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original research

Injury Characteristics in the German Professional Male Soccer Leagues After a Shortened Winter Break

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Context: The winter break in the top 2 German professional soccer leagues was shortened from 6.5 to 3.5 weeks in the 2009–2010 season.

Objective: To investigate whether this change affected injury characteristics by comparing the second half of the 2008–2009 (long winter break) with the equivalent period in the 2009–2010 season (short winter break).

Design: Prospective cohort study.

Setting: German male professional soccer leagues.

Patients or Other Participants: Seven professional German male soccer teams (184 players in the 2008–2009 season, 188 players in the 2009–2010 season).

Main Outcome Measure(s): Injury incidences and injury characteristics (cause of injury, location, severity, type, diagnosis), including their monthly distribution, were recorded.

Results: A total of 300 time-loss injuries (2008–2009 n = 151, 2009–2010 n = 149) occurred. The overall injury incidence per 1000 soccer hours was 5.90 (95% confidence interval = 5.03, 6.82) in 2008–2009 and 6.55 (5.58, 7.69) in 2009–2010. Match injuries per 1000 hours were 31.5 (25.0, 38.0) in the first season and 26.5 (20.2, 32.7) in the second season; the corresponding training values were 2.67 (2.08–3.44) and 3.98 (3.19–4.95), respectively. The training injury incidence (incidence rate ratio = 1.49 [95% confidence interval = 1.07, 2.08], $P = .02$) and the risk of sustaining a knee injury (incidence rate ratio = 1.66 [1.00, 2.76], $P = .049$) were higher in 2009–2010 after the short winter break; the incidence of moderate and severe injuries (time loss >7 days) trended higher (incidence rate ratio = 1.34 [0.96, 1.86], $P = .09$).

Conclusions: Shortening the winter break from 6.5 to 3.5 weeks did not change the overall injury incidence; however, a higher number of training, knee, and possibly more severe injuries (time loss >7 days) occurred.

Key Words: injury surveillance, injury incidence, epidemiology, football, inadequate recovery

Key Points

- Shortening the winter break in professional male football was not associated with a change in the overall injury incidence.
- However, the shortened winter break was associated with increased numbers of training and knee injuries. A trend toward an increased number of more severe injuries (requiring time loss >7 days) was also evident.

International (mainly European) data on injury characteristics in professional male soccer are available. Reported overall injury incidence rates (training and match injuries) vary between 6.2 and 9.4 per 1000 hours of soccer exposure. Injury rates are between 16.6 and 42.0 per 1000 match hours and between 2.9 and 11.8 per 1000 training hours.[1–4]

In 2009–2010, the in-season winter break in Germany's top 2 professional soccer leagues (1st and 2nd Bundesliga) was shortened from 6.5 to 3.5 weeks, mainly for financial reasons. One season runs from August to mid-December (first half) and from January to May (second half). The break starts just before Christmas, when half of the 34 seasonal-league games are played. The change in winter-break duration did not affect the schedule congestion of the matches during the season, as the competition period of the second half of the season remained constant at 16 weeks.

In a written survey, about 50% of the clubs involved raised concerns that a shortened winter break would negatively affect the risk of injury. They reasoned that reducing the break by 3 weeks would not allow for sufficient recovery between the season halves.

Researchers have looked into the various effects of acute fatigue (within 72–96 hours of exposure). Acute fatigue not only seems to increase the injury rate and injury severity in matches[5–7] but also promotes high-risk biomechanics[8–11] and may reduce physical performance. The latter appears to be acutely disturbed but restored by 96 hours.[5,7,12] Whether cumulative fatigue can induce similar effects is largely unknown. To the best of our knowledge, only 1 group[13] has assessed the long-term consequences of a lack of recovery: 10 weeks ahead of the 2002 World Cup, 60% of the players who participated in more than 1 match per week subsequently underperformed or suffered an injury during the tournament.

The main aim of our observational study was to test the hypothesis that a shortened in-season winter break negatively affected injury rates. We also evaluated whether a shortened break had an effect on injury characteristics.

Table 1. Anthropometric and Exposure Data

Variable	Season(s)			Interseason Comparison *P*
	Both	2008–2009	2009–2010	
No. of teams	7	7	7	
No. of players[a]	254	184	188	
Player anthropometrics, mean ± SD				
Age, y	25.2 ± 4.2	25.2 ± 4.1	25.2 ± 4.3	.95
Height, cm	184 ± 7	184 ± 7	184 ± 7	.45
Weight, kg	79 ± 7	79 ± 7	79 ± 7	.61
Exposure time per player, mean ± SD, h				
Overall (training + match)	129.8 ± 49.7	139.1 ± 46.2	120.7 ± 44.6	<.001
Match	14.7 ± 11.3	15.5 ± 12.3	13.9 ± 10.3	.15
Training	115.1 ± 43.5	123.5 ± 52.9	106.8 ± 39.1	<.001

[a] 118 players participated in both seasons.

METHODS

The study was designed as a prospective, observational cohort study. The shortening of the winter break in Germany's 2 highest professional soccer leagues starting with the 2009–2010 season was officially announced in the fall of 2008. Shortly thereafter, the involved teams (all teams of the 1st and 2nd Bundesliga) were notified by the German Soccer League and asked to participate in the study. Baseline information, injury characteristics (severity, location, type, cause of injury, diagnosis), and exposure time for training and competition were recorded by the teams' medical staffs according to the Fédération Internationale de Football Association consensus statement on injury studies in soccer.[14] Data were prospectively collected over the second half of the 2008–2009 and 2009–2010 seasons. The starting point was January 1, and the end point was the completion of the season in May. In the 2009–2010 season, the winter break was shortened from 6.5 to 3.5 weeks. The competition period of the second half of the season remained unchanged at 16 weeks. The time schedules of the different seasons were as follows: the first part of the 2008–2009 season lasted from August 15 to December 12, 2008 (in 2009–2010, August 7–December 18, 2009) and the second part from January 30 to May 23, 2009 (in 2009–2010, January 15–May 8, 2010). Teams participating in the National Cup final (1 week after the last match of the season) continued recording data until the final. The preparation phrases for the 2010 Soccer World Cup and the World Cup itself were not included in the study.

The regional ethics committee of the Saarland County Medical Association (Saarländische Ärztekammer) approved the study. All players gave their written informed consent before the start of the study.

Participants

Nine professional soccer teams took part in the 2008–2009 season and 7 in the 2009–2010 season. Of the initial 9 clubs, 1 club had to be excluded as it was relegated from the 2nd league after the first season. Another club terminated participation because of time constraints. Seven clubs could be analyzed for 2 seasons: 5 from the Premier League and 2 from the Second League. There were no further dropouts, and all players from the 7 teams participated. Players who were injured at the beginning of the season were included; however, their preexisting injuries were not taken into account. Twenty-six goalkeepers (10.2%), 80 defenders (31.5%), 94 midfielders (37.0%), and 54 strikers (21.3%) took part. Player characteristics are listed in Table 1.

Calculation of the 95% confidence interval

$$incidence \ x/\div \ e^{1.96 \, x \sqrt{\frac{1}{number \ of \ injuries}}}$$

Figure 1. Calculation of the 95% confidence interval for injury incidences.

Injury Definition and Injury Recording

Players' injuries were prospectively recorded. The *time-loss* definition was according to the Fédération Internationale de Football Association consensus statement[14]: a player was injured as long as he could not fully participate in training or competition. Injuries were classified in 5 categories according to the time loss (match or training): *slight* (0 days), *minimal* (1–3 days), *mild* (4–7 days), *moderate* (8–28 days), or *severe* (>28 days). If a player had to stop training or participating in a match because of injury on 1 day but could participate the next day, the time loss was recorded as zero days. Clubs did not consistently report on time-loss injuries of zero-day duration, so we had to exclude these injuries from the analysis. Absent days were cross-checked against the exposure registration form for accuracy. In case of simultaneous injuries, only the main (ie, more severe) injury was considered. If the injury was caused by a single identifiable event, it was categorized as *traumatic*. If repetitive microtrauma was involved, the injury was classified as *overuse*. The injury form of the consensus statement was translated into German; alternatively, clubs involved in European club competitions could send the original Union of European Football Associations form[15] instead. Injuries were diagnosed by the team physician(s) or physiotherapist(s) or both. At least 1 physiotherapist was on-site during each training session. The clubs were regularly contacted by phone, e-mail, or both to encourage the medical staffs to promptly record and transmit the information. Information was cross-checked for completeness and aligned with data on soccer injuries available via the Internet and print media. If a discrepancy was noted between the media reports and the physiotherapists' reports, the club was contacted for further details.

Exposure Registration

According to the Fédération Internationale de Football Association consensus statement, *training* was defined as

Table 2. Cause of Injury, Days of Absence, and Injury Severity[a] Extended on Next Page

	Overall						Training	
	2008–2009		2009–2010				2008–2009	
Variable	No.	Incidence	No.	Incidence	IRR	P	No.	Incidence
Cause of injury								
Trauma	98	3.83 (3.14, 4.67)	99	4.35 (3.57, 5.30)	1.14 (0.86, 1.50)	.37	34	1.49 (1.06, 2.09)
Overuse	53	2.07 (1.58, 2.71)	50	2.20 (1.67, 2.90)	1.06 (0.72, 1.56)	.77	27	1.18 (0.81, 1.73)
Days of absence, median (quartiles)	6 (3–13)		8 (3–22)			.33	7 (3–12)	
Injury severity								
All injuries	151	5.90 (5.03, 6.82)	149	6.55 (5.58, 7.69)	1.11 (0.89, 1.39)	.37	61	2.67 (2.08, 3.44)
Minimal	43	1.68 (1.25, 2.27)	45	1.98 (1.48, 2.65)	1.18 (0.78, 1.79)	.45	17	0.75 (0.46, 1.20)
Mild	44	1.72 (1.28, 2.31)	28	1.23 (0.85, 1.78)	0.72 (0.45, 1.15)	.17	17	0.75 (0.46, 1.20)
Moderate	44	1.72 (1.28, 2.31)	50	2.20 (1.67, 2.90)	1.28 (0.85, 1.92)	.24	18	0.79 (0.49, 1.25)
Severe	20	0.78 (0.50, 1.10)	26	1.14 (0.78, 1.68)	1.46 (0.82, 2.62)	.20	9	0.39 (0.21, 0.76)

Abbreviation: IRR, incidence rate ratio.

[a] IRRs compare the 2009–2010 season with the 2008–2009 season using the z statistic.

[b] $P < .05$.

any physical activity carried out under the guidance of the clubs' coaches. Exposure time was registered on a daily basis in minutes, and reasons for nonparticipation (injury, illness, "other reason") were provided. When information was missing (6.1%), exposure time was estimated using the mean value of the same team. League, National Cup, European Cup, Champions League, National Team, and friendly games (against other clubs only) counted toward match exposure time.

Statistical Analysis

We calculated means and standard deviations for continuous data and frequency tables for categorical data. Anthropo-

Table 3. Injury Location and Type by Severity of Injuries and Season Extended on Next Page

Orchard Sports Injury Classification System	Total No. of Injuries, Both Seasons (2008–2009/2009–2010)	No. of Injuries by Severity (Days Lost)	
		Minimal (1–3 d)	
		2008–2009	2009–2010
Injury location			
Head/face	11 (4/7)	0	3
Neck/cervical spine	2 (0/2)	0	1
Shoulder/clavicle	4 (4/0)	3	0
Upper arm	0 (0/0)		
Elbow	1 (1/0)	0	0
Forearm	0 (0/0)		
Wrist	1 (0/1)	0	1
Hand/finger/thumb	5 (3/2)	1	2
Sternum/ribs/upper back	7 (3/4)	1	0
Abdomen	3 (1/2)	1	1
Lower back/pelvis/sacrum	18 (5/13)	2	5
Hip/groin	12 (5/7)	1	1
Thigh	88 (50/38)	9	10
Knee	62 (25/37)	7	10
Lower leg/Achilles tendon	24 (14/10)	4	3
Ankle	50 (26/24)	8	7
Foot/toe	12 (10/2)	6	1
Injury type			
Fracture	15 (8/7)	1	1
Other bony injury	5 (0/5)	0	0
Dislocation/subluxation	2 (2/0)	1	0
Sprain/ligament injury	74 (33/41)	8	9
Meniscus/cartilage lesion	9 (6/3)	0	0
Muscle injury/strain	98 (53/45)	11	10
Tendon injury	15 (10/5)	1	4
Hematoma/contusion	54 (28/26)	16	13
Abrasion	4 (1/3)	0	1
Laceration	3 (2/1)	1	0
Concussion	4 (1/3)	0	2
Nerve injury/dental lesion	0 (0/0)		
Other injury	17 (7/10)	4	5

Table 2. Extended From Previous Page

Training				Match					
2009–2010				2008–2009		2009–2010			
No.	Incidence	IRR	P	No.	Incidence	No.	Incidence	IRR	P
45	2.23 (1.67, 3.00)	1.50 (0.96, 2.34)	.07	64	22.30 (17.45, 28.49)	54	20.66 (15.83, 26.98)	0.93 (0.65, 1.33)	.68
35	1.73 (1.25, 2.42)	1.47 (0.89, 2.43)	.13	26	9.06 (6.17, 13.30)	15	5.74 (3.46, 9.52)	0.63 (0.34, 1.20)	.16
8 (3–16)			.47	5 (3–14)		7 (3–26)			.49
80	3.98 (3.19, 4.95)[b]	1.49 (1.07, 2.08)	.02	90	31.5 (25.0, 38.0)	69	26.5 (20.2, 32.7)	0.84 (0.62, 1.15)	.28
24	1.19 (0.8, 1.78)	1.60 (0.86, 2.98)	.14	26	9.06 (6.17, 13.30)	21	8.03 (5.24, 12.33)	0.59 (0.31, 1.13)	.11
14	0.70 (0.41, 1.18)	0.93 (0.46, 1.90)	.85	27	9.41 (6.45, 13.72)	14	5.36 (3.17, 9.05)	0.57 (0.30, 1.09)	.09
28	1.39 (0.96, 2.02)	1.76 (0.98, 3.19)	.06	26	9.06 (6.17, 13.30)	22	8.42 (5.54, 12.79)	0.93 (0.53, 1.64)	.80
14	0.70 (0.41, 1.18)	1.76 (0.76, 4.08)	.18	11	3.83 (2.12, 6.92)	12	4.59 (2.61, 8.09)	1.20 (0.53, 2.72)	.67

metric data were normally distributed and compared using an unpaired Student *t* test. Because exposure times and severity of injuries (days of absence) were not normally distributed, we compared them using the Mann-Whitney *U* test.

Injury incidence was calculated per 1000 hours of soccer exposure (number of injuries/hours of exposure $\times$ 1000). The calculation of the 95% confidence interval for incidences is presented in Figure 1.

Differences in injury incidences between the seasons were considered significant if the 95% confidence interval of the incidence rate ratio did not include 1.0 and if the *P* value of the *z* statistic was $< .05$.[15,16]

RESULTS

Risk Exposure, Injury Incidence, and Cause of Injury

The overall exposure to soccer from January to May was 25 576 hours in the 2008–2009 season (22 816 training and 2870 match hours) and 22 748 hours in the 2009–2010 season (20 116 training and 2613 match hours). The

Table 3. Extended From Previous Page

No. of Injuries by Severity (Days Lost)					
Mild (4–7 d)		Moderate (8–28 d)		Severe (>28 d)	
2008–2009	2009–2010	2008–2009	2009–2010	2008–2009	2009–2010
2	0	2	3	0	1
0	1	0	0	0	0
0	0	0	0	1	0
0	0	1	0	0	0
0	0	0	0	0	0
1	0	1	0	0	0
1	2	1	1	0	1
0	0	0	0	0	1
1	3	1	5	1	0
1	1	3	2	0	3
20	8	19	18	2	2
3	8	6	7	9	12
3	4	5	3	2	0
11	1	4	7	3	9
1	0	1	1	2	0
2	2	3	2	2	2
0	1	0	1	0	3
0	0	1	0	0	0
11	6	7	11	7	15
0	0	1	0	5	3
19	9	21	21	2	5
1	0	5	1	3	0
8	8	4	4	0	1
0	0	1	2	0	0
1	0	0	1	0	0
1	0	0	1	0	0
1	2	1	3	1	0

Table 4. Most Common Injury Subtype and Diagnosis[a] Extended on Next Page

Injury Type/Diagnosis	Overall						Training	
	2008–2009		2009–2010				2008–2009	
	No.	Incidence	No.	Incidence	IRR	*P*	No.	Incidence
Muscle strain/injury	53	2.07 (1.58, 2.71)	45	1.98 (1.48, 2.65)	0.95 (0.64, 1.42)	.82	21	0.9 (0.60, 1.41)
Sprain/joint injury	41	1.60 (1.18, 2.18)	44	1.93 (1.44, 2.60)	1.05 (0.69, 1.60)	.83	16	0.7 (0.43, 1.14)
Groin injury	5	0.20 (0.08, 0.47)	7	0.31 (0.15, 0.65)	1.57 (0.50, 4.96)	.44	1	0.04 (0.01, 0.31)
Hamstrings injury	21	0.82 (0.54, 1.26)	20	0.88 (0.57, 1.36)	1.07 (0.58, 1.98)	.83	6	0.26 (0.12, 0.59)
Knee-ligament injury (including distortion)	12	0.47 (0.27, 0.83)	20	0.88 (0.57, 1.36)	1.87 (0.92, 3.83)	.09	4	0.17 (0.07, 0.47)
Anterior cruciate ligament rupture	2	0.08 (0.02, 0.31)	3	0.13 (0.04, 0.41)	1.69 (0.28, 10.1)	.57	2	0.09 (0.02, 0.35)
Ankle sprain (including syndesmosis injury)	21	0.82 (0.54, 1.26)	16	0.7 (0.43, 1.15)	0.86 (0.45, 1.64)	.64	9	0.39 (0.21, 0.76)

Abbreviations: IRR, incidence rate ratio; NA, not applicable.

[a] IRRs compare the 2009–2010 with the 2008–2009 season using the *z* statistic.

average training and overall exposure time per player were higher in 2008–2009 ($P < .001$; Table 1).

A total of 300 time-loss injuries (training n = 141, match n = 159) were recorded (season 2008–2009 n = 151, season 2009–2010 n = 149).

The training injury incidence was higher in the 2009–2010 season ($P = .02$), whereas the overall and match injury incidences were comparable between seasons. On average, a player sustained 0.8 injuries per half season lasting for 14.8 days. This meant that at any given club event, whether it was for training or a match, 3 players on average (or 11% of the squad) were absent because of injury. There was no difference between seasons (P = .33–.49; Table 2). Traumatic injuries accounted for 66%; the rest were attributed to overuse (Table 2).

Injury Severity, Location, and Types

The distribution of injury severity is shown in Tables 2 and 3. Taking the more severe injuries (ie, moderate and severe injuries, absence ≥8 days) into account, the training injury risk was significant ($P = .02$) and the overall injury risk by trend ($P = .09$) increased in the second season. Injury types and locations are presented in Tables 3 and 4. The risk of sustaining a knee injury was higher in 2009–2010 ($P = .049$).

Most Common Injury Subtype and Diagnosis

The single most common injury was a thigh-muscle strain, representing 26.3% (n = 79 of 300) of all injuries, with the posterior thigh being the most affected (hamstrings: 13.7%, n = 41 of 300). On average, each team sustained 5.6 thigh-muscle injuries per half season, with an average duration of 10.6 days. Sprain/joint injuries (P = .07) and knee-ligament injuries (P = .05) tended to occur more often during training sessions in the season with the shortened winter break. The same applied to knee-ligament injuries when overall exposure was taken into account (P = .09; Table 4).

Monthly Injury Distribution

In the second season, the training and overall injury risks were higher in January (training $P = .02$; overall $P = .04$), whereas the match injury risk was lower in March ($P = .03$; Figure 2A through C).

DISCUSSION

Our main finding was that the shortened winter break did not affect the overall and match injury incidences. However, it was associated with a significant increase in the incidence of training and knee injuries and a trend toward an increased risk of sustaining injuries lasting more than 7 days (ie, injuries categorized as moderate or severe).

The 2009–2010 increase in the training injury rates was mainly caused by the difference in January, the first month of return to training after the winter break. The shortened winter break limited the time for recovery before the second part of the season, which could explain higher initial fatigue levels at the start of the January training. The influence of acute fatigue on injury risk has repeatedly been studied[8–11,17]; however, there is a scarcity of literature addressing the cumulative aspects of fatigue. Some of the findings related to acute fatigue seem readily transferable. In general, acute muscular fatigue has been proposed as a risk factor for joint and ligament injuries. Muscles contribute to joint stability, especially in muscle-controlled joints. Furthermore, they can act as agonists for ligaments (eg, the hamstrings muscles for the anterior cruciate ligament), further promoting joint stability and protecting the ligament. Muscles have the capacity to absorb energy, thus reducing potentially detrimental forces on joints, ligaments, etc.[17] These factors could explain the higher number of training injuries at the beginning of the year and also the higher number of knee injuries in this study. In addition, acute fatigue impairs neuromuscular control and biomechanics. Both factors have been studied extensively with regard to anterior cruciate ligament injuries. Knee- and hip-flexion angles decrease and proximal tibial anterior shear force and knee-varus moments increase when performing stop-jump tasks or sidestep-cutting tasks under fatigued conditions, thus facilitating the dynamic knee-valgus position as a risk factor for anterior cruciate ligament ruptures.[8–11] Furthermore, the risk of muscle injuries has been linked to a fatigued state, as muscles can absorb less energy in this condition before stretching to the point of injury.[17] In most of these studies, the authors investigated acute fatigue, and their samples differed from ours. Knee-ligament injuries in soccer have been investigated mainly in adolescent female participants because they are at an increased risk. Whether these data are transferable to men is unclear.

Training content is a top-secret matter and protected by club privacy, so we could not ask for details. However, it

Table 4. Extended From Previous Page

Training				Match					
2009–2010				2008–2009		2009–2010			
No.	Incidence	IRR	*P*	No.	Incidence	No.	Incidence	IRR	*P*
22	1.09 (0.72, 1.66)	1.19 (0.65, 2.16)	.57	32	11.15 (7.88, 15.76)	23	8.80 (5.85, 13.24)	0.79 (0.46, 1.35)	.39
25	1.24 (0.84, 1.84)	1.77 (0.95, 3.32)	.07	25	8.71 (5.86, 12.89)	19	7.27 (4.64, 11.40)	0.83 (0.46, 1.52)	.55
3	0.15 (0.05, 0.46)	3.40 (0.35, 32.4)	.29	4	1.39 (0.52, 3.71)	4	1.53 (0.57, 4.08)	1.10 (0.28, 4.39)	.89
8	0.40 (0.20, 0.80)	1.51 (0.53, 4.36)	.44	15	5.23 (3.15, 8.67)	12	4.59 (2.61, 8.09)	0.88 (0.41, 1.88)	.72
11	0.55 (0.3, 0.99)	3.12 (0.99, 9.80)	.05	8	2.79 (1.39, 5.57)	9	3.44 (1.79, 6.62)	1.24 (0.48, 3.20)	.66
1	0.05 (0.01, 0.35)	0.57 (0.05, 6.25)	.64	0		2	0.77 (0.19, 3.06)	NA	NA
10	0.5 (0.27, 0.92)	1.26 (0.50, 3.10)	.62	12	4.18 (2.37, 7.36)	6	2.30 (1.03, 5.11)	0.55 (0.21, 1.46)	.23

seems conceivable that coaches could have increased the intensity and the competitiveness of training early in the year because of the limited preparation time, further promoting an increased level of fatigue. A contributing factor on the players' side might have been that they had less time to secure a place on the first squad. As a consequence, they might have trained harder and more competitively. Higher competitive levels also have been reported to negatively affect injury rates.[18]

Training content itself could have been changed as a matter of prioritization, possibly adding to the fatigue and injury problem. For instance, the time spent on endurance, sport training, and preventive measures could have been sacrificed (eg, for game tactics, technical skills). Better-conditioned soccer players can better cope with training load and are less injury prone.[19] Diminished attention to preventive measures could have played a role, especially given the higher number of knee and more severe injuries. Preventive measures have been developed to address more severe injuries (anterior cruciate ligament ruptures in young female soccer players),[8,10,20] as these injuries affect the clubs' and the players' finances and health the most. Effective programs tend to run for at least 6 to 8 weeks and consist of multiple components. They are typically initiated in the preseason at a frequency of 2 to 3 times per week and are performed on a maintenance level (1–2 times per week) during the season. First, the preparation time was only 3.5 weeks, which is too short for the recommended initial period. Second, multicomponent programs require a large amount of training time, and coaches might be more inclined to cut back or even abandon such programs because of time constraints.[8,19–26]

The study encountered a few methodologic limitations. Because of the way the clubs' medical staffs recorded data, time-loss injuries of zero-day duration remained unrecognized. This documentation practice can produce inconsistencies when the data are compared with those from other soccer injury studies. Delayed injury documentation and data transfer might be major contributing factors here. However, it is likely that minor injuries are commonly underreported. According to Bjørneboe et al,[27] the real injury incidence is likely to be underestimated by at least 20% if the club's medical staff prospectively collects data as suggested in the Fédération Internationale de Football Association injury consensus statement. To minimize such underreporting, we also obtained information from the mass media. Accurate documentation including minor injuries would be very helpful in the future, bearing in mind that minor injuries may precede more severe injuries.

We investigated the second half of the season only. A higher number of participating clubs would have been desirable, yet this was deemed impossible in the professional soccer setting because study participation was optional and could not be made mandatory. Therefore, our results might not necessarily represent accurate injury characteristics because the entire season and league were not considered. A purely media-based German soccer injury study conducted in the 2004–2005 season revealed a higher match injury incidence (37.5 per 1000 match hours).[3]

We did not ask for training protocols. Thus, assumed changes in training content remained unrecognized, but it is nearly impossible to obtain accurate data on training contents because of club privacy.

An inherent problem of this study design is that it lacks a controlled and standardized intervention and so does not allow for a definitive statement on a possible causal relationship between the shortening of the winter break and the changes in injury characteristics. Nonetheless, the decision of the German Soccer League to shorten the winter break offered the unique opportunity to investigate the influence of an impaired in-season recovery period under real-life conditions in one of the best soccer leagues in the world.

CONCLUSIONS

The shortened winter break in the 2009–2010 season of the German professional male soccer leagues did not affect the overall and match injury incidences. However, it was associated with an increase in training and knee injury incidences. The increased training injury risk was mainly caused by a difference in recovery time in January, the first month of return to football after the in-season break. Too little recovery time between the halves of the season could have led to increased fatigue levels, promoting risky biomechanics and suboptimal neuromuscular control and provoking injuries. High-intensity and competitive training could have further contributed to an increased fatigue level. Less attention placed on the development of sound basic physical fitness and preventive measures might also serve as possible explanations, the latter aspect contributing to the higher number of more severe joint-ligament injuries. Thus, careful planning and monitoring of training and recovery, as well as the continuous pursuit of multicomponent injury-prevention programs, may help to reduce injury risk when an in-season break is shortened (or lacking). Further studies would be needed to investigate the underlying causes and to look into causal relationships;

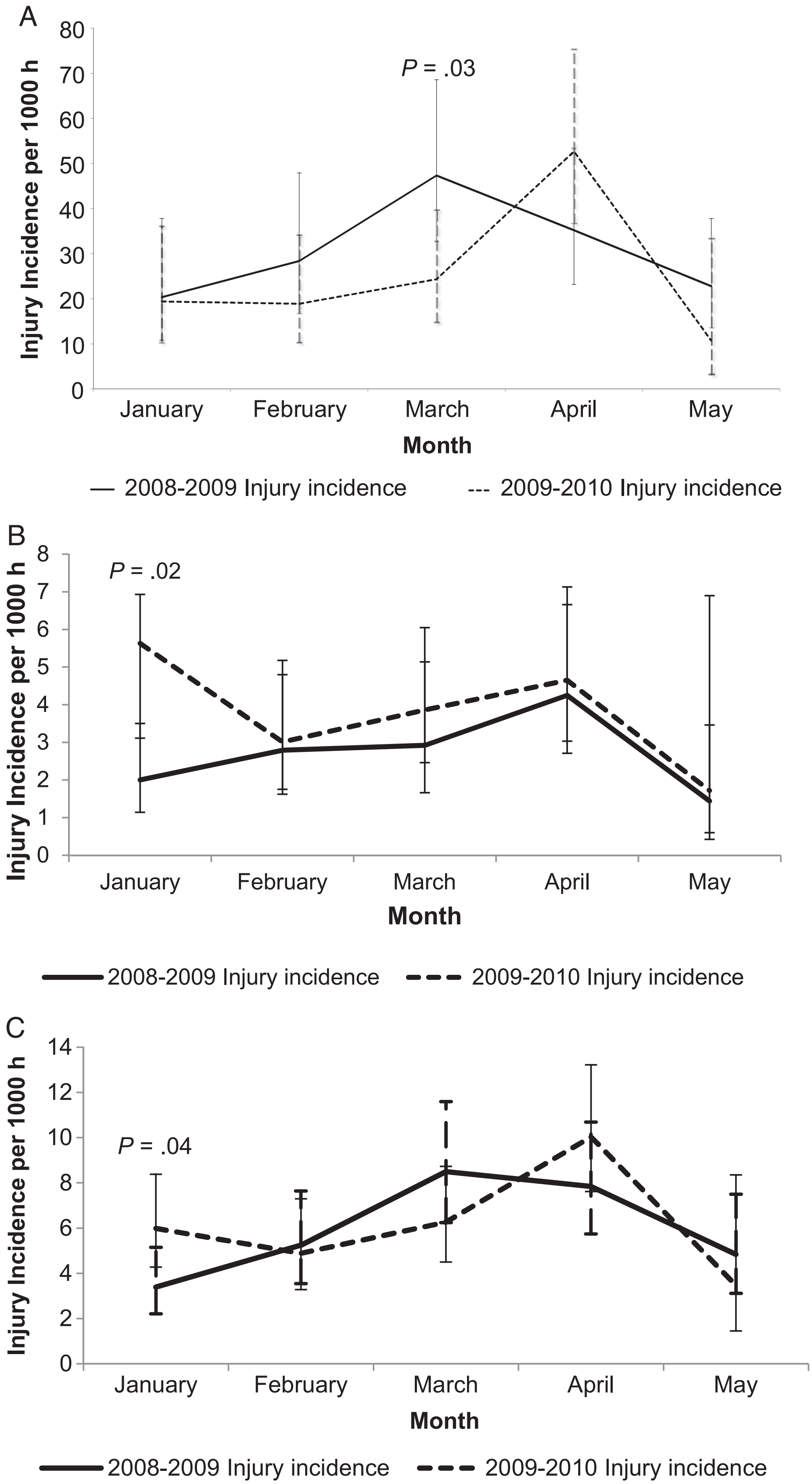

Figure 2. A, Monthly match injury incidence. B, Monthly training injury incidence. C, Monthly overall injury incidence. *P* values are calculated using the *z* statistic.

however, this could be almost impossible, as it is highly unlikely that the winter-break duration will be changed again.

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