Comparing Microclimates of Artificial Turf and Natural Grass Fields in Hot Weather

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Background

Artificial turf sports fields are increasingly popular due to their durability, consistent playability, and lower maintenance costs (1). One concern, however, is that artificial turf tends to get hotter than natural grass, raising questions about whether this increases risk of heat-related illness in athletes.

While turf surfaces are often significantly warmer than grass on sunny days (1), athletes typically have limited direct contact with the ground, especially when wearing shoes. Therefore, the air temperature just above the surface, known as the microclimate, is more relevant to heat stress.

Although few studies have examined this, some evidence suggests that air temperature over artificial turf is higher than above grass (1,2). However, heat stress is influenced not only by air temperature but also by humidity and solar radiation (3,4). Wet bulb globe temperature (WBGT), which combines these factors, has been found to be similar over both surfaces (1,5). This may be due to artificial turf retaining less moisture than grass, resulting in lower humidity that offsets the higher air temperature (6).

Recent Investigation

We conducted a field study comparing environmental heat stress on adjacent artificial turf (2" Slit-Film [DoublePlay Natural], FieldTurf, Calhoun, GA) and natural grass fields during hot weather. The turf (baseball outfield) and grass (football) fields were located approximately 275 meters apart at a sports complex in Sioux Falls, SD, with minimal structures or trees to influence conditions. Both field locations were also located approximately 2 km from a National Weather Service (NWS) station, which provided reference values for this investigation. Data were collected on days with forecasted highs of 26.7°C (80.0°F) or above, during morning (7:30–9:30 AM), afternoon (1:00–4:00 PM) and evening (6:30–8:30 PM) periods to capture variations in solar exposure and environmental conditions. All measurements were taken between July 13 and July 25, 2025.

At each site, a portable weather station (5400 Heat Stress Tracker, Kestrel Instruments, Boothwyn, PA) was positioned at a height of 1.2 m (4.0 ft), consistent with international guidelines for heat safety monitoring (7). Measurements included surface temperature, air temperature, relative humidity, wind speed, and WBGT. Pairwise comparisons using paired t-tests were performed to assess differences in environmental measures between turf and grass.

Findings

Across 11 sessions (two in the morning, three in the afternoon, and six in the evening), the average ambient temperature recorded by the NWS was 27.1 ± 3.1°C (80.7 ± 5.5°F), with a relative humidity of 74 ± 9%, corresponding to a heat index of 29.4°C (85.0 °F).

Surface temperatures were significantly higher on artificial turf (34.9 ± 11.4°C [94.8 ± 20.6°F]) than on grass (24.0 ± 4.6°C [75.3 ± 8.2°F]; P < 0.001)(Figure 1A). Surface temperatures on turf (22.9–57.9°C [73.2–136.2°F]) also had greater variability compared to grass (19.2–32.7 °C [66.6–90.9°F]). Air temperature at 1.2 m above turf (28.4 ± 2.8°C [83.1 ± 5.0°F]) was also significantly higher than above grass (27.4 ± 2.8 °C [81.3 ± 5.0°F]; P < 0.001)(Figure 1B), while relative humidity was significantly lower on turf (65.3 ± 0.1% versus 70.1 ± 0.1%]; P < 0.001)(Figure 1C). Despite these differences, WBGT values at 1.2 m were nearly identical (Turf: 27.02 ± 2.34 °C [80.6 ± 4.2°F]; Grass: 26.94 ± 2.52 °C [80.5 ± 4.5°F]; P < 0.001)(Figure 1D), suggesting similar overall heat stress conditions.

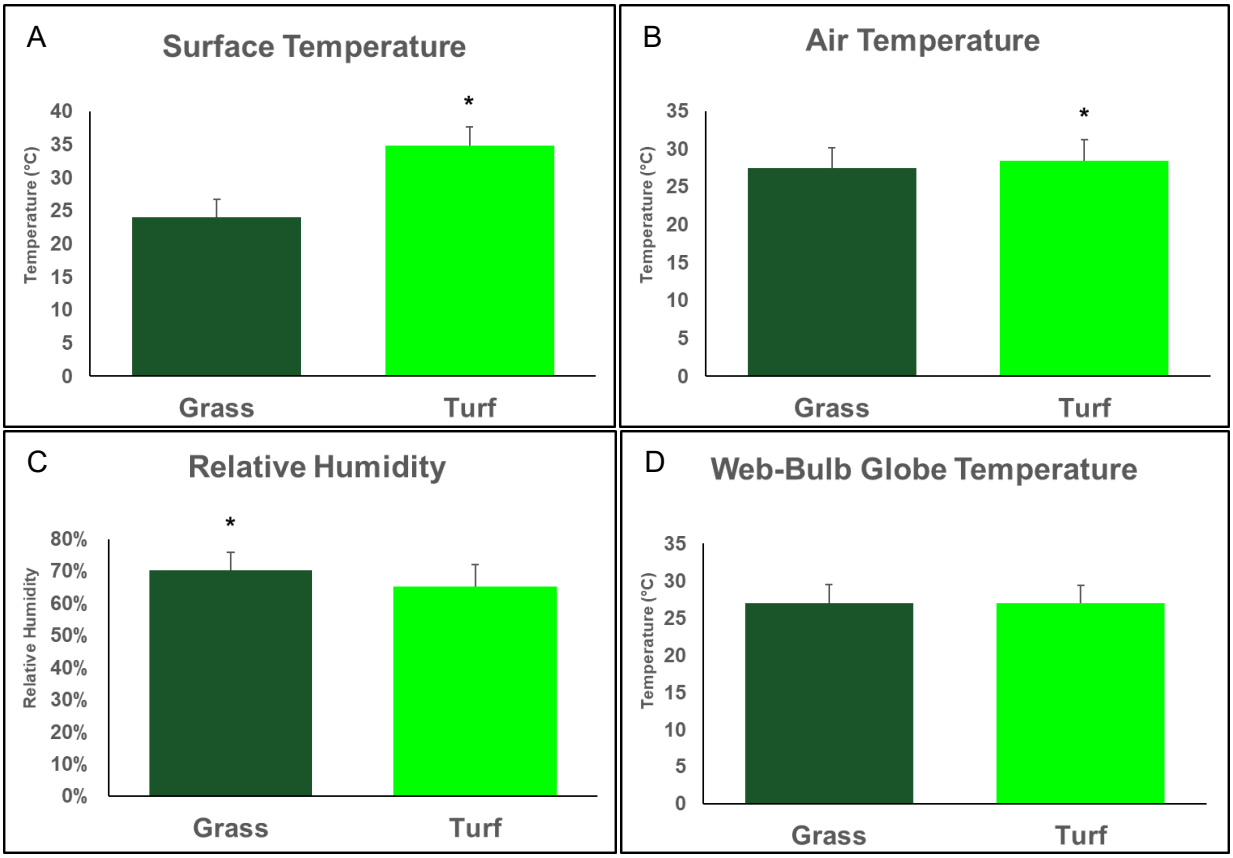

Figure 1. Environmental heat stress measurements taken at the surface (A) and at a height of 1.2 m (B–D) above artificial turf and natural grass fields.

Summary

Although artificial turf surfaces and the air above them were hotter than grass, WBGT, a comprehensive indicator of heat stress, did not differ significantly between the two surface types. The higher air temperatures over turf were offset by correspondingly lower relative humidity, resulting in comparable overall heat stress.

These findings challenge the assumption that artificial turf inherently increases the risk of heat illness. To date, there are no known reports of higher heat illness rates among athletes playing on turf compared to grass. Further research is needed to explore physiological responses and long-term health outcomes.

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