AN ENVIRONMENTAL STRESS INDEX (ESI) AS A SUBSTITUTE FOR THE WET BULB GLOBE TEMPERATURE (WBGT)

D.S. Moran[1], K.B. Pandolf[2], Y. Shapiro[1], Y. Heled[1], Y. Shani[1], W.T. Matthew[2] and R.R. Gonzalez[2],
[1]Heller Institute of Medical Research, Tel Hashomer, Israel and [2]USARIEM, Natick, MA, USA.

In 1957, Yaglou and Minard developed the WBGT as a thermal index calculated as follows: $WBGT = 0.7T_w + 0.2T_g + 0.1T_a$ where: T_w = wet bulb temperature, T_g = black globe temperature, and T_a = ambient temperature. This index has been used extensively for evaluating environmental heat stress in the US Army and Navy, during sport activities, and for determining safety guidance for workers in different occupations. However, WBGT was found to be limited in evaluating heat stress mainly due to the inconvenience of measuring T_g. A new environmental stress index (ESI), based on T_a, relative humidity (RH), and solar radiation (SR) was developed as follows: $ESI = 0.63T_a - 0.03RH + 0.002SR + 0.0054(T_a \cdot RH) - 0.073(0.1 + SR)^{-1}$. The purpose of this study was to determine whether the ESI could be used as an alternative for WBGT. The ESI was applied to databases obtained from 3 different climatic conditions in Israel, and was compared to the WBGT. The correlation coefficients between the two indices were found to be high as follows:

Climate	R^2	P	Measurements
Hot/wet	0.982	0.001	8,328
Hot/dry	0.981	0.001	8,426
Extremely hot/dry	0.985	0.001	8,795

These results strengthen the possibility of evaluating heat stress by ESI using the more common, fast response and accurate climatic measures (e.g., T_a, RH) and for the first time including solar radiation as a variable in thermal stress assessment. However, more studies should be done for further validation.

Yaglou, C.P. and Minard, D. (1957) Control of heat casualties at military training centers. *Arch. Indus. Health* 16:302-305.

dmoran@glil-yam.org.il