INCIDENCE OF INJURIES IN SOCCER PLAYERS – MAPPINGFOOT: A PROSPECTIVE COHORT STUDY

INCIDÊNCIA DE LESÕES EM JOGADORES DE FUTEBOL – MAPPINGFOOT: UM ESTUDO DE COORTE PROSPECTIVO

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ABSTRACT

Introduction: Although the positive effects of physical activity on global health are well documented, sports practice is associated with a greater risk of injury; in professional soccer in particular, the risk is substantial. Objective: The primary objective of this study was to investigate the incidence of injuries among male athletes competing in the regional soccer championship. The secondary objective was to determine the prevalence of injuries. Methods: In this prospective cohort study, level of evidence II, the incidence and prevalence of injuries were assessed using an adapted version of the UEFA Champions League Study questionnaire. Results: This study included 310 male athletes from ten teams, aged 26.53±4.75 years, height 180.93±6.49 cm, and weight 79.32±8.29 kg, with a 4-month follow-up. Ninety-two injuries were recorded, representing a prevalence of 29.68% injuries. The body part most frequently injured was the lower limbs (86.9%). The main types of injuries were muscle tear/strain (37.0%), sprain/ligament (19.6%), and other injuries (14.1%). The injuries were mainly caused during run/sprint (33.7%), kick (12.0%) and jumping/landing (6.5%). The incidences of injuries were 15.88±8.57, 2.04±1.09, and 3.65±1.50 injuries/1000h of exposure during matches, training, and matches/training, respectively. Time-loss over the season was between 1 and 50 days, and the severity of the injuries was as follows: light (25%), minor (22.8%), moderate (43.5%) and severe (8.7%). Conclusion: This study suggests that there is a higher incidence of injuries during matches compared to training, among male regional soccer championship players. The lower limbs are the body part most affected, with a higher prevalence of rupture/strain in the thigh region, during running/sprinting. ***Level of evidence II; Prospective Cohort Study.***

Keywords: Prevalence; Incidence; Athletic injuries; Soccer; Cohort studies.

RESUMO

Introdução: Embora os efeitos positivos da atividade física na saúde global sejam bem documentados, a prática esportiva está associada a um risco maior de lesões; especialmente no futebol profissional, o risco é substancial. Objetivo: O objetivo primário deste estudo foi investigar a incidência de lesões em atletas do sexo masculino que competem em campeonatos regionais de futebol. O objetivo secundário foi determinar a prevalência de lesões. Métodos: Neste estudo de coorte prospectivo, nível de evidência II, a incidência e a prevalência de lesões foram avaliados usando uma versão adaptada do questionário de estudo da Liga dos Campeões da UEFA. Resultados: Este estudo incluiu 310 atletas do sexo masculino de 10 equipes, com idade 26,53 ± 4,75 anos, estatura 180,93 ± 6,49 cm e peso 79,32 ± 8,29 kg, durante 4 meses de acompanhamento. Foram registradas 92 lesões, o que representa uma prevalência de 29,68%. A parte do corpo que teve lesões mais frequentes foram os membros inferiores (86,9%). Os principais tipos de lesão foram ruptura/distensão muscular (37,0%), entorse/ligamento (19,6%) e outras lesões (14,1%). As lesões foram causadas principalmente durante corrida/sprint (33,7%), chute (12,0%) e salto/aterrissagem (6,5%). A incidência de lesões foi de 15,88 ± 8,57, 2,04 ± 1,09 e 3,65 ± 1,50 lesões/1.000 horas de exposição durante jogos, treinamento e jogos/treinamento, respectivamente. O tempo de afastamento na temporada variou de 1 a 50 dias e a gravidade das lesões foi a seguinte: leve (25%), menor (22,8%), moderada (43,5%) e grave (8,7%). Conclusão: O presente estudo sugere que existe maior incidência de lesões durante os jogos em comparação com os treinos entre jogadores do sexo masculino em campeonatos regionais de futebol. Os membros inferiores são a região mais acometida, com maior prevalência de ruptura/distensão na região da coxa durante a corrida/sprint. ***Nível de evidência II; Estudo de coorte prospectivo.***

Descritores: *Prevalência; Incidência; Traumatismos em atletas; Futebol; Estudos de coortes.*

RESUMEN

Introducción: Aunque los efectos positivos de la actividad física en la salud global estén bien documentados, la práctica deportiva está asociada a un riesgo mayor de lesiones; especialmente en el fútbol profesional, el riesgo es sustancial. Objetivo: El objetivo primario de este estudio fue investigar la incidencia de lesiones en atletas del sexo masculino que compiten en campeonatos regionales de fútbol. El resultado secundario fue determinar la

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prevalencia de lesiones. Métodos: En este estudio de cohorte prospectivo, nivel de evidencia II, la incidencia y la prevalencia de lesiones fueron evaluadas usando una versión adaptada del cuestionario de estudio de la Liga de Campeones de la UEFA. Resultados: Este estudio incluyó a 310 atletas del sexo masculino de 10 equipos, edad 26,53 ± 4,75 años, estatura 180,93 ± 6,49 cm y peso 79,32 ± 8,29 kg, durante 4 meses de acompañamiento. Se registraron 92 lesiones, lo que representa una prevalencia de 29,68%. La parte del cuerpo que tuvo lesiones más frecuentes fueron los miembros inferiores (86,9%). Los principales tipos de lesión fueron rotura/distensión muscular (37,0%), esguince/ligamento (19,6%) y otras lesiones (14,1%). Las lesiones fueron causadas principalmente durante carrera/sprint (33,7%), puntapié (12,0%) y salto/aterrizaje (6,5%). La incidencia de lesiones fue de 15,88 ± 8,57, 2,04 ± 1,09 y 3,65 ± 1,50 lesiones/1000 horas de exposición durante partidos, entrenamientos y partidos/entrenamientos, respectivamente. El tiempo de alejamiento en la temporada varió de 1 a 50 días, y la gravedad de las lesiones fue la siguiente: leve (25%), menor (22,8%), moderada (43,5%) y grave (8,7%). Conclusión: El presente estudio sugiere que existe mayor incidencia de lesiones durante los partidos en comparación con los entrenamientos entre jugadores del sexo masculino en campeonatos regionales de fútbol. Los miembros inferiores son la región más acometida, con mayor prevalencia de rotura/distensión en la región del muslo durante la carrera/sprint. ***Nivel de evidencia II, Estudio de cohorte prospectivo.***

Descriptores: *Prevalencia; Incidencia; Traumatismos en atletas; Fútbol; Estudios de cohortes.*

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INTRODUCTION

Soccer is a sport with a high number of injuries[1], especially in high performance. Professional players are exposed to very high demand for training and matches throughout the year. This high exposure can lead to an increased incidence of injuries, thereby compromising physical health, sports performance as well as athletes' career. Soccer has experienced an increase in physical demands in recent years, leading to an increased risk of injury[2]. Due to the growth in national and international competitions, the number of matches during the season is increasing in high-performance soccer.

Injury prevention and athlete health protection are essential to promote sports safety for sports teams to maximize their chances of success and for individuals to achieve optimal performance[3].

Regardless of the number of matches, the incidence of injuries during matches seems to be higher when compared to training[4], that is, the longer the exposure to the high intensity of matches, may enhance this finding. In addition to the high exposure load, players who have been injured before are at greater risk of injury the following season than uninjured players [1]. Accordingly to Junge and Dvorak[3], these changes in the incidence of injuries in professional-level tournaments can be influenced by the play style, refereeing, duration, and intensity of the match.

In the European scenario, there are several studies on the incidence of injuries in soccer, either in male soccer[4–7], as well as in female soccer[8]. Likewise, there are other studies from different continents investigating the incidence of football injuries[9,10].

In Brazil, there are some studies in the central region of the country[11–13], mostly linked to the CBF (Brazilian Football Confederation), which created a model of an epidemiological study of injuries in professional soccer players[2]. Given the differences in performance level, medical support, match frequencies, and weather, it is plausible that the incidence and severity of football injuries may differ among soccer leagues [14]. Thus, the importance of studies in different regions of Brazil on the incidence of injuries becomes crucial. Therefore, the present study aimed to investigate the incidence and prevalence of injuries of male professional athletes competing in the regional championship of the state of Rio Grande do Sul / Brazil during a season.

METHODS

We conducted a prospective cohort study to evaluate the prevalence and incidence of injuries of a male regional soccer championship in southern Brazil in 2018 during the competitive period (January - April). In the two months preceding the regional championship (November and December) all clubs in the first division of the regional championship, as well as their respective physicians and physiotherapists, with the knowledge of the technical committees, were invited to participate in the study. The inclusion criteria for the studies were: to be a certified professional soccer player at Federação Gaúcha de Futebol (FGF) and to sign the informed consent form. Subsequently, to avoid possible data acquisition bias, training was carried out to fill in the official study documents, providing printed, digital support material and a video tutorial. A team of researchers was available to club departments to support team professionals. The official documents were kindly provided by Dr. Ekstrand, for conducting this study. This study did not perform the sample calculation because it is an exploratory study of a regional soccer championship and was approved by the ethical committee, register in Plataforma Brasil, CAAE:79384417.1.0000.5328. All the study participants gave their written informed consent after detailed information.

Data collection and organization

The documents made available by the researchers were completed by the team professionals (physicians and physiotherapists), in their respective clubs. Profile data from each player were collected: ID, date of birth, height, weight, dominant leg and position. Individual exposure times for training and matches were collected using the monitoring form, as well as the type of training or match. Data on the mechanism, type and time of injury (training or match), body region, recurrence, exams, and time-loss were collected on the injury card. A special thigh injury card was used to collect more specific data on this body segment. Contact by the research team with the medical department of the clubs was done weekly by telephone and/or email to update the database. The severity of injuries was based on the classification used by UEFA[15], with time-loss being the number of days away from activities. Four categories were considered: light (1 to 3 days), minor (4 to 7 days), moderate (8 to 28 days), and severe (> 28 days).

Incidence and prevalence

To assess the incidence of the injuries, we have used the formula ((Σ injuries/Σ exposure hours) × 1000). And for prevalence, we used a descriptive analysis of the data through statistical software.

Terms and definitions

The terms and definitions of the study are summarized in the supplementary material (Chart 1, adapted Ekstrand, 2011)[16].

Chart 1. Study terms and definitions.

Training: training of the team involving physical activity supervised by the coaching committee
Match: competitive or friendly match against another team
Injury: injury incurred in a soccer game that makes it impossible for the player to participate in training or future games (i. e., a removal injury)
Rehabilitation: a player is considered injured until the medical team allows full participation in training and availability for matches
Recurrence: injury of the same type and in the same location as the initial injury, occurring no more than 2 months after a player returns to full participation following the initial injury
Light injury: injury causing an 1-3-day absence from training and match
Minor injury: injury causing a 4-7-day absence from training and match
Moderate injury: injury causing an 8-28-day absence from training and match
Serious injury: injury causing a more than 28-day absence from training and match
Traumatic injury: injury of sudden onset and known cause
Overuse injury: injury of insidious onset and no known trauma
Foul injury: injury resulting from a foul, in accordance with the referee's decision
Injury incidence: number of injuries per 1000 hours ((Σ injuries/Σ exposure hours) × 1000)

Statistical analysis

Descriptive analysis of the collected data was performed as mean, standard deviation, confidence interval, and percentage values. To assess the normality of the data, the shapiro-wilk test was used and a comparison between the ANOVA-oneway and Bonferroni posthoc groups and the adopted significance level of 5%. To missing data was used multiple imputation methods. For analysis, we used the SPSS 20.0 Software.

RESULTS

The study participants were men and averaged 26.53 ± 4.75 years, the height of 180.93 ± 6.49 cm, and weight of 79.32 ± 8.29 kg. There was no difference in age, height, and weight between the clubs (p> 0.05). Of the twelve clubs that participated in the competition, ten completed the study data, totaling 310 participants.

Injury Prevalence

In the 4-month follow-up period, the prevalence of injuries during the season was 29.68% of the total cases. Just over half 51.1% of injuries were during training and 46.7% during matches. Of these, 33.7% were during soccer training, 32.6% during regional championship matches, 13.0% during friendly matches. The most prevalent injuries were in the lower limbs (86.9%), mainly in the thigh region (38.0%), followed by the knee (15.2%), hip/groin (9.8%), and ankle (9.8%). Muscle tear/strain (37.0%), sprain/ligament (19.6%), and other injuries (14.1%) were the main types of injuries. The primary injury mechanisms observed were during run/sprint (33.7%), kick (12.0%), and jumping/landing (6.5%) (Table 1). Lesions were balanced between overuse and trauma, 37.0% and 35.9%, respectively.

Most injuries (73.9%) were not caused by contact with another player or object. The main methods for defining the diagnosis were magnetic resonance imaging (38.0%), ultrasound (33.7%), and clinical findings (15.2%). When we analyzed the thigh injuries, we observed that the most prevalent type of injury in the population studied was muscle tear/strain (71.4%) during run/sprint (51.4%). Just over half of the injuries were in the back (51.4%) compared to the front (48.6%), and the level of the strain injuries was mostly minor (41.7%) and moderate (30.6%). (Table 2)

Table 1. Prevalence of injuries: part of the body, type and mechanism.

Variable	Frequency	(%)
Part of the body		
Head/face	2	2.2
Sternum/upper back	1	1.1
Abdomen	3	3.3
Shoulder/clavicle	3	3.3
Arm	1	1.1
Lumbar spine/pelvis	3	3.3
Hand/finger/thumb	2	2.2
Hip/groin	9	9.8
Thigh	35	38.0
Knee	14	15.2
Leg/Achilles tendon	6	6.5
Ankle	9	9.8
Foot/toe	4	4.3
Total	92	100.0
Type		
Concussion	2	2.2
Fracture	2	2.2
Other bone injuries	1	1.1
Luxation/subluxation	3	3.3
Sprain/ligament	18	19.6
Meniscus/cartilage injury	2	2.2
Muscle tear/strain	34	37.0
Synovitis/effusion	1	1.1
Non-specified overuse	8	8.7
Hematoma/bruise/ecchymosis	7	7.6
Nerve injury	1	1.1
Other injuries	13	14.1
Total	92	100.0
Mechanism		
Run/sprint	31	33.7
Twist	4	4.3
Kick	11	12.0
Pass/crossover	2	2.2
Dribble	1	1.1
Jump/landing	6	6.5
Fall	2	2.2
Stretching	1	1.1
Slipping	1	1.1
Overuse	5	5.4
Hit by the ball	3	3.3
Collision	2	2.2
Heading	3	3.3
Tackled by another player	2	2.2
Tacking another player	1	1.1
Kicked by another player	5	5.4
Blocked	2	2.2
Unknown mechanism	1	1.1
Other mechanism	3	3.3
Not available	6	6.5
Total	92	100.0

Exposure time, injury incidence and return to activity time

The total exposure time was 26,239 hours, of which 23,335 hours for training and 2,905 hours for matches. The average exposure time was 2,624±975 hours per club, with a total of 92 injuries during the regional championship season. In this period, the observed incidence of injuries was 15.88±8.57, 2.04±1.09 and 3.65±1.50 and 10.26±7.38 per 1,000 hours of exposure to training, matches, matches-training and matches/training ratio, respectively. (Table 3)

The time-loss (training/matches) in the 2018 season ranged from 1 to 50 days, with a median of 8 (95% CI 9.26 - 14.13) and mode 2 days. In the present sample, the severity of the lesions was as follows: light (25%), minor (22.8%), moderate (43.5%), and severe (8.7%). (Table 4)

Table 2. Prevalence of thigh injuries: type, mechanism and classification.

Variable	Frequência	(%)
Type		
Hematoma/bruise/ecchymosis	3	8.6
Muscle tear/strain	25	71.4
Overuse/hypertonia	4	11.4
Ruptured tendon/tendinopathy	1	2.9
Other types	2	5.7
Total	35	100.0
Mechanism		
Run/sprint	18	51.4
Kick	8	22.9
Jump/landing	2	5.7
Stretching	1	2.9
Slipping	1	2.9
Overuse	3	8.6
Kicked by another player	2	5.7
Total	35	100.0
Location		
Front of the thigh	17	48.6
Back of the thigh	18	51.4
Classification		
Muscle disorder induced by fatigue	5	13.9
Late onset muscle pain	2	5.9
Partial muscle injury - minor	15	41.7
Partial muscle injury - moderate	11	30.6
Other classification	1	2.9
Not available	1	5.6
Total	35	100.0

Table 3. Incidence of injuries per 1,000 hours of exposure.

Teams	Match	Training	Match and Training	Match/Training Ratio
Team 1	7.73	1.11	1.94	6.93
Team 2	12.92	3.44	5.43	3.76
Team 3	22.36	2.90	5.61	7.72
Team 4	31.26	1.22	3.40	25.59
Team 5	10.23	1.50	2.62	6.81
Team 6	15.15	0.90	2.06	16.87
Team 7	10.38	0.71	1.88	14.56
Team 8	28.99	2.02	5.40	14.36
Team 9	9.63	3.18	4.10	3.03
Team 10	10.11	3.37	4.09	3.00
Total	15.88±8.57	2.04±1.09	3.65±1.50	10.26±7.38

Table 4. Injuries severity.

Severity	Frequence	(%)
Light	23	25.0
Minor	21	22.8
Moderate	40	43.5
Severe	8	8.7
Total	92	100.0

DISCUSSION

The main findings of this study were (I) the high incidence of injuries during matches compared to training; (II) the high prevalence of injuries in the thigh region; (III) the time-loss for training/matches for any type of injury ranged from 1 to 50 days, with median 8 and mode of 2 days; (IV) the severity of the lesions was mostly of moderate degree.

In our study, the incidence of matches injuries was higher than the incidence during training (15.88±8.57 vs 2.04±1.09 injuries / 1,000h, p <0.01), previous corroborating findings. We also observed that the average injury incidence values during training in some previous studies are lower, equal, or higher to our study, as well as for the injury incidence during matches[6,14,16–19,22–24,26]. These variations may be due to training intensity, number of matches, type of preventive measures, nutritional level, psychological profile of players and coaches, gender, among others[6,25,27–29].

The incidence of injuries during matches in our study was higher than previous studies in European countries[4,14]. However, values nearly twice as low as the last four previous World Cups[3]. The incidence of injuries during training in this study (2.04 ± 1.09 injuries / 1,000h) was similar to that found in the Dutch (2.8, 95% CI = 2.3, 3.3) and lower than in the Swedish (5.3; 95% CI = 4.7, 5.8) and Danish (11.8; 95% CI = 6.7, 16.9)[30–32].

The post-match recovery time is relative to each match, the variability of the recovery level of each athlete as well. A large number of matches on the national calendar can impair the recovery time of athletes, which may contribute to an increased incidence of injuries and a possible drop in performance. Dupont et al. (2010)[28] report that the recovery time between two matches, 72-96 hours, seems to be sufficient to maintain the performance level tested in professional soccer athletes, but the injury incidence rate increases exponentially when compared to Athletes playing one match a week. In Brazil, these numbers are not different, brazilian soccer athletes are more prone to injuries because of their extensive training and a large number of matches[2], as previously mentioned. However, Ispirlidis & Cols (2015)[33] demonstrated that it took 96 to 120 hours of rest to reach baseline values for 20 m sprint performance and normalize blood markers of muscle damage (creatine kinase) and inflammation (uric acid).

Characteristics of the predominance of injury severity varied among studies. Similar to some studies[4,6,9,20], we found a predominance of moderate lesions. In other studies[1,3,8,25,34], there was a predominance of mild and minimal lesions. These differences cannot be explained by the use of different methods, as the studies cited above followed international consensus agreements on procedures for data collection in epidemiological studies of football injuries recommended by FIFA and UEFA[15]. However, the variability of the methods in other studies limits a greater comparison between them, according to Netto et al. (2019)[11], the numbers are quite different due to the definitions of injury, duration of the championship or season, as well as the inclusion or not of injuries in training.

Injuries to the lower limbs in soccer are the most prevalent, and the main affected region of the body is the thigh[6,11]. In our study, we observed a higher prevalence of minor to moderate rupture/strain during the running/sprint in the thigh region. Corroborating with previous findings [3,6,11,13,16,34–36] who point to the thigh as the segment with the highest prevalence of injuries. Ekstrand et al.[6] report that muscle injuries are one of the major problems faced by soccer players and account for 20% to 37% of all time-loss injuries at the male professional level.

The main mechanisms of injuries observed were during run/sprint, with muscle tear/strain being the most prevalent type of injury. According to Ekstrand et. al.[6], a team of 25 players at the elite level can expect about 15 muscle injuries each season lasting 10-11 months per season, with a 2-week training absence for each injury. This amount of absent time can

be tricky because players who have been sidelined due to injury limit the possibility of optimal team performance. However, Stubbe et al[4] found a higher prevalence of injuries by contact with other players and the main affected segment was the knee. The higher rate of bruising in men may be due to higher intensity and more contact situations in male soccer[25].

In addition to muscle injuries that are very recurrent in soccer, concussions in professional soccer can generate neurocognitive deficits and have worried numbers[25], although the number of injuries in the last World Cups did not increase statistically significantly. Headaches and especially concussions at the 2014 FIFA World Cup caused much discussion[3]. In this study there was a prevalence of 2 concussions, similar to Bayne et al.[9] and relatively small compared to other studies[11,29] In the study by Ross et al. (2016)[29], there were twice as many concussions in women compared to men, including the rate of concussion injuries caused by ball contact among women 2.43 times that of men.

Previous injuries and inadequate rehabilitation are commonly suggested as risk factors for soccer injuries. Some studies have found high injury recurrence rates in Scandinavian football[1], and others point to lower rates [20]. According to Ekstrand (2011)[20], one possible explanation for lower recurrence may be that professional clubs have greater medical support, providing more personalized rehabilitation for injured players. Also, it can be speculated that improvements in rehabilitation through control of functional testing before returning to training and match may further reduce the risk of injury. In our study, no recurrence of the lesion was found during the regional championship.

Another two points that should be noted is the time-loss from the players from their work activities and the degree of severity of injuries. In the present study, we observed that the time-loss from training and/or matches was a minimum of 1 day and a maximum of 50 days, with a confidence interval of 9.26 - 14.13 days. In the study by Larruskain[25], on comparing the incidence of injuries between men and women, they pointed to five times higher incidence of bruises in men, which are predominantly minimum and minor injuries (83%), due to the higher intensity and more contact situations in men's soccer.

Finally, this study brings results that can help sports professionals in improving your clinical conduct and bring important data for scientific production in the population studied.

The limitation of our study was not having the participation of all championship clubs. However, among 12 teams, we had the participation of ten teams. Second, prevalence data such as injury mechanism (6.5%) and thigh injury classification (5.6%) are missing. However, this loss does not affect the primary outcome of the study, but only brings a small imprecision in the measures mentioned above.

CONCLUSION

The present study concludes that there is a higher incidence of injuries during matches compared to training in the male regional soccer championship of Rio Grande do Sul state - Brazil in the 2018 season. The lower limbs being the most affected region, with a higher prevalence of muscle tear/strain during run/sprint in the thigh region.

Data availability statement

The raw data the study is available at - https://osf.io/e7zy2/[37]

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