3rd Annual Collaborative Solutions for Safety in Sport National Meeting

Wet Bulb Globe Temperature FAQs

Environmental Monitoring Indices

- Wet bulb globe temperature (WBGT)
- Air temperature
- Relative humidity
  - Sling psychrometer
- Heat index
  - OSHA chart
How are they different?

**Wet Bulb Globe Temperature**

- Invented in 1950s for the US Army and Marine Corps
- Wet Bulb Temperature ($T_w$)
  - Humidity, (Wind)
- Globe Temperature ($T_g$)
  - Solar radiation, (Wind)
- Dry Bulb Temperature ($T_d$)
  - Air temperature

\[
WBGT = 0.7T_w + 0.2T_g + 0.1T_d
\]


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How are they different?

**Sling Psychrometer**

- Two thermometers mounted together in the same device.

- Calculates the difference between:
  - Ambient temperature
  - Wet-bulb thermometer

- Measures relative humidity
  - Allows clinician to then derive heat index

$50-\$100/unit
How are they different?
Heat Index

• Heat Index is **how hot it feels** when relative humidity is factored into the ambient temperature.

• Heat Index is created based on shady, light-wind conditions.
  - Not full sunshine
  - Not strong-wind

• Number may NOT be reliable under extreme heat conditions

How are they different?
Heat Index

• Assumptions of Heat Index
  - Shaded
    - (full sun can increase Heat Index by 15°F)
  - 5’7”, 147 lbs
  - Long pants and short sleeve shirt
  - Walking at 3 mph
Why WBGT?

- WBGT is a more comprehensive representation of environmental conditions
  - Solar radiation & wind speed are factored into the equation
- Devised to account for physical activity

Regional Specificity

- Regional specific guideline by Grundstein et al. (2015)
- Quantifying locally oppressive conditions
On-Site vs. Weather Station Data

• Distance between the activity venue and weather station
  • Geographical consideration

• Time of the day that the reading was taken

• Differences in topography

• Influence from playing surface?
  • May or may not influence the value

Which device should I use?

• What do you use currently?
  • Does it measure wet bulb globe temperature?

• Example: Kestrel 5400 Heat Stress Tracker
  • $479-599
  • Activity modification alert
  • Bluetooth
Adapting scientific evidence to our practice

Georgia State High School Association Example

• Developed data-driven heat acclimatization guideline
  • Investigated the incidents rate of exertional heat illness pre-policy adaptation (2009-2011) and post-policy adaptation (2012-2014)

• Experts also developed activity modification guideline to go with the heat acclimatization guideline
## GHSA WBGT Guideline

<table>
<thead>
<tr>
<th>WBGT READING (°F)</th>
<th>ACTIVITY GUIDELINES &amp; REST BREAK GUIDELINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 82.0</td>
<td>Normal activities; Provide at least three separate rest breaks each hour of minimum 3 minutes each during workout</td>
</tr>
<tr>
<td>82.0-86.9</td>
<td>Use discretion for intense or prolonged exercise; watch at-risk players carefully; Provide at least three separate rest breaks each hour of a minimum of four-minute duration each</td>
</tr>
<tr>
<td>87.0-89.9</td>
<td>Maximum practice time is two hours. For Football: players restricted to helmet, shoulder pads, and shorts during practice. All protective equipment must be removed for conditioning activities. For all sports: Provide at least four separate rest breaks each hour of a minimum of four minutes each</td>
</tr>
<tr>
<td>90.0-92.0</td>
<td>Maximum length of practice is one hour, no protective equipment may be worn during practice and there may be no conditioning activities. There must be 20-minutes of rest breaks provided during the hour of practice</td>
</tr>
<tr>
<td>Over 92.1</td>
<td>No outdoor workouts; Cancel exercise; delay practices until a cooler WBGT reading occurs</td>
</tr>
</tbody>
</table>