Climatic Influence on Home Advantage in Gulf Region Football
Statistical Analysis using International Match Outcomes

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1 OBJECTIVES

While the relevance of time-motion analysis to determine fatigue occurrence in match-play has recently been questioned (Carling, 2013), reductions in match-running performance during football competition in hot *vs.* cool conditions highlights the importance of heat acclimatisation. This is of utmost consideration for teams playing away matches at higher temperature and/or humidity (Grantham et al., 2010), as it can adversely affect players' thermoregulatory control (Cheuvront et Haymes, 2001; Vihma, 2010). However, no study has yet focused on the influence of heat stress on football home advantage at an international level.

Therefore we investigated the impact of climatic variables on international football results and scores in the specific context of the World Cup 2022 perspective by applying statistical analyses aiming to control for factors including the home advantage and the difference in FIFA ranking between national squads.

2 METHODS

2.1 Data Collection and Analysis

Relevant information on football match outcomes and environmental conditions data were extracted from two websites: (i) the official internet website of FIFA in order to collect FIFA-recognised Olympic and A level football results, scores and ranking for six national teams representing Gulf Cooperation Council (GCC), and (ii) "Weather Underground" website centralizing climatic data from weather stations owned by government agencies referenced by the World Meteorological Organization (WMO). It was used to collect both home countries' and opponents' average dry bulb temperature (°C) and relative humidity (%) of the month preceding the matches. Temperature and humidity of the day for all matches for the three different venues (home, played in GCC; away, played in the opponent' country; or neutral, played neither at home nor away) were also granted.

Six variables were defined: (i) the probability of a favourable outcome (i.e. win or draw vs. loss) (ii) the difference between the number of goals scored and the number of goals conceded (ΔGoals), (iii) the difference in team FIFA-ranking (ΔRank), (iv) the home advantage along with (v) the temperature (ΔT) and (vi) the humidity (ΔH) differences between the home venue of a specific team and that of the match venue. Two additional variables were used to determine the best environmental predictor for the probability of favourable outcome and ΔGoals: (vii) the heat index (ΔHI) and (viii) the wet bulb globe temperature (WBGT) (ΔWBGT) difference between the home venue of a specific team and that of the match venue.

2.2 Statistics

Generalised linear mixed models with a logit link function for a binomial residual distribution and a random intercept for country were developed. The parameter estimates were reported as odds ratios (OR) for the favourable outcome or beta coefficient (β) for the ΔGoals with 95% of confidence interval (95% CI). For all procedures, a P-value <0.05 was considered as cut-off for significance.

3 RESULTS

A total of 2008 games over 55 years between 1957 and 2012 were used.

In GCC region, home teams have greater probability of a favourable outcome ($P<0.001$) and higher ΔGoals ($P<0.001$) than their opponents. After adjustment for ΔRank, home advantage and ΔH, ΔT

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was clearly identified as a significant explanatory variable. With every 1°C increase in temperature, both the probability of favourable outcome [OR=1.02 (95% CI 1.01; 1.02, P<0.001] and ΔGoals [β=0.02 (0.01; 0.04), P<0.001] increased. ΔH appeared to be of lower importance than ΔT in affecting the favourable outcome [OR=1.00 (1.00; 1.01); P>0.05] and ΔGoals [β=0.01 (0.01; 0.01); P<0.001]. Meanwhile, the probability of favourable outcome and ΔGoals decreased [OR=0.99 (0.98; 0.99) and β=-0.02 (-0.02; -0.02), respectively; both P<0.001] when playing against a stronger opponent.

To determine the best climatic predictor on the likelihood of a probability of favourable outcome or on ΔGoals, the different environmental variables collected or calculated were compared after adjustment for ΔRank and home advantage. While ΔT was significant (P<0.001), adding ΔH was found to be of lower importance in affecting the match outcomes (see above). Replacing these two variables by ΔHI decreased the model fit and appeared non-significant. Finally, when using ΔWBGT, both the probability of favourable outcome [OR=1.02 (95% CI 1.01; 1.03); P<0.001] and ΔGoals [β=0.03 (95% CI 0.02; 0.05); P<0.001] increased with a similar reading than as for ΔT. These relationships were highlighted by plotting the different climatic variables against ΔGoals (figure 1).

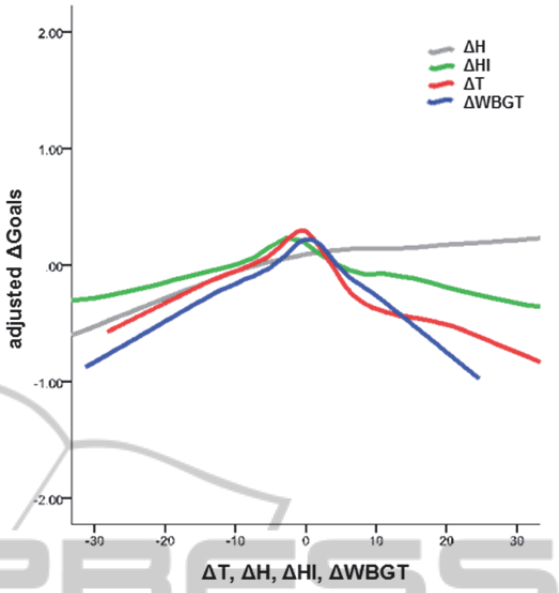

Figure 1: Relationship between temperature (ΔT), humidity (ΔH), heat index (ΔHI), wet bulb globe temperature (ΔWBGT) differences and the adjusted ΔGoals.

4 DISCUSSION AND CONCLUSIONS

Our results showed that the differences in heat stress conditions between home and away teams significantly affect the outcome of international football matches in the GCC region and therefore represent an integral component of the home advantage in these hot countries. Hot weather teams (i.e. GCC), presumably better heat-acclimatised, tend to have greater probability of favourable outcome and higher ΔGoals at home with an increase in ΔT. However, ΔRank plays an important role in our dataset which tends to disguise the impact of the environmental conditions.

Finally, our results suggest that temperature and WBGT approximation, but not humidity or heat index, are more likely to reflect the impact of environmental conditions on match performance.

REFERENCES

Carling C., 2013. Interpreting Physical Performance in Professional Soccer Match-Play: Should We be More Pragmatic in Our Approach? *Sports Med* [Epub ahead of print].

Cheuvront S. N., Haymes E. M., 2001. Thermoregulation and marathon running: biological and environmental influences. *Sports Med* 31(10): 743-62.

Grantham J., Cheung S. S., Connes P., Febbraio M. A., Gaoua N., Gonzalez-Alonso J. et al., 2010. Current knowledge on playing football in hot environments. *Scand J Med Sci Sports* 20, Suppl 3: 161-7.

Vihma T., 2010. Effects of weather on the performance of marathon runners. *Int J Biometeorol* 54(3): 297-306.