injury in referees only during the match refereeing or during physical training. But the study developed in Brazil expanded the investigative field, as it sought to identify injuries that occurred beyond the playing field and during training sessions, investigating also those that affected the referees during the physical tests imposed by the sports entities which the referees were credited.

The battery of physical tests developed by FIFA to evaluate the soccer referees is controversial, being a much discussed issue and focus of numerous studies¹²⁻¹⁴. However, we only have knowledge of a study aimed to identify the incidence and types of injuries that referees are exposed during the physical tests often applied by the federations, soccer confederations and the largest soccer entity. In addition, most studies developed with referees in Brazil took place in Paraná state, so nothing is known about the situations or incidence of injuries in the referees from other states. Therefore, the aim of this study was to identify the circumstances and consequences of injuries suffered by football referees in the states of São Paulo and Rio Grande do Sul, during the game, the training and the physical test, mainly due these states have teams that are among the most competitive Brazilian soccer.

Material and methods

This study is characterized as a retrospective study aimed to identify the situation, the location and the type of injuries that soccer referees are affected. The procedures adopted in this study are consistent

with Resolution 196/96 of the National Health Commission, and was approved by the Research Ethics Committee of the UEPG (resolution 25438/2012). A written consent was obtained from all subjects before the beginning of this study, after a brief but detailed explanation of the nature of the research.

The participants of this study were 36 referees that belong to the FPF (17) and FGF (19). All well experienced refers that acts at the A serie of the Brazilian championship.

The exclusion criterion was used the non-participation of the referees to this event. To collect the data we used a semi-structured questionnaire, applied through interviews by an experienced researcher.

The questionnaire used was proposed by Paes *et al.*¹⁵. Thus, the questions were standardized in order to accurately characterize the activities related to refereeing only account for sports injuries. So just were considered the sports injuries occurred in three situations previously defined: during a soccer match, during physical training or during the physical tests applied by the federations or the Brazilian Soccer Confederation (CBF), for the referee's physical evaluation. The injuries occurred outside that these three situations were discarded. In addition, the referee was asked: how many times you trained during the week, if there was accompanying a professional, the average duration of these sessions, when he joined the Federation Referee Panel and if he practiced soccer before becoming referee, in one of three ways: professional, amateur or hobby.

The injury definition used was previously proposed by Union Football Association European (UEFA)¹⁶, one injury was defined as a pain or discomfort, resulting in removal of any of the aforementioned activities (training and physical test official refereeing). Were considering five injuries: strain, dislocation, sprain, fracture and contusion. The questionnaire also identified the referee injured sought medical aid and physiotherapy. Finally, it was also possible to collect data necessary for determining the Body Mass Index (BMI) determined by body weight divided by the square of height.

The test developed by FIFA to measure aerobic capacity, consists of 20 runs of 150 m, covered in 30 seconds at intervals of 50 meters walk, traveled in 40 seconds, times indicated for the category of national referees. Already the anaerobic capacity is measured by applying six sprints of 40 meters.

The exposure time in training was calculated on the basis of information provided by the referees during the interview. The exposure time in physical tests was calculated in the same way, however, considering that the referees are tested at least twice a year, by the refereeing department, and this information is used to calculate the time spent in this situation. In the surveyed federations, the referees departments do not store data on the amount of annual performances of the referees and, therefore, the exposure time in the matches cannot be calculated. The risk of injury per 1000 hours was calculated as the number of injuries x 1000 / total hours spent on each of the situations above mentioned¹⁷.

Statistical analysis was performed using SPSS (version 11; SPSS Institute, Chicago, Illinois). For the statistical processing of information was used initially descriptive statistics to group the results as mean values, standard deviation and percentage. Due to the small sample number, adopted the logarithmic conversion to non-standard variables, according to the Gaussian curve in order to use the parametric statistical

parameters. We used the “t” test for independent samples, adopting the significance level of 5%.

Results

The average age of the referees (n = 36) was 32.0 ± 5.6 years. Despite the referees by FGF are younger, as shown in Table 1, this difference was not statistically significant (p = 0.0565). The average body weight of the all sample was 84 ± 7,4kg, and found no significant difference between the weight of the referees measured in each state (p = 0.2007). Regarding the height of the referees both federations had the same height, as shown in Table 1. Thus there was no statistically significant difference (p = 0.4336). Another variable that showed no statistically significant difference was BMI (p = 0.3100).

Fifty two percent (52%) from the entire sample (n = 36) had experienced some type of sports injury (n = 19) in one of the situations described above. Twenty-two (22) injuries were identified; one referee suffered four injuries. The most frequent injuries in referees were strain and sprain. The third type of injury developed by the referees was the fracture, as shown in Table 2. The referees showed no dislocation or contusion.

Of the twenty-two (22) injuries reported, thirteen (13) occurred during physical training, five (5) during the physical tests applied by the FPF or FGF Referees Committee and only four occurred when the referee was refereeing a match. Therefore, 59% of injuries that affect the referees occur during physical training. The types and situations where the referees are affected by injuries can be seen in Table 3. When calculated the incidence of injuries per 1000 hours of activity, the following average values of incidence were found: 0.47 ± 0.11 and 1.41 ± 1.08 injuries per 1000 hours of refereeing; 88.3 ± 27.8 and 166.7 ± 55.5 injuries per 1000 hours of testing for referees of FPF and FGF, respectively.

Table 1. Data from anthropometric evaluation of referees from FPF and FGF.

		Age	Weight	Height	BMI
Referees (FPF)	Mean	35.0±4.7	83.0±7.5	1.82±0.07	24.81±1.4
Referees (FGF)	Mean	31.0±5.9	86.0±7.1	1.82±0.06	24.86±1.3

Table 2. Types and location from injuries occurred in soccer referees by FCF e FGF.

Injury	Location	Referee (FPF)	Referee (FGF)
Sprain	Ankle	4	4
	Knee	1	1
Strain	Anterior thigh	1	0
	Posterior thigh	2	4
	Calf	3	0
Fracture	Ankle	1	0
	Feet	1	0

With regard to physical preparation, the referees involved in this study (n=36) reported train frequency of 4.0 ± 1.1 times per week, with an average duration of 60 ± 25.9 min. There was no statistically significant difference in the frequency (4±1.1 vs 1.1±3 times a week, p= 0.0861) and the duration of each training session (60 ± 26.7 vs 60 ± 25.8 min, p= 0.8981) between the referees of FPF and FGF. Regarding the preparation and monitoring of the physical training by a professional of Physical Education, nine referees of FPF reported train with a physical education professional, yet eight (8) training on their own. However, referees by FGF mostly train on their own, since that eighteen (18) they said train without professional supervision of physical education.

When asked about his experiences in the professional soccer before becoming referees, eight (8) referees reported having practiced soccer professionally. The largest number of referees (n = 14) reported having practiced soccer in an amateur way. Already eleven (11) referees said only have had contact with soccer in leisure time. Only three referees reported not having any kind of contact with soccer before they entered the refereeing.

Discussion

The scientific nature of work involving soccer referees is very recent and scarce, if we take as reference the studies involving players¹⁷. However, the referees involved in this study had ages, weight and height (Table 1) similar to the data of research involving Danish⁴, Italians¹⁸, Chilean¹⁹, Brazilian^{20,21} and international referees from FIFA²².

Location and types presented by this study involving referees were similar to those reported in earlier research developed with Swiss referees^{8,9}, for FIFA international referees¹⁰ and Brazilian referees¹¹.

At nineteen (19) referees who have been affected by injury, 85% said they had sought medical help in order to injury severity, and shortly after this diagnosis, they were subjected to physical therapy programs. According to the data presented in Table 2, the referees reported only three types of injury, the most common being the sprain and strain. The mean time of recovery from strain reported by the referees was 44 days on average. The time reported by the referees to return to refereeing is greater than the time described in the literature for the recovery of a player due a hamstring injury. Yoon *et al.*²³ investigated the injury incidence in Asian tournaments found that 45,3% of strain injuries, removing the athletes for more than four days of practices and games. Lopes *et al.*²⁴ in a clinical muscle injury study, reported that the shortest period necessary for healing and functional rehabilitation is between two to three weeks. The same authors reported that the presence of bruising, 24h after injury, determines a serious injury, with a six to eight week prognosis. Cross *et al.*²⁵ evaluated the prognostic quadriceps muscle injury and noted that the central tendon injuries took an average time of rehabilitation from twenty-seven (27) days. The longer time required to recover the referees may be due to the players have at their disposal a group of specialist sports injury that act immediately after the injury, and in addition, the athlete in 24h is available for work physiotherapy.

Soccer referees in several countries, including where soccer is highly competitive, as in Italy, Spain, Portugal and Brazil, so the match refereeing is used only for supplement their family income, not, therefore, their

full time professional activity. However, despite the short time every day that the referees have to train to accompany the moves during a game no matter the pace that they occur²⁶. To improve this situation, the UEFA and FIFA have moved on to professionalize the soccer referees in recent seasons¹³.

All injuries reported by the referees occurred in the lower limb (Table 2), this is another similarity between the injuries that affect soccer referees and players. A study of the topography of injuries involving players in soccer, held for 64 games of the World Cup 2002, found that the injuries sustained during this competition affected predominantly the knee joints, ankle, thigh and calf muscles²⁷. Another study during soccer competitions organized by FIFA and the Olympic Games between 1998 and 2001, it was found that the injuries occurred mainly in the ankle (17%), thigh (16%), leg (15%) and knee (12%), that is also the inferior member²⁸.

The referees have a higher number of injuries in training than in the game (Table 3) and this is an unusual situation because the distance covered by the referee is similar to soccer player. According to the scientific literature soccer referee covered distances between 9 and 12 km during the game²² and, the soccer player during the match, in particular the midfielder, also covered between 9 and 12 km during the match²³.

The highest number of injury during training suggests that the referees may be undergoing a very high training load and inadequate exercise, since 80% of injured referees reporting train without accompaniment of a physical education professional. Corroborating our findings it was found that during the preparation of referees for the World Cup 2006 the most damage occurred also during training¹⁰. Players have a higher number of injuries during the game due to stroke (contusion), ie, players have more ankle injuries and knee, due there is constant contact between them. However, muscular injuries were also higher than other types of injuries in a study involving soccer players in Brazil²⁹.

Another factor that contributes to the greater number of muscle injuries in referees can be explained by the low level of flexibility shown by these professionals. In a study conducted with soccer referees, to check the mobility of the hip joint, since the main limitation of maximum mobility is observed in the posterior thigh muscle structure³⁰. Therefore, low flexibility observed in referees contributed to injuries that occur mainly in the muscles of the back of the thigh, as in this study (Table 2), since the reduction or lack of flexibility is a limiting factor for sport performance being a facilitator for muscular injuries⁷.

To try to reduce the high number of injury to referees during training, it would be necessary to develop training programs that consider not only the physical demands of the referee during the match, but also the energy needs for the performance of physical tests FIFA because if they cannot succeed in these, cannot refereeing in official matches.

Thus decrease the number of injuries not only during training but also during the physical tests, the two situations shown in this study where there is a large incidence of injuries (Table 3). Actually, due the amount of injury occurred in soccer, the FIFA had been developed a specific program for injury reduction by soccer referees³¹.

The weekly frequency of training of referees studied was 4.0 ± 1.1 times per week, with an average duration of 60 ± 25.9 min. The session number dedicated to the weekly training of the referees of this study was similar to that reported by national level referees in Brazil¹¹. However, the duration of the session was lower, since the elite referees of CBF train an average of 75 minutes per session¹¹. Physical activity practiced by most referees during training is aerobic running, being ignored by them anaerobic work as intermittent races. The main result of this study is that the referee trains with frequency, duration and type of physical activity compatible with the minimal quantity of physical activity recommended by health maintenance. This has also been observed and discussed in another country. Krstrup and Bangsbo⁴ developed a study with Danish referees and reported that the training of high-class referees often consisted of moderate intensity running between 3 and 7 km.

The majority of the referees increase the intensity and frequency of training, especially nearly of the physical tests applied by the federations or the confederations. This is because, as noted above, if do not achieve success in the tests may not settle any competitive games. As the referees know that the test there evidence anaerobic (sprinting) begin to practice them without a gradual preparation and expert guidance, so occurring the injury.

As already highlighted, the second largest number of injury occurs when the referees are performing the physical tests determined by FIFA (Table 3). These tests are performed in athletics track, that is, on a more regular surface that soccer field. This may account for the low number of sprains in this situation. However, there is the presence of muscle injuries (strains) and it is attributed to the exaggerated physical effort applied by the referees in the tests in order to pass the test.

In two states where it aims to evaluate the physical performance of the referees in FIFA fitness tests, it was found that most reprovved during performance of anaerobic tests, when compared to the number of failures in aerobic test^{32,33}. The large number of failures in anaerobic evidence shows that the referees were not prepared to run these types of motor action.

Studies show that soccer referees to be able to refereeing national and international games, they need to have some years of experience³⁴ so the referees studied here had an average age of 32 years old and 11 years of experience. In the study involving Swiss referees was observed that the older referees had a higher number of injuries⁹ and the same occurred with the study of Brazilian referees¹⁵. Arnason *et al.*³⁵ report that increasing age elevated the risk factor for injury in soccer players. The age difference between players and referees can be justified by the item experience because Refereeing Committee by FIFA and UEFA considering as a fundamental for the individual enter to the elite group of refereeing³⁶. Thus, the referees should undergo specialized training program to ensure an appropriate level of physical preparation to conduct an official soccer match and be subjected to physical tests, mainly considerer with increasing age there was a greater predisposition for sports injuries.

Table 3. Type and situations where referee suffered injuries.

Injury type	Training	Test	Match
Strain	5	3	2
Sprain	6	2	2
Fracture	2		

Conclusion

After analyzing the data, we concluded that soccer referees have a higher incidence of injury during training and fitness test. The most frequent injury is the strain, more specifically in the thigh. It was also found that most of the injured referees undergo physical training without the accompaniment of a professional of Physical Education, and the duration, weekly frequency and type of training unsuitable for a person to present himself as a soccer referee, as this sport is highly competitive. Therefore, the associations should be responsible for the provision of training programs for referees, with specialized professionals, this could help minimize the appearance of injuries over the years, as the referees can act in this sport until 45 years of so that thus they would be less exposed to injury occurrence in the three situations investigated.

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