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INTRODUCTION

Football is one of the most practiced activities in the world [1]. This sport is characterized by having great physical contact, short, fast, and non-continuous movements, such as acceleration and deceleration, changes in direction, and jumps [2]. For this reason, he is responsible for the largest number of injuries in the world sport, a fact that causes several losses for the athlete and for the club, as well as days of lost training, expenses with the treatment, investment in an athlete who is not paying and the loss of team productivity. In this context, there is an enormous interest in optimizing the diagnosis, therapy, and the rehabilitation process after injuries to minimize withdrawal from sport and recurrence rates [3,4].

In addition, sport-specific factors may interfere with each type of injury, as it is a high-intensity intermittent sport, with variable characteristics between players, which depends on the athlete's position on the field, that is; goalkeeper (explosive strength, flexibility, balance, localized muscular endurance and reaction speed), lateral (explosive strength, endurance, and coordination), defenders (strength, momentum, balance, reaction speed, and agility), midfield (endurance, coordination, recovery, and speed) and attackers (speed, agility, balance, and explosive strength) [5]. This can show us a big difference in the types of injuries, observing the athlete's position and his wear in training and games [6].

In Brazil, they increasingly try to improve or find a balance between the physical fitness of the athletes and the schedule requirements to be met by the teams during the season. The number of games and hours dedicated to training sessions increased significantly, which makes the occurrence of muscle and osteoarticular injuries in athletes more frequent, the incidence of injuries is estimated at 327 injuries in the 2017 Brazilian championship, 26 injuries/1000h [7]. Thus, in order to minimize the damage caused to the athletes' bodies, due to the number of games and training, sports medicine has been investigating ways to offer individualized assistance to these professionals [8-11]. Through the advancement of sports medicine, there is greater knowledge about the physiology of effort and especially the physiological and biomechanical characteristics involved in each modality, allowing them to make individualized protocols for each athlete [12-17].

Therefore, the present study carried out an epidemiological study featuring the type and location of the injury, severity based on recovery time, game position, injury for hours of exposure, and characteristics of the athletes involved (age, mass, height, and BMI).

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METHODS

This epidemiological study was developed at a training center for soccer athletes from a club of the first Brazilian division. Initially, data were collected in the sub 15, sub 17, and sub 20 categories, where the number of athletes, type, and location of injuries was recorded, as well as the severity and time when they occurred. The medical team was responsible for evaluating the injured athletes and assigning a diagnosis, following specific recommendations for each type of injury. This study was an open cohort, so if a player joined or left the team during the season, he was not excluded from the survey. At the end of the season, this study investigated 129 male athletes for 238 + - 110 days, including in the under 20 category - 3 goalkeepers, 6 defenders, 5 full-backs, 9 defensive midfielders, 10 midfielders, 10 attackers, in the sub 17 category - 4 goalkeepers, 6 defenders, 4 defenders, 10 defensive midfielders, 9 midfielders, 10 attackers, in the sub 15 category - 3 goalkeepers, 6 defenders, 5 defenders, 9 defensive midfielders, 10 midfielders, and 10 attackers. In total - 10 goalkeepers, 18 defenders, 14 full-backs, 28 defenders, 29 midfielders, and 30 attackers.

Procedures

The injuries were recorded by the club's medical team, who were trained to use the F-MARC form, a form from the International Football Federation (FIFA) medical research center at the start of the season [3,10]. The moment of the injury was marked immediately after it occurred [10].

The injuries were classified by the moment it occurred (game or training), severity, location, type, mechanism, and recurrence. The severity of the injury was defined according to the number of days lost by the player between the day of the injury and the return to activities with the team, as well as the availability to go to games. The severity of the injury was classified according to the number of days lost: minimal (1-3 days), mild (4-7 days), moderate (8 - 28 days), and severe (more than 28 days) [9]. The location of the lesion was defined according to the following categories: head/neck, upper limbs, trunk, and lower limbs.

The type of injury was classified as stress (fracture/bone), joints/ligament, muscle/tendon, contusions, skin laceration/injury, central/peripheral system, and others. All muscle tensions were confirmed by the imaging diagnosis. The injury mechanism was classified as traumatic, that is, resulting from a specific moment, or as overuse, that is, caused by repeated microtrauma. Recurrence was defined as the same type and location of the injury that occurred after the player returned to full activity with the team. Recurrence was classified as early, when the lesion occurred within an interval of fewer than two months, or late when it occurred between 2 and 12 months [10].

Then, these athletes were referred to the physiotherapy sector where they underwent an evaluation with the two physical therapists, who proposed a functional diagnosis and specific therapeutic measures for each individual. Thus, each athlete's time off was recorded and the average for each type of injury was calculated.

Data preparation

The injuries were organized in number and percentage according to the location, type, mechanism, recurrence. The hours of training and games were calculated based on the weekly schedule that was sent to us by email by the coordination of the club. For each field training, of all categories, two hours and thirty minutes were considered. Regarding the games, for the sub 15 category, each game counted as 1 hour, for the sub 17 category each game counted as an hour and 20 minutes, and for the sub 20 category, each game counted as an hour and 30 minutes.

Statistical analysis

To perform the data analysis, the GraphPad Prism 6 software was used. All variables were analyzed using the Kolmogorov-Smirnov test. The comparison between groups was performed using the Kruskal-Wallis test, the post hocused was Dunn's test. Correlations were performed with the aid of the Spearman test. Results with p[?]0.05 were established as statistically significant.

RESULTS

The season consisted of 266 days for the sub 20, 273 days for the sub 17, and 287 days for the sub 15, during which 65 matches were played for the sub 20, 65 matches were played for the sub 17 and 75 matches were played for the sub 15. Currently, the analyzed team is composed of 129 athletes subdivided into 3 categories, 44 athletes make up the Sub 15 team, 42 athletes make up the Sub 17 team, and 43 the Sub 20 team, of this total 62 records of injured athletes were evaluated during the period between January and November of the year 2015 for male athletes of the categories Sub20 (17 athletes), Sub17 (20 athletes) and Sub15 (22 athletes) of a professional team, of the first soccer division, in the city of Sao Paulo. The average age of the participants was 16.35 +- 1.76 years, the Sub20 group had an average age of 18.71 +- 0.07 years, the Sub17 average age of 16.30 +- 0.47, and the Sub15 14, 59 +- 0.50 years. Figure 1 represents the boxplot's referring to the BMI of the analyzed categories.

Figure 1: Boxplot's referring to the injured athletes' BMI by categories.
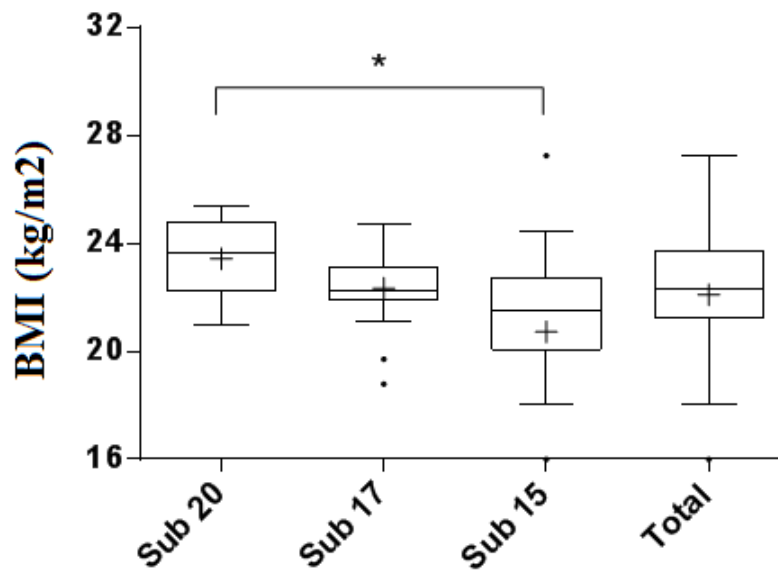
BMI: body mass index; *: Statistically significant value. p = 0.0069

The injury rate was 50% for the Sub15 team, 47.61% for the Sub 17 team, and 39.53% for the Sub 20 team. Table 1 shows the data regarding the age, body mass, height, and BMI of the injured participants divided by the position that each athlete plays on the field.

Table 1: Characteristics of athletes injured by position.

Position	Age (years))	Mass (kg)	Height (m)	BMI (kg / m2)
Goalkeeper (9)	16±0,70	74,38±6,43	1,85±0,01	21,52±1,83
Defender (11)	16,63±1,96	75,16±7,65	1,80±0,07	23,03±1,11
Steering wheel (9)	16,88±1,90	71,68±9,21	1,73±0,07	23,73±1,99
Midfield (10)	17±1,82	68,24±6,67	1,74±0,05	22,27±1,43
Side (7)	16,57±1,51	66,57±4,17	1,73±0,04	22,21±1,36
Forward (8)	16,62±1,18	68,52±6,59	1,74±0,07	22,56±0,78
Without a defined position (8)	14±0	64,44±10,42	1,71±0,07	21,82±2,24
Total (62)	16,35±1,76	70,11±8,30	1,76±0,07	22,49±1,76

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Kg: kilogram; m: meters; BMI: Body mass index.

The exposure time in training and games is shown in table 2. Note that the training load is significantly higher than the game load in all categories. Also, the relationship between the number of injuries per thousand hours of total training was studied.

Table 2: Hours of training and games by category; relationship

Category	Hours of training	Hours of Games	Injury Ratio / 1000h of training	Injury / 1000h match ratio
Sub 15	584	112,5		
Sub 17	690	97,5		
Sub 20	612	97,5		
Total	1886	307,5	25,98	42,27

h: hours

As for the time when the injuries occurred, 13 (21%) occurred during the game, 49 (79%) during training. Regarding the appearance of new injuries, 49 athletes (79%) did not have recurrent injuries and 13 athletes (21%) presented new injuries. All athletes who had recurrent injuries suffered only one new injury after the first event. The mean time of leave after injury was 3.65 ± 4.82 weeks, with minimum and maximum values, respectively, from 1 day to 24 weeks.

There were 25 muscle injuries (40.32%), 9 bone injuries (15.41%), 27 joint injuries (43.54%), and one pathology (1.61%) classified as another. The ankle and foot region was affected by 12 injuries; the knee for 12 injuries; hamstrings for 9 injuries; 7 groin injuries, gastrocnemius by injury; the quadriceps for 9 injuries; the lung from an injury; the shoulder for two injuries; the elbow for two injuries; the lumbar spine from an injury; the nose for an injury; the occipital bone from an injury; the hand for four injuries.

Table 3 shows the correlation indices established between the number of injuries and the percentage of fat (% of fat) in the body and the BMI of each athlete. There was no correlation between the number of injuries and body measurements of% fat and BMI.

Table 3: Correlation between the number of injuries with BMI and percentage of body fat.

	Sub20	Sub17	Sub15	Total
No. of injuries X% of body fat	p=0,78 R=-0,04	p=0,31 R=0,15	p=0,30 R=0,15	p=0,27 R=0,09
No. of injuries X BMI	p=0,88 R=-0,02	p=0,25 R=-0,18	p=0,72 R=0,05	p=0,06 R=0,44

No.; number; %: percentage; BMI: body mass index.

Table 4 provides data on the correlation indices established between injury severity and age, BMI, position, recurrence, and time of injury. No correlation was found between any of these variables when compared to the severity of the injuries.

Table 4: Correlation between the severity of injuries with age, BMI, position in the field, and the presence of recurrent injuries.

	SI X Age	SI X BMI	SI X BMI	SI X Position	SI X Recurring injuries	SI X Recurring injuries	SI X Injury timing
R	0,07	0,13	0,13	0,22	0,04	0,04	0,08

p	0,58	0,30	0,30	0,10	0,74	0,74	0,50

SI: Severity of the injury; BMI: Body mass index.

DISCUSSION

This study characterized the injury profile in a training center for soccer athletes from a club of the first Brazilian division. It was observed that the incidence of injuries was 50% for the Sub15 team, 47.61% for the Sub 17 team, and 39.53% for the Sub 20 team. Although no correlation was found between the injury index and anthropometric factors and with the position of the athletes, specific training characteristics in each category, as well as preventive and regenerative programs and financial interests can explain the difference in the incidence of injury and time off in each category.

The incidence of injuries observed during games 13 (21%) was lower than those that occurred in training 49 (79%). However, when we analyze the ratio of injuries that occurred every thousand hours of training and playing, we have higher values of injuries that occurred in games; 25.98 and 42.27 respectively. These data coincide with those of a study carried out in a professional club of the first division of Brazilian football, which shows an 18 times higher rate of injuries in games [5]. Other studies have reported lower values: an average of 27.5 / 1000 hours by the Union of European Football Associations (UEFA) [14] and 21.8 / 1000 hours by teams from the Japanese first division [15]. This fact can be explained by the high number of matches played in Brazilian football when compared to other countries.

In the present study, the mean BMI value was 22.8 and there was no correlation between this variable and the number of injuries, different from what was shown in the study by Rodrigues et al. [18], where a higher injury rate was found in the group of athletes with a BMI of 18.5 to 24.9 and in the group of athletes with a BMI <18, a lower number of injuries was found, and this study was conducted in basic categories. There were no athletes with a BMI <18 to observe the number of injuries in this BMI range.

In this study, the anatomical region most affected was the lower limbs, where a number of 18 injuries were found in the thigh, 12 injuries in the ankle, 12 injuries in the knee, 7 injuries in the groin, and one injury in the calf. A smaller number of injuries were found in the upper limbs, with 2 being documented on the shoulder, 4 on the hand, and 2 on the elbow. These results are related to those of Rodrigues et al. [18] where similar data were found in baseline categories: 18 ankle injuries, followed by 14 knee injuries, 13 hip/thigh injuries, and 5 wrist, hand, and fingers injuries. However, these findings do not agree with a study carried out in a professional club, where only lower limb injuries were found. Most of the injuries found in this study were non-contact and non-recurring. The recurrence rate (21%) is within what is reported in the literature (20-25%) [18]. Other authors have found even lower recurrence values in professional elite football [5].

Regarding the severity of the injuries, no correlation was found with age, BMI, position, recurrence, and time when the injury occurred. This can be explained by the fact that the sample is homogeneous with respect to BMI. In addition, although the athletes have a defined position in their respective teams, most of the activities performed in training situations are similar for all positions. Although no correlation was found between severity and the time when the injuries occurred, all knee sprains that resulted in rupture of the anterior cruciate ligament occurred during official matches.

In this context, a systematic review and meta-analysis of epidemiological data on injuries in professional male soccer were carried out. The overall incidence of injuries in professional male soccer players was 8.1 injuries/1000 hours of exposure. The incidence of gambling injuries (36 injuries/1000 hours of exposure) was almost 10 times higher than the incidence rate of training injuries (3.7 injuries/1000 hours of exposure). Lower extremity injuries had the highest incidence rates (6.8 injuries / 1000 hours of exposure). The most common types of injury were muscle/tendon (4.6 injuries/1000 hours of exposure), often associated with traumatic incidents. Mild injuries (1-3 days wasted) were the most common. The injury incidence rate in the top 5 European professional leagues was not different from the professional leagues in other countries (6.8 vs 7.6 injuries/1000 hours of exposure, respectively) [19].

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CONCLUSION

This study described the injury profile in a Brazilian athlete training center. Similarities and differences were found when compared to other studies done both in grassroots categories and with professional athletes in different countries. The game is the time when the greatest number of injuries occurs, but no correlation was found between the severity of the injuries and variables with age, BMI, position, recurrence, and the time when these injuries occurred. Future analyzes should be carried out, looking for a tendency of the type of injury that mostly happens in a given position, thus optimizing the development of preventive strategies.

DECLARATION OF POTENTIAL CONFLICT OF INTEREST

The authors declare no conflict of interest.

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DATA SHARING STATEMENT

No additional data are available

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