Injuries During Return to Sport After the COVID-19 Lockdown

An Epidemiologic Study of Italian Professional Soccer Players

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Background: The injury rate in professional soccer players may be influenced by match frequency.

Purpose: To assess how changes in match frequency that occurred because of coronavirus disease 2019 (COVID-19) influenced training and match injuries in the Italian Serie A league.

Study Design: Descriptive epidemiology study.

Methods: Three phases in the Serie A league, each 41 days long, were evaluated: phase A was the beginning of the 2019-2020 season; phase B was a period after the COVID-19 lockdown was lifted, when the remaining matches of the season were played with greater frequency; and phase C was the beginning of the 2020-2021 season. All male professional soccer players who were injured during the 3 phases were included. Player age, height, position, injury history, and return to play (RTP) were retrieved from a publicly available website. Training- and match-related injuries during each of the 3 phases were collected and compared. Moreover, match injuries that occurred after the lockdown phase (phase B), in which there were 12 days designated for playing matches ("match-days"), were compared with injuries in the first 12 match-days of phases A and C.

Results: When comparing 41-day periods, we observed the injury burden (per 1000 exposure-hours) was significantly lower in phase B (278.99 days absent) than in phase A (425.4 days absent; $P < .05$) and phase C (484.76 days absent; $P < .05$). A longer mean RTP period was recorded in phase A than in phase B (44.6 vs 23.1 days; $P < .05$). Regarding 12–match day periods (81 days in phase A, 41 days in phase B, and 89 days in phase C), there was a significantly higher match injury rate (0.56 vs 0.39 injuries/1000 exposure-hours; $P < .05$) and incidence (11.8% vs 9.3%; $P < .05$) in phase B than in phase A and a longer mean RTP period in phase A than in phase B (41.8 vs 23.1 days; $P < .05$). Finally, the rate and incidence of training-related injuries were significantly higher in phase B (4.6 injuries/1000 exposure-hours and 6.5, respectively) than in phase A (1.41 injuries/1000 exposure-hours and 2.04, respectively) ($P < .05$).

Conclusion: Both training- and match-related injuries were greater during the abbreviated period after the COVID-19 lockdown. These may be linked to the greater match frequency of that period.

Keywords: football; injuries; epidemiology; sports trauma

European football (soccer) is the most popular sport in the world, and it also plays an important role from societal and preventive viewpoints. In fact, regular recreational soccer activity is a good method to improve population health.[5] Professional soccer has a high risk of injury, however. Hawkins and Fuller[14] found that the overall risk of injury to professional soccer players was around 1000 times higher than that found in other industrial occupations more traditionally regarded as high risk. Several studies have shown that a professional soccer team of 28 players could expect about 50 severe injuries per season.[7,8]

While injuries could affect players' health and team performance, they also have an important economic effect.[5] Teams that can avoid or minimize injuries have been shown to have a greater chance of success in terms of their final league position compared with those that manage injuries less effectively.[1,6,13] Match frequency can also affect the injury rate, as previous studies have shown that injury

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rates are higher if a team plays 2 matches separated by $\leq$4 days compared with $\geq$6 days.[2,4] Bengtsson et al[3] showed a significantly higher risk of muscle injuries for match exposure separated by <3 days.

The Italian National League (Serie A) is composed of 20 teams; each team plays against the other teams twice within a single season (between August and May), for a total of 38 matches per team. The coronavirus disease 2019 (COVID-19) global pandemic that occurred in 2020 changed the 2019-2020 season, including the Serie A league. As the result of a break in Serie A league matches on March 9, 2020, soccer players began an isolation ("lockdown") period in their homes, interrupting and modifying their regular training sessions.

On May 18, 2020, the resumption of group training for professional teams and referees was authorized, and the first official postlockdown match was played on June 22, 2020; the season was finally concluded on August 2, 2020. The remaining 12 days designated for playing matches ("match-days") in the 2019-2020 season were compressed into 41 days, leading to a greater match frequency than usual. Furthermore, the 2020-2021 season started with a shorter preseason preparation. In fact, there were only 49 days from the end of the 2019-2020 season to the start of the 2020-2021 season instead of the usual 90 days.

This study aimed to report training and match injuries during the postlockdown phase, comparing them with injuries during the first part of the 2019-2020 season and the beginning of the 2020-2021 season. Our hypothesis was that changes that occurred because of the pandemic break resulted in a higher rate of injury.

METHODS

In this retrospective study, 3 phases of equal length were considered. Phase A was defined as the beginning of the 2019-2020 season between August 24, 2019, and October 4, 2019 (41 days); phase B was the period after the lockdown break between June 22, 2020, and August 2, 2020 (41 days); and phase C represented the 2020-2021 season between September 20, 2020, and October 31, 2020 (41 days). We identified all male professional soccer players who sustained an injury in the Serie A league during each 41-day period. Injuries were divided into training-related injuries or match-related injuries, and the training and match injuries of the 3 phases were compared. Moreover, match injuries that occurred after the lockdown phase, consisting of 12 match-days, were compared with the first 12 match-days of the 2019-2020 season and the first 12 match-days of the 2020-2021 season.

Player data, including age, height, position, injury history, and return-to-play (RTP) time, were retrieved from the publicly available media-based platform Transfermarkt (www.transfermarkt.com). Missing data, such as "unknown injury" reported on Transfermarkt, weight, or affected side, were searched via other publicly available online sources (official team websites and sports media websites).

The operational definitions used in the study are shown in Table 1. Absences due to a reason other than injury, including illness and COVID-19, were excluded from the study. Whenever possible, injuries were classified as muscle tears, delayed-onset muscle soreness, knee and ankle sprains, overuse (groin pain, tendinopathy, and low back pain), trauma (contusion, fracture, dislocation, and head injury), or other.

Statistical Analysis

Descriptive statistical analysis of the data was conducted to describe the sample using the calculation of the mean, standard deviation, maximum, and minimum. The chi-square test was used to compare the independence or influence between 2 qualitative variables. Continuous variables were statistically compared using the 2-tailed Mann-Whitney U test, and statistical significance was set at $P \leq .05$. All data analysis was conducted using SPSS Version 25 (IBM Corp).

RESULTS

A total of 20 teams were investigated in the study in each phase. A total of 763 players were included in phase A; 748 players, in phase B; and 567 players, in phase C. A total of 375 injuries were registered, with 177 (47.2%) occurring during matches and 198 (52.8%) occurring during training.

Match-Related Injuries

Match Injuries Within Each 41-Day Period. During each 41-day interval, 60 matches were evaluated in phase A; 120 matches, in phase B; and 50 matches, in phase C. In total, 126 injuries were recorded. No significant differences were recorded regarding anthropometrics (Table 2). Injury burden (per 1000 exposure-hours) was significantly lower in phase B (278.99 days absent) than in phase A (425.4 days absent; $P < .05$) and phase C (484.76 days

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Ethical approval was not sought for the present study.

TABLE 1
Operational Definitions Used in the Study

Term	Definition
Injury	Injury resulting from playing soccer and leading to a player being unable to participate fully in future match play
Injury burden	No. of days of absence per 1000 exposure-hours
Injury rate	No. of injuries per 1000 exposure-hours
Injury incidence	No. of injuries occurred over the study period
Exposure	1.5 h per game played, multiplied by each player who can potentially play
Match injury	Injury during a match
Match frequency	No. of days between 2 matches
Match-day	Day on which a soccer match takes place
Training injury	Injury during a training session
Minimal injury	Injury causing 0-3 days' absence from training and match play
Mild injury	Injury causing 4-7 days' absence from training and match play
Moderate injury	Injury causing 8-28 days' absence from training and match play
Severe injury	Injury causing >28 days' absence from training and match play
Return to play	No. of days from injury to the first match appearance with the first team, reserve team, youth team, or national team

TABLE 2
Match-Related Injuries Within Each 41-d Period in Phases A, B, and C[a]

	Phase A (2019-2020 Season)	Phase B (Postlockdown)	Phase C (2020-2021 Season)
No. of teams	20	20	20
No. of match-days	6	12	5
No. of matches	60	120	50
Match frequency, d between matches, mean	6.8	3.4	8.2
No. of injuries	28	68	30
Player anthropometrics			
Age, y, mean ± SD (range)	27.6 ± 3.2 (20-34)	28.1 ± 4 (20-37)	27.6 ± 4.3 (21-39)
Height, cm, mean ± SD (range)	183.5 ± 5.7 (167-196)	183.6 ± 5.7 (170-195)	183.4 ± 5.8 (170-194)
Weight, kg, mean ± SD (range)	77.4 ± 5.3 (61-96)	78.5 ± 6.2 (65-93)	78 ± 5.9 (64-92)
BMI, mean	23.8	22.7	22.6
Match injury rate	0.46	0.56	0.6
Match injury incidence, %	11.11	11.8	14.2
RTP, d, mean	**44.6**[b]	23.1	33.9
Injury burden, days absent, mean	425.4	**278.99**[b,c]	484.76
Injury severity, n (%)			
Minimal (1-3 d)	2 (7.2)	5 (7.5)	0 (0)
Mild (4-7 d)	2 (7.2)	12 (17.6)	2 (6.7)
Moderate (7-28 d)	14 (50)	36 (52.9)	12 (40)
Severe (>28 d)	8 (28.6)	15 (22)	**16**[c,d] **(53.3)**
Injury type, n (%)			
Muscle tear	15 (53.6)	41 (60.3)	20 (66.7)
Knee sprain	2 (7.2)	6 (8.8)	0 (0)
Trauma	7 (25)	13 (19.1)	7 (23.3)
Ankle sprain	2 (7.2)	8 (11.8)	3 (10)
Overuse	0 (0)	0 (0)	0 (0)
Other	0 (0)	0 (0)	0 (0)
Player position, n (%)			
Goalkeeper	1 (3.6)	3 (4.4)	1 (3.3)
Defender	12 (42.9)	33 (48.5)	11 (36.7)
Midfielder	6 (21.4)	17 (25)	12 (40)
Forward	9 (32.1)	15 (22.1)	6 (20)

[a]Bold values indicate statistical significance ($P \leq .05$). BMI, body mass index; RTP, return to play.
[b]Significant difference between phase A and phase B cohorts.
[c]Significant difference between phase B and phase C cohorts.
[d]Significant difference between phase A and phase C cohorts.

absent; $P < .05$), while a significantly longer mean RTP time was recorded in phase A compared with phase B (44.6 vs 23.1 days; $P < .05$) (Table 2).

Match Injuries Within Each 12–Match Day Period. In phase A, 12 matches were played in 81 days (1 match every 6.75 days), while in phase B, 12 matches were played

TABLE 3
Match-Related Injuries Within Each 12 Match–Day Period in Phases A, B, and C[a]

	Phase A (2019-2020 Season)	Phase B (Postlockdown)	Phase C (2020-2021 Season)
No. of teams	20	20	20
No. of match-days	12	12	12
No. of matches	120	120	120
Match frequency, days between matches, mean	6.8	3.4	7.4
No. of injuries	47	**68[b]**	**62[c]**
Player anthropometrics			
Age, y, mean ± SD (range)	28.6 ± 3.2 (20-34)	28.1 ± 4 (20-37)	27.6 ± 4.3 (21-39)
Height, cm, mean ± SD (range)	183.5 ± 5.9 (168-197)	183.6 ± 5.7 (170-195)	183.4 ± 5.8 (171-193)
Weight, kg, mean ± SD (range)	77.3 ± 5.7 (62-94)	78.5 ± 6.2 (65-93)	78.1 ± 6 (64-91)
BMI, mean	23.7	22.7	22.9
Match injury rate	0.39	**0.56[b]**	0.51
Match injury incidence, %	9.3	**11.8[b]**	10.7
RTP, d, mean (range)	**41.8[b] (3-339)**	23.1 (3-150)	32.1 (4-110)
Injury burden, days absent, mean	390.2	278.99	346.52
Injury severity, n (%)			
Minimal (1-3 d)	1 (2.1)	5 (7.4)	0 (0)
Mild (4-7 d)	8 (17)	**12[d] (17.6)**	4 (6.5)
Moderate (7-28 d)	17 (36.2)	**36[b] (52.9)**	27 (43.5)
Severe (>28 d)	**21[b] (44.7)**	15 (22.1)	**31[d] (50)**
Injury type, n (%)			
Muscle tear	30 (63.8)	41 (60.3)	43 (69.3)
Knee sprain	4 (8.5)	6 (8.8)	3 (4.8)
Trauma	10 (21.3)	13 (19.1)	13 (21)
Ankle sprain	3 (6.4)	8 (11.8)	3 (4.9)
Overuse	0 (0)	0 (0)	0 (0)
Other	0 (0)	0 (0)	0 (0)
Player position, n (%)			
Goalkeeper	0 (0)	3 (4.4)	3 (4.8)
Defender	22 (46.8)	**33[d] (48.5)**	22 (35.5)
Midfielder	14 (29.8)	17 (25)	**22[c,d] (35.5)**
Forward	11 (23.4)	15 (22.1)	15 (24.2)

[a]Bold values indicate statistical significance ($P \leq .05$). BMI, body mass index; RTP, return to play.
[b]Significant difference between phase A and phase B cohorts.
[c]Significant difference between phase A and phase C cohorts.
[d]Significant difference between phase B and phase C cohorts.

in 41 days (1 match every 3.4 days). In phase C, 12 matches were played in 89 days (1 match every 7.4 days). Over all 3 phases, 177 injuries were recorded. There was a significantly higher match injury rate (0.56 vs 0.39 injuries/1000 exposure-hours; $P < .05$) and incidence (11.8% vs 9.3%; $P < .05$) in phase B versus phase A. And again, there was a longer mean RTP period in phase A versus phase B (41.8 vs 23.1 days; $P < .05$) (Table 3).

Training-Related Injuries

In total, 198 training-related injuries were recorded. In phase B compared with phase A, there were significantly more injuries (78 vs 51, respectively; $P < .05$), as well as a higher rate of training-related injuries (4.6 vs 1.41 injuries/1000 exposure-hours, respectively; $P < .05$) and injury incidence (6.5% vs 2.04%, respectively; $P < .05$) (Table 4).

DISCUSSION

The main finding of this study was the increase in injury rate and incidence after the lockdown phase as compared with the beginning of the 2019-2020 season, and this trend was confirmed during the 2020-2021 season. Although the 2020-2021 season was considered a normal season with a regular training and game schedule, the shorter preseason period before returning to competition represented an additional risk factor for the increase in injuries. Ekstrand et al[11] demonstrated that completing more preseason training sessions may help elite soccer teams to remain healthier during the competitive season.

Concerning the injury incidence, Ekstrand et al[10] showed that most reported injuries occurred during match play (6785 match-related vs 5035 training-related injuries), representing a match injury incidence of 23.8 injuries/1000 hours. During training, the incidence was 3.4 injuries/1000 hours. Ekstrand et al[9] defined an injury as any physical complaint sustained by a player that resulted from a soccer match or soccer training that led to the player's being unable to participate in future soccer training or match play while in the present study, injury was defined as any physical complaint incurred playing soccer that does not allow the player to participate in matches.

TABLE 4
Training Injuries That Occurred in Each 41-d Study Period[a]

	Phase A (2019-2020 Season)	Phase B (Postlockdown)	Phase C (2020-2021 Season)
No. of teams	20	20	20
No. of match-days	41	41	41
Match-days excluded	6	12	5
No. of injuries	50	**76[b]**	72
Player anthropometrics			
Age, y, mean ± SD (range)	27.5 ± 3.1 (20-33)	27.9 ± 3.5 (21-37)	27.8 ± 4.1 (20-39)
Height, cm, mean ± SD (range)	183.9 ± 5.6 (162-195)	183.5 ± 5.8 (168-196)	183.6 ± 5.8 (171-192)
Weight, kg, mean ± SD (range)	77.8 ± 5.1 (61-92)	78.7 ± 5.2 (63-96)	78.3 ± 6 (69-92)
BMI, mean	23.1	22.6	22.8
Training injury rate	1.41	**4.6[b]**	1.9
Training injury incidence, %	2.04	**6.5[b]**	2.7
RTP, d, mean (range)	**21.5[b] (2-168)**	14.5 (2-76)	27.2 (3-103)
Injury burden, days absent, mean	50.2	58	**75.3[c]**
Injury severity, n (%)			
Minimal (1-3 d)	3 (5.8)	14 (18.4)	4 (5.6)
Mild (4-7 d)	13 (26)	14 (18.4)	**4[c] (5.6)**
Moderate (7-28 d)	23 (46)	40 (52.6)	40 (55.5)
Severe (>28 d)	11 (22)	8 (10.6)	**24[d] (33.3)**
Injury type, n (%)			
Muscle tear	34 (68)	47 (61.8)	**65[c,d] (90.3)**
Knee sprain	6 (12)	8 (10.6)	3 (4.1)
Trauma	4 (8)	12 (15.8)	1 (1.4)
Ankle sprain	1 (2)	2 (2.7)	1 (1.4)
Overuse	3 (6)	4 (5.2)	2 (2.8)
Other	2 (4)	3 (3.9)	0 (0)
Player position, n (%)			
Goalkeeper	2 (4)	5 (6.5)	2 (2.8)
Defender	20 (40)	24 (31.6)	26 (36.1)
Midfielder	16 (32)	30 (39.4)	25 (34.7)
Forward	12 (24)	17 (22.5)	19 (26.4)

[a]Bold values indicate a statistical significance ($P \leq .05$). BMI, body mass index; RTP, return to play.
[b]Significant difference between phase A and phase B cohorts.
[c]Significant difference between phase A and phase C cohorts.
[d]Significant difference between phase B and phase C cohorts.

Also, the match frequency has been found to negatively affect the incidence of injuries. Bengtsson et al[3] found that total injury rates and muscle injury rates were increased in league matches with <4 days compared with >6 days of recovery. These findings were confirmed in the current study, in which there was a significantly higher risk of injury occurring when the same number of matches were played in fewer days.

A factor that may have mitigated the risk of injury is a rule change that increased the number of allowable substitutions from 3 in phase A to 5 in phases B and C. Orchard et al[15] evaluated the effect of the increased use of the interchange bench on hamstring injuries, and they suggested that regular interchanges protected individual players against muscle injuries. This study did not seem to agree with a higher risk of match injury using more interchanges, but this could affect other factors (ie, match congestion, short preseason, etc). Further studies could explain the effect of interchanges.

Limitations

The main limitation of the study is related to the inherent study design, which does not use direct reporting from medical staff. We did not have access to medical records, radiographs, or magnetic resonance imaging scans, and we did not have information about associated lesions, surgical techniques, or rehabilitation programs. It is also possible that some injuries were missed.

However, we believe that Transfermarkt is free from ascertainment bias because the medical staff is not involved in the collection and analysis of the data. We also recognize the possibility of other biases, such as wrong medical data, that are provided by reporters and cannot be ratified for privacy regulations. Moreover, the lack of training data could affect results in terms of precise exposure. However, the use of the online soccer archive to gather the data (Transfermarkt) represents the best available and independent option previously and successfully employed in other epidemiology sports medicine studies.[12]

CONCLUSION

To the best of our knowledge, the current study presents the most extensive series of elite European soccer players sustaining an injury, analyzing RTP, injury rate, and

injury incidence after COVID-19 lockdown. The postlockdown RTP resulted in a significant increase in injuries in both training and matches. It is probably linked to a greater match frequency and a reduction of the preseason period for the 2020-2021 season. These epidemiological data could be used by soccer personnel to better understand how COVID-19 affected the Italian Serie A. Further studies are needed to understand if some changes that were made (eg, the transition from 3 to 4 substitutions) could compensate for the increased risk of injury.

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