Research Article
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Prevalence of musculoskeletal injuries in brazilian professional soccer athletes

Abstract

Objective: To determine the prevalence and characteristics of musculoskeletal injuries in the male soccer athletes from a Brazilian northeast professional team, Esporte Clube Bahia, during the 2017 season.

Methods: A retrospective analysis of the occurrence of sports injuries was carried out through a survey of the medical records. The athletes were separated into two groups: those who did not suffer injuries and those who did. The epidemiological data, minutes played and number of matches were described by measures of central tendency such as mean, mode and median, and their dispersion measures, by standard deviation. The number, type and degree of injuries, the anatomical location, moment of occurrence, laterality and position in which the athlete played were described by absolute and relative frequency.

Results: Data were collected from 29 athletes who played for the club in 2017, with an overall mean age of 26.67. It was observed that the difference between means of age is significantly different between the groups of athletes who suffered injury and those who did not (P=0.0002). The age group with the highest number of injuries was from 26 to 33 year old. The average number of matches of the athletes who suffered injuries was on average 3.12 higher (P=0.0122) than those who did not, as well as the athletes who suffered injuries played on average 1184.8 minutes more than those who did not suffer injuries (P=0.0120). The most prevalent injury was muscle strain, with 27.59% (n=8), followed by sprain and myalgia, both with 13.79% (n=4), contusion and rupture, corresponding to 10.34% (n=3). Conclusion: The study looked at the high frequency of musculoskeletal injuries in current soccer, especially strain, myalgia and sprain. The high prevalence of injuries during training and, especially, during the second half of the official matches are also noteworthy.

Keywords: athletic injuries, soccer, tournament, injury burden

Volume 3 Issue 3 - 2019

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Received: November 12, 2019 | **Published:** November 29, 2019

Introduction

Soccer is one of the most popular sports in the world, with approximately 400 million amateur and professional practitioners in more than 150 countries, of different age groups, social levels and of both genders, although the vast majority (approximately 80%) are male.[1-3] It is a sport that involves short, fast and discontinuous movements, acceleration and deceleration, changes of direction, jumps and rotational movements, as well as a lot of physical contact. The association of all these characteristics results in a high number of injuries, which arouses great interest within the field of sports traumatology.[1,3-5]

The performance of this sport depends on the adequate development of tactical, technical, nutritional, psychological and physical factors. The team is divided into: goalkeepers, defenders, midfielders and forwards, who cover different distances with specific intensities and movements for each position and, as in any physical activity, this can generate overloads in the locomotor system, causing an increase in the incidence of injuries that is proportional to the increased load of the sports performance.[1,3,4] In addition, the pursuit of fame and success imposes on athletes the necessary and unavoidable condition of being subjected to physical and psychic efforts that are very close to their physiological limits, which exposes them to a potentially pathological range of activity and results in a high number of sports injuries.[1,3,5]

High-performance sports have undergone many changes over the last few years, especially in relation to the increasing physical demand and the risk of injury. It is estimated that the rate of incidence of injuries in soccer happens at around 10-15/1,000 hours of training, being four to six times greater during matches. However, this statistic varies greatly between the studies, depending on the study design and the criteria used to define and characterize the injuries. This heterogeneity hampers the epidemiological analysis, data collection, and the uniformity of diagnostic criteria and recovery time.[1,2,6,7]

In Brazil, there has been an advance in sports medicine, leading to a deeper knowledge of exercise physiology and allowing specific protocols for each athlete, according to their characteristics. On the other hand, the excessive number of matches and practices have been putting the athletes on the threshold of occurrence of muscular and osteoarticular injuries. In soccer, statistics became an important tool in assessing the degree of training overload and excessive number of matches in relation to the number and types of injuries,[1,2] and epidemiological studies are the first step in the elaboration of a preventive program.[8,9]

When it comes to athletes, sports injuries can be described as a painful syndrome that acts preventing them from performing their sports activities, or even just impairing their performance. In the United States, the National Athletic Injury Reporting System (NAIRS)

classifies sports injuries in three levels according to the time that the athlete ceases customary participation in order to recover: minor injuries (from one to seven days of absence), moderate significant injuries (from 8 to 21 days) and serious injuries (above 21 days of absence or with permanent injuries).[7]

Soccer injuries may present some different definitions and characteristics. An injury can be defined as any physical complaint suffered by a player resulting from a soccer match or practice, regardless of the need for medical attention or absence from soccer activities.[10] However, a consensus regarding the definition of injury in soccer is still the greatest challenge in the field, both in relation to diagnosis and severity, as well as type of injury, due to the use of heterogeneous methods, several definitions of injuries, and different characteristics of the teams evaluated. Thus, there is no uniformly established system in the studies of incidence of injuries in soccer.[10]

From the socioeconomic point of view, it should be noted that players require intensive medical care with different rehabilitation periods, sometimes with hospital admission or in the club's own medical department. The absence of these players in their field activities results in great financial and career losses, not to mention some real financial disasters for their clubs, sponsors and agents.[2,7] The athletes often refuse to remain in treatment or even to receive the appropriate therapy, since the pressure for non-withdrawal and/or early return of the players still under treatment is a common reality in professional soccer.[7]

Soccer injuries are associated with athlete's age, load and training pattern, and level of competitions.[10-13] It is important to understand their characteristics as well as to recognize possible factors that lead to certain types of injuries so that there may be more effective preventive methods. Thus, the objective of this study is to determine the prevalence of musculoskeletal injuries in professional male soccer athletes of the Esporte Clube Bahia during the 2017 season.

Methods

A retrospective epidemiological survey on the musculoskeletal injuries that occurred in the soccer athletes of the Esporte Clube Bahia during the 2017 season was performed. Initially, 36 male professional players representing the Bahia Club in the competitions that took place in the year of 2017 - Campeonato Baiano, Northeast Cup, Brazil Cup, Brazilian Championship were selected for this study. In order to do it, consent was obtained for access and analysis of the medical records of the athletes through the Informed Consent Form and letter of consent signed by the coordinator of the Medical Department of the club, with the proviso that the athletes' identifications were preserved. The records were filled out by the club's physicians and physiotherapists, and they contained information on the occurrence and characteristics of the injuries of the athletes.

The inclusion criteria were: players of the professional category, with a contract signed with Esporte Clube Bahia and who practiced and/or played in the club during the 2017 season; musculoskeletal injuries clinically diagnosed as well as by imaging methods by club physicians, which removed the athlete for at least one day of sports activities in order to recover. Players who presented some type of musculoskeletal injury before the beginning of the 2017 season and were in treatment of these prior conditions were excluded from the study. After applying the inclusion and exclusion criteria, out of the 36 athletes initially selected, 29 players were finally included in this study.

The athletes were separated into two groups: those who did not suffer injuries and those who did. Epidemiological data such as age, weight, height and BMI were described by means of central measures such as mean, mode and median, and their dispersion measurements by standard deviation, as well as the minutes played and the number of matches. The number of injuries, type of injury, degree of injury, anatomical location of the injury, moment of occurrence, laterality of the injury and position in which the athlete played were described by absolute and relative frequency. All quantitative variables were tested for distribution using the Anderson-Darling test, which was normally distributed when the P-value was higher than 0.05. Subsequently, the minutes on the field, age, weight, height, and BMI were compared between the groups using the non-parametric Mann-Whitney U test, considering a significant P value of less than 0.05 and a confidence interval of 95%.

Results

Data from 29 athletes who played in national, regional and/or state competitions were observed in the year of 2017. In general, an overall mean age of 26.67 with a standard deviation of 3.45 years, with a mode of 28 years and median of 26 were obtained. The average weight of the studied athletes was 77.19 kg, with standard deviation of 7.20Kg, and mode and median of 78kg. The mean height was 1.80m, + - 0.07m with mode and median of 1.80m. The BMI of the athletes showed a mean of 23.81 + - 1.23 kg/m2 with mode and median of approximately 24 (Table 1).

Table 1 Difference between epidemiological data from players who got injured and those who did not during the championships

Total		Injured			Not Injured			P Value
Mean	SD	N	Mean	SD	N	Mean	SD	
23.67	3.44	15	26.96	2.70	14	23	3.35	0.0002
77.19	7.20	15	78.17	7.68	14	75.14	5.81	0.1995
1.80	0.07	15	1.79	0.07	14	1.82	0.06	0.1749
23.81	1.23	15	24.36	0.67	14	22.69	1.38	0.0017

Citation: Thomaz DM, Queiroz GCD, Sadigursky D. Prevalence of musculoskeletal injuries in brazilian professional soccer athletes. *MOJ Sports Med.* 2019;3(3):52–57. DOI: 10.15406/mojsm.2019.03.00080

It was observed that 15 (51.72%) athletes suffered injuries during the study period, and 14 did not, and each injured player had an average of 1.93 injuries.

When checking if there was a difference between the epidemiological profile among the players who were injured and those not injured, it was observed that the difference between age averages is significantly different between the groups (P=0.0002), with the players who were injured being 3.96 years older than those who were not injured (95% CI 2.04 - 5.89), and no significant difference in weight and height were observed among athletes. It was also observed that the BMI of those who were injured was, on average, 1.66 kg/m2 (95% CI 1.033 - 2.29) higher than those who did not suffer injuries.

The number of matches of the athletes who suffered injuries was on average 3.12 higher (95% CI 3.11 - 23.96, P=0.0122) than those who did not suffer injuries. (Table 2) When the athletes' minutes on the field were compared, it was observed that the ones who suffered injuries played on average 1184.8 more minutes than those who did not suffer injuries (95% CI 274.8 - 2094.7, P=0.0120) (Figures 1&2).

Table 2 Comparison between the number of matches and the minutes on the field

	Injured			Not Injured			P Value
	N	Mean	SD	N	Mean	SD	
N of Matches	15	32.90	16.67	14	19.36	13.94	0.0122
Minutes on the field	15	2654.8	1455.3	14	1470	1218.2	0.0120

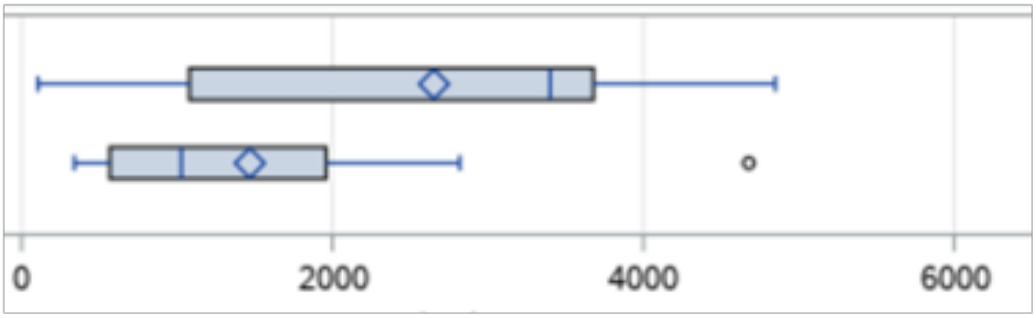

Figure 1 Distribution of the minutes played between the injured and not injured groups.

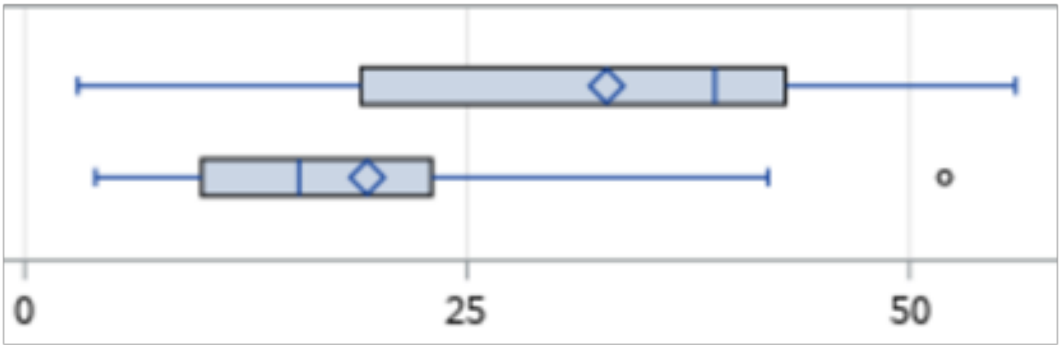

Figure 2 Distribution of the number of matches played between the injured and not injured groups.

Among the 15 athletes who suffered injuries, 5 (35.7%) suffered only 1 injury; the majority of them, corresponding to 46.7%, suffered 2 injuries during the period studied; only 2 (13.3%) suffered 3 injuries and only 1 (6.7%) suffered 4 injuries; a total of 29 injuries were recorded. (Table 3) The most prevalent injury was strain, with 27.59% (n=8), followed by sprain and myalgia, both with 13.79% (n=4); then with 3 reports of contusion and rupture corresponding to 10.34%; all other injuries were recorded only 1 time each (Figure 3).

Considering the absolute number of injuries, 43.83% (n=13) of them were classified as Level 1 (Time of absence <7 days), followed by injuries classified as Level 2 (Time of absence between 7 and 28 days) with 37.93% (n=11) and, finally, only 5 injuries (17.24%) were classified as Level 3 (Time of absence greater than 28 days).

In terms of laterality of the injuries, the majority occurred on the right side, corresponding to 22 injuries (81.48%), followed by injuries on the left side, with 4 (14.81%), and only 1 athlete presented bilateral injury. It is worth noting that eithrer there is no laterality data for 1 of the injuries or it was not applicable (Table 4).

The most affected anatomic region was the lower limbs, with a score of 28 injuries, comparing to only 1 of the upper limbs. Among injuries in the lower limbs, thigh injuries were the most frequent, with 24.14% of the cases recorded (n=7) (Table 5).

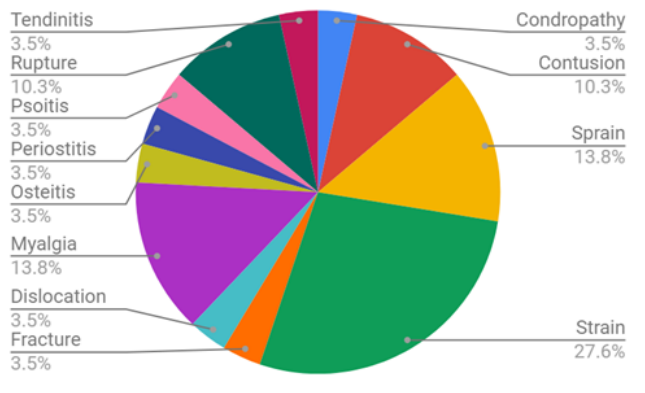

Figure 3 Graph of the distribution of injuries in percentages.

Table 3 Frequency of the recorded injuries

	N	%
Chondropathy	1	3.45
Contusion	3	10.34
Sprain	4	13.79
Strain	8	27.59
Fracture	1	3.45
Dislocation	1	3.45
Myalgia	4	13.79
Osteitis	1	3.45
Periostitis	1	3.45
Psoitis	1	3.45
Rupture	3	10.34
Tendinitis	1	3.45
Total	29	100

Table 4 Frequency of laterality of the registered injuries

	N	%
Bilateral	1	3.7
Right	22	81.48
Left	4	14.81

*The laterality was not applicable in one of the injuries

Table 5 Anatomic region

Anatomical region of injury	N	%
Tight	7	24.14
Knee	6	20.69
Hips	5	17.24
Foot	4	13.79
Leg	3	10.34
Elbow	1	3.45
Pelvis	2	6.9
Ankle	1	3.45

The majority of injuries occurred in the second quarter of the year, corresponding to 44.83% (n=13), with 11 injuries occurring until April/2017 (37.93%); and 5 injuries were recorded (17.24%) between May/2017 and August/2017.

Among the 29 injuries, 14 occurred in the second half of the official matches, corresponding to 48.28%; while only 3 injuries occurred in the first half, corresponding to 10.34%. The remaining 41.38% of the injuries occurred during practice sessions (n=12). Regarding the place where the injuries occurred, the majority happened in matches/practices in the city of the club (home), with 20 injuries being observed, corresponding to 68,97%; consequently, all the other 9 happened in other cities (away matches).

For the calculation of number of injuries, one athlete who suffered 2 injuries with only 170 minutes of play was withdrawn, being considered an outlier. For the other 14 athletes, the average of 1.37 injury/1000 min of playing time was observed, with the lowest coefficient of 0.21 injury/1000 min of playing time, and highest with 5.88 injuries /1000 min of playing time.

When the number of injuries per athlete's position in the field was observed, the majority of injuries (n=9) occurred in athletes who played the position of stopper (defensive midfielder), with a mean of 3 injuries per stopper. They were followed by defenders, reaching 7 injuries in athletes in this position, with an average of 2.43 injuries per defender. In terms of absolute number of injuries, forwards occupy the third position with 6 injuries, however, the mean of the forward's injury is only 1.67 injuries per athlete (Table 6).

Table 6 Average of injuries based on athlete's position on field

Position	N of injuries	Average number of injuries	SD	Min	Max
Forward	6	1.67	0.52	1	2
Wing-back	2	2.00	0.00	2	2
Midfielder	5	1.80	0.45	1	2
Stopper	9	3.00	1.22	1	4
Defender	7	2.43	0.53	2	3

Discussion

A population of 29 professional soccer players was studied during one season. A total of 15 athletes sustained injuries, presenting 29 injury registrations, with muscle strain being the most prevalent injury with 27.59%, followed by sprain and myalgia, both with 13.79%, contusion and rupture corresponding to 10.34%, while all other injuries were recorded only 1 time each.

In the present study, the majority of the athletes studied (51.7%) sustained injuries, with an average of 1.93 injuries per athlete among the injured players. The study by Raymundo, J. et al.[6] found that more than 84% of the athletes presented some injury during the 2003 season and the average number of injuries per athlete was almost two (1.9) per season.[6] The very high incidence of injuries during one season in this study may be justified by the fact that the sample studied was composed of young players. This profile of soccer athletes presents a higher incidence of injuries than the average,[2] probably due to anxiety, inconsequential behavior and inexperience to avoid some situations that present high risk of injury.

In the study of Pedrinelli, A. et al.,[2] the prevalence of injuries in soccer athletes who participated in the 2011 Copa America in Argentina was investigated. Each team participated in a minimum of 3 and a maximum of 6 matches, thus, a total of 26 matches were played in that competition in 17 days, totaling 2430 minutes of play. At the end of the championship, 26 athletes were injured, accumulating 63 injuries.[2] This high number of injuries in a short period of time, different from the present study in which the prevalence of injuries in a whole season was evaluated, is probably due to the greater number of players who participated in the Copa America when compared to the n of this study (n=29), as well as the fact that this championship presents a more intense competitiveness than the local competitions in Brazil.

Corroborating with our study, in which the most frequent injury was muscle strain (n=8, 27.59%), studies by Cohen, M. et al.,[1] Stewien ET of M.[14] and Raymundo, J. et al.[6] also demonstrated muscle injuries in the first place. However, the most prevalent type of injury in the work of Pedrinelli, A. et al.[2] was contusion, with 25 cases (39%), 9 of which (36%) were in the knee, the most affected segment. Contusion was also the most prevalent injury in the work of de Carvalho DA,[3] who evaluated the prevalence of orthopedic injuries in players in the youth teams of a professional soccer club. This difference can be explained by the fact that many of the contusions suffered by the athletes of Esporte Clube Bahia in 2017 did not require absence from the activities, and, therefore, they were not reported in the medical records. Regardless of the type of injury most frequently being contusion, strain or sprain, it should be emphasized that, in the vast majority of the studies, these injuries are always among the most prevalent.[1-4,7,12]

This present study observed a prevalence of almost 14% of myalgia, defined as muscular pain without fiber rupture. Meanwhile, de Carvalho DA[3] found twice as many for this type of injury (28.7%) in players in the youth categories (with ages between 15 and 20 years old). Most studies do not address this complaint in a specific way, placing reports of muscle pain (delayed onset muscle soreness, post-stress myalgia, and contractures) along with strain (fiber injury). This result may be influenced by the development of physiological muscular condition found in younger athletes, associated with the increase in the volume and intensity of training to improve performance.

Regarding the anatomical topography of the injuries, the results of this study are in accordance with the literature, with a greater incidence of injuries in the lower limbs,[1,2,4,11-13] with 28 injuries in these segments, whereas only one injury occurred in the upper limbs . De Carvalho DA[3] showed that 85.7% of injuries occurred in the lower limbs and 14.3% occurred in the rest of the body (3.3% in the upper limbs, 4.7% in the trunk and 6.3% in the head and neck). The most affected regions were the thigh and knee,[2,3] as it was in the present work, where thigh injuries were the most frequent (24.14%), followed by knee injuries (20.69%). This disproportion between the body segments can be attributed to the higher demand of the lower extremity in soccer and the specificity of the sport.[4]

In some epidemiological studies, it can also be observed that the risk of injury varies from one player to another according to the position played on the field. However, with the advent of modern soccer, in which players do not have fixed positions, this situation has been changing, as reported by Pedrinelli, A. et al.,[2] who stated that there is no significant difference between player's position and incidence of injury. The goalkeeper position is responsible for most upper limb injuries, since it is the only position that uses such limbs to perform their function.[2] In the present study, the only upper limb injury (elbow) that occurred in the 2017 season was exactly in a goalkeeper, while the stopper position was the one with the highest number of injuries, with a mean of 3 per stopper, similar to the research done by Borges et al.,[15] who verified that players of this position were affected in 31.7% (15); followed by defenders, midfielders, forwards and, lastly, the wing-defenders. The injuries occurred more frequently in midfielders and attackers in works such as the one done by Pedrinelli, A.[2] This divergence can be justified by the different characteristics of competitions, generating a greater exposure or vulnerability of the athletes of certain positions on the field.

Regarding the prevalence according to the diagnosis, the contusions, the strains and the sprains are the most frequent injuries found in the literature.[3] The present study shows similar results, since, besides showing that injuries of lower limbs occurred as an absolute majority, such as in the work of Hawkins RD[16] who verified an incidence of injuries of 87% in lower limbs, the most frequent types found were contusions and contractures. As most injuries occur in the thigh and leg muscles, there was an agreement with the results obtained, since they pointed the thigh muscles as the main anatomical region of injury.

Cohen, M. et al.[1] found a percentage similarity in the numbers of injuries by athletes in relation to the age group of players between 26 and 40 years old, while the percentage of injury per athlete was lower in players under 20 years old(1). In the proposed study, it was observed that the injured players were, on average, 3.96 years older than those who did not get injured(P=0.0002). Raymundo J. et al.[6] did not demonstrate a direct association of age and frequency of injuries in professional soccer athletes, probably due to the age homogeneity among the evaluated athletes (20-25 year old).[6] Another study[7] also verified that most of the injuries (60%) occurred in players in between 20 and 25 years old.

In the present study, about 48% of the injuries occurred in the second half of the official match, corroborating with the work of Hawkins, RD,[16] who found a higher incidence of injuries in the second half of the match (57%), and with the study conducted by Pedrinelli, A. et al.,[2] in which 26 injuries were reported to the research, with 46% of them occurring during the second half of the match. However, this same study verified an occurrence of 50% of the injuries in the first half of the match, while our study found only 10.34%. This is probably due to the fact that the contusions (most common injuries that occurred in this study) which did not prevent the athletes from remaining in the match were included in the results, unlike the present work, in which only injuries that prevented athletes from continuing to play were reported.

This study observed an occurrence of about 41% of injuries during training. Ekstrand et al.[13] observed that 53% of the occurrence of injuries in soccer players happened during matches valid for competitions and 47% of them during training, which is similar to the results found in this work. On the contrary, another study that carried out an epidemiological survey of the injuries that occurred in two seasons (24 months), with 310 athletes between 15 and 20 years old in a soccer club, found that the most frequent moment of the injuries was during the trainings, with a total of about 88%. The injuries in matches totaled about 12%.[3] This divergence can be justified by two factors: the reduced n of our study and also the fact that this study evaluated athletes of other categories and not professionals, which

can cause different characteristics of the injuries and the moments in which they occur. In a systematic review, it was concluded that the incidence of injuries in official matches is higher than in training for both professional and amateur athletes, although young players present a higher incidence of injuries in training than professional players, probably due to the pressure to reach the elite of the sport.[12]

Some methodological limitations of the present study should be pointed out. There is potential for information bias of the outcome, since accurate data on the injuries may have been altered or even omitted by the medical team's staff of the club. Some information obtained on the injuries were incomplete, making it impossible to include the data regarding the moment of play in which they occurred and their severity estimated by the period of absence from physical activities. Moreover, the small number of the sample of players and the transversal nature of the study hampers the establishment of an unequivocal cause-and-effect relationship.

A problem associated with the epidemiological evaluation of soccer injuries is the inconsistent way in which the injury is defined and how data is collected and recorded. There is no consensus on the study design, data collection, definition of injury and period of observation. In order to interpret the results of an epidemiological study on soccer injuries, it is necessary to compare the results with data from other published studies. However, the methodological differences among the studies may be greater than any statistically significant difference in the results (5), putting the present work as a bibliographical option for future investigations related to the prevalence of soccer injuries.

Conclusion

The results of this study point to the high frequency of musculoskeletal injuries in soccer, especially strain, myalgia and sprain, justified by the accumulation of matches and training, intensity and sudden movements performed by the players, as well as the short duration of the preseason.

The study found an average of nearly two injuries per player. Athletes who participated in a larger number of matches and played for more minutes throughout the 2017 season were the ones with the highest number of injuries. The high prevalence of injuries during training is also noteworthy, and especially in the second half of the official matches, while only slightly more than 10% occurred during the first half. In addition, the athletes who presented the highest mean of injury were those who played as stoppers.

Due to the enormous importance of reducing the time of the athlete's absence from their activities, as well as designing injury prevention programs, it is essential that there is a growing awareness of the profile of the injuries in professional soccer, requiring a number of researches to make it significant.

Acknowledgements

None.

Conflicts of interest

None.

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