

Orthopaedics injuries in male professional football players in Brazil: a prospective comparison between two divisions

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Summary

Background: Football is a high-speed contact sport and the risk of injury is high. The objective of this study was to compare the two main divisions (A1 and A2) of the São Paulo Football Championship and to perform a correlation analysis of the variables studied.

Methods: A prospective study was conducted using an electronic questionnaire previously developed by the Medical Committee of the São Paulo Football Federation. The questionnaire was sent to the doctors of the teams playing in the A1 and A2 divisions of the São Paulo Football Championship after each round.

Setting: 2016 São Paulo Football Championship.

Results: The comparison of divisions A1 and A2 showed few significant differences among the various variables analysed in this study. The only significant differences were for right-side involvement in division A1 ($p=0.044$) and morning matches in division A2 ($p<0.001$). The correlation analysis of the variables studied showed expected associations, including sprains with a higher rate of need for surgery, ultrasound with muscle strains and moderate severity (8-28 days lost) with muscle strains.

Conclusion: Despite the differences between the two divisions regarding budgets and team characteristics, there was a little difference in the vari-

ables analysed and there were associations such as sprains with a higher rate of need for surgery, ultrasound with muscle strains and moderate severity (8-28 days lost) with muscle strains. Level of evidence: II b, individual cohort study.

KEY WORDS: football, injuries, athletes, epidemiology.

Introduction

Football is one of the most popular sports in the world; it is played by more than 60,000,000 people in over 150 countries, according to a Fédération Internationale de Football Association (FIFA) report¹. Because football is a high-speed contact sport, the risk of injury is high. Muscle strains, contusions and sprains comprise 75% of the injuries of professional football athletes, and the majority occur in the lower limbs (60-85%). Muscle injuries account for over 30% of total injuries and for about 25% of absence from playing time. Treatment of such injuries is especially problematic and often a frustrating challenge for the sports physician².

Some lesions, particularly to the muscles and tendons, can be prevented by ensuring good muscle condition, but others that arise during particular circumstances of the match are inevitable, and it is then that action must be taken to bring about a full recovery as soon as possible. Although some programs have been developed to prevent such injuries^{3,4}, which have been the object of widespread consensus and have been publicized and analyzed, they still lack evidence^{5,6}.

Previous studies in Brazil and other countries have been characterized by wide variations in study design, data collection methodologies, definitions of injury, diagnostic criteria and evaluations of recovery time⁷. In Brazil, studies on this topic are scarce, and little is known about the types of injuries that football players incur or how and when they occur, which hinders the prevention, treatment and rehabilitation of injuries⁸.

The Paulista Football Championship is considered the main regional championship in Brazil. It comprises divisions A1 and A2, which differ in terms of budget and team characteristics. We found no studies that compared two divisions of a football championship.

The objective of the study was to compare divisions A1 and A2 and to perform a correlation analysis of the variables studied.

Supplementary Material 1 . Questionnaire for lesion evaluation



Injuries mapping of the 2016 Paulista Football Championship

1. Which match are you going to report?
2. Was there a lesion during the match?
 Yes No
3. What is the birthday of the athlete injured?
4. What is the position of the athlete?
 Goalkeeper Full-back
 Center-back Defensive midfielder
 Attacking midfielder Striker
5. When did the lesion occurred?
 0-15 min. 16-30 min
 31-45 min. 46-60 min.
 61-75 min. 76-90 min.
 First Half overtime
 Second Half overtime
6. Location of the lesion:
 Head/Neck Trunk Upper limbs
 Lower limbs
7. Side of the lesion:
 Right Left
 Not applicable
- 8.Type of lesion
 Strain Sprain Contusion Fracture
 Dislocation Laceration
 Concussion Cramping Others
- 9.Did the lesion occurred after contact with other athlete?
 Yes No
10. Initial diagnosis

Methodology

This study was approved by the Ethics Committee of the Federal University of São Paulo/São Paulo School of Medicine (567236616.3.0000.5505).

This was a prospective study conducted using an electronic questionnaire that was previously developed by the medical committee of the Paulista Football Federation. The questionnaire was sent to the doctors of the teams playing in divisions A1 and A2 of the Paulista Football Championship after each round of matches in the 2016 Championship.

The questionnaire was sent to the doctors after each round to assess the incidence of injuries and their characteristics. The questionnaire comprised 10 questions about the characteristics of the match, the athlete and the injury (Supplementary Material 1).

The definition of injury adopted here was the one proposed by Fuller et al.⁹ for the 2005 FIFA consensus statement, according to which an injury is “any physical complaint resulting from a football match or football training, irrespective of the need for medical attention or time loss from football activities”.

To evaluate the outcomes of the injuries reported, a questionnaire was sent out for each injury that occurred and was answered after the athlete’s return to training and matches. The questionnaire comprised 6 questions designed to gather information on different aspects of the injury outcomes, such as the complementary exams performed and the final diagnosis (Supplementary Material 2).

To obtain the match schedule, we requested the match

records from the Paulista Football Federation and divided the match times as follows: morning (the match started before 12 pm), afternoon (the match started before 6 pm) and night (the match started after 6 pm).

To assess the risk of injury, we calculated the incidence of injury, which is expressed as the number of injuries per 1000 hours of exposure^{9,10}. The following formula was used to calculate match exposure:

Exposure = number of match injuries x number of players participating in the match x match duration in minutes/60.

To calculate the match injury incidence, the following formula was used:

Incidence = number of match injuries x 1000 hours/exposure time

For athletes who suffered an anterior cruciate ligament (ACL) tear and underwent surgery, the injury time loss was set as 180 days.

The injury time loss in the players from division A1 ranged from 0 to 180, with an average of 19 days; for the players in division A2, the number of injury time loss ranged from 0 to 180, with an average of 26 days. Regarding the match schedule, night matches were the most common in both divisions, corresponding to 57.2% of the matches in division A1 and 52.7% of those in division A2. Morning matches were more common in division A2 (15.2%) than in division A1 (6.1%).

Statistical analysis

We used non-parametric statistical tests because the data were quantitative and continuous. We used the test for the equality of two proportions to characterize the

Supplementary material 2. Questionnaire for lesions accompaniment



Accompaniment of the lesions of the 2016 Paulista Football Championship

1. Which complementary exams were done?

None

X-ray

Ultrasonography

Computed Tomography

Magnetic Resonance Imaging

Other (specify)

4. Days that the athlete lost:

2. Did the lesion demanded a surgery?

Yes

No

If yes, which one?

5. Severity scale

Minimal (less than 3 days lost)

Mild (4 -7 days lost)

Moderate (8 -28 days lost)

Major (29 days-8 weeks lost)

Severe (> 8 weeks lost)

3. Date of the return to sport:

6. Final diagnosis:

relative frequency distribution of the qualitative variables. To compare the quantitative variables, we used ANOVA. For qualitative variables, we used the chi-square test and Yates' correction for datasets with fewer than 5 data points. To assess the associations between qualitative variables, we compared the distribution of the total column with the distribution of the intermediate columns. Differences with $p < 0.05$ were considered statistically significant. SPSS V17 software was used to perform the statistical analysis. The study was conducted ethically according to international standards¹¹.

Results

A total of 158 matches were played in division A1, and 203 matches were played in division A2. There was a total of 126 injuries in players from division A1 (0.79 injuries per match) and 128 injuries in players from division A2 (0.63 injuries per match). The ages of the injured players in division A1 ranged from 18 to 37 years, with an average of 26 years; the ages of the injured players in division A2 ranged from 19 to 38 years, with an average of 27 years.

Seven surgeries (5.6%) were needed for players in division A1, compared with 12 surgeries (9%) for players in division A2. In 53.6% of the players in division A1 and 44.8% of the players in division A2, there was contact prior to the injury. Regarding the complementary exams, in both divisions, Magnetic Resonance Image was the most frequently requested exam (Fig. 1). Regarding the side affected by the injuries, the right side was the most

frequently affected (52%) among the division A1 players, while the left side (41.8%) was the most frequently affected among the division A2 players. Regarding the injury site, the lower limbs were the most frequently affected among players in both divisions (73%). In both divisions, the strikers were the players most often affected by injuries (Fig. 2). Regarding severity, injuries of moderate severity (8-28 days lost) were the most common, comprising 36.8% of the cases in division A1 and 32.1% of those in division A2 (Fig. 3).

In both divisions, the most common injury period was at the end of the first half, at minutes 31-45 (Fig. 4). Muscle strains were the most common injuries in both divisions, representing 36% of the cases in division A1 and 43.3% of cases in division A2 (Fig. 5). Division A1 had an incidence of 24,16 injuries per 1000 match hours, while the incidence in division A2 was 19,10 injuries per 1000 match hours. When the two divisions were grouped together, we obtained a total of 21.32 injuries for every 1000 match hours.

Comparison between divisions A1 and A2

In the comparison between divisions A1 and A2, we concluded that there were very few significant differences between the variables analysed in this study. The only significant differences were found for right-side involvement, which was more common in division A1 ($p=0.044$), and morning matches, which were more common in division A2 ($p < 0.001$).

Correlations among variables

When the type of injury was considered in terms of the

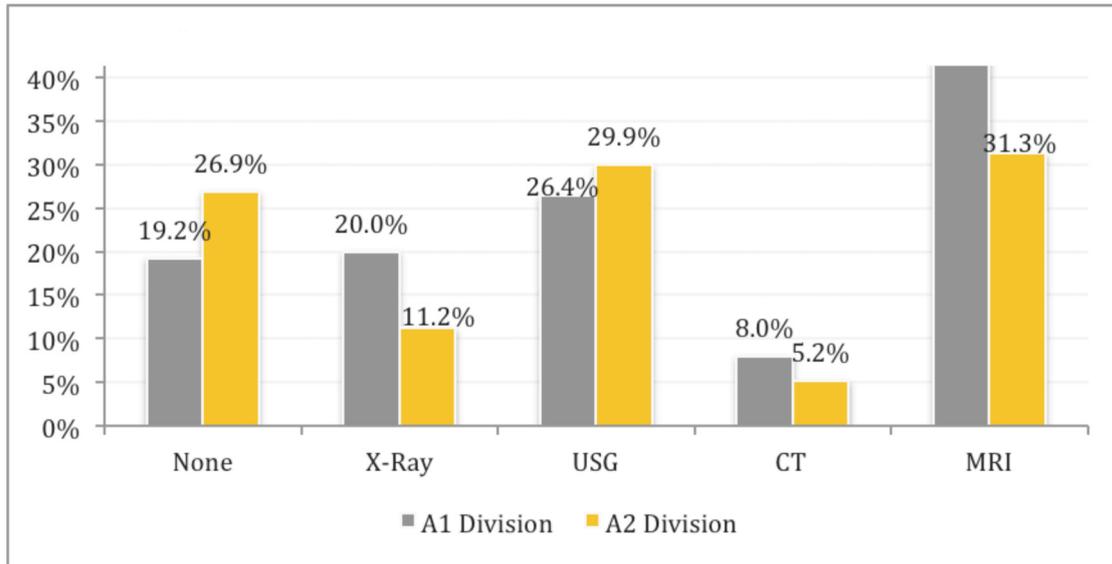


Figure 1. Comparison between divisions regarding exams ordered.

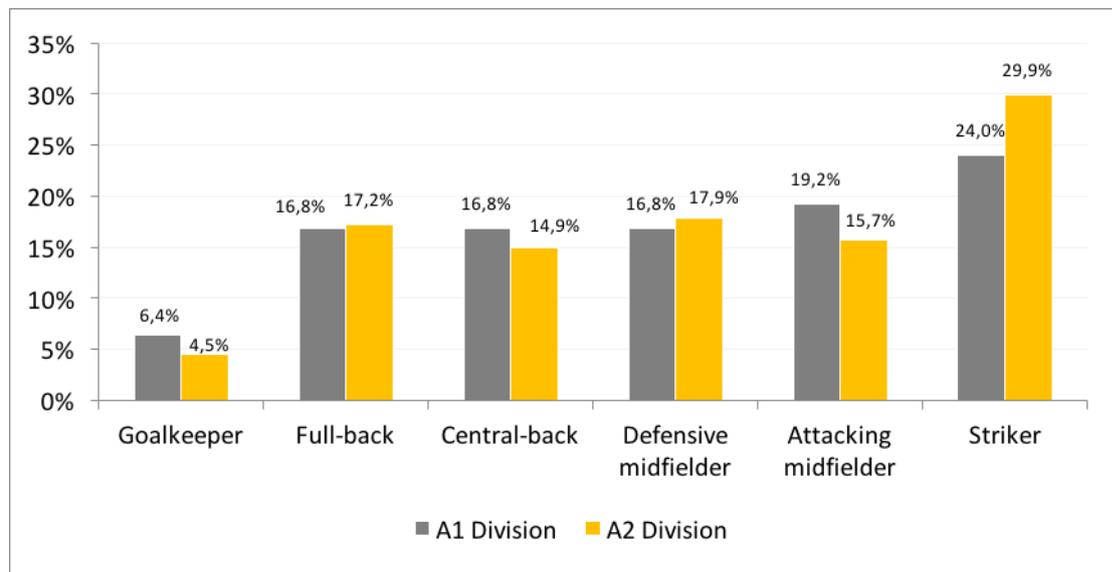


Figure 2. Comparison between divisions for player position.

different variables studied, we observed no association of injury type with the age of the injured athletes, the match hour or the position of the player (Tab. I).

We found the following associations: 21% of sprains resulted in surgery and 100% of strains and lacerations did not require surgery; 66% of sprains occurred on the right side. For sprains, ultrasound was requested in 52% of cases. For sprains, Magnetic Resonance Image was requested in 54% of cases. For contusions, X-rays were requested in 33% of cases, whereas for lacerations, no test was requested in 88% of cases. Strains were of moderate severity in 54% of cases. Sprains were of severe severity in 21% of cases, and lacerations were of mild severity in 79% of cases.

There was no significant difference between the injured site and the player's position; between injury severity

and match hour; between the player's position and the final diagnosis; or between the age of the player and the final diagnosis.

Comparison of the top 10 x bottom 10 teams

When comparing the final standings of the teams from divisions A1 and A2 (top 10 x bottom 10) in relation to the number of fouls committed and the number of injuries, we observed no difference between the groups.

Discussion

Statement of principal findings

The main finding of this study is the minimal difference in the studied variables between divisions A1 and A2,

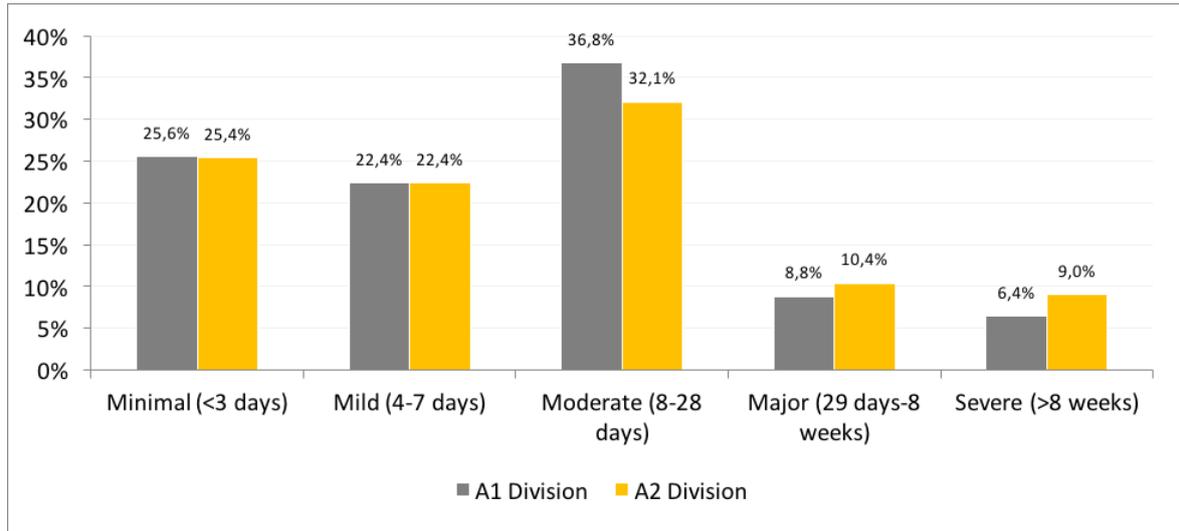


Figure 3. Comparison between divisions for severity scale.

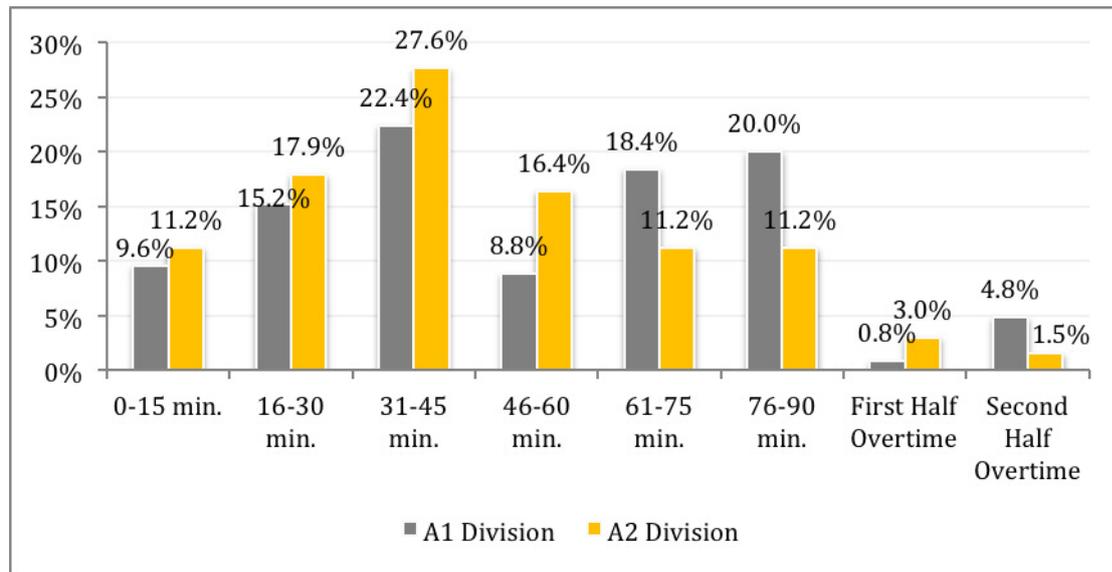


Figure 4. Comparison between divisions regarding injury moment.

although there were differences regarding the budget and the number of matches. It is worth noting that the differences between the divisions in the affected body side and match schedule may have been due to chance. Because this is the first study to compare different divisions of a football championship, it was not possible to compare our results with those of other studies in the literature.

On average, the athletes from the two divisions missed 23.2 days due to injury, which is higher than the value found in the study by Stubbe et al.¹², which reported an average of 8 days of missed time. One possibility for this high average was the presence of 10 cases of ACL tears, which has an injury time loss of more than 6 months on average. We found an average of 0.71 in-

juries per match for the two divisions, which is below the values reported in several studies, including those by Pedrinelli et al.¹³ and Junge et al.¹⁴, who each observed a frequency of 2.4 injuries per match.

In our study, the most common injuries in both divisions were contusions, strains and sprains in the lower limbs, which is in agreement with the results reported in the literature^{13,15-18}. We found that in both divisions, strikers were the players most affected by injuries; this differs from the findings of previous studies, in which midfielders were the most affected^{19,20}. This difference may be explained by the fact that previous studies did not subdivide midfielders into defensive and attacking midfielders, which we did. Regarding the incidence of injuries per 1000 match hours in both divisions, our results are

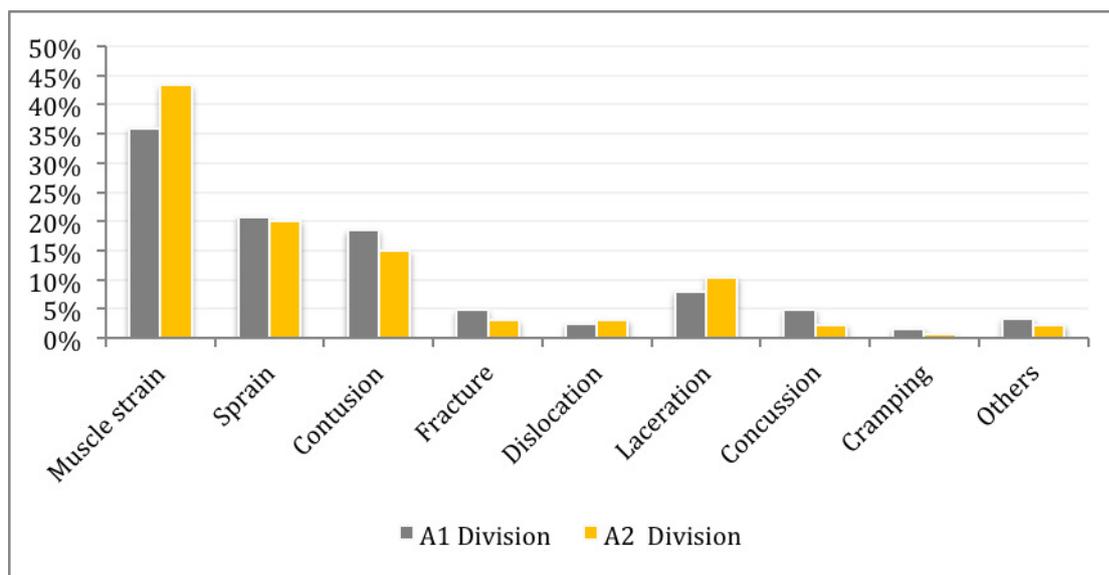


Figure 5. Comparison between divisions regarding injury type.

within the range reported in the literature, with incidences from 15 to 70 injuries per 1000 match hours^{13,21-23}. It is important to note that the large range emerged because the previous studies differed in terms of study design, data collection methodology and definition of injury⁷. Another difference was the injury time. In our study, injuries most often occurred at minutes 31-45 in both divisions, while other studies have shown that most injuries occur in the last 30 minutes of a match^{13,22}. In our study, 49% of the injuries occurred after contact, a value similar to the result found by Pedrinelli et al.¹³ but lower than those reported by other studies in the literature, in which injuries after contact corresponded to more than 70% of cases^{22,23}. Melegati et al.²⁴ showed that through the implementation of a group and personalized injury prevention program, they were able to reduce the total number of muscle injuries and days absent because of injury, in a team of elite soccer players, as compared to the previous season. Specifically, muscle injuries accounted for 31% of all injuries, as compared to 59% of all injuries sustained by the team during the previous season. The number of injuries/1000 hours of exposure was reduced by half (from 5.6 to 2.5) and the days absent/1000 hours fell from 106 to 37.

The most frequently requested complementary exam after an injury for both divisions was an MRI, which may be because muscle injuries were the most common type of injury, and they are typically evaluated using that exam. In our study, most of the injuries were of moderate severity (requiring the player to miss 8 to 28 days) in both divisions. This finding was similar to the results reported by Stubbe et al.¹² but differed from those of Pedrinelli et al.¹³ and Cohen et al.¹, which noted that mild injuries (4 to 7 days missed) were most common. Only 7.7% of injuries required surgery, as the vast majority of injuries that affect football players, such as strains and bruises, are usually managed conservatively. Pangrazio et al.²³ showed that serious football in-

juries are rare, but it is increasingly necessary to set protocols for action which ensure good medical attention at all levels to address the problems that arise, both during training and in competitions, and to be prepared to treat serious injuries if these occur.

In the correlation analysis of the variables, we found expected associations, such as an association between sprains and a higher rate of surgery, likely because ACL tears were included in this category of injury and are treated with surgery. Muscle strains and lacerations were associated with a lack of need for surgery. Muscle strains were associated with a lack of contact before injury, and lacerations and contusions were associated with contact before the injury, as expected considering the trauma mechanisms that lead to these types of injuries. Sprains were associated with right-side involvement, which may be related to dominance of the right limb in most players. Regarding the requested exams, we found an association between ultrasonography and muscle strains, which is expected as this is the least expensive and most accessible type of exam used for this type of injury. Magnetic Resonance Images were associated with sprains, likely because they allow the evaluation of ligament injuries. X-rays were associated with contusions because this exam is easily accessible and enables the diagnosis of fractures. Lacerations were associated with the absence of exam requests because they are routinely evaluated without a need for complementary exams. Regarding injury severity, there was an association between lacerations and minimal severity (up to 3 days missed) because this type of injury does not require athletes to miss training and matches. There was also an association between contusions and mild severity (4 to 7 days missed) because these injuries require little recovery time. There was an association between moderate severity (8 to 28 days missed) and strains, which was expected given that most injuries of this type require a recovery time that falls within that interval. Moreover,

Table I. Association among type of lesion and qualitative variables.

Type of Lesion		Strain		Sprain		Contusion		Laceration		Total		P-value
		N	%	N	%	N	%	N	%	N	%	
Surgery	Yes	0	0%	11	21%	2	5%	0	0%	13	6%	<0,001 (Y)
	No	103	100%	41	79%	41	95%	24	100%	209	94%	
Contact	Yes	4	4%	35	66%	39	91%	24	100%	102	46%	<0,001 (Y)
	No	99	96%	18	34%	4	9%	0	0%	121	54%	
Hour	Morning	13	13%	7	13%	3	7%	1	4%	24	11%	0,485
	Afternoon	44	43%	19	36%	16	37%	7	29%	86	39%	
	Night	46	45%	27	51%	24	56%	16	67%	113	51%	
Side	Right	52	50%	35	66%	16	37%	2	8%	105	47%	<0,001 (Y)
	Left	50	49%	18	34%	19	44%	0	0%	87	39%	
	Not applicable	1	1%	0	0%	8	19%	22	92%	31	14%	
Exams	None	8	7%	11	19%	12	24%	21	88%	52	21%	<0,001 (Y)
	X-Ray	0	0%	11	19%	16	33%	2	8%	29	12%	
	MRI	46	40%	32	54%	9	18%	0	0%	87	35%	
Severity	USG	59	52%	5	8%	6	12%	0	0%	70	28%	<0,001 (Y)
	CT	1	1%	0	0%	6	12%	1	4%	8	3%	
	Minimal	8	8%	6	12%	21	49%	19	79%	54	24%	
	Mild	23	22%	11	21%	10	23%	4	17%	48	22%	
	Moderate	56	54%	19	37%	7	16%	1	4%	83	37%	
Position	Major	16	16%	5	10%	1	2%	0	0%	22	10%	0,870
	Severe	0	0%	11	21%	4	9%	0	0%	15	7%	
	Goalkeeper	3	3%	1	2%	4	9%	2	8%	10	4%	
	Full-back	20	19%	8	15%	6	14%	3	13%	37	17%	
	Center-back	14	14%	12	23%	6	14%	3	13%	35	16%	
Striker	Defensive midfielder	17	17%	9	17%	8	19%	6	25%	40	18%	
	Attacking midfielder	20	19%	11	21%	7	16%	4	17%	42	19%	
	Striker	29	28%	12	23%	12	28%	6	25%	59	26%	

there was association between sprains and severe injury (more than 8 weeks missed), which can be justified by the fact that sprains are related to ligament injuries, especially of the knee, which may require surgery and a prolonged recovery time. We found no studies that addressed these relationships; therefore, we could not make comparisons.

We compared the standings of the teams playing in divisions A1 and A2 (top 10 x bottom 10) to assess whether a greater number of fouls and injuries would be related to a worse standing in the championship, but we found no such association. To perform this comparison, we compared only the first-round matches, in

which division A1 teams played 15 matches each and division A2 teams played 19 matches each. This procedure was adopted to decrease the bias and standardize the number of matches among the clubs, since the top teams played a greater number of matches until the end of the championship.

Strengths and weakness of the study

Some methodological limitations of this study must be noted. There is the possibility of outcome reporting bias because accurate data regarding injuries may have been changed or even omitted by the team doctors. In addition, the study evaluated acute injuries that oc-

curred during matches; thus, chronic injuries, injuries that occurred during training and diseases not related to the sport were not recorded. Another limitation is that the exposure time was calculated based on 22 players and 90 minutes per match. A more accurate method would be to consider extra time or the actual duration of each match and the number of minutes of exposure for each player individually. The strengths of this study include the fact that it is the first study in Brazil to compare the two major divisions of the country's main regional championship. In addition, we performed correlations that can be conducted in other studies for comparison purposes, and this study confirmed certain associations, which albeit expected, had not been previously evaluated.

Meaning of the study

It is the first study to compare two major divisions and we evaluated associations that had not been previously evaluated.

Unanswered questions and future research

The comparisons we conducted can be evaluated in future studies to demonstrate if similar results are found in different countries.

Conclusions

Despite the differences between the two divisions in terms of budget and characteristics of the teams, there was little difference in the analysed variables. The most common injuries in both divisions were contusions, strains and sprains in the lower limbs and there were associations such as sprains with a higher rate of need for surgery, ultrasound with muscle strains and moderate severity (8-28 days lost) with muscle strains.

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