

# Prospective Evaluation of Injuries occurred during the Brazilian Soccer Championship in 2016\*

## *Avaliação prospectiva das lesões esportivas ocorridas durante as partidas do Campeonato Brasileiro de Futebol em 2016*

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### Abstract

**Objective** To identify the incidence, the prevalence, the characteristics, and the possible risk factors for injuries occurring during the matches of the Brazilian Soccer Championship.

**Methods** A prospective study was carried out to collect data on the injuries that occurred during the 2016 Brazilian Soccer Championship. Lesions were recorded by the physician responsible for each team through an online software.

**Results** Among the 864 athletes included in the study, 231 (26.7%) of the players presented some injury during the tournament. In total, 312 injuries were recorded during the Brazilian Soccer Championship, with an average of 0.82 injuries per game. The incidence of injuries was 24.9 injuries per 1,000 match hours. Midfielders and forwards presented, respectively, an injury risk 3.6 and 2.4 times higher than goalkeepers.

**Conclusion** The prevalence and incidence of lesions were, respectively, 26.7% and 24.9 injuries per 1,000 match hours. The most frequently affected body segment was the lower limbs (76.3%), and the athletes acting in midfield and forward positions were the most affected. Moreover, the greater prevalence of injuries occurred in the first part of the championship.

### Keywords

- ▶ soccer
- ▶ athletes
- ▶ athletic injuries
- ▶ epidemiology

### Resumo

#### Palavras-chave

- ▶ futebol
- ▶ atletas
- ▶ traumatismos em atletas
- ▶ epidemiologia

**Objetivo** Determinar a prevalência, as características e possíveis fatores de risco para as lesões ocorridas durante as partidas do Campeonato Brasileiro de Futebol.

**Métodos** Realizou-se um estudo prospectivo com coleta dos dados referentes às lesões ocorridas durante o Campeonato Brasileiro de Futebol de 2016. O registro das lesões foi realizado pelo médico responsável de cada equipe, por meio de um sistema online de mapeamento de lesões.

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**Resultados** Dentre os 864 atletas que foram incluídos no estudo, 231 (26,7%) dos jogadores apresentaram alguma lesão durante o torneio. No total, foram registradas 312 lesões durante o Campeonato Brasileiro, com média de 0,82 lesões por partida. A incidência de lesões foi de 24,9 lesões para cada 1.000 horas de jogo. Meias e atacantes apresentaram, respectivamente, risco 3,6 e 2,4 vezes maior de sofrer lesão do que os goleiros.

**Conclusão** A prevalência e incidência de lesões foi, respectivamente, 26,7% e 24,9 lesões para cada 1.000 horas de partida. O segmento corporal mais frequentemente afetado foram os membros inferiores (76,3%), sendo que os atletas que atuaram nas posições meia e atacante foram os mais acometidos. Observou-se também maior predomínio de lesões no primeiro turno do campeonato.

## Introduction

Soccer is a complex sport, since it involves a considerable injury risk and is associated with a significant economic, social and sporting impact.<sup>1</sup> At the professional level, epidemiological studies show an incidence rate of 16 to 28 injuries per 1,000 hours of exposure.<sup>2,3</sup>

In today's soccer, it has been difficult to strike a balance between the preparation and the demands of the athletes. On the one hand, sports medicine is advancing, leading to a better knowledge of effort physiology and allowing the creation of specific protocols individualized for each athlete, according to their characteristics. On the other hand, there is also an excess of matches and training, placing the athlete within the limits of muscle and joint injuries.<sup>4</sup>

Soccer is the main practiced modality in Brazil.<sup>5</sup> Despite this, there is a lack of local epidemiological and observational studies, which prevents the practical progress of the monitoring and action of the professionals working in the preventive and healing aspects of the sporting elite. The literature documents numerous risk factors for the development of soccer injuries; however, local determinants, including temperature, altitude, and field conditions, emphasize the importance of local researches resulting in propositions of measures and procedures.<sup>6,7</sup> In addition, there is a notable shortage of Brazilian studies aimed at documenting injury characteristics during a whole soccer competition.

Thus, the present study aims to determine the prevalence, the characteristics, and the possible risk factors for injuries occurring during the 2016 Brazilian Soccer Championship matches.

## Methods

This is a prospective cohort study collecting data on injuries occurred during the 2016 Brazilian Soccer Championship, A Series (May to December). The injury registry was performed by the physician responsible for each team, through an online injury mapping system available at the physician's portal of the Brazilian Soccer Confederation (CBF, in the Portuguese acronym) ([portaldomedico.cbf.com.br](http://portaldomedico.cbf.com.br)).

All of the athletes regularly enrolled in the 2016 Brazilian Soccer Championship who participated in at least 1 match of

the tournament were included in the study. Athletes that did not play in at least one match were excluded from the study. The variables studied included: distribution of athletes per clubs, field positioning, age group, number of matches played, and the participation time in the matches. Lesions were recorded per location, description, severity, relapse, and timing of occurrence during the championship.

The classification of the severity of the lesion considered the number of days until the complete return of the athlete to the sport, as follows: mild (1–3 days), minor (4–7 days), moderate (8–28 days), major (28 days–8 weeks), and severe (> 8 weeks).<sup>8</sup>

To assess the risk of lesion, its incidence was calculated and expressed as the number of injuries per 1,000 hours of exposure. Exposure during matches was calculated according to the following formula:

Exposure = number of matches x number of players per match x duration of the match in hours

The incidence of injuries per 1,000 match hours was determined by the following formula:

$$\text{Incidence} = \frac{\text{Total number of injuries} \times 1,000 \text{ hours}}{\text{Exposure}}$$

In 1998, the International Federation of Association Football (FIFA, in the French acronym), through its Medical Assessment and Research Center, established a consensus on the definitions, methods, implementation, and standards of records that must be adopted in studies about soccer-related injuries.<sup>9</sup>

The present study used the same model established by the FIFA to monitor the incidence of injuries during the 2016 Brazilian Soccer Championship

Central trend and dispersion measures were expressed as means and standard deviations (mean  $\pm$  SDs) for continuous variables with symmetrical distribution, and in medians, minimum and maximum values (median, minimum–maximum) for variables with asymmetric distribution. Categorical variables were expressed as absolute and relative values. Estimates of differences between categorical variables were calculated using the Fisher exact test and the Pearson chi-squared test. Odds ratios (ORs) were calculated to quantify the risk of lesions associated with some study variables. All of

the tests considered a minimum significance level of 5% and a minimum test power of 95%.

The present study was approved by the Ethics Committee on Research in Human Beings under the number 2,405,471, and the data was provided by the CBF.

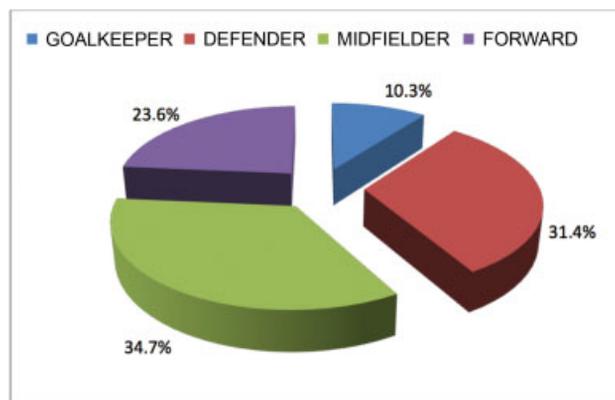
### Results

A total number of 864 athletes participating in the 2016 Brazilian Soccer Championship were included in the present study. The tournament had 38 rounds and 379 matches played between 20 soccer clubs. The teams had, on average, 43 athletes participating in at least 1 championship match. The distribution of the number of athletes and the frequency of injuries in each team is presented in ►Table 1. The distribution of the athletes according to their field positioning is shown in ►Fig. 1. ►Fig. 2 illustrates the distribution of the athletes according to age. The athletes participating in the championship were, on average, 22 years old, while the average age of injured athletes was 27 years old

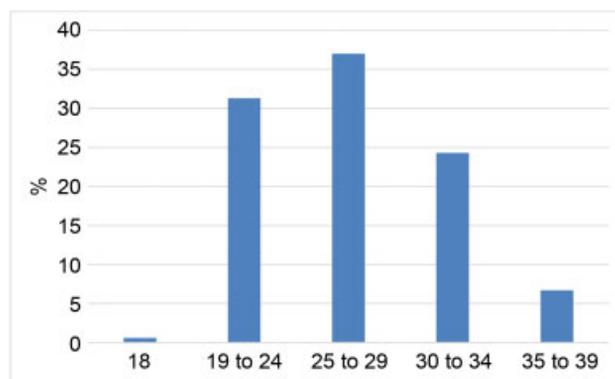
Regarding the number of matches played, only 63 athletes (7.3%) participated in > 35 rounds, and only 8 athletes (0.9%) played all matches. A total of 76 athletes (8.8%) had only 1 participation in the tournament (►Fig. 3). The total match

**Table 1** Number of athletes and injury frequency distribution in each team

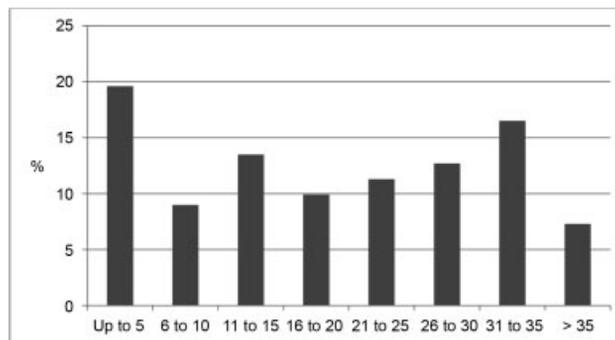
Team	Number of athletes	Frequency of injured athletes
	n (%)	n (%)
A	51 (5.9%)	18 (35.3%)
B	47 (5.4%)	15 (31.9%)
C	37 (4.3%)	10 (27%)
D	38 (4.4%)	6 (15.8%)
E	50 (5.8%)	10 (20.0%)
F	38 (4.4%)	15 (39.5%)
G	37 (4.3%)	15 (40.5%)
H	43 (5.0%)	13 (30.2%)
I	43 (5.0%)	5 (11.6%)
J	48 (5.5%)	15 (31.2%)
K	46 (5.3%)	8 (17.4%)
L	49 (5.7%)	12 (24.5%)
M	40 (4.6%)	26 (65%)
N	46 (5.3%)	8 (17.4%)
O	36 (4.2%)	7 (19.4%)
P	42 (4.9%)	13 (30.9%)
Q	41 (4.7%)	13 (31.7%)
R	40 (4.6%)	4 (10.0%)
S	43 (5.0%)	12 (27.9%)
T	49 (5.7%)	6 (12.2%)



**Fig. 1** Distribution of the athletes according to field positioning – 2016 Brazilian Soccer Championship.



**Fig. 2** Distribution of the athletes according to age.



**Fig. 3** Frequency distribution of athlete participation in tournament rounds – 2016 Brazilian Soccer Championship.

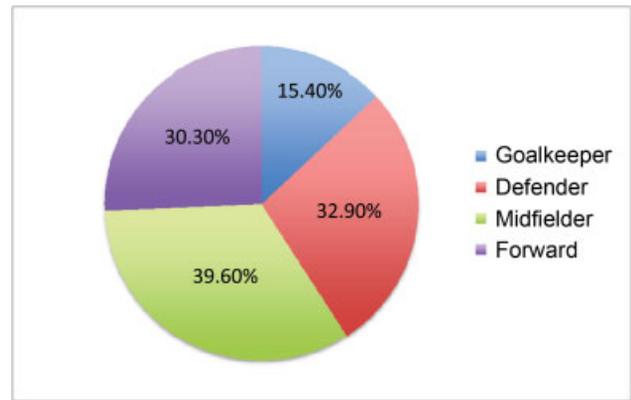
time was, on average, 1,603 minutes, ranging from 45 to 8,069 minutes (95% confidence interval [CI]: 1,045–2,137).

Among the 864 athletes included in the present study, 231 (26.7%) presented some injury during the tournament. Approximately 93% of the injured athletes had 1 or 2 injuries during the championship (►Table 2). In total, 312 injuries were recorded during the 2016 Brazilian Soccer Championship, with an average of 0.82 injuries per game. The incidence was of 24.9 injuries per 1,000 match hours. The distribution of lesions according to their location is shown in ►Fig. 4. The highest injury prevalence was observed in midfielders and

**Table 2** Distribution of number of injuries per athlete

Number of injuries/athlete	n
1	231 (74.0%)
2	60 (19.2%)
3	15 (4.8%)
4	4 (1.4%)
5	1 (0.3%)
6	1 (0.3%)
Total	312 (100%)

forwards (69.9%) (►Fig. 5). The distribution of lower limb lesions according to the severity classification is shown in ►Fig. 6. The most common injuries diagnosed during championship matches were hamstring muscle lesion (24%), adductor muscle lesion (9%), cutting wound (8%), lateral ligament injury of the ankle (6%), quadriceps muscle injury (4.5%), and concussion (4%). In 177 lower limbs injuries (74.4%), the athlete was substituted at a median match time of 27 minutes. In midfielders and forwards, the lesion risk was 3.6 (OR = 3.60; 95%CI: 1.95–6.62) and 2.4 (OR = 2.38; 95%CI: 1.26–4.52) times higher compared with goalkeepers. ►Fig. 7 shows the frequency distribution of

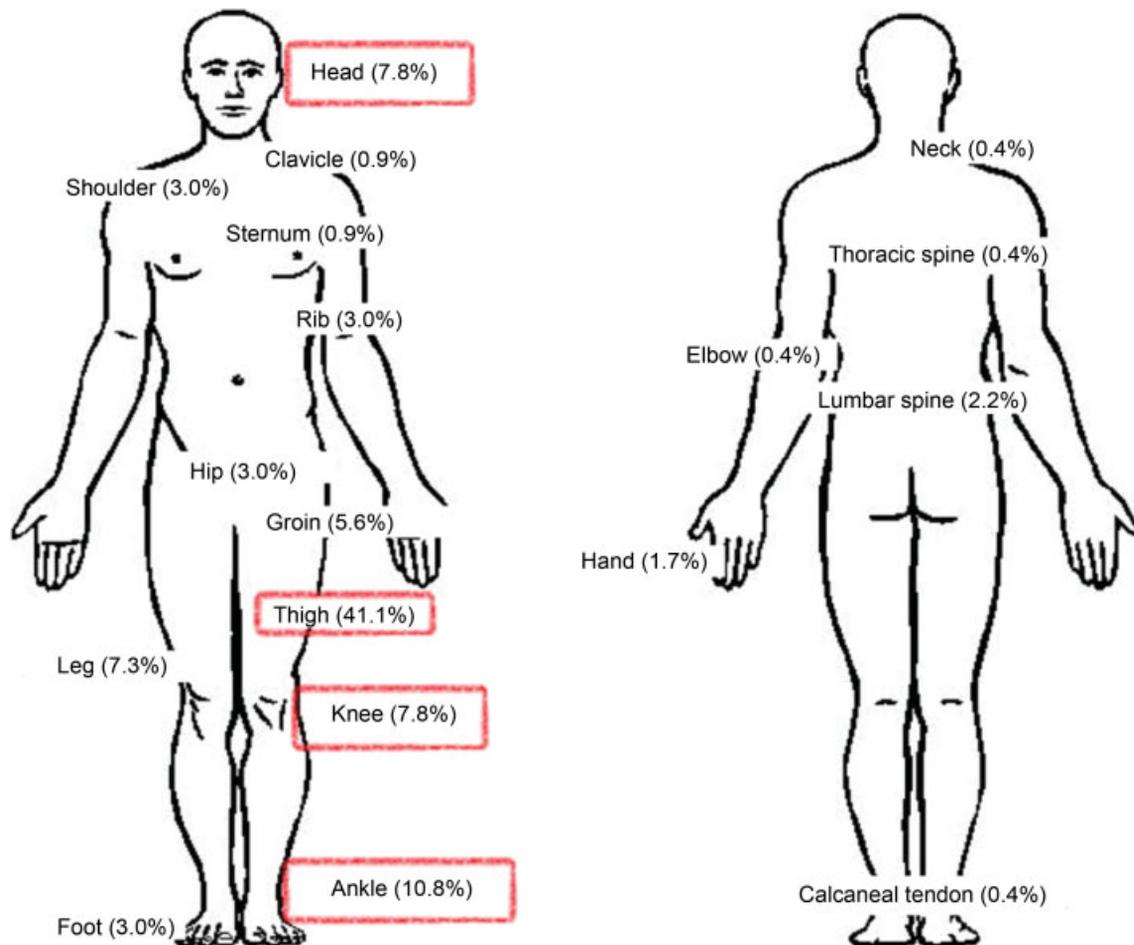


**Fig. 5** Lesion distribution according to field positioning.

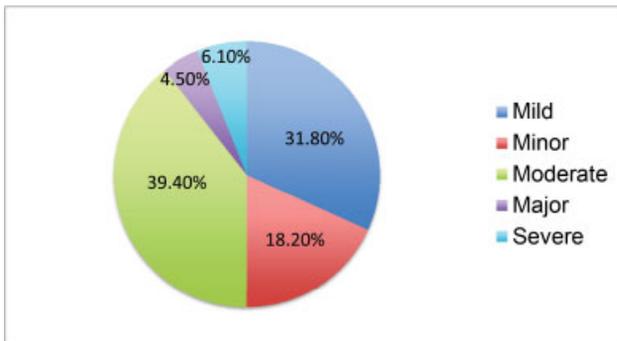
injuries during tournament rounds. A greater prevalence of injuries was observed during the first half of the championship.

**Discussion**

The main findings of the present study were a 26.7% prevalence and an incidence of 24.9 injuries per 1,000 match hours in the main Brazilian soccer championship, with most



**Fig. 4** Lesion distribution in injured athletes – 2016 Brazilian Soccer Championship.

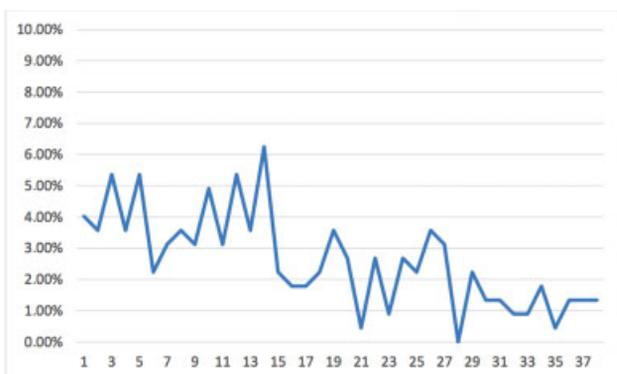


**Fig. 6** Lower limb injuries distribution according to severity classification.

injuries in lower limbs, affecting mainly midfielders and forwards during the first half of the tournament. To our knowledge, this is the first study to document the prevalence and main epidemiological variables related to injuries during the Brazilian Soccer Championship.

The average age of the athletes in the present study was 22 years old, suggesting a relatively young age group. The Brazilian Championship is considered a long and intense tournament, since the 38 rounds are played in ~ 7 months. Many of these matches are preceded by long trips, which certainly end up undermining the recovery process, so critical in high-performance sports. Although it is believed that younger individuals may present a faster posteffort regenerative process than older athletes, a recent study with high-level French players has shown a more satisfactory recovery in adult athletes when compared to U-17 players, even though the latter reported a greater perception of effort and postmatch fatigue.<sup>10</sup> Cohen et al,<sup>4</sup> in an epidemiological study, showed that professional soccer players < 26 years old had a lower incidence of orthopedic injuries. It is known that the physical condition, sleep quality, nutrition, experience, and stress control are factors strongly associated with lesion recovery and incidence.<sup>11,12</sup>

Earlier studies have shown that a team of 25 players can expect ~ 50 injuries per season.<sup>1</sup> This means that, on average, 12% of the players are unavailable for training and playing matches due to injuries. In the present study, 26.7% of the players competing at the championship presented some



**Fig. 7** Lesion frequency distribution during tournament halves.

injury, and that each club, on average, had 15.6 injuries during the championship.

The incidence of injuries in soccer is quite variable. Most studies present rates ranging from 15 to 30 injuries per 1,000 hours of sports practice.<sup>1,6,13</sup> The numbers are quite different due to the several injury definitions, to the duration of the championship or season, and to the inclusion of lesions occurred during training. Pedrinelli et al<sup>14</sup> found a rate of 70 injuries per 1,000 matching hours at the 2011 Copa America. This tournament had 26 matches in a 17-day period, which may justify the slightly higher incidence compared with most epidemiological studies in soccer. The rate of 24.9 lesions per 1,000 matching hours in the present study is very similar to the values found in the literature.

The findings presented here regarding lesion severity showed that most of the injuries were characterized as mild or moderate. Arliani et al,<sup>13</sup> in an epidemiological study conducted during the São Paulo State Soccer Championship (Campeonato Paulista), also identified that most lesions had the same severity profile. In addition to the health problem, these injuries cause sportive and economic damage due to the number of days off the field. The estimated average cost of a player from an elite European club away for a month due to an injury is ~ 500,000 €, and a European team can expect ~ 50 injuries per season.<sup>15</sup>

The tactical position of the players in the field also seems to significantly influence the number of injuries. Our results are similar to those of previous studies, since a greater number of injuries occurred in midfielders and forwards (69.9%). These facts are perhaps related to a style change in the currently played soccer, in which forwards are more intensely and often violently marked.

Among the most affected segments in the present study, lower limbs injuries were more common (76.3%), which may be closely related to the increased demand required from the player and the soccer performance per se. Some authors report that this increase in sportive intensity favors the occurrence of musculoskeletal injuries in professional soccer players, especially in the lower extremities.<sup>16</sup> Most injuries occur in the hamstrings. Ekstrand et al demonstrated an average annual increase of 2.3% in the hamstring injury rate and a 4.1% increase in the total injury load of these muscles over a 13-year study period.<sup>17</sup> The finding of increasing lesion rates is a concern, and the prevention of such injuries must be a priority among soccer clubs and professionals.

Regarding the distribution of injuries during the championship, there was a higher concentration of injuries in the first half of the tournament. In European studies, traumatic injuries were more common during the competitive season (September to May), while overload injuries peaked during the preseason period, in July. Perhaps, this is due to the greater intensity of training and matches during the preseason and the beginning of the championship.<sup>1</sup>

The present study had some methodological limitations. There is a possibility of information bias of results, since accurate data on the lesions may have been altered or even omitted by club physicians. In addition, the study evaluated acute injuries occurring during matches, and, consequently,

chronic lesions, as well as those occurring during training and other non sport-related diseases were not registered. Moreover, the exposure time was calculated using 22 players and 90 minutes per match. A more accurate method would consider the extra time or the actual time of each match and the number of exposure minutes for each individual player. **However, this is the first prospective study with data analysis of the main national championship, with a large sample of players and involving the current tournament model, which started in 2002, with running points and 2 halves (38 matches per club).**

The results and data of the present study will certainly guide preventive measures in the countless Brazilian soccer teams, allowing a future reduction in the number and severity of injuries.

## Conclusion

The prevalence of injuries in athletes participating in the 2016 Brazilian Soccer Championship was 26.7%, with 74.0% of the cases being only 1 injury during the tournament. The lesion incidence was of 24.9 injuries per 1,000 matching hours.

The most frequently affected body segments were the lower limbs (76.3%), and midfielders and forwards were the most affected athletes. A higher prevalence of injuries in the first half of the championship was also observed. **The findings of the present study indicate possible preventive measures to reduce or minimize the number and severity of soccer injuries, since it addresses probable risk factors.**

### Conflicts of interests

The authors have no conflicts of interests to declare.

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