Title
Heat acclimation of a professional soccer referee prior to the 2022 FIFA World Cup: A case study

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Background
The 2022 FIFA World Cup was held in Qatar, where environmental conditions were expected to present a thermoregulatory challenge for referees. Athletes typically undertake heat acclimation programmes prior to major sporting events occurring in the heat. However, these programmes are typically based on completing multiple sessions within a short period of time (~10-14 days). Logistical challenges arise when referees still have officiating duties during this acclimation window.

Aim
To document the heat acclimation programme used by a referee prior to the 2022 FIFA World Cup.

Methods
One male professional English referee (age: 44 years) undertook a heat acclimation programme over 22 days. On days one (pre-intervention [PRE]) and 22 (post-intervention [POST]), a heat tolerance test (30 minutes running at 9 $km \cdot h^{-1}$ with 2% gradient in 40ºC and 40% relative humidity) was performed. Core body temperature, skin temperature, heart rate, sweat rate, thermal sensation and thermal comfort were measured. In the 19 days between tests, various methods of heat exposure were used to overcome logistical constraints. Seven sessions were performed in the environmental chamber (ranging between 60-90 minutes, 30-40ºC and 40-70% relative humidity), two 30-minute saunas at 90ºC and two unsupervised 30-minute hot baths at ~40ºC. Additionally in this 19-day period, the referee officiated three English Premier League and two Champions League matches.

Results
Compared with the PRE test smaller increases during the POST test were observed for core temperature (change [range], PRE: 1.74ºC [36.66-38.40]; POST: 1.52ºC [36.48-38.00]) and heart rate (PRE: 109 $b \cdot min^{-1}$ [58-167]; POST: 104 $b \cdot min^{-1}$ [58-162]). Compared with the PRE test greater increases in the POST test were observed for skin temperature (PRE: 3.4ºC [33.3-36.7]; POST: 3.5ºC [32.7-36.2]) and sweat rate (PRE: 1.94 $L \cdot h^{-1}$; POST: 2.27 $L \cdot h^{-1}$). Thermal sensation (mean: PRE: 6.3 AU; POST: 6.5 AU) was rated higher and thermal comfort rated lower (PRE: 3.2 AU; POST: 2.5 AU) in the POST test compared with the PRE test.

Conclusion
The acclimation programme elicited positive changes in physiological measures during exercise in the heat, despite the chaotic officiating schedule of the referee during the programme. This highlights that a variety of heat acclimation methods can be effectively employed by practitioners to overcome logistical constraints.