

Wet Bulb Globe Temperature (WBGT) Index

Ambient temperature is only one component of environmental heat or cold stress; others are humidity, wind speed, and radiant heat. The most widely used heat stress index is the wet bulb globe temperature (WBGT) index:

$$\text{WBGT} = (0.7 T_{wb}) + (0.2 T_g) + (0.1 T_{db})$$

...where T_{wb} is the wet bulb temperature, T_g is the black globe temperature, and T_{db} is the shaded dry bulb temperature [28]. T_{db} refers to air temperature measured with a standard dry bulb thermometer not in direct sunlight. T_{wb} is measured with a water-saturated cloth wick over a dry bulb thermometer (not immersed in water). T_g is measured by inserting a dry bulb thermometer into a standard black metal globe. Both T_{wb} and T_g are measured in direct sunlight.

A portable monitor that gives the WBGT index in degrees Celsius or degrees Fahrenheit has proven useful during races and in military training [28]. The measurement of air temperature alone is inadequate. The importance of humidity in total heat stress can be readily appreciated because T_{wb} accounts for 70% of the index whereas T_{db} accounts for only 10%.

The risk of heat illness due to environmental stress should be communicated to runners in four categories:

- Very high risk: WBGT above 28°C (82°F);
- High risk: WBGT 23-28°C (73-82°F);
- Moderate risk: WBGT 18-23°C (65-73°F);
- Low risk: WBGT below 18°C (65°F).

You should know the risk of heat exhaustion. When the WBGT index is above 28°C (82°F), the risk of heat exhaustion or heatstroke is very high; it is recommended that the race be postponed until less stressful conditions prevail, rescheduled, or canceled. High risk [WBGT index = 23-28°C (73-82°F)] indicates that operators should be aware that heat exhaustion or heatstroke may be experienced by anyone even with tactical gear and ballistic vests; anyone who is particularly sensitive to heat or humidity probably should be operational. Moderate risk [WBGT index = 18-23°C (65-73°F)] indicates that heat and humidity will increase during the course of an operation if conducted during the morning or early afternoon. Low risk [WBGT index = below 18°C (65°F)] does not guarantee that heat exhaustion (even heatstroke) will not occur; it only indicates that the risk is low.

The risk of hypothermia also should be communicated as indicated. A WBGT index below 10°C (50°F) indicates that hypothermia may occur in individuals out of gear, snipers or those occupying stationary security positions, especially in wet and windy conditions. Core body temperatures as low as 92°F have been observed in 65°F conditions.

²⁸ DEPARTMENT OF THE ARMY. *Prevention, Treatment and Control of Heat Injury*, Washington, DC: Department of the Army, Technical Bulletin No. TB MED 507, 1980, pp. 1-21.

WBGT Alternatives:

Industrial and military safety personnel often require an easy, quick and accurate assessment of heat stress as a potential risk. The widely used WBGT index to evaluate heat stress is cumbersome and suited for a fixed site station rather than a mobile situation. Recently, a modified discomfort index (MDI) compiled from ambient temperature (Ta) and wet bulb temperature (Tw) was suggested to evaluate heat stress. HYPOTHESIS: Validation of the simple and easy-to-operate MDI on an independent database can determine whether this index is able to serve as a reliable and valid alternative to WBGT. METHODS: Four separate database sets obtained from the Marine Corps Training Site on Parris Island, SC, served to validate this index. Hourly weather measurements were collected daily during 4 yr, representing a wide range of environmental conditions. RESULTS: The MDI validity was tested vs. the WBGT index. A highly significant correlation coefficient (r) greater than 0.95 ($p < 0.001$) was found in each of the four database sets. CONCLUSIONS: The simply constructed and user friendly MDI is easier to calculate and use than WBGT, and it has the potential to serve as an attractive alternative to the WBGT index in assessing heat stress.