



ORIGINAL ARTICLE

Injury rates following the COVID-19 lockdown: A case study from an UEFA futsal champions league finalist

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Abstract

Introduction: Recently, a pandemic disease (i.e., COVID-19) arose complicated conditions for players, clubs, and sports competitions. Most European countries postponed or canceled their respective leagues as players were forced into a long-term lockdown. This case study presents and compares the absolute and relative non-contact lower-limb injury rates and characteristics before and after the lockdown from a Finalist of the UEFA Futsal Champion League.

Material and methods: Thirteen elite futsal players (age: 27 ± 2.8 years old; body mass: 76 ± 5.4 kg; height: 1.79 ± 0.1 m; body fat: $9 \pm 1.6\%$) participated in this study. Injury severity, location, type, and mechanism were recorded. Data from the 6 weeks pre- and post-lockdown were collected, and injury rates were expressed per 1,000 training and match hours.

Results: Chi-Square tests revealed a significant difference ($p = 0.039$) in the distribution of the number of injuries between the two moments. No overuse and non-contact injuries were observed during the 6 weeks before the lockdown. Nevertheless, 38% (i.e., 5) of the players suffered minimal severity (i.e., ≤ 3 days of court absence) overuse injuries in the hip/groin and thigh muscles post-home-confinement.

Conclusions: Elite male futsal players sustained a substantially higher number of lower-body non-contact injuries after the lockdown. Practitioners should implement a thorough analysis of players' neuromuscular qualities and fatigue to identify individual training and recovery needs and, thus, prescribe more tailored injury-reduction programs.

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Introduction

In 2020, a pandemic disease (i.e., COVID-19) arose complicated circumstances for athletes, clubs, and sports competitions.¹ Most European countries postponed or canceled their respective championships as players were forced into a long-term lockdown during the in-season period (March-May). This unprecedented situation led National leagues and federations to adjust the competitive calendars to allow finishing the competitions in due time. For example, the *Liga Nacional de Fútbol Sala* (LNFS; 1st Division of Spain) determined that the league's first play-off game was to be played within few weeks after a ~60-day lockdown, a period with reduced training. Therefore, several recommendations were provided by the scientific community to tackle the potential detraining effects on physical performance and minimize the risk of injury when returning-to-competition after the lockdown.^{2–4}

Futsal is a high-intensity intermittent team-sport, in which players are exposed to high metabolic and neuromechanical stress during match-play.⁵ Regarding injury characteristics, a recent meta-analysis⁶ found that male players displayed: 1) an overall injury incidence rate of 6.8 injuries/1000-h and; 2) an incidence rate of 44.9 injuries/1000-h during match-play. Likewise, it was found that professional players from the 1st and 2nd LNFS sustained ~10 injuries/1000-h of training and ~60 injuries/1000-h of competition during the pre-season and that most injuries affected the lower-limbs (i.e., 92.1%).⁷ Nevertheless, all previously published data are based on the analysis of “regular” competitive scenarios (i.e., no in-season breaks due to a lockdown) and no investigation has reported the effects of the unique situation caused by COVID-19 on injury occurrence in elite futsal.

Therefore, the aims of this case study were to examine and compare the absolute and relative lower-limb injury rates 6 weeks pre- and post-lockdown. Due to the extensive period of reduced training, we hypothesized that the relative number of non-contact injuries would be greater after the season intermission (i.e., post-lockdown).

Materials and methods

Study design

A pre-post retrospective cohort case study design was used. Due to the COVID-19 pandemic, all futsal activities (i.e., training and competition) were canceled on March 14th, 2020. The pre-lockdown injury profile was compiled from January 27th, 2020 to March 13th, 2020. During this period, players completed 53.3 ± 5.4 h of training and 6 matches. The post-lockdown injuries were collected from May 12th, 2020 to June 24th, 2020 (last league play-off game). Players completed 52.9 ± 2.8 h of training and 5 matches. These time periods were selected for further analysis to guarantee

similar exposure time. Only non-contact lower-body injuries were analyzed (injuries caused by external factors, such as contact with other players, were disregarded). In the present study, an injury was defined as any physical complaint sustained by a player that resulted from a match or training, irrespective of need for medical attention or time loss from activities.⁸ The team's physician was responsible for the evaluation and recording of injuries according to the consensus statement of injuries in soccer,⁸ previously used in futsal.⁷

Participants

Thirteen elite male futsal players (age: 27 ± 2.8 years; body mass: 76 ± 5.4 kg; height: 1.79 ± 0.1 m; body fat: $9 \pm 1.6\%$), competing in LNFS and Finalists of the UEFA Futsal Champions League were monitored. By signing a professional contract with the club, all players provided individual consent for data collection and study participation. All procedures were approved by the Local Human Subjects Ethics Committee and conducted according to the Declaration of Helsinki.

Procedures

Injuries were classified according to: 1) severity; 2) location; 3) type; and 4) mechanism. No injury reoccurrence was observed; hence, this condition was excluded. Injury severity considered the time period from the day of the injury to the date of the player's return to full participation with the team and was classified as: minimal (≤ 3 days); mild (4 – 7 days); moderate (8 – 28 days); and severe (> 28 days). If the player sustained an injury but was available the following day, the incident was recorded as a time loss of zero-day severity. Injury location and type were classified and divided into six (i.e., hip-groin, thigh, knee, lower leg-Achilles tendon, ankle, foot-toe) and four categories (i.e., fractures and bone stress, joint [non-bone] and ligament, muscle and tendon, contusions), respectively.⁸ Injury mechanisms were classified as overuse (i.e., unidentifiable event, usually due to repeated micro-traumas) or traumatic (i.e., specific identifiable occurrence).⁸

Time exposure for each player considered the total time spent in training and competition. Team talks and video tactical sessions, meetings with sport psychologists and nutritionists, and personal activities undertaken away from the team's staff were not included. Injury rates were expressed per 1,000 hours of training and match combined.

Statistical analysis

Statistical analysis was performed using SPSS Statistics, version 22.0 (SPSS, Inc., Chicago, IL). Descriptive data of absolute and relative number of injured athletes pre- and post-lockdown were reported. The distribution in the number of injuries between both periods of analysis was compared through the Chi-Square test and the z-test and the 95%

confidence intervals (95% CIs) were computed. The statistical significance was set as $p \leq 0.05$.

Results

Tables 1 and 2 report the pre- and post-lockdown lower-limb injury rates and characteristics. No lower-limb overuse injuries were observed pre-lockdown. Nevertheless, 38% (i.e., 5) of players suffered from non-contact overuse injuries after the lockdown in hip-groin and thigh muscles, all sustained during training. Chi-Square tests revealed a significant difference in the distribution of the number of injuries between the two moments ($p = 0.039$).

Discussion

This case study identified a greater number of non-contact lower-body injuries (incidence of $7.73 \pm 1000 \text{ h}^{-1}$ [95% CI: 2.19–13.27]) after the lockdown in an elite futsal team. Specifically, ~40% of the players (i.e., 5) suffered minimal severity injuries (i.e., ≤ 3 days of court absence) during the 6 weeks following home-confinement. Conversely, no injuries were registered before the lockdown considering the same exposure time.

In general terms, overuse injuries are more common during the pre-season when compared to the rest of season.^{9,10} This has been suggested to occur due to inadequate recovery and/or inappropriate loading during the first weeks of preparation following reduced training periods (i.e., transition period).¹⁰ Considering the context of the present study, the post-lockdown period may be considered as a “mini preparatory phase” with the distinctive aspect that players returned from a home-confinement characterized by a sudden decrease in the number and frequency of high-intensity motor actions, especially those involving the stretch-shortening cycle (as compared to the in-season).¹¹ Moreover, players had only a few weeks to prepare for a highly demanding official play-off league match. Therefore, we speculate that some athletes were not able to cope with the high physical and technical demands of futsal training and competition; hence, the greater number of overuse injuries.¹²

Previous studies have shown the detrimental effects of the COVID-19 lockdown on neuromuscular performance in elite team-sports athletes.^{13,14} In particular, a recent study¹¹ using the same sample of elite male futsal players revealed that home-confinement resulted in a significant impairment in 10-m sprint performance. Of interest, vertical jump height remained unaltered, although several kinetic

Table 2 Injury characteristics post-COVID-19 lockdown.

Post-COVID-19 Injury Characteristics		
Mechanism of injury	Overuse	5
Injury severity	Minimal	5
Injury location lower-limbs	Hip/groin	4 (80%)
	Thigh	1 (20%)
Injury type	Muscle and tendon	5 (100%)

variables (i.e., eccentric peak velocity and power, rate of force development, and landing peak force) were affected post-lockdown, despite players performing a maintenance training program while confined, as described elsewhere.¹¹ Noteworthy, the main differences were obtained for the eccentric and landing phases, suggesting that alterations on muscle-tendon properties¹³ or stretch-shortening cycle mechanisms may have occurred during this period. To some extent, these important modifications can justify the higher number of injuries post-lockdown. These changes in neuromuscular function may have affected players' ability to efficiently decelerate and tolerate high eccentric-loading actions, which is highly and frequently required in futsal.⁵

It is important to highlight that futsal is characterized by high-intensity activities such as accelerations, decelerations, and directional changes.⁵ The issue here is that, during the lockdown, it was not possible to provide these types of stimuli to the players. In addition, the reduced period of training before competition could have resulted in the higher rates of injuries observed in the post-lockdown period, even considering that the number of matches was greater before the home-confinement (6 official matches vs 4 friendly and 1 official). Importantly, due to the reduced sample size and the elite level of the players examined here, the present results should not be generalized. Further retrospective investigations on pre- and post-lockdown injury rates with greater sample sizes and timeframes or involving athletes from different sports and performance levels are warranted.

In summary, a significant increase in non-contact lower-body injuries was observed after the COVID-19 lockdown in elite futsal players. Specifically, when considering an equal exposure time, the injury incidence was $7.73 \pm 1000 \text{ h}^{-1}$ (95% CI: 2.19–13.27) after the quarantine, as opposed to no overuse injuries recorded pre-lockdown. Therefore, following long-term training cessation, practitioners are advised to: 1) implement a thorough analysis of players' neuromuscular qualities and fatigue [through vertical jump kinetics, for example¹⁵], to identify individual necessities and, thus, prescribe more tailored injury-reduction programs; 2) optimize recovery strategies to allow players to better tolerate

Table 1 Injury indices before and after the COVID-19 lockdown.

	Pre-COVID-19	Post-COVID-19	$p \chi^2$
Total Exposure Time (h)	53.3 ± 5.4	52.9 ± 2.8	
Total Injuries	-	5	
Injury Incidence ($n \cdot 1000 \text{ h}^{-1}$)	0	7.73 (95% CI: 2.19–13.27)	0.039

Values presented as mean \pm SD.

$p \leq 0.05$; significant pre – post differences analyzed by a Chi-Square test.

h: hours; SD: standard deviation.

the high training and playing demands during congested calendars; and 3) closely monitor external and internal training loads. Finally, sport organizations and federations should consider that players may need longer preparation periods to ensure safer return-to-competition practices after prolonged periods of training cessation or reduced training, and that competitive schedules should be adjusted to protect players' health and maintain optimal levels of performance throughout the competitive period.

Conflicts of interest

The Authors declare that they don't have any conflict of interests.

References

1. Toresdahl BG, Asif IM. Coronavirus Disease 2019 (COVID-19): Considerations for the Competitive Athlete. Los Angeles, CA: SAGE Publications Sage CA; 2020.
2. Chen P, Mao L, Nassis GP, et al. Coronavirus disease (COVID-19): the need to maintain regular physical activity while taking precautions. *J Sport Health Sci.* 2020;9:103–4.
3. Dwyer MJ, Pasini M, De Dominicis S, Righi E. Physical activity: benefits and challenges during the COVID-19 pandemic. *Scan J Med Sci Sports.* 2020;30:1291.
4. Jukic I, Calleja-González J, Cos F, et al. Strategies and solutions for team sports athletes in isolation due to covid-19. *Sports Basel.* 2020;8:56.
5. Spyrou K, Freitas TT, Marín-Cascales E, PE Alcaraz. Physical and physiological match-play demands and player characteristics in futsal: a systematic review. *Front Psychol.* 2020;11.
6. Ruiz-Pérez I, López-Valenciano A, Elvira JL, et al. Epidemiology of injuries in elite male and female futsal: a systematic review and meta-analysis. *Sci Med Football.* 2020: 1–13.
7. López-Segovia M, Fernández V. Preseason injury characteristics in Spanish professional futsal players: the LNFS project. *J Strength Cond Res.* 2019.
8. Fuller CW, Ekstrand J, Junge A, et al. Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Scan J Med Sci Sports.* 2006;16:83–92.
9. Ekstrand J, Hägglund M, Waldén M. Injury incidence and injury patterns in professional football: the UEFA injury study. *Br J Sports Med.* 2011;45:553–8.
10. Noya SJ, Gómez-Carmona PM, Gracia-Marco L, Moliner-Urdiales D, Sillero-Quintana M. Epidemiology of injuries in first division Spanish football. *J Sports Sci.* 2014;32:1263–70.
11. Spyrou K, Alcaraz PE, Marín-Cascales E, et al. The effects of the COVID-19 lockdown on neuromuscular performance and body composition in elite futsal players. *J Strength Cond Res.* 2021;35:2309–15.
12. McIntosh AS. Risk compensation, motivation, injuries, and biomechanics in competitive sport. *Br J Sports Med.* 2005;39:2–3.
13. Cohen DD, Restrepo A, Richter C, et al. Detraining of specific neuromuscular qualities in elite footballers during COVID-19 quarantine. *Sci Med Football.* 2020: 1–6.
14. Grazioli R, Loturco I, Baroni BM, et al. Coronavirus disease-19 quarantine is more detrimental than traditional off-season on physical conditioning of professional soccer players. *J Strength Cond Res.* 2020;34:3316–20.
15. Claudino JG, Cronin J, Mezêncio B, et al. The countermovement jump to monitor neuromuscular status: a meta-analysis. *J Sci Med Sport.* 2017;20:397–402.