SUPPLEMENT

Causation of injuries in female football players in top-level tournaments

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Background: Analyses of tackle parameters in injury situations have provided valuable information regarding men's football. However, there are no similar data for women's football.
Objective: To categorise the tackle mechanisms leading to injury in elite women's football.
Study design: Retrospective video analysis of injury situations.
Methods: Events associated with all reported injuries during six women's top-level tournaments were analysed on video recordings for tackle parameters.
Results: More than half of all injuries were due to tackles from the side (52%, 103/200), whereas tackles from behind were much less commonly involved in injury situations (11%, 21/200). One-footed (65%, 130/200) and upper body (21%, 42/200) tackle actions were most common. Sliding-in tackles leading to injury were the least likely to be sanctioned by match referees. Tackling players (45%, 90/200) were almost as likely to be injured as the tackled player (55%).
Conclusion: The present study found differences between injury mechanisms in women's football and previously published data on men's football. Further research, especially using video analysis, is needed for a better understanding of risk situations in football.

Football carries a high risk of injury.[1 2] In Europe it is responsible for between a quarter and a half of all sports-related injuries.[3–5] In Switzerland, the cost associated with these injuries is approximately US$120 million every year at 2003 values, which is nearly 0.5% of the gross domestic product.[5]

Many studies have identified player-to-player contact as the major cause of injury,[2 6–11] and video analysis has been used to analyse tackling parameters in injury situations.[7 12–15] Fuller *et al* found that a clash of heads and two-footed tackles had the highest likelihood that a tackled player would sustain an injury,[13] whereas Arnason *et al*[14] identified ''breakdown attacks, defensive tackling and heading duels'' as the major causes of injuries in international football. Although football injuries are of equal concern for male and female players, almost all reported data are on male players. We found only one investigation of injury causation in female football players, and but it focused solely on head injuries.[15] This lack of information is surprising, as women's football has been increasing in popularity—for example, in the past 10 years the number of licensed female football players has increased by 160% in Germany, by more than 250% in Switzerland, by 210% in the USA and more than 30% in Sweden.[16]

Public interest in women's football is high[17] and growing. The number of international women's matches is increasing,[18] and women's youth tournaments have been integrated into the official calendar of the Fédération Internationale de Football Association (FIFA). It has been reported that ''the game is rapidly changing not only in playing dynamics but also the distinct athletics of the players''.[19] This reflects a positive trend in the international standing of female footballers and of the sport in general. However, enhanced physical condition, and especially match exposure, may lead to an increased risk of injuries.[19–21] Recent publications have reported lower rates of injury for women than for men,[8 22 23] whereas older studies mainly show the opposite.[24–27] However, Giza *et al*[22] found that age and skill level may have more of an influence that sex alone, and this is supported by several previously published studies.[1 8 10 27] There is, therefore, a need to investigate further the mechanisms of injury in women's football to provide a better understanding of the risk factors involved and to develop effective strategies for prevention of injuries.[28]

The present study aimed to:

(1) analyse the various tackling parameters that lead to injury in women's football;
(2) compare the findings with results reported previously for men's football.[13]

METHOD

We included six top-level tournaments (1999 and 2003 FIFA Women's World Cup, 2000 and 2004 Women's Olympic Football Tournament, 2002 and 2004 FIFA U-19 Women's World Championship) in the study. Injuries were reported by the team doctors on the official FIFA Medical Assessment and Research Centre (F-MARC) injury report form, including information about the location, type and severity of the injury. All match injuries that needed medical attention were recorded in accordance with the definitions and procedures described by Fuller *et al*[29] and procedures adopted in previous studies on injury surveillance conducted by F-MARC. We obtained videotapes of each match from FIFA Information Services. Injury events that could be identified on the videotapes were included in the analysis.

Tackle assessment

To allow comparisons with men's football, we used the methods previously used for assessing tackles.[13 17] The tackled player was defined as the player being in control of the ball at the time of the tackle or as the player from the team in control of the ball immediately prior to the incident, such as in the case of passes, free kicks and corner kicks.

The following tackle parameters were recorded for each injury incident:

- tackling direction of the tackling player with respect to the tackled player (behind, side, front);

- tackling mode of the tackling player (staying on feet, sliding-in, jumping vertically);
- tackling action adopted by the tackling player (one-footed, two-footed, use of arms, use of upper body, use of head);
- match referee's decision (non-foul, foul, yellow card, red card);
- on-pitch treatment (defined as any medical attendance seen on video);
- time in the match;
- striking player (defined as the player putting in active force in the incident leading to injury).

For analysis of the inter-rater reliability, two observers independently categorised tackle direction and mode of 10% of the injury situations. Agreement in each parameter was 96%. Data related to the stage of the tournament, the injured player's playing position and whether the injured player was replaced were obtained from the official FIFA reports and statistics, which are produced for each tournament.[30–35] Non-contact injuries were treated separately. They were analysed for time in the match, mechanism of injury (running, shooting, change in direction, contact with the ball or other object) and playing position of the injured player.

In addition, we recorded all on-pitch treatments in the matches analysed for injury situations to compare their incidence with the team doctors' post-match injury reports. Furthermore, the tackle mechanism responsible for all the on-pitch treatments that did not result in a post-match injury report was analysed for one tournament (FIFA Women's World Cup 2003).

Data presentation

The ''tackle code'' represents a combination of the two tackling parameters—direction and mode—of the tackling player, resulting in a total of nine combinations. (Abbreviations used for tackle direction: B, from behind; S, from the side; F, from the front; and for tackle mode: st, staying on feet; si, sliding-in; vj, vertical jump.)

Calculation of incidence

We defined the incidence of injuries as the number of injury reports/1000 player hours, on the basis of 22 players/game, with a game lasting for 90 min. Extra time and reduced numbers of players on the field were not taken into account.[8 17 22 36] The rate of injury for each playing position was calculated on the assumption that all teams played in the 1:4:4:2 formation (one goalkeeper, four defenders, four midfielder and two forwards).[12 14 17]

Data analysis

We analysed the data using frequencies, cross-tabulations and χ^2 tests. The 95% confidence intervals were calculated using the formula:

$$95\%\ \text{CI} = \text{incidence} \pm 1.96 \times (\text{incidence/square root (number of incidents)})$$

Statistical significance was accepted at $p<0.05$.

RESULTS

We assessed video recordings of 142 team matches, corresponding to 4686 player hours of match exposure. A total of 293 post-match reports of injury were provided by the team doctors; this corresponds to a rate of 62.5 injuries/1000 player hours. Of the 293 injuries recorded, 60 (20.5%) could not be investigated (event not identified on video: 48; event identified on video but tackle details not visible: 9; video of incident not available (one match): 3). We found no significant differences between the information on the medical reports associated with the injury incidents and those not found on the video recordings.

In the 233 injury situations analysed, 200 (86%) injuries resulted from player-to-player contact and 33 (14%) from non-contact incidents.

Injury location

Contact injuries

Most of the 200 contact injuries identified were to the head/neck (20%), ankle (19%) and thigh (13%) with nearly 60% of the injuries occurring on the lower extremities (table 1). The number of head/neck, upper body and lower extremity injuries differed significantly as a function of the tackle code ($p<0.001$) and tackle action ($p<0.001$).

Non-contact injuries

Of the 33 non-contact injuries identified, 7 were to the head/neck, 6 to the upper body, and 19 to the lower extremities. The injuries to head/neck and torso were all caused by impact with the ball. Injuries to the lower extremities were caused mainly by shooting (53%) and running (42%); in three incidents (16%) a change of direction while running or shooting was the cause of injury.

Tackle parameters

Of the 200 contact injuries, 110 (55%) were sustained by the tackled and 90 (45%) by the tackling player. The distributions of tackle direction and mode were similar for injuries sustained by tackled and tackling players. More injury events involved tackles from the side (52%) than from the front (38%) or behind (11%). Incidents in which the tackling player stayed on her feet and approached from the side or from the front accounted for 44% of all injuries. Tackles involving one-footed or upper body action accounted for most of the injuries (86% *v* 14% of the rest of the actions; $p<0.001$; see table 2). All five injuries caused by a two-footed tackle were sustained by the tackled player.

In 85% (169/200) of all injury sequences the tackling player was the striking player—hence the active player in the challenge for the ball. However, in 40% (80/200) of the injury

Table 1 Tackle and injury characteristics of contact situations as function of the location of the injury

	Head/neck	Torso	Thigh	Knee	Lower leg	Ankle	Foot	Other*
Total	40	20	26	19	22	38	7	25
Tackle code								
B-st	2	0	1	1	0	4	1	1
B-si	2	0	0	0	0	2	1	0
B-vj	4	1	0	0	0	0	0	1
S-st	5	4	12	6	6	13	0	7
S-sl	2	0	2	7	8	6	1	3
S-vj	7	5	1	0	0	2	0	4
F-st	5	5	5	1	3	7	2	5
F-si	3	2	4	4	5	4	2	3
F-vj	10	3	1	0	0	0	0	1
Action								
One-footed	11	9	20	17	17	32	7	14
Two-footed	0	0	1	1	3	0	0	0
Upper body	11	11	5	1	2	4	0	8
Heads	15	0	0	0	0	0	0	0
Others	3	0	0	0	0	2	0	3
Playing position								
Goalkeeper	4	3	2	3	0	1	2	5
Defender	16	9	11	7	7	16	1	12
Midfielder	11	5	10	5	8	14	3	1
Forward	9	2	3	4	8	7	1	7

B, from behind; F, from the front; S, from the side; si, sliding-in; st, staying on feet; vj, vertical jump.
*Upper extremity, shoulder, hip and groin.

Table 2 Tackle parameters and frequencies

Tackle code	Action						Injuries/1000 tackles*	Time loss injuries† n/N	Referee decision‡
	Injuries	One-footed	Two-footed	Upper body	Heads	Others			
Women's football									
B-st	10	9	0	1	0	0	3.4	6/9	6
B.si	5	5	0	0	0	0	10.3	1/4	4 (1)
B-vj	6	0	0	2	4	0	2.6	2/4	2
S-st	54	36	0	13	1	4	5.9	24/49	19 (4)
S-si	30	28	1	0	0	1	19.7	8/25	4
S-vj	19	4	0	12	2	1	8.7	9/17	8 (1)
F-st	33	23	0	9	1	0	21.5	14/26	14
F-si	28	21	4	1	0	2	66.7	14/23	9 (3)
F-vj	15	4	0	4	7	0	42.3	6/12	6
All	200	130	5	42	15	8	9.6	84/169	72 (9)
Men's football									
B-st	19	17	0	0	0	2	12.7	3/7	11 (1)
B.si	6	6	0	0	0	0	14.8	2/4	4 (2)
B-vj	18	1	0	13	3	1	15.9	3/6	3
S-st	62	47	1	3	0	11	31.6	22/52	36 (7)
S-si	31	29	1	0	0	1	27.2	14/25	15
S-vj	18	1	1	11	1	4	62.3	7/16	4
F-st	21	19	0	1	0	1	15.3	1/10	12 (4)
F-si	16	10	5	0	1	0	25.5	4/6	7 (1)
F-vj	9	3	0	3	1	2	61.2	4/4	4 (1)
All	200	133	8	31	6	22	23.3	60/130	96 (16)

B, from behind; F, from the front; S, from the side; si, sliding-in; st, staying on feet; vj, vertical jump.
*Tscholl *et al*.[17]
†Information missing.
‡Figures in parentheses represent the number of fouls in which a yellow card was awarded.

events, the striking player was injured. We did not find any significant differences between the tackle parameters with respect to the ''tackling'' or the ''striking'' player.

Referee's decision

Of all incidents leading to injuries, 36% (72/200, see table 2) were sanctioned by the match referee as foul play. Injuries caused by foul play were no more likely to result in time loss (foul: 58%, 36/62; non-foul: 45%, 48/107) or on-pitch treatment (foul: 72%, 92/128; non-foul: 64%, 46/72). The percentage of injuries regarded as being caused by foul play did not vary during the course of the match. Incidents in which the tackled player was injured were no more likely to be sanctioned by the referee than incidents in which the tackling player was injured (44% (48/110) and 27% (24/90), respectively).

Sliding-in tackles were the least likely to be sanctioned by the referee regardless of whether the tackled or the tackling player was injured (27% (17/63) and 40% (55/137), respectively). Referees' decisions did not differ significantly with regard to tackle directions.

Loss of time

Half of all injuries (50%) resulted in time loss regardless of whether the tackling or the tackled player had been injured. The injuries associated with loss of time did not differ significantly from injuries with no time loss with respect to injury location, playing position of the injured player, stage of the match, time in the match, tournament type, referee's decision, tackle direction or mode and contact/non-contact injuries.

From the video recordings, we identified 14 of the 17 reported injuries that team doctors had estimated would lead to an absence from football activities for more than seven days. Four of these resulted from non-contact situations (ligament rupture in the knee: two, thigh strain: two), and the four players were replaced within 10 min. Six of the 10 contact injuries identified affected the tackled player. An equal number of injuries were caused by tackles from the side and from the front, and there no injuries from tackles from behind. Three incidents were sanctioned by the referee, of which one received a yellow card. In 9/10 contact injuries, the player was replaced within 10 min.

Among the 200 contact injuries, 72 (36%) of the injured players were replaced; 60% of these replacements took place within 10 min following the injury. However, an additional 34 (17%) injuries occurred in the last 10 min of the match.

Time in the match, tournament type and stage of the tournament

We did not find any significant differences in the incidence of injuries between the two halves of a match or the tournament type (table 3). The incidence also did not differ significantly between the group and knockout stages of the tournament, although in knockout matches 2.5 times more injuries occurred in the last 15 min of the second half of the match compared with any other time of the game ($p<0.01$).

Playing position

Contact injuries

The rate of injury was highest for forwards (49.3 injuries/1000 player hours) followed by goalkeepers and defenders (46.9 and 46.4/1000 player hours, respectively); the rate was lowest for midfielders (34.6/1000 player hours). The differences were not significant. The incidence of all injuries and those leading to loss of time did not differ significantly for the four playing positions. We did not find any significant difference with regard to injury location as a function of playing positions (table 4). In terms of the mode of tackle, injuries to goalkeepers were mainly caused by tackles from the front (70% *v* 34% for the back and side, respectively; $p<0.01$), whereas among defenders and forwards most injuries were caused by tackles from the side (61% respectively 57% (forwards) *v* 39% (goal keepers and midfielder); $p<0.01$). The defenders were the only players who sustained more injuries as the tackling rather than the tackled player (61% and 39%, respectively; $p<0.001$).

Table 3 Number of injuries and tackle parameters as a function of the time period of the match

Time (min)	Contact injuries	Injuries/1000 tackles*	Time loss injuries† n/N	Referee's decision‡	Tackle code B-st	B-si	B-vj	S-st	S-si	S-vj	F-st	F-si	F-vj	Tackle action One-footed	Two-footed	Upper body	Heads	Other	Non-contact injuries
0–15	25	6.9	14/22	12 (1)	2	1	2	4	3	6	1	3	3	12	0	6	6	1	6
16–30	35	10.8	14/33	13 (1)	1	2	1	7	3	6	8	6	1	22	0	11	1	1	4
31–45+	33	10.4	14/29	13 (2)	1	0	0	6	6	2	9	7	2	24	1	6	2	0	3
46–60	29	8.2	9/24	9 (2)	2	0	0	11	5	2	3	2	4	23	1	1	3	1	7
61–75	35	10.1	14/27	10 (2)	2	0	2	12	7	2	4	4	2	22	1	6	3	3	8
76–90+	43	11.1	19/34	15 (1)	2	2	1	14	6	1	8	6	3	27	2	12	0	2	5
	200	9.6	84/169	72 (9)	10	5	6	54	30	19	33	28	15	130	5	42	15	8	33

B, from behind; F, from the front; S, from the side; si, sliding-in; st, staying on feet; vj, vertical jump.
*Tscholl *et al*, 2006.[17]
†Information missing.
‡Figures in parenthesis represent the number of fouls in which a yellow card was awarded.

Non-contact injuries

A third of all non-contact injuries occurred in forwards. The rate of injury for non-contact situations was 12.9 injuries/1000 player hours for forwards, 9.4 for goalkeepers, 6.5 for defenders and 4.1 for midfielders. The number of non-contact injuries in the second half was 30% greater than the first half, although the difference was not significant. More than 90% of players with non-contact injuries (31/33) and contact injuries (188/200) played from the beginning of the match, whereas only 77% of players with contact injuries started the game. We did not find any significant differences in non-contact injuries with respect to type of tournament, stage or time in the match.

Medical reports

The post-match medical reports and the information obtained from the video analysis were in agreement for contact/non-contact classification of the injury in 89% (173/195) of the cases, for referee's decision in 68% (127/189) and for on-pitch treatment in 88% (171/194).

On average, we identified 1.4 (range 0.6–2.6 per tournament) on-pitch treatments per game on video, but these were not associated with a reported injury. The detailed analysis of the FIFA Women's World Cup 2003 showed no significant differences between the 39 reported injuries and the 31 on-pitch treatments without a physician's report with respect to the three main tackle parameters (direction, mode and action), referee's decision or for playing positions.

DISCUSSION

Our analysis of six women's football tournaments shows a lower rate of injuries among female players compared with their male counterparts.[23] Recent reports in the literature agree well with this finding,[8 22 37] although earlier reports did not find a noticeable difference.[19 38] Despite scientific research into football injuries over the past three decades, no reduction in injuries has been found up to the present time.[39] Several approaches to reduction of injuries have been proposed in recent years: some focus on the players and their training methods,[40 41] awareness[42] and tackling behaviours,[7 13 14 43] and others on the referee and their decisions[6 44 45] as well as their physical demands.[46] The present study focused on tackling mechanisms leading to injuries in women's football.

We identified 80% of all reported injuries on the video recordings; previous studies using video sequences of reported

Table 4 Characteristics of injury situations as functions of playing position

	Goalkeeper	Defender	Midfielder	Forward	All
Injuries, n (%)	20 (10)	79 (40)	59 (30)	42 (21)	200 (100)
Tackled	13 (65)	31 (39)	34 (58)	32 (76)	110 (55)
Tackling	7 (35)	48 (61)	25 (42)	10 (24)	90 (45)
Rate of injury (injuries/1000 h)	46.9	46.4	34.6	49.3	42.7
Tackle code					
B-st	2	4	1	3	10
B.si	0	2	2	1	5
B-vj	1	2	1	2	6
S-st	1	22	16	15	54
S-sl	1	17	5	7	30
S-vj	1	9	7	2	19
F-st	7	9	12	5	33
F-si	6	7	12	3	28
F-vj	1	7	3	4	15
Non-contact injuries, n (%)	4 (12)	11 (33)	7 (21)	11 (33)	33 (100)
On-pitch treatment, n (%)	16 (80)	55 (70)	40 (68)	27 (64)	138 (69)

B, from behind; F, from the front; S, from the side; si, sliding-in; st, staying on feet; vj, vertical jump.

What is already known on this topic

- Player-to-player contact is a major cause of injury in international top-level football.
- Several video-based investigations in men's football have identified high-risk tackling mechanisms, and these have led to changes in the laws of the game.

What this study adds

- The comparison of women's and men's football in terms of tackle mechanisms leading to injury showed some differences.
- Tackles from behind were rarely seen in injury situations in female players, whereas sliding-in tackles were shown to have a much higher risk than in men's football.
- The use of elbows in aerial challenges was rarely a cause of injury in women's football.
- These sex differences in tackle properties need to be taken into account by match referees to ensure the safety of players.

injuries identified between 43% and 82%.[7 13 14] The completeness of data can therefore be considered to be a strength of the present study. Of all reported injuries, 14% were due to non-contact mechanisms, and taking into account previous studies, this is the lowest percentage to have been found for women's football.[4 19 26] Non-contact injuries often occur away from the player with the ball; these incidents will most probably occur off-camera and therefore cannot be analysed with this approach. A similar proposition for non-contact injuries have been made for men's football.[6 8 11 36]

An interesting finding of our study is that 45% of the injuries were incurred by the tackling player (95% CI 39% to 51%). The player therefore was not in possession of the ball—rather challenging for its tenure. Studies in men's football have reported 26% (95% CI 22% to 30%)[13] and 34% (95% CI 27% to 41%)[12] of the injured were tackling.

As tackle information, based on the definition used this study, always referred to the actions of the tackling player, we also focused on the ''striking player''—the player putting the active and decisive force into the incident. It seems to be promising for two reasons:

- The active move in the challenge for the ball leading to injury is of interest.
- The match referee often sees the active player in a contest, regardless of whether this player is in possession of the ball.

Using this approach—for example, in a situation when the player in possession of the ball tries to ward off an opponent's challenge with his or her elbow—it would be the tackled player's actions that would be recorded rather than the tackling player's actions. We assumed that the player subjected to the ''striking'' force would be injured in most situations. This hypothesis, however, proved to be incorrect, as we did not find any significant difference between the data analysed on the basis of the ''tackling'' and the ''striking'' player. We therefore decided for this study to focus on the tackling player, thus allowing comparisons of tackle parameters between women's and men's football.

Tackles from behind accounted for 11% of all injuries, whereas in men's tournaments more than twice as many injuries have been reported to result from these incidents ($p<0.025$).[13] Injuries resulting from sliding-in tackles were the least sanctioned situations by the match referee (27%). This is surprising as sliding-in tackles showed the highest risk of injury among all three tackle modes in women's football (26 *v* 7 injuries/1000 tackles for the other modes; $p<0.001$; see table 2). The lower risk of injury associated with sliding-in tackles in men's football may be explained by better timing and technique in such situations; however, further studies are needed to clarify the issue of sex differences. In men's football aerial challenges have been shown to lead to many injuries and they are less likely to be sanctioned by the referees than tackles in which the player staying on their feet or was sliding in (26% *v* 56%; $p<0.05$) (see table 2). This was not observed in women's football, and we rarely saw the women use their hands in aerial challenges, which in men's football has been reported to be an important mechanism of injury.[13]

Overall, 72 (36%) of 200 injury situations were sanctioned by the referee with a free kick (for tackling player: 61; for tackled player: 11); a yellow card was always attributed to the tackling player. In the comparable data from men's football, a slightly higher percentage of injuries resulted from fouls (48%) and yellow cards (see table 2), although the differences were not significant. These results are similar to values reported in previous studies (29–50%).[8 12 36 44] As reported previously by Hawkins and Fuller,[12] no correlation was found between injuries leading to loss of time and the referee's decision. It is surprising that injuries to the tackling and the tackled player were not different with respect to loss of time as observed in men's football.[13] We therefore conclude, bearing in mind the injury repartition between the tackled and the tackling player, that at least in women's football ''tackling'' and ''being tackled'' have a similar risk for injuries with and without loss of time.

In the present study, we identified four non-contact and 10 contact injuries leading to moderate/severe injuries (leading to absence of more than a week from football). No injury was due to a tackle action from behind, which underscores the success of the international ruling body for football against dangerous tackles.[47] However, match referees award a free kick in only three cases, one of which was a yellow card against the tackling player. Chomiak *et al* found that professional fouls were responsible for up to a third of all severe injuries.[48] Pilz *et al* reported that young players learn early to break the rules in the interest of success,[49] therefore improving player behaviour has a crucial role in reducing the number of injuries. We did not find any difference in the number of injuries recorded in the first and second half of the match. Some previous studies support this observation[11 23 48] but other studies have reported more injuries in the second half.[2 12] There was a tendency for more contact injuries towards the end of each half but not for non-contact injuries; this confirms findings of previous studies among professional and youth players.[2 12 23 36 50]

With regard to playing positions, our results show that forwards were the most injured and midfielders the least injured, which is in agreement with some previous studies[19 21] although Giza *et al* found that midfielder sustained the most injuries.[22] Data from men's football mainly show that there is no difference between playing positions.[13 43 48] Differences in injury location with regard to playing position, as found previously for male goalkeepers,[51 52] could not be affirmed in the present study.

Data from the team doctors' medical reports showed a high correlation with the results from the video analysis in terms of contact/non-contact mechanism (89%) and medical treatment

of the player (88%), whereas the correlation was moderate (68%) for the referee's decision. However, the lack of concordance between the information from the medical report and the video sequences may partly be due to a wrong selection of the video recordings, especially for non-contact injuries.

In all FIFA tournaments, the official medical team of each country participating in a tournament is required to record "any physical complaint incurred during the match that received medical attention from the team physician regardless of the consequences with respect to absence from the match or training"[23 29]; this requirement includes on-pitch treatments. On average, we found that 1.4 on-pitch treatments/match identified on video did not have a post-match medical report. It is recognised that players may simulate an injury to gain an advantage: in such cases the doctor therefore has to make a judgement whether an injury actually occurred. Nevertheless, we analysed the non-reported incidents of on-pitch treatments for the 2003 World Cup and compared the main tackle parameters of tackle code, playing position and time of the incident with the same parameters for reported injuries. There were no significant differences. Therefore we can assume that if the number of injuries in the six tournaments were under-reported, the causation of injuries in women's football would not be altered. However, the applied method may be further developed as follows:

- each on-pitch treatment needs clarification regarding possible injury;
- the video assessment of each injury should be done directly after the game, in the presence of a member of the official medical team and a member of FIFA.

CONCLUSIONS

The present study has identified several differences in the causation of injuries between women's and men's football. The main differences are a much higher risk of injury in sliding-in tackles and a lower risk for tackles from behind in women's football, emphasising that findings in women and men cannot be transferred. Furthermore, our reporting system proved to be reliable, although there may have been some under-reporting. A few changes to the method are worth considering for future studies.

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