Elite football teams that do not have a winter break lose on average 303 player-days more per season to injuries than those teams that do: a comparison among 35 professional European teams

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ABSTRACT

Objective To compare injury rates among professional men's football teams that have a winter break in their league season schedule with corresponding rates in teams that do not.

Methods 56 football teams from 15 European countries were prospectively followed for seven seasons (2010/2011–2016/2017)—a total of 155 team-seasons. Individual training, match exposure and time-loss injuries were registered. Four different injury rates were analysed over four periods within the season, and linear regression was performed on team-level data to analyse the effect of winter break on each of the injury rates. Crude analyses and analyses adjusted for climatic region were performed.

Results 9660 injuries were reported during 1 447 011 exposure hours. English teams had no winter break scheduled in the season calendar: the other European teams had a mean winter break scheduled for 10.0 days. Teams without a winter break lost on average 303 days more per season due to injuries than teams with a winter break during the whole season (p<0.001). The results were similar across the three periods August–December (p=0.013), January–March (p<0.001) and April–May (p=0.050). Teams without a winter break also had a higher incidence of severe injuries than teams with a winter break during the whole season (2.1 severe injuries more per season for teams without a winter break, p=0.002), as well as during the period January–March (p=0.003). A winter break was not associated with higher team training attendance or team match availability. Climatic region was also associated with injury rates.

Conclusions The absence of a scheduled winter break was associated with a higher injury burden, both before and during the two periods following the time that many European teams take a winter break. Teams without a winter break (English clubs) had a higher incidence of severe injuries following the time of the year that other teams (other European clubs) had their scheduled break.

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INTRODUCTION

Most European elite football leagues have a winter break that coincides with the middle of the football season. To the best of our knowledge, only one study has evaluated the effect of a winter break on injury rates.[1] Shortening of the winter break from 6.5 to 3.5 weeks was not associated with a change in the overall injury risk in two top male football leagues in Germany across the 2008/2009 and 2009/2010 seasons, but it was associated with a higher number of training and knee injuries.[1] Team schedules vary in the different football playing countries. In England, for example, there is no scheduled winter break. The effect of the absence of a winter break on injury rates has not been investigated.

The purpose of this study was to compare injury rates, player attendance at training sessions and availability at matches in teams from countries that have a winter break with corresponding rates in teams from countries that do not. We hypothesised that the injury rate would increase and that the proportion of players attending training and being available for matches would decrease in the second part of the season for teams with no winter break.

MATERIALS AND METHODS

This is a substudy of the UEFA Elite Club Injury Study (ECIS) and included 56 teams from 15 European countries during seven consecutive seasons (2010/2011 to 2016/2017) with a total of 206 team seasons (table 1). All teams participated in the highest level of domestic competition and some also participated regularly in the UEFA Champions League or Europa League competitions.

Data collection

Data collection procedures and definitions followed the UEFA guidelines and were aligned with the consensus statement for football injury surveillance.[2 3] Individual player participation in training and matches was registered by a contact person on each team using an exposure form, which were sent to the study group on a monthly basis. All team training and match exposure data were included. The team medical staff recorded injuries on an injury form, which was also sent to the study group each month. The injury form had information about the diagnosis, nature and circumstances of the injury occurrence. A recordable injury was defined as any physical complaint sustained by a player resulting from a football match or football training session that led to the player being unable to take a full part in future football training or match play (ie, time-loss injury). The player was considered injured until the team medical staff allowed full participation in training and availability for match selection. Injury absence was measured as the number of days from injury occurrence to full participation.

Definition of winter break

The winter break was defined as the number of days between the last team activity (training or match)

Table 1 Number of teams and team seasons included in the analyses, including the mean length and range of the scheduled winter break (in days) per country

Country	Number of teams	Number of team seasons	Mean length of scheduled winter break (days)	Range (days)
England	21	75	No break	–
Belgium	2	10	8.6	7–10
Croatia	1	1	21.0	–
Denmark	1	2	29.5	29–30
France	4	12	8.1	6–10
Germany	5	19	14.0	8–17
Greece	2	3	6.3	6–7
Italy	5	21	7.9	2–14
Netherlands	2	13	12.5	11–14
Portugal	4	18	6.4	4–10
Scotland	1	3	4.3	0–7
Slovenia	1	3	23.0	12–32
Spain	5	20	6.9	5–10
Switzerland	1	3	24.0	21–27
Turkey	1	3	8.0	6–9
Total	56	206	10.0 (English teams excluded)	0–27

before the break and the first activity (training or match) after the break. The matches are scheduled by the league associations and the trainings are scheduled by each team. Therefore, the length of the break depends on the schedules both from the league association and from each team.

The dependent variables were evaluated using the explanatory variable 'winter break,' which includes two categories (coded as 0/1) defined as teams that had a winter break and teams that were not scheduled to have a winter break, respectively. Teams from 14 different countries were represented in the first category (35 teams, 131 team seasons); only English teams were represented in the second category (21 teams, 75 team seasons).

Evaluation of winter break and team injury rates

Four different types of team injury rates were used as dependent variables: (1) injury burden, (2) incidence of severe injuries, (3) team training attendance and (4) team match availability. Injury burden was expressed as the sum of lay-off days/sum of exposure hours per 1000 hours of football training and match play, thus accounting for the incidence and severity of injuries in a single season.[4] Incidence of severe injuries was calculated as the sum of severe injuries (defined as injuries causing absence of more than 28 days)/sum of exposure hours per 1000 hours of football training and match play. The results were also expressed per season in addition to per 1000 hours of exposure. Team training attendance was expressed as the average attendance at training over a season expressed as a percentage. Team match availability was calculated as the average availability for matches over a season expressed as a percentage.

These four key outcomes were evaluated over four different periods: the whole season, the period between the beginning of the season and the winter break (August to December), the period immediately following the winter break (January to March) and the period at the end of the season (April to May).

Classification of climatic regions

Teams were categorised into different climatic types based on the Köppen-Geiger map,[5] which is based on average monthly temperature and precipitation. In this study, the teams were divided in the same two groups as in Waldén *et al*[6] (coded as 0/1): one 'southern' group representing teams from the Mediterranean region with a warm/hot and dry summer together with a wet winter climate (14 teams, 48 team seasons) and one 'northern' group representing teams from the middle and north of Europe with a warm summer and cooler winter climate (42 teams, 158 team seasons).

Statistical analyses

Generalised linear models with identity link were used to fit a linear regression to team-level data with each team season change as an observation, to analyse the effect of winter break on team injury rates using the SPSS procedure GENLIN (link=identity, distribution=normal). The effects of the explanatory variable 'winter break' (as well as climate region in the adjusted analyses) on the different injury rate measures (injury burden, incidence of severe injuries, team training attendance and team match availability) were analysed in separate models. Both crude and adjusted analyses were performed, and adjustments were made for a variable indicating the climate region of the teams in the latter analysis, because previous reports have indicated that teams from geographical regions with milder summers and cooler winters have a higher injury risk compared with teams with a Mediterranean climate.[6] All analyses were two-sided and the significance level set at p value <0.05. Pearson's r correlation was used to determine the effect sizes between the injury rate measures and the explanatory variable(s). This measure can vary between –1 and 1, where –1 represents perfect negative association/correlation and 1 represents perfect positive association/correlation. In other words, the higher the absolute value of r, the larger the effect size.

RESULTS

In total, the 206 teams had 9627 injuries (4240 training, 5387 match play) during 1 440 721 hours of football training and match play. The mean length of the winter break was 10.0 days with a range of 0–27 days (table 1), and the mean exposure time during the season was approximately 6994 hours per team.

Effects of winter break on injury burden

The mean injury burden was 185.9 days lost/1000 hours (1300 days lost per season) for teams without a winter break and 127.0 days lost/1000 hours (888 days lost per season) for the whole season for teams with a winter break (table 2). The adjusted analysis showed that teams without a winter break lost on average 303 days more per season due to injuries than teams with a winter break during the whole season ($p<0.001$). The results were similar across the three periods: August–December (228 days lost more for teams without a winter break, $p=0.013$), January–March (466 days lost more for teams without a winter break, $p<0.001$) and April–May (267 days lost more for teams without a winter break, $p=0.050$).

Climatic region had no significant impact on the association between winter break and injury burden for any of the four periods studied. Teams from the northern climatic region had a higher injury burden than teams from the southern climatic region during the whole season ($p<0.001$) and during August–December ($p<0.001$). No such associations were found during

Table 2 Associations between team season injury rates (dependent variable) and winter break (explanatory variable) in the crude analyses and between team season injury rates (dependent variable) and the explanatory variables 'winter break' and 'climate region'

	Crude analyses			Adjusted analyses					Mean teams without winter break	Mean teams with winter break
Dependent variable	β for winter break (95% CI)	P values for winter break	Effect size (*r*)	β for winter break (95% CI)	P values for winter break	β for climatic region (95% CI)	P values for climatic region	Effect size (*r*)		
Injury burden										
Whole season	58.8 (40.6 to 77.0)	<0.001	0.404	43.3 (23.9 to 62.7)	<0.001	42.2 (20.2 to 64.3)	<0.001	0.465	185.9	127.0
August to December	55.7 (31.3 to 80.0)	<0.001	0.298	32.6 (6.9 to 58.4)	0.013	62.9 (33.6 to 92.1)	<0.001	0.401	202.1	146.5
January to March	79.1 (50.2 to 108.0)	<0.001	0.351	66.6 (35.2 to 98.1)	<0.001	34.4 (–1.7 to 70.5)	0.062	0.371	199.3	120.3
April to May	48.9 (13.9 to 83.9)	0.006	0.191	38.2 (–0.1 to 76.4)	0.050	29.6 (–13.8 to 73.0)	0.181	0.212	171.2	122.3
Severe injury incidence										
Whole season	0.5 (0.3 to 0.7)	<0.001	0.334	0.3 (0.1 to 0.5)	0.002	0.5 (0.3 to 0.7)	<0.001	0.430	1.6	1.1
August to December	0.5 (0.3 to 0.8)	<0.001	0.263	0.3 (–0.0 to 0.5)	0.062	0.7 (0.4 to 1.0)	<0.001	0.388	1.8	1.3
January to March	0.7 (0.4 to 1.0)	<0.001	0.291	0.5 (0.2 to 0.8)	0.003	0.5 (0.1 to 0.9)	0.012	0.334	1.7	1.0
April to May	0.3 (–0.1 to 0.6)	0.133	0.106	0.1 (–0.3 to 0.5)	0.502	0.4 (–0.0 to 0.8)	0.081	0.162	1.3	1.0
Team training attendance										
Whole season	–1.3 (–2.6 to 0.0)	0.053	–0.133	0.2 (–1.2 to 1.6)	0.778	–4.1 (–5.7 to –2.5)	<0.001	0.360	82.7%	84.1%
August to December	–0.5 (–2.1 to 1.2)	0.583	–0.038	1.2 (–0.5 to 3.0)	0.152	–4.6 (–6.6 to –2.7)	<0.001	0.313	80.2%	80.6%
January to March	–2.2 (–3.7 to –0.6)	0.006	–0.188	–0.9 (–2.5 to 0.7)	0.285	–3.5 (–5.3 to –1.6)	<0.001	0.305	82.8%	85.0%
April to May	–2.5 (–4.3 to –0.7)	0.007	–0.189	–1.1 (–3.1 to 0.8)	0.250	–3.8 (–6.0 to –1.6)	0.001	0.299	85.9%	88.4%
Team match availability										
Whole season	–1.8 (–3.1 to –0.5)	0.007	–0.186	–0.2 (–1.5 to 1.1)	0.758	–4.3 (–5.8 to –2.8)	<0.001	0.402	86.0%	87.8%
August to December	–1.1 (–2.6 to 0.4)	0.156	–0.098	0.6 (–1.0 to 2.1)	0.475	–4.5 (–6.3 to –2.7)	<0.001	0.341	85.9%	87.0%
January to March	–2.9 (–4.4 to –1.4)	<0.001	–0.250	–1.4 (–3.0 to 0.2)	0.090	–4.2 (–6.0 to –2.3)	<0.001	0.380	85.4%	88.3%
April to May	–2.7 (–4.5 to –0.9)	0.003	–0.204	–1.2 (–3.1 to 0.7)	0.217	–4.2 (–6.4 to –2.0)	<0.001	0.326	86.1%	88.8%

January–March and April–May (p=0.062 and p=0.181, respectively).

Effects of winter break on severe injury incidence

Teams without a winter break had a mean of 1.6 severe injuries per season; the corresponding incidence for teams with a winter break was 1.1 (table 2). In the adjusted analysis, we found that a winter break was associated with a lower incidence of severe injuries for two of the periods examined, the whole season (2.1 severe injuries more per season for teams without a winter break, p=0.002) and January–March (3.5 severe injuries more for teams without a winter break, p=0.003). However, there was no such association for August–December (p=0.062) or April–May (p=0.502).

The analyses also showed that teams from the northern climatic region had a higher incidence of severe injuries than teams from the southern climatic region during three of the periods studied, the whole season (p<0.001), August–December (p<0.001) and January–March (p=0.012), while there was no such association for April–May (p=0.081).

Effects of winter break on team training attendance and team match availability

The mean team training attendance for the whole season was 82.7% for teams without a winter break and 84.1% for the teams with a winter break. Team match availability was not different at 86.0% and 87.8%, respectively. In the adjusted analysis, the presence of a winter break was not associated with higher team training attendance or match availability for any of the four periods studied. Teams from the northern climatic region (76.7% of the team seasons analysed) had a lower team training attendance and team match availability than teams from the southern climatic region (23.3% of the team seasons analysed) during all periods analysed (p<0.001 in all analyses).

DISCUSSION

We report an association between the lack of a winter break and a higher injury burden, as well as an association with a higher incidence of severe injury. Specifically, we report a greater injury burden per season for teams without a winter break compared with teams with a winter break (on average 303 days lost more per season for the former). However, we found no association between the absence of a winter break and the attendance of players at team training or in match availability.

Is fatigue the problem?

This is a prospective epidemiological study revealing significant associations, but causative factors cannot be evaluated using this study design. However, we can speculate as to the effects that a lack of winter break may have on injuries and player availability. The long-term consequences of a lack of recovery were previously studied by Ekstrand *et al*[7] before and during the 2002 FIFA World Cup. That study showed that a period of densely scheduled matches may leave many players depleted of energy and both emotionally and physically fatigued, which could result in an increased risk for injury and poor performance during the following period.[7]

Fatigue could be defined as the failure to maintain a required or expected capacity[8] and is demonstrated by a decrease in physical function.[9] If a winter break allows for recovery from physiological and mental stress, one would expect a higher injury risk in the second half of the season for teams without a winter break. This study considered this hypothesis with a focus on the injury burden.

Injury burden was defined as the number of absence days/1000 hours of exposure.[4] We found a significantly higher injury burden for teams without a winter break during the second part of the season as well as the period from August to December. If fatigue and a lack of recovery is a reason for this difference, one could speculate that the summer break is too short for a full recovery after 11 months of activity. The 6-week preparation period before an upcoming season may also be too short to prepare the players to withstand the load that will be placed on them during the competitive season, especially since many top teams devote part of the preseason to promotional tours associated with long-distance travel in a short period of time. The combination of these factors could explain why teams with no winter break and a short preseason preparation period might have chronically fatigued players and more injuries as a result.

Could the predominating climate explain the findings?

The analyses in this study showed that the climate and the effect of climate on the pitches are confounding factors. The climate affected the association between winter break and team training attendance and team match availability for several of the studied periods (compare the crude analyses with the adjusted analyses in table 2).

Regional differences could also be important to consider when studying football teams from different countries.[6] Waldén *et al* studied regional differences in injury incidence in the UEFA ECIS during the 2001/2002–2009/2010 seasons.[6] They reported that overall injury incidence was higher for teams located in northern Europe with mild summers and colder winters than for teams located in southern Europe. This study covered the 2010/2011 to 2016/2017 seasons and found similar results, and regional differences are still a risk factor to consider. The crude analysis showed that the effect size (r) for the association between winter break and injury burden was 0.404 and the coefficient of determination (R^2) was 0.163, meaning that the presence of a winter break explained 16.3% of the variation in injury burden.

Could other factors influence?

Other factors potentially influencing injury rates include differences in play intensity, refereeing decisions, incidences of foul play and differences in the number of tight matches in different countries' leagues. As the relation of such factors to injury rates in different countries and leagues has not been investigated, we need to be cautious in the conclusions we draw. Our data relating to injuries are incontrovertible, but English leagues may have other factors—in addition to lack of a winter break—that explain the greater injury burden and injury severity.

Methodological considerations

The strength of this study lies in its substantial dataset, which was obtained from a homogeneous group of male professional footballers. The ECIS is an appropriate, reliable and useful tool for evaluating injury risk and injury patterns in elite male footballers.[2]

The major limitation of the study is that although we have found an association between injury risk and winter break, we cannot claim that a lack of winter break is a cause of an increased injury risk, and other factors may contribute to a higher injury risk. The English Premier League is for instance widely regarded as the most competitive of the European football leagues. There

are several teams that can compete regularly for the title, which leads to a higher proportion of the games being extremely competitive with a potential higher risk of injury.

We speculate that a lack of a winter break means insufficient physical and mental recovery with a latent cumulative fatigue, potentially contributing to more injuries. However, we have not measured fatigue in this study. Future studies including measurement of physical and mental fatigue along with player performance and well-being in relation to injury rates and player availability are needed.

CONCLUSION

We conclude that the lack of a winter break was negatively associated with the injury burden and the incidence of severe injuries. The association between the lack of a winter break and higher injury burden was present during the period before the winter break and two following periods (immediately after and towards the end of the season). The association between the lack of a winter break and a higher incidence of severe injuries was present during the period immediately after the winter break, but not before the break.

What are the findings?

- The absence of a winter break was negatively associated with injury burden both before and after the break, while the absence of a winter break was negatively associated with the incidence of severe injuries only immediately after, but not before the break.
- The absence of a winter break was not associated with lower attendance at team training sessions or availability for team matches.
- Climate and the effect of climate on the football pitches was a confounding factor, especially for training attendance and match availability.

How might it impact on clinical practice in the future?

- This study provides club medical teams where there is no winter break with compelling data to encourage their clubs to engage in formal or informal winter break programmes.
- This study can also provide club medical teams where there is a winter break with compelling data to maintain the status quo and avoid using this time to undertake commercial tours.

Correction notice This article has been corrected since it published Online First. The conclusion and 'what are the findings' statements have been updated.

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