



Prevalence of injuries and associated factors among portuguese teenage soccer players: A cross-sectional study

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ABSTRACT

Introduction: There is scarce literature on the prevalence of injuries among teenage soccer players and their associated factors.

Objectives: This study aimed to investigate the prevalence of injuries in Portuguese male and female teenage soccer players and their associations with sociodemographic, anthropometric, and training factors.

Methodology: A cross-sectional study was conducted with 162 teenage players (120 males and 42 females) from two Portuguese soccer teams. The players completed a questionnaire to provide sociodemographic and anthropometric information and to report the injuries suffered since the beginning of soccer practice to date.

Results: The general injury prevalence was found to be 64.8%, with male players presenting a prevalence of 62.5%, and female players of 71.4%. The injury prevalence during matches and training sessions was 45.7% and 56.2%, respectively. The four body regions most commonly affected were: the ankle (32.1%), thigh (24.7%), knee (17.3%) and wrist (9.3%); and the four most common types of injury were: ligament sprains (37.7%), muscle strains (14.8%), muscle contractures/tension (13.6%) and fractures (9.9%). In terms of injury severity, sprains mostly resulted in absences of 8-28 days (moderate); muscle strains and contractures/muscle tension resulted in absences of 1-3 days (minimum); and fractures more than 28 days (severe). Significant associations were found between: ankle injuries and being a midfielder ($p=0.002$); wrist injuries and being a younger player ($p=0.036$); sprains and being a goalkeeper ($p=0.014$); and muscle contractures/tension and shorter warm-up durations ($p=0.023$).

Conclusion: The prevalence of injuries among teenage male and female soccer players is high, emphasizing the need for continuous adoption of injury prevention strategies, particularly among younger players.

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RESUMO

Introdução: A literatura é escassa no que diz respeito à prevalência de lesões em jogadores de futebol adolescentes e aos seus fatores associados.

Objetivos: Investigar a prevalência de lesões em jogadores e jogadoras adolescentes de futebol em Portugal, bem como a sua associação com fatores sociodemográficos, antropométricos e relacionados com o treino.

Metodologia: Foi realizado um estudo transversal com 162 jogadores adolescentes (120 do sexo masculino e 42 do sexo feminino) pertencentes a duas equipas portuguesas de futebol. Os participantes preencheram um questionário para fornecer informações sociodemográficas e antropométricas, bem como para reportar as lesões sofridas desde o início da prática de futebol até à data do estudo.

Resultados: A prevalência geral de lesões foi de 64,8%, sendo de 62,5% entre os jogadores do sexo masculino e de 71,4% entre as jogadoras do sexo feminino. A prevalência de lesões em jogos e treinos foi de 45,7% e 56,2%, respetivamente. As quatro regiões corporais mais frequentemente afetadas foram: o tornozelo (32,1%), coxa (24,7%), joelho (17,3%) e punho (9,3%). Os quatro tipos de lesão mais comuns foram: entorses ligamentares (37,7%), distensões musculares (14,8%), contraturas/tensão muscular (13,6%) e fraturas (9,9%). Relativamente à gravidade das lesões, as entorses resultaram principalmente em ausências de 8 a 28 dias (moderadas); as distensões e contraturas/tensão muscular em ausências de 1 a 3 dias (mínimas); e as fraturas em ausências superiores a 28 dias (graves). Verificaram-se associações significativas entre: lesões no tornozelo e a posição de médio ($p=0,002$); lesões no punho e jogadores mais jovens ($p=0,036$); entorses e a posição de guarda-redes ($p=0,014$); e contraturas/tensão muscular e durações de aquecimento mais curtas ($p=0,023$).

Conclusões: A prevalência de lesões entre jogadores e jogadoras adolescentes de futebol é elevada, o que reforça a necessidade de uma adoção contínua de estratégias de prevenção de lesões, especialmente entre os atletas mais jovens.

Introduction

Soccer is the most popular team sport, being played by more than 300 million individuals worldwide.¹ Effectively, the popularity of soccer has been continuously growing, and particularly the number of female players has also increased to an estimated 16 million players around the world, according to the 2023 report of FIFA,² which marks a 24% increase in comparison with the 2019 survey.

Soccer requires the players to execute several complex technical and tactical gestures,² being exposed to numerous high-impact and high-contact situations,³ which can lead to different injuries during its practice. Nevertheless, the presence of varied intrinsic and extrinsic factors cannot be disregarded. Particularly in young players, the need to adapt the load of trainings and matches to the athletes' maturity has been defended, as those who mature later suffer significantly higher overuse injuries, with the period between 13.5 and 14.5 years being identified as the most difficult to balance load.⁴ Effectively, at these ages, players experience periods of fast growth and maturation of collagen tissue, which leads to excessive strain and contributes to increased injury rates in different body regions.^{5,6} In this context, according to the UEFA Consensus, an injury can be defined as any physical complaint, whether in a match

or training situation, regardless of the need for medical attention or time loss from sporting activity.⁷

An epidemiological study in female high-school soccer players⁸ registered a prevalence of injuries for the season of 36.5%, most of them of a contact nature. Also, the authors revealed that the lower limbs (77.8%) were more injured than the upper limbs (22.2%), with the knees (22.2%) and ankles (15.9%) being the most affected body regions, while muscle injury was the most frequent injury type. A comparative study additionally reported significantly more contusions, fractures, joint dislocations, and musculotendinous injuries in males compared to female players.⁹

Epidemiologic investigations are the first step to developing preventive strategies, as they survey the prevalence, type, location, and severity of injuries and the respective associated factors, which have implications for player safety and long-term athletic development. Despite so many practitioners, previous research has mostly focused on adult and male players, leaving a significant gap in the understanding of injury patterns, specifically during the critical adolescent growth period. Furthermore, while female participation in soccer is rapidly growing, with previous studies stating that females seem to sustain more severe injuries than males,⁹ direct comparisons between male and female teenage players within the same study and methodological framework remain scarce.

Nevertheless, considering the anatomical, biomechanical, neuromuscular, and hormonal variances,⁹ differences in injury prevalence between male and female players are expected. Moreover, although previous studies have described specific physical characteristics required for different playing positions among teenage soccer players,¹⁰ the prevalence of injuries according to the players' position in youth athletes remains underexplored. Indeed, earlier studies including mixed samples of adult and underage players, assessed the prevalence of several injuries by field position but excluded players who had not yet reached full maturity in order to control for age-related effects.¹¹ However, these studies did not justify the absence of such analyses among younger players, thereby overlooking the potential training load these athletes may experience while striving to reach more professional levels. Nevertheless, in adult players, more injuries have been shown in centrally positioned players compared with those occupying lateral or forward positions,¹¹ which may also be expected in younger players.

In that sense, this study aimed to investigate the prevalence of injuries in Portuguese male and female teenage soccer players and their associations with sociodemographic, anthropometric, and training factors.

Methodology

Study Design, Participants, and Setting

This observational study was reported according to the STROBE Statement¹² for cross-sectional studies.

A convenience sample of 162 healthy teenage soccer players (120 males and 42 females) participated in the study, and met the following eligibility criteria: at least one year of soccer practice, and aged between 12 and 17 years old. Data collection took place at the medical departments of two Portuguese soccer teams from the north of the country, during April and May, corresponding to a late-season period. Both soccer teams had an artificial turf field.

Participants were approached personally in the soccer clubs before trainings in the presence of their legal representatives since they were minors. The aims and procedures involved in the study were explained, and if the minors agreed to participate, their legal representative was asked to sign the Informed Consent Form, providing written confirmation of the minor's participation acceptance. Participants were informed that they could withdraw from the study without any personal prejudice, following the Declaration of Helsinki. Participants and their legal representatives were assured of anonymity and confidentiality of the collected data, ensuring that it would not be used for purposes other than this research. Each participant was assigned a numerical code, preventing their identification in any of the questionnaires, which were destroyed at the end of the study. The study was approved by the Ethical

Committee of the Fernando Pessoa University (ESS/FSA – 375/23-2) on March 8, 2023.

Questionnaire

A self-completion questionnaire that was developed for this study was completed in the presence of the legal representatives of the participants, with the investigator being available for questions but not directly involved in the completion process. The questionnaire consisted of questions regarding sociodemographic (age, sex), and anthropometric variables (weight, height, body mass index, and dominance), as well as to assess soccer practice information (years of soccer practice, number of weekly trainings and their duration, the field position, whether it is carried out warm-up and cooling and how long they last, as well as which cooling is most frequently carried out). Leg dominance was determined as the preferred kicking leg.¹³

Also, questions regarding past or present injuries addressing the location and type of injury, severity, and treatment (surgical or conservative) from the beginning of soccer practice up to the date of participation in the study were answered. Although the injuries were self-reported, the medical departments of the surveyed teams kept documented diagnostic data on their players' injuries, which reduces the possibility of errors in reporting the actual injuries suffered, as the players could ask the medical departments professionals in case of doubts to conclude the filling of the questionnaire.

An injury was defined in accordance with the FIFA Consensus⁷ as any physical complaint sustained by a player, either occurring during a match or training, regardless of the need for medical attention/care or time away from sports activity. A recurrent injury was considered an injury of the same type and location as the initial injury, occurring after a player's return after the initial injury.⁷

Regarding injury severity, it was considered the number of days from the date of the injury to the return to full participation in training and availability for matches.⁷ Injuries were categorized according to their severity as: minimal (1-3 days absence), mild (4-7 days), moderate (8-28 days), or severe (absence from sports for more than 28 days).¹⁴

Statistical Procedures

Data was analyzed using the "Statistical Package for the Social Sciences" (SPSS version 26). Normality of the data distribution was assessed with the Kolmogorov-Smirnov test, and since normality was not verified, the continuous variables, such as age, weight, height, body mass index (BMI), years of soccer practice, number of weekly trainings, duration of trainings, and duration of warm-ups, were described as median and interquartile range. Nominal variables, including sex, dominance, field position, if the participant performed a warm-up and cool-down, which type of cool-down was

performed, the prevalence of injuries by body region and type, as well as initial injuries, recurrences, and injury severity, were described as Frequency (n) and Percentage (%). For prevalence data, 95% confidence intervals were also provided.

Finally, the associations between the 4 most prevalent injured body regions and injury types to nominal variables such as age (12-14 years, 15-17 years), sex (male, female), BMI (underweight, normal, overweight), field position (goalkeeper, defender, midfielder, forward), and warm-up duration (1-10 minutes, 11-20 minutes, 21-30 minutes), were assessed using the Chi-square test. A significance level of 0.05 was adopted for all analyses.

Results

All legal representatives and teenagers who were approached agreed to participate in the study and fully completed the study questionnaire, with a final sample of 162 teenage soccer players.

Sample characterization

Table 1 presents the sample characterization regarding socio-demographic, anthropometric, and soccer practice variables.

Table 1: Sociodemographic, anthropometric, and soccer practice characterization of the sample.

Age (years) ^a		14.0, 2.0
Sex ^b		
	Male	120 (74.1)
	Female	42 (25.9)
Weight (kg) ^a		56.0, 13.0
Height (m) ^a		1.7, 0.1
BMI (kg/m²) ^a		20.2, 3.9
Dominance ^b		
	Right	131 (80.9)
	Left	31 (19.1)
Years of soccer practice ^a		5.0, 5.0
Number of weekly trainings ^a		3.0, 0.0
Duration of trainings (min/day) ^a		60.0, 30.0
Field position ^b		
	Goalkeeper	12 (7.4)
	Defender	60 (37.0)
	Midfielder	64 (39.5)
	Forward	26 (16.0)
Warm-up ^b		
	Yes	162 (100.0)
	No	0 (0.0)
Duration of warm-ups (min) ^a		10.0, 5.0
Cool-down ^b		
	Yes	98 (60.5)
	No	64 (39.5)

Notes: ^a Median, Interquartile Range; ^b n (%); min: minutes

Prevalence of Injuries

In the general sample, a total of 105 players (64.8%) reported having experienced some injury related to soccer at least once. Specifically, by sex, 75 from the 120 male participants (62.5%) and 30 from the 42 female participants (71.4%) suffered a injury at least once.

Table 2 displays the reported prevalence of injuries by body region of the total sample and by sex. In the total sample, the 4 body regions with the highest prevalence of injuries were the ankle (32.1%), followed by the thigh (24.7%), the knee (17.3%), and the wrist (9.3%). Concerning initial injuries and recurrences, among the 52 players who reported having suffered some type of ankle injury, 36 experienced the injury only once (69.2%), while the remaining 16 suffered the same injury two or more times (30.8%). In the thigh, out of the 40 players who reported having had some injury, 33 suffered only once (82.5%), while 7 experienced the injury at least twice (17.5%). Regarding knee injuries, 15 players (89.3%) had only one injury, and the remaining 3 (10.7%) had two injuries. Finally, for wrist injuries, all 15 recorded injuries occurred only once (100%). Regarding the prevalence by sex, in the male players, the 4 most affected body regions were the ankle (28.3%), the thigh (20.8%), the knee (15.8%) and the wrist (10.8%), while in the female participants were: the ankle (42.9%), the thigh (35.7%), the knee (21.4%) and the leg (7.1%).

Table 2: Prevalence of injuries by body region of the total sample, and in the male and female players.

Body Region	Total (n = 162)		Male Players (n = 120)		Female Players (n = 42)	
	n	% (CI 95%)	n	% (CI 95%)	n	% (CI 95%)
Ankle	52	32.1 (25.4-39.6)%	34	28.3 (21.0-37.0)%	18	42.9 (29.1-57.8)%
Thigh	40	24.7 (18.7-31.9)%	25	20.8 (14.5-28.9)%	15	35.7 (23.0-50.8)%
Knee	28	17.3 (12.2-23.9)%	19	15.8 (10.3-23.4)%	9	21.4 (11.7-35.9)%
Wrist	15	9.3 (5.7-14.7)%	13	10.8 (6.4-17.7)%	2	4.8 (1.3-15.8)%
Leg	10	6.2 (3.4-11.0)%	7	5.8 (2.9-11.6)%	3	7.1 (2.5-19.0)%
Head	4	2.5 (1.0-6.2)%	3	2.5 (0.8-7.1)%	1	2.4 (0.4-12.3)%
Shoulders	3	1.9 (0.6-5.6)%	2	1.7 (0.5-5.9)%	1	2.4 (0.4-12.3)%
Forearm	3	1.9 (0.6-5.6)%	2	1.7 (0.5-5.9)%	1	2.4 (0.4-12.3)%
Hand	2	1.2 (0.3-4.4)%	2	1.7 (0.5-5.9)%	0	0.0 (0.0-8.4)%
Thoracic	2	1.2 (0.3-4.4)%	2	1.7 (0.5-5.9)%	0	0.0 (0.0-8.4)%
Lumbar	2	1.2 (0.3-4.4)%	1	0.8 (0.2-4.6)%	1	2.4 (0.4-12.3)%
Foot	2	1.2 (0.3-4.4)%	2	1.7 (0.5-5.9)%	0	0.0 (0.0-8.4)%

Body Region	Total (n = 162)		Male Players (n = 120)		Female Players (n = 42)	
	n	% (CI 95%)	n	% (CI 95%)	n	% (CI 95%)
Arm	1	0.6 (0.1-3.4)%	1	0.8 (0.2-4.6)%	0	0.0 (0.0-8.4)%
Hip	1	0.6 (0.1-3.4)%	1	0.8 (0.2-4.6)%	0	0.0 (0.0-8.4)%
Elbow	0	0.0 (0.0-2.3)%	0	0.0 (0.0-3.1)%	0	0.0 (0.0-8.4)%
Cervical	0	0.0 (0.0-2.3)%	0	0.0 (0.0-3.1)%	0	0.0 (0.0-8.4)%

Table 3 describes the prevalence of injuries in the sample by type of injury of the total sample, and by sex. In the general sample, the four most common injury types were ligament sprains (37.7%), followed by muscle strains (14.8%), muscle contractures or tension (13.6%), and fractures (9.9%). Concerning ligament sprains, out of the 61 reported, 41 were related to the ankle (67.2%), 11 to the wrist (18.0%), eight to the knee (13.1%), and one to the hand (1.6%). For muscle strains, out of the 24 reported, 21 occurred in the thigh (87.5%) and three in the leg (12.5%). Muscle contractures or tension were reported by 22 players, with 16 of them occurring in the thigh (69.6%), four in the leg (17.4%), two in the lumbar spine (8.7%), and one in the thoracic spine (4.3%). Concerning fractures, suffered by 16 players, three were recorded in the forearm (18.8%), three in the wrist (18.8%), two in the shoulder (12.5%), two in the ankle (12.5%), and one in each of the following regions (6.3%): head, arm, thoracic spine, knee, leg, and foot. Out of the 16 players who suffered fractures, four had to receive surgical intervention (in the ankle, leg, forearm, and wrist). The four most common injuries in the male players were: ligament sprains (35.0%), muscle contractures/tension and fractures (12.5%), and muscle strains (11.7%). Regarding the female players, the four most common injuries were: ligament sprains (45.2%), muscle strains (23.8%), muscle contractures/tension (16.7%) and tendinopathies (11.9%).

Table 3: Prevalence of injuries by type of injury of the total sample, and in the male and female players.

Type of Injury	Total (n = 162)		Male Players (n = 120)		Female Players (n = 42)	
	n	% (CI 95%)	n	% (CI 95%)	n	% (CI 95%)
Ligament Sprain	61	37.7 (30.6-45.3)%	42	35.0 (27.1-43.9)%	19	45.2 (31.2-60.1)%
Muscle Strain	24	14.8 (10.1-21.1)%	14	11.7 (7.1-18.6)%	10	23.8 (13.5-38.5)%
Muscle Contractures/Tension	22	13.6 (9.1-19.7)%	15	12.5 (7.7-19.6)%	7	16.7 (8.3-30.1)%
Fracture	16	9.9 (6.2-15.4)%	15	12.5 (7.7-19.6)%	1	2.4 (0.4-12.3)%
Tendinopathy	14	8.6 (5.2-14.0)%	9	7.5 (4.0-13.6)%	5	11.9 (5.2-25.0)%
Partial Muscle Rupture	5	3.1 (1.3-7.0)%	5	4.2 (1.8-9.4)%	0	0.0 (0.0-8.4)%
Ligament Rupture	5	3.1 (1.3-7.0)%	1	0.8 (0.2-4.6)%	4	9.5 (3.8-22.1)%
Concussion	4	2.5 (1.0-6.2)%	3	2.5 (0.8-7.1)%	1	2.4 (0.4-12.3)%
Meniscal Injury	3	1.9 (0.6-5.3)%	2	1.7 (0.5-5.9)%	1	2.4 (0.4-12.3)%
Subluxation/Dislocation	1	0.6 (0.1-3.4)%	1	0.8 (0.2-4.6)%	0	0.0 (0.0-8.4)%
Total Muscle Rupture	0	0.0 (0.0-2.3)%	0	0.0 (0.0-3.1)%	0	0.0 (0.0-8.4)%
Contusion	0	0.0 (0.0-2.3)%	0	0.0 (0.0-3.1)%	0	0.0 (0.0-8.4)%

The severity of the four most prevalent injuries in this study is described in Table 4. Regarding sprains, most of them resulted in absences from sports activities from eight to 28 days (moderate severity). Muscle strains and muscle contractures/tension predominantly fell into the minimum severity category, implying an absence of one to three days. Finally, 93.7% of the reported fractures resulted in players being absent from sports activities for more than 28 days (severe).

Table 4: Severity of the four most prevalent injuries.

Injury Type	Sprain (n = 61)	Muscle Strain (n = 24)	Muscle Contractures/ Tension (n = 22)	Fractures (n = 16)
Minimal (1-3 days)	16 (26.2 [16.8-38.4]%)	7 (29.2 [14.9-49.2]%)	10 (45.5 [26.9-65.3]%)	0 (0.0 [0.0-19.4]%)
Mild (4-7 days)	12 (19.7% [11.6-31.3])	6 (25.0 [12.0-44.9]%)	4 (18.2% [7.3-38.5])	0 (0.0 [0.0-19.4]%)
Moderate (8-28 days)	18 (29.5 [19.6-41.9]%)	5 (20.8 [9.2-40.5]%)	6 (27.3 [13.2-48.2]%)	1 (6.3 [1.1-28.3]%)
Severe (>28 days)	15 (24.6 [15.5-36.7]%)	6 (25.0 [12.0-44.9]%)	2 (9.0 [2.5-27.8]%)	15 (93.7 [71.7-98.9]%)

Associated Factors

Associations were tested between the four body regions and injury types with higher prevalence and the following variables: sex, BMI, playing position, age, and warm-up duration.

Regarding body regions, a significant association was only found between ankle injuries and field position. Midfielders showed a significantly higher prevalence of ankle injuries ($p=0.002$) compared to other positions (goalkeepers, defenders, and forwards). No associations were observed for thigh and knee injuries with the studied variables ($p>0.05$). For wrist injuries, a significant association was recorded only with age, with younger players (12-14 years) having a significantly higher prevalence compared to older players (15-17 years) ($p=0.036$).

Concerning injury types, a significant association with sprains was only found for field position, with goalkeepers having a higher prevalence of sprains compared to others ($p=0.014$). No associations were found for muscle strains and fractures ($p>0.05$). Finally, muscle contractures/tension were significantly associated with warm-up duration, with players who had a shorter warm-up duration (1-10 minutes) showing a significantly higher prevalence of muscle contractures and tension ($p=0.023$).

Discussion

The aim of this study was to investigate the prevalence of injuries in male and female teenage soccer players and their associations with sociodemographic, anthropometric, and training factors.

The results of the present study revealed that the prevalence of injuries in the players of the sample was high (64.8%). Effectively, the high prevalence of injuries in young soccer players may be related to the high intensity of trainings and matches, as well as the high levels of stress and pressure they are exposed to, as they are striving to be selected to better soccer teams.^{15,16} The study of da Silva, de França and de Paula¹⁷ who collected answers from 64 soccer players (26 female and 38 male), considered a sample aged between 16 and 39 years, having reported a prevalence of 59.4%, which is close to the results presented here. However, as adults were also considered in the sample of da Silva, de França and de Paula¹⁷ this comparison should be interpreted with caution, and the lack of studies emphasizes the need of more epidemiological investigations addressing this topic. Concerning the prevalence by sex, the present study observed a higher percentage of general injuries in the female players (71.4%) in comparison with males (62.5%). These results are not in line with Mufty, Bollars, Vanlommel, Van Crombrugge, Corten and Bellemans⁹ who provided opposite evidence. Despite of a clear growth of female participation in soccer, it is proposed that medical support in female teams is still inferior comparatively to

male ones, and especially in young and non-elite teams, which can lead to a delayed diagnosis and course of treatment's definition, causing an incomplete or inadequate treatment of the injury sustained by these players, eventually conducting to reinjuries,⁹ which may explain the higher prevalence of injuries found in the female players of the present study.

In the teenage soccer players of the present study, a higher prevalence of injuries was observed during training (56.2%), compared to matches (45.7%). These results are in line with those of Le Gall, Carling, Reilly, Vandewalle, Church and Rochcongar¹⁸ in youth soccer players under 16 years of age, as 69.1% of injuries occurred in training and 30.9% during matches. It is possible to verify that the percentages presented by Le Gall, Carling, Reilly, Vandewalle, Church and Rochcongar¹⁸ are higher compared to the ones of this study. Effectively, these authors collected the sustained injuries by 66 players over a 10-season period, while only seven players (3.7%) of our sample had 10 or more years of practice. In that sense, it would be expected a higher number of injuries in data collected for longer periods, as well as a lower memory bias regarding past injuries. Also, the systematic reviews of Pfirrmann, Herbst, Ingelfinger, Simon and Tug¹⁶ and Jones, Almousa, Gibb, Allamby, Mullen, Andersen and Williams¹⁹ confirm more injuries during training in youth soccer players, which contrasts with reports in adult players.¹⁶

This study also found that the four most affected body regions in the total sample were the ankle (32.1%), the thigh (24.7%), the knee (17.3%), and the wrist (9.3%). The results of the questionnaire by Wang, Yang, and Zheng also revealed that injuries in young soccer players mainly affect the ankle, knee, hand, and thigh, which is consistent with our findings. According to Pfirrmann, Herbst, Ingelfinger, Simon and Tug¹⁶ injuries in the thighs are the most frequently reported, followed by ankle and knee injuries, regardless of whether the players are young or adult. As expected, the lower limb is more affected than the upper limb, since soccer requires more technical gestures involving the lower limbs, such as sprinting, cutting, or jumping.¹⁴ Regarding the wrist injuries, these are described as being mostly traumatic,²⁰ constituting one of the body regions with more fractures in general and specifically in the upper limb.²¹ They are also more prevalent in goalkeepers, who often take shots with great impacts from teammates²⁰ and suffer falls.²²

The prevalence analysis by sex demonstrated that the four most common injuries in the male players were: ligament sprains (35.0%), muscle contractures/tension and fractures (12.5%), and muscle strains (11.7%). Regarding the female players, the four most common injuries were: ligament sprains (45.2%), muscle strains (23.8%), muscle contractures/tension (16.7%), and tendinopathies (11.9%). Mufty, Bollars, Vanlommel, Van Crombrugge, Corten and

Bellemans ⁹ investigated the soccer injuries sustained by a large sample of soccer players, both underage and adults. In the younger players, similar to our results, sprains were more common in females (39.86%) than in male players (28.73%), while fractures were more frequent in males (17.58%) than in females (14.15%). A higher prevalence of muscle injuries was observed in the female players in this sample, both for muscle strains, muscle contractures/tension, and tendinopathies. Conversely, Mufty, Bollars, Vanlommel, Van Crombrugge, Corten and Bellemans ⁹ reported a higher percentage of musculotendinous injuries in the male players (15.79%) than in female players (12.65%).

The four most common types of injury in the general sample of this study were ligament sprains (37.7%), muscle strains (14.8%), muscle contractures/tension (13.6%), and fractures (9.9%). Pfirrmann, Herbst, Ingelfinger, Simon and Tug ¹⁶ also state that strains and sprains are the most common injuries; however, fractures represent only a small percentage, despite being classified mostly as major injuries. Nilsson, Östenberg and Alricsson ²³ registered that 53% of all injuries in youth soccer players are muscle strains, stating that this is the most prevalent injury. Unequivocally, the percentage declared by these authors is much higher than the one of our study, despite of a lower sample size. However, Nilsson, Östenberg and Alricsson ²³ considered elite players, which was not verified in the recruited soccer teams of this sample. It is possible that elite players may have more intense training routines and are more competitive, which could explain the higher percentage seen in the study.

Previously, it has been described that more than 70% of reinjuries are either strains, mostly in the leg, thigh, and groin; or sprains, in the ankle and knee.²⁴ Indeed, strains and sprains are reported to result in a higher risk of reinjury.^{16,24} In the present study, 30.8% of players suffered a reinjury in the ankle, 17.5% in the thigh, and 10.7% in the knee, indicating a high incidence of reinjury in these body regions.

Regarding the severity of the injuries, the results of this study described that the majority of the reported strains (29.5%) resulted in absences between eight and 28 days (moderate); most muscle strains (29.2%) and muscle contractures/tension (45.5%) between one and three days (minimum); and 93.7% of the reported fractures resulted in more than 28 days (severe) of absence. The available literature does not describe the severity according to the type of injury, but only in general. Nilsson, Östenberg and Alricsson ²³ documented that 31% of all registered injuries in 43 young elite soccer players were severe injuries, resulting in more than 28 days of absence, while Jones, Almousa, Gibb, Allamby, Mullen, Andersen and Williams ¹⁹ states that severe injuries are around 18%, which is considerably lower and demarks a lack of consensus between the available studies. Teenage soccer players are still maturing and

experiencing rapid growth, which can affect motor control and lead to a high susceptibility to severe injuries. This highlights the relevance of conducting further investigations into the effects of injury prevention programs that consider these factors. Regarding minor and moderate injuries, Jones, Almousa, Gibb, Allamby, Mullen, Andersen and Williams ¹⁹ state that 21% of all injuries are minor, and 41% are moderate.

In this study, a significant association was found between ankle injuries and being a midfielder. Kofotolis ²⁵ describes that midfielders usually perform complex skills such as cuttings, running, or tackles, that may predispose them to higher injuries in this body region, and justify the reported association.

Regarding injury type, a significant association was also found between sprains and being a goalkeeper. According to a recent review,²⁶ in the upper limbs, goalkeepers most commonly suffer acromioclavicular sprains, as well as in wrist/hands. Regarding the lower limbs, the most common sprains are in the medial lateral ligament of the knee and in the external compartment of the ankle. It has also been suggested that goalkeepers do not receive adequate training in their early years compared to players in other positions, resulting in poorer physical capacity and technique²⁶, which can compromise joint stability and lead to more sprains.

The present investigation also found a significant association between wrist injuries and younger players. According to Gaston and Loeffler ³ the most commonly injured body regions are in the lower limbs. However, the high-impacts and high-energy falls present in soccer can often lead to upper limb injuries. Indeed, wrist injuries appear to be quite common in younger players. A previous study that analyzed urgent injuries in underage players concluded that the most affected age group was between 10 and 14 years old.²⁷ These data are therefore in line with the results found in the present study, in which a higher prevalence of wrist injuries was observed in the 12-14 age group compared to the 15-17 group.

Finally, muscle contractures/tension was significantly associated with warm-up duration. Players who warmed up for one-10 minutes showed a significantly higher prevalence of muscle contractures and tension. According to previous studies, warming up positively affects the mechanical properties of muscles, reducing tension and intramuscular fluid pressure, thereby reducing the risk of muscle injury.²⁸ Therefore, it is expected that athletes who do not warm up sufficiently are more susceptible to developing higher levels of muscle tension.

In this study, no significant associations were found between sex and other parameters under study. However, in the ankle, it was previously described that young male players develop more injuries compared to females.²⁹ Regarding the knee, young females have a greater tendency to

suffer injuries in this joint, with the prevalence of ruptures of the anterior cruciate ligament being especially high (risk 2.8 times higher than in male players), which can be attributed to the fact that dynamic valgus of the lower limbs is higher in females, with the majority of anterior cruciate ligament injuries associated with hyperextension in valgus of the knee during landing, changing direction or cutting.³⁰

Several limitations of this study must be acknowledged. Firstly, the injury data were self-reported, which may have introduced recall bias. Secondly, the relatively small sample size, particularly for the female subgroup, may have limited the statistical power to detect sex-specific associations and increases the uncertainty reflected in the wide 95% confidence intervals, and effectively, an a priori sample size calculation was not performed. Consequently, the subgroup analyses, especially those involving female players, should be interpreted with caution. Thirdly, the study was conducted in only two soccer teams located within the same geographical area, which restricts the generalizability of the findings to broader populations. Moreover, the lack of detailed information regarding training intensity and load may have constrained the interpretation of potential confounding effects on injury risk.

Conclusion

The present findings suggest a high prevalence of injuries among teenage male and female soccer players, emphasizing the need for continuous adoption of injury prevention strategies.

The prevalence of injuries was higher in training compared to matches. The most affected body regions were the ankle, thigh, knee, and wrist; and the most common types of injury were ligament sprains, muscle strains, muscle contractures/tension, and fractures. Sprains were considered moderately severe, muscle strains and contractures/muscle tension were considered minimally severe, and fractures were considered severe.

Being a midfielder was significantly associated with ankle injuries, while being a younger player was associated with more wrist injuries. Being a goalkeeper was also associated with developing sprains. Finally, shorter warm-ups were associated with more muscle contractures/tension.

In that sense, these findings suggest that structured warm-up programs should be encouraged in youth soccer training, as these protocols have been shown to effectively reduce practice-related injuries. Furthermore, training intensity should be monitored and age-appropriate workload management should be ensured to minimize overuse injuries.

For future research, longitudinal and prospective cohort studies are necessary to confirm these associations and to better establish causal relationships. The creation of national injury registries or databases could provide more comprehensive epidemiological data. Additionally, prospective

injury surveillance and intervention trials assessing the effectiveness of specific prevention programs are recommended, as well as cross-country comparisons, particularly involving different climates or training conditions. Finally, future research should continue to address potential sex and field position differences in injury mechanisms and outcomes to inform more targeted prevention strategies.

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