The association between ground hardness and injury over the course of a season in professional football

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Leicester City Football Club
• “An employer must make every reasonable practical effort to ensure the health and safety of employees at work”.
• The pitch is their place of work.
Fear of escalating injury costs

Dyer straits! Five starts, no goals...and Kieron Dyer will cost West Ham 30million quid!

EXCLUSIVE By MATT BARLOW
Last updated at 11:18 AM on 9th February 2010

Kieron Dyer’s West Ham nightmare will cost the club close to a staggering £30million over the course of his four-year contract at Upton Park.

Dyer has started only five Barclays Premier League games for the Hammers in two-and-a-half years and has yet to score a goal for the club.

The former England midfielder is fast becoming an emblem of the reckless financial regime of Icelandic owner Bjorgolfur Gudmundsson and his sidekick Eggert Magnusson.

West Ham’s medical team raised doubts about Dyer’s signing when he arrived from Newcastle in August 2007 but the transfer was rushed through before the deadline because the owners were keen to showcase top-class players.

Dyer, who has managed just 558 minutes of League action for the club, signed a four-year deal reported to be worth £70,000 a week but broke his right leg soon after his debut and missed more than a year as he suffered complications in his recovery.
Pitch construction and maintenance
Current standards player surface

• IOG 2001
  • High: 65-120 (G).
  • Standard: 55-140 (G).
  • Basic 35-200 (G).
  • Why?
FURIOUS FERGUSON BLAMES WEMBLEY PITCH FOR MICHAEL OWEN'S KO

7th March 2010

By Daily Star Reporter

SIR ALEX FERGUSON has blamed the poor Wembley pitch for ending Michael Owen's season.

Owen was forced off with a badly torn hamstring after scoring in United's 2-1 Carling Cup Final win over Aston Villa last Sunday.

And Fergie blasted: "It's a bad one. The muscle has come off the bone and it requires surgery. I'm certain the pitch had a lot to do with it."

Wembley's controversial pitch is to be replaced for the 10th time in three years due to the combined effects of a harsh winter and freak weather conditions.

The decision to change the surface again was taken on Wednesday night after the England match against Egypt. But the FA insist it is not a knee-jerk reaction to negative comments from Ferguson and Aston Villa boss Martin O'Neill after the final last Sunday.
Current standards player surface

- IOG 2001:
  - High: 65-120 (G).
  - Standard: 55-140 (G).
  - Basic 35-200 (G).
- What values do injuries occur?
- What types of injuries are they likely to be?
- Links need to be made.
Aetiology of injury within football

- Risk of injury >1000 high risk industrial occupations.
- **Intrinsic:**
  - Age, previous injury, core stability, biomechanics, ethnicity.
- Extensive literature addressing intervention protocols.
Aetiology of injury within football

- Participation exposes individual to external or extrinsic risk.
  - **Extrinsic Factors**
  - Pitch/Stadia surroundings.
  - Opponents.
  - Footwear.
  - Climatic conditions.
  - Surface Traction.
  - Ground hardness.
Available evidence:

Ground hardness & injury

- Orchard (2001 & 2002) study AFL
- No objective research in professional football
Research questions in professional football

- Is injury associated with ground hardness?
- Is there a difference between training and match data?
- Does pitch construction affect injury?
Methodology

• LCFC Professional Players.
• N=42.
• Mean age 24.26 yrs (17-39).
• Injury incidence: training and matches prospectively recorded.
• Injury defined: ‘any pain or disability suffered by a player during a match or training session and subsequently assessed by the head physiotherapist’.
Methodology

• Ground hardness: 2.25kg Clegg-Hammer.

• 15 sites: 5 readings (1m²) each site.

• Prior to every training session or match.
Results: Seasonal variability

Graph 1. Ground hardness variability for training and match data over the 2008-2009 season
<table>
<thead>
<tr>
<th>Pitch type</th>
<th>Exposure</th>
<th>Mean Hardness</th>
<th>Standard deviation</th>
<th>Range</th>
<th>Average Injuries per game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand soil mix</td>
<td>100</td>
<td>81.50</td>
<td>5.06</td>
<td>116.20–53.20</td>
<td>0.60</td>
</tr>
<tr>
<td>Sand soil mix</td>
<td>13</td>
<td>74.6</td>
<td>7.77</td>
<td>112.79–51.39</td>
<td>1.23</td>
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<tr>
<td>Fibre sand</td>
<td>40</td>
<td>88.5</td>
<td>5.7</td>
<td>111.4–58.0</td>
<td>1.35</td>
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<tr>
<td>Desso</td>
<td>2</td>
<td>75.8</td>
<td>7.4</td>
<td>94.07–57.59</td>
<td>1.50</td>
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</tbody>
</table>
Results

Average monthly ground hardness and incidence of injuries in Training

<table>
<thead>
<tr>
<th>Calender Month</th>
<th>Ground hardness (G)</th>
<th>Total Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Sept</td>
<td>20.00</td>
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<tr>
<td>Mar</td>
<td>80.00</td>
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<tr>
<td>Apr</td>
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<td>90.00</td>
</tr>
<tr>
<td>May</td>
<td>100.00</td>
<td>100.00</td>
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</table>
Results

Average monthly ground hardness and incidence of injuries in Matches

<table>
<thead>
<tr>
<th>Calendar Month</th>
<th>Ground Hardness (G)</th>
<th>Total Injuries</th>
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</thead>
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<tr>
<td>Aug</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Sept</td>
<td>35</td>
<td>7</td>
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<tr>
<td>Oct</td>
<td>65</td>
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<td>Jan</td>
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<td>Mar</td>
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<td>25</td>
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<tr>
<td>Apr</td>
<td>70</td>
<td>20</td>
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</table>
The association between ground hardness and all injuries incurred during training in the 2008-9 season, $r=0.36$ (P<0.001)
Results: correlation and binary logistic regression analysis

The association between ground hardness and all **match-day** injuries incurred in the 2008-9 season (P>0.05)
• Elementary differential calculus.
• Minimum risk of injury occurs when ground hardness = $0.59/(2\times0.003)=98$ (G)
Discussion

- Pitches soften over the course of the season.
- Different findings to that of AFL and Rugby.
- Training.
- Matches.
- Limitations.
The Future

- Continue longitudinal study.
- Objective tests moisture, traction, hardness, GPS.
- Performance Indicators as a factor of ground hardness.
- Prozone information: Heat Maps reflect a more accurate exposure to the surface.
Thank you & Questions?
Appendix

• 1. Raw training data.
• 2. Raw Match Data.
• 3. Bibliography.
## Results: Table 1. Training exposure, injuries and ground hardness data over the course of the 2008-2009 season.

| Month   | Number training sessions | Total Hours trained (Hours:Mins) | Average ground hardness | Standard deviation of hardness | Total injuries | Muscle Injury | Soft tissue | Ligament | Joint | Tendon | Nerve |
|---------|--------------------------|----------------------------------|-------------------------|-------------------------------|----------------|--------------|-------------|-----------|--------|--------|-------|-------|
| August  | 17                       | 29:38                            | 84.21                   | 3.73                          | 6              | 0            | 0           | 2         | 4      | 0      | 0     |
| September | 13                      | 22:00                            | 86.91                   | 13.42                         | 8              | 4            | 0           | 2         | 2      | 0      | 0     |
| October | 14                       | 23:49                            | 91.84                   | 7.36                          | 0              | 0            | 0           | 0         | 0      | 0      | 0     |
| November | 11                      | 22:26                            | 81.57                   | 5.74                          | 18             | 4            | 4           | 8         | 0      | 2      | 0     |
| December | 9                       | 15:46                            | 80.50                   | 8.88                          | 10             | 0            | 4           | 2         | 2      | 2      | 0     |
| January | 18                       | 21:01                            | 77.80                   | 7.82                          | 18             | 6            | 4           | 2         | 4      | 2      | 0     |
| February | 21                      | 22:57                            | 68.95                   | 13.23                         | 18             | 4            | 6           | 2         | 2      | 4      | 0     |
| March   | 16                       | 25:33                            | 71.53                   | 5.77                          | 22             | 4            | 12          | 0         | 6      | 0      | 0     |
| April   | 10                       | 15:45                            | 77.96                   | 4.61                          | 14             | 6            | 0           | 2         | 4      | 2      | 0     |
## Appendix 2: Raw Match Data

Table 2. Match exposure, injuries and ground hardness data over the course of the 2008-2009 season.

<table>
<thead>
<tr>
<th>Month</th>
<th>Number matches</th>
<th>Total Match Hours (Hours:Mins)</th>
<th>Average ground hardness</th>
<th>Standard deviation of hardness</th>
<th>Total injuries</th>
<th>Muscle Injury</th>
<th>Soft tissue</th>
<th>Ligament</th>
<th>Joint</th>
<th>Tendon</th>
<th>Nerve</th>
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<td>89.89</td>
<td>3.83</td>
<td>14</td>
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<td>7:30</td>
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<td>16.74</td>
<td>14</td>
<td>6</td>
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<td>4</td>
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<td>81.79</td>
<td>14.92</td>
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Bibliography


Orchard, J. (2002) Is there a relationship between ground and climatic conditions and injuries in football? Sports Medicine, 32 (7): 419-432


