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Understanding Injury Dynamics in Youth Soccer: A Six-Season Study of Traumatic and Overuse Injuries

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Abstract

Despite extensive research on adolescent and late-pubertal soccer players, there is limited longitudinal data on injury incidence in prepubertal and early pubertal soccer players. This study aimed to analyze the incidence and distribution of traumatic and overuse injuries in youth soccer players aged 8 to 15 years over six competitive seasons. A prospective cohort study was conducted on 811 youth soccer players from a professional soccer academy, tracking injuries across six seasons (2016/17–2021/22). Injury data were extracted from medical records and classified based on the FIFA consensus statement. Injuries were categorized as traumatic or overuse, with incidence expressed per 1000 hours of exposure. While the distribution of traumatic and overuse injuries remained consistent across age categories, younger players exhibited a higher proportion of overuse injuries, whereas older players sustained more traumatic injuries. Additionally, injury incidence increased with age, with the highest number recorded in U15 players. The overall traumatic-to-overuse injury ratio was approximately 50:50, differing from patterns seen in senior-level players. Injury incidence in youth soccer players follows an age-related trend, with overuse injuries being more prevalent in younger players and traumatic injuries increasing with age. These findings highlight the need for age-specific injury prevention programs, emphasizing proper workload management for younger players and injury mitigation strategies for older athletes. Future research should investigate long-term injury trends and predictors across multiple clubs to optimize player development and safety.

Keywords: *youth soccer, injury incidence, traumatic injuries, overuse injuries, player development, injury prevention*

Introduction

Youth soccer (football) participation expands worldwide, with more and more children being registered in domestic clubs and associations every year. Due to the growing interest and related intensified competition, the training and selection process in youth soccer has gotten more challenging, with stronger, faster, and more agile children being selected (Fortin-Guichard et al., 2022; Mikić, Marasović, Rađa, Erceg, & Sivrić, 2024). Studies have shown that the intensity of play in youth soccer, primarily observed through an increase in the number of explosive actions, progressively increases with the age of the players (Di Giminiani & Visca, 2017; Ergun, Denerel, Mehmet, & Ertat, 2013; Sermaxhaj et al., 2024; Wagner et al., 2023). Related to this, an increased load is necessary for the development of players' skills and capacities, as well as for their preparation and adaptation to the demands of the senior level (Rabbani, Wong, Clemente, & Kargarfard, 2021). Due to this increased training and game load, injuries are an inevitable part of the overall process (Bourogiannis, Hatzimanouil, Semanltianou, Georgiadis, & Sykaras, 2023; Eckard, Padua, Hearn, Pexa, & Frank, 2018). Despite advancements in knowledge, technology, and the growing number of professionals involved in training, the continuous rise in injury rates remains a serious issue in this population of athletes (Bourdon et al., 2017; Price, Hawkins, Hulse, & Hodson, 2004). Injuries disrupt the development of young athletes by negatively affecting their future performances and keeping them away from sports training for a period of time, thereby slowing down the development of relevant abilities (Jones et al., 2019).

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Given the growing interest in soccer, a comprehensive investigation into injury occurrence in this vulnerable population is essential to create a safer environment for young participants.

Due to the importance of this topic and the sensitivity of the observed population, the issue of injuries in young soccer players has been extensively studied (Jones et al., 2019; Nilsson, Östenberg, & Alricsson, 2016; Read, Oliver, Croix, Myer, & Lloyd, 2015; Rössler, Junge, Chomiak, Dvorak, & Faude, 2016). Studies conducted on soccer players from the U9 to U21 categories indicate an injury rate ranging from 1.3 to 21.1 per 1000 hours of exposure, with a mean of 5.8 injuries per 1000 hours (Weishorn et al., 2023). Notably, as players age, both the absolute number of injuries and the proportion of injured players within a team increase (e.g., 22% in older players (U18 to U21) versus 10% in younger players (U9 to U16) (Jones et al., 2019). The injury rate is higher in older players (U17 to U21), reaching 7.9 injuries per 1000 hours, compared to younger categories (U9 to U16), which record 3.7 injuries per 1000 hours (Jones et al., 2019). Interestingly, authors suggest that soccer players over the age of 14 exhibit injury characteristics similar to adult players in terms of injury type, location, mechanism, and even frequency (Hägglund, Waldén, & Ekstrand, 2009; Junge & Dvorak, 2004). Chronologically older and more physically developed players tend to play more aggressively, take greater risks, and engage in a significantly higher number of physical duels, much like senior players, which directly correlates with an increased risk of injury (Le Gall et al., 2006).

While numerous studies focus on soccer players in late puberty and adolescence, there is a significant lack of research on prepubertal children (Faude, Rößler, & Junge, 2013). The available data indicate an overall injury incidence of 0.1 to 1.6 injuries per 1000 hours for children under 12 years old (Faude et al., 2013; Rinaldo, Gualdi-Russo, & Zaccagni, 2021). The lower number of injuries in this age group can be attributed to several factors, including the lower intensity of play and generally fewer training hours (Rinaldo et al., 2021; Rommers et al., 2020). Due to inter-individual differences in the growth and maturation process, it is crucial to examine injury characteristics in the youngest age categories, as their physical development presents unique challenges. Between the ages of 11 and 13 in female children and 13 and 15 in male children, rapid skeletal growth occurs—a phase known as peak height velocity (PHV). Research suggests that during this period, as well as one year before and after PHV, young athletes are at an increased risk of both traumatic and overuse injuries. This heightened susceptibility is likely due to increased physical load, reduced load resistance caused by adolescent "clumsiness," and pre-existing growth-related pain syndromes (Bult, Barendrecht, & Tak, 2018; Maternea, Farooqb, Johnsona, Greigc, & McNaughtonc, 2016; Van der Sluis, Elferink-Gemser, Brink, & Visscher, 2015).

Among the youngest soccer players, the most common traumatic injuries are bone fractures, particularly of the tibia and forearm bones. These injuries are often attributed to the immaturity of the skeletal system and insufficiently developed falling techniques. Since training intensity increases with age, excessively intense training sessions introduced too early can lead to overuse injuries and even burnout syndrome, especially when combined with inadequate rest and recovery protocols (Brenner, Medicine, & Fitness, 2007; Brink et al., 2010). Additionally, growth-related injuries, such as Osgood-Schlatter disease (which peaks in the U14 category) and Sever's disease (which peaks in the U11 category), are common issues in youth soccer and affect approximately 17% of pre-adolescent players (Schultz, 2022). Due to their more developed bodies and higher levels of strength and power, older players are more prone to traumatic injuries, which predominantly include knee and ankle sprains, muscle lesions, and contusions (Wik et al., 2021).

A review of the literature highlights a lack of systematic longitudinal studies examining injury frequencies by type in prepubertal and early pubertal youth soccer players. Tracking the distribution of injuries over the years of growth and development is essential for assessing the adaptation of young athletes to soccer-specific training. Therefore, the present study aims to determine the frequency of both traumatic and overuse injuries in soccer players aged 8 to 15 years. By identifying injury patterns in this population, these findings can contribute to developing appropriate training strategies and optimizing training loads, ensuring that young soccer players are trained safely and effectively. A deeper understanding of injury risks in younger athletes is crucial for fostering long-term athletic development while minimizing injury-related setbacks.

Methods

Study design

This prospective cohort study examined the frequency and characteristics of traumatic and overuse injuries in youth soccer players aged 8 to 15 years. The study was conducted over a multi-season period, tracking injury incidence and distribution across different age categories. Injury data were extracted from the internal medical database of a professional soccer academy. Before participation, all players and their legal guardians were

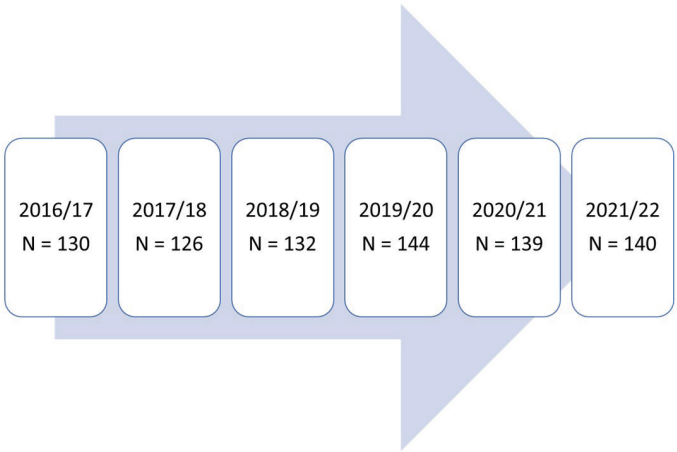

FIGURE 1. Time line of the study protocol with number of subjects tested in each competitive season

informed about the purpose and methodology of the study, and written informed consent was obtained. The study was conducted in accordance with the Declaration of Helsinki and received approval from the Ethics Committee of the Faculty of Kinesiology (Ethical Approval Number: 2181-205-02-05-23-0007). The study protocol is presented in Figure 1.

Participants

A total of 811 youth soccer players (age range 8–15 years) were included in this study. All participants were registered players of a professional youth soccer academy, competing in their respective age categories (U9, U11, U13, U15). Players were included from the moment of their registration and were excluded immediately upon leaving the academy. In order to ensure data consistency, only players who completed a full competitive season were included in the final analysis. Confidentiality of the extracted injury data was maintained by assigning anonymous identification codes to each participant, known only to the research team.

Variables and data collection

All injuries were systematically recorded and classified by medical professionals of the academy during daily medical check-ups before or after training sessions and matches. Injury classification was based on the consensus statement of the FIFA Medical Assessment and Research Centre (Fuller et al., 2006). Injuries were classified as either acute (traumatic) injuries or overuse injuries based on their mechanism of occurrence. Acute injuries were defined as those resulting from a specific, identifiable event, such as fractures, sprains, or contusions, whereas overuse injuries were attributed to repetitive microtrauma without a clear incident, including conditions like tendinopathies, Osgood-Schlatter disease, and Sever's disease. Injury severity was assessed based on time lost from training and competition, and soccer exposure was calculated for each season by summing the total training and match hours per player. Adjustments were made for the 2019/2020 season to account for training interruptions caused by the COVID-19 pandemic. Injury incidence was expressed as the number of injuries per 1000 hours of exposure, with injuries further categorized by type, anatomical location, and severity. Additionally, the proportion of traumatic vs. overuse injuries was analyzed across age groups, while reinjury was defined as an injury occurring at the same location and of the same type after the player had returned to full participation.

Statistics

Descriptive data were presented as arithmetic means and standard deviations. The muscle injury incidence was calculated as the number of injuries sustained per 1000 hours of exposure, while the injury incidence rate ratio (IRR) and 95% confidence intervals were computed to compare injury rates between the first and last observed seasons. To examine differences between acute and overuse injuries, a chi-square test was performed using an online statistical calculator. The level of statistical significance was set at $p<0.05$. Statistical analyses were conducted using MedCalc Statistical Software (ver-

Table 1. Injury incidence /1000 h of exposure

SEASON	CATEGORY	TRAUMA	OVERUSE	OVERALL	TRAUMA/OVERUSE RATIO
2016/17	U9	0.87	0.87	1.74	1.00
	U11	1.72	4.17	5.88	0.41
	U13	3.27	4.12	7.39	0.79
	U15	6.98	4.93	11.92	1.41
2017/18	U9	0.00	1.45	1.45	0.00
	U11	3.04	2.03	5.06	1.50
	U13	4.66	3.73	8.39	1.25
	U15	3.22	3.10	6.33	1.04
2018/19	U9	1.38	0.69	2.07	2.00
	U11	4.17	2.45	6.62	1.70
	U13	3.66	3.18	6.84	1.15
	U15	3.35	3.48	6.83	0.96
2019/20	U9	0.42	1.25	1.66	0.33
	U11	1.04	1.82	2.85	0.57
	U13	3.02	3.96	6.98	0.76
	U15	2.39	2.67	5.06	0.89
2020/21	U9	1.08	0.36	1.44	3.00
	U11	0.87	0.87	1.74	1.00
	U13	1.34	1.78	3.12	0.75
	U15	2.41	2.90	5.31	0.83
2021/22	U9	0.35	0.35	0.69	1.00
	U11	1.60	1.20	2.80	1.33
	U13	2.91	2.32	5.23	1.25
	U15	3.86	2.79	6.65	1.38

sion 19.2.6), Microsoft Excel 2019 (Microsoft, Redmond, WA, USA), and SPSS (IBM, Armonk, NY, USA, version 25.0).

Results

Injury incidence for all age categories, expressed as the number of injuries per 1000 hours of exposure is presented in Table 1, separately for traumatic, overuse and overall injuries. Additionally, the ratio between traumatic and overuse injuries is presented with values above 1 indicating more traumatic injuries for specific categories and seasons, and vice versa.

The injury incidence rate ratios (IRR) (Table 2) were calculated for the overall sample and individual age categories between 2016/17 and 2021/22, showing a general decrease in injury incidence across all groups (IRR =1.73, 95% CI: 1.35–2.22). The most significant decline was observed in the U9 category (IRR =2.25, 95% CI: 0.92–5.49).

Table 2. Injury incidence rate ratio (IRR), comparison between year 1 and year 6 with 95% confidence intervals

	IRR 1-6	95% CI	
ALL	1.73	1.35	2.23
U9	2.25	0.92	5.49
U11	2.10	1.34	3.13
U13	1.41	1.05	1.86
U15	1.79	1.45	2.18

Figure 2 presents the total number of both traumatic and overuse injuries for each category in the observed period. Results suggest a higher number of overuse injuries in all categories except the oldest, U15 (126 traumatic vs 106 overuse).

The results of the chi-square test are presented in Table 3 and show no significant differences between the number of players suffering traumatic compared to players with overuse injuries. For the U9 category in the second season, no traumatic injuries were recorded so the calculations were conducted for the remaining three categories.

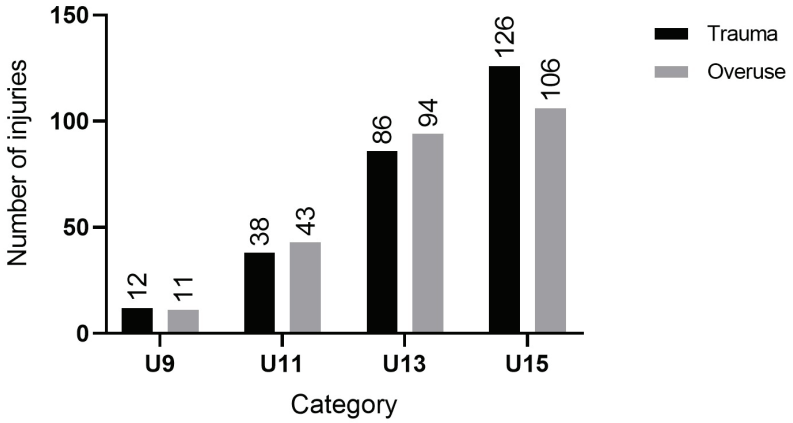

FIGURE 2. Total number of traumatic and overuse injuries per category

Table 3. Differences between the number of players with traumatic and overuse injuries (Chi-square test - χ2)

SEASON	CATEGORY	TRAUMA		OVERUSE		χ2 (p)
		N	%	N	%	
16/17	U9	3	20%	2	13.3%	6.47 (0.09)
	U11	5	17.9%	14	50.0%	
	U13	14	32.6%	22	51.2%	
	U15	31	68.9%	24	53.3%	
17/18	U9	0	0%	3	21.4%	0.22 (0.89)
	U11	8	29.6%	7	25.9%	
	U13	21	52.6%	16	42.1%	
	U15	19	42.3%	18	38.5%	
18/19	U9	4	17.4%	2	8.7%	0.97 (0.81)
	U11	10	36.7%	7	26.7%	
	U13	14	35.7%	15	40.5%	
	U15	17	40.4%	16	38.3%	

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Table 3. Differences between the number of players with traumatic and overuse injuries (Chi-square test - χ2)

SEASON	CATEGORY	TRAUMA		OVERUSE		χ2 (p)
		N	%	N	%	
19/20	U9	1	4.2%	2	8.3%	1.05 (0.79)
	U11	4	11.4%	5	14.3%	
	U13	12	30.0%	15	37.5%	
	U15	15	32.6%	12	26.1%	
20/21	U9	3	13.6%	1	4.5%	1.35 (0.72)
	U11	3	9.1%	4	12.1%	
	U13	8	19.5%	10	24.4%	
	U15	17	37.8%	17	37.8%	
21/22	U9	1	4.5%	1	4.5%	0.13 (0.98)
	U11	7	20.0%	5	14.3%	
	U13	16	38.6%	13	31.8%	
	U15	20	51.2%	14	34.9%	
OVERALL	U9	12	9.9%	11	9.1%	2.26 (0.52)
	U11	37	20.1%	42	22.9%	
	U13	84	34.7%	92	37.9%	
	U15	120	45.4%	101	38.1%	

Discussion

This study aimed to analyze the incidence of traumatic and overuse injuries in soccer players aged 8 to 15 years, revealing several key findings. The most notable result is that there were no significant differences in the types of injuries across individual age categories, indicating a consistent injury distribution throughout development. However, younger players exhibited a slightly higher incidence of overuse injuries, whereas older players sustained more traumatic injuries. Moreover, the findings confirm that injury incidence increases with age, as older players experienced more injuries than younger age groups. Finally, the overall number of acute and overuse injuries was similar across all age groups, suggesting a balanced occurrence of both injury types.

The absence of significant differences in the distribution of traumatic and overuse injuries across individual age categories suggests a consistent injury pattern throughout player development. This finding indicates that, despite physiological and biomechanical changes associated with growth, young soccer players experience similar proportions of acute and overuse injuries at different stages of development. Such results align with previous research emphasizing that both traumatic and overuse injuries remain prevalent across youth age groups (Pulici, 2024). A similar distribution of injury types may reflect the structured training methodologies and injury prevention programs implemented at the academy, ensuring balanced workloads across different age categories. Additionally, the lack of significant variation in injury type suggests that injury mechanisms remain relatively unchanged during early soccer development, reinforcing the need for generalized prevention strategies applicable to all age groups.

However, results suggest a slightly higher incidence of overuse injuries in younger players and a greater incidence of traumatic injuries in older players with also general increase in injury incidence in older age. The observed differences in injury patterns across age groups can be explained by the changing demands of training and competition as players develop. Younger players tend to sustain more overuse injuries, likely due to repetitive movements involved in learning new techniques, a high volume of training repetitions, and insufficient mastery of movement patterns (Zwolski, Quatman-Yates, & Paterno, 2017). While increased training loads generally have a protective effect by enhancing strength and neuromuscular control, excessive training exposure can lead to overuse injuries, overtraining, and even illness (Serfaty & Palmer, 2025).

In contrast, older players experience a higher proportion of traumatic injuries, reflecting the increased physical intensity of matches, greater competitiveness, and more aggressive style of play. With stronger, faster, and larger players engaging in frequent duels and physical contact, the likelihood of trauma-induced injuries such as sprains, contusions, and fractures increases. The overall rise in injury incidence with age is consistent with previous studies, which attribute this trend to greater training and match exposure, as well as the higher physical and tactical demands of the game (Karabin, Pupiš, & Švantner, 2024; Rabie, Arafa, Bahloul, & Abdelbadie, 2025; Serfaty & Palmer, 2025).

Our study found that the total traumatic-to-overuse injury ratio over six seasons was approximately 50:50, which is in line with previous studies on youth soccer (Błażkiewicz, Grygorowicz, Białostocki, & Czaprowski, 2018; Rommers et al., 2020). However, this distribution differs from patterns seen in senior players, where traumatic injuries tend to be more prevalent (Leppänen et al., 2019; Rommers et al., 2020). The shift toward more acute injuries in older players is likely due to increased match intensity, greater physical contact, higher training loads, and more competitive play at the senior level.

Additionally, mature athletes may have better neuromuscular control and movement efficiency, reducing the likelihood of overuse injuries while being more exposed to high-impact

trauma (Mandorino, Figueiredo, Gjaka, & Tessitore, 2023). These findings emphasize the importance of tailoring injury prevention strategies to different age groups, considering the evolving injury risks as players transition from youth to senior-level competition.

Conclusion

This study examined the incidence and distribution of traumatic and overuse injuries in youth soccer players aged 8 to 15 years over a six-season period, revealing several key findings. The results showed that injury types were consistently distributed across all age categories, with younger players experiencing slightly more overuse injuries, while older players sustained more traumatic injuries and more injuries overall. The number of traumatic and overuse injuries was unexpectedly equal, suggesting that training methodologies and injury prevention strategies may influence injury patterns.

From a practical perspective, these findings highlight the importance of age-specific injury prevention programs that account for the unique physiological and biomechanical demands of young athletes. Coaches and medical staff should closely monitor training loads, ensuring a gradual progression in intensity to minimize overuse injuries in younger players while implementing techniques to reduce the risk of traumatic injuries in older age groups. Future research should focus on longitudinal studies with larger number of clubs to examine the long-term effects of injury trends on player development and to identify age-specific injury predictors.

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Conflict of interest
The authors declare that there is no conflict of interest.

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