

# Use of the Wet Bulb Globe Temperature (WBGT) Index to quantify environmental heat loads during Three-day-event competitions

R. C. SCHROTER, D. J. MARLIN\* and L. B. JEFFCOTT†

*Centre for Biological and Medical Systems, Imperial College of Science, Technology and Medicine, London, SW7 2BZ and \*Equine Centre, Animal Health Trust, Newmarket, Suffolk CB8 7DW and †Department of Clinical Veterinary Medicine, University of Cambridge, Cambridge CB3 0ES, UK.*

In recent years, many top level international 3-day-event competitions have been held in what were considered to be hot and highly stressful conditions, both from the viewpoint of animal welfare and the wellbeing of riders. However, it has proved difficult to quantify the environmental heat load in a way that objectively reflected the effects of local weather conditions on both horse and rider. The so-called 'Comfort Index', based on the sum of the ambient temperature (°C) and relative humidity (%), has been used for some years but was severely criticised after the 1994 World Equestrian Games for failing to indicate the considerable contribution of the solar heat load on the horses (Jeffcott 1995).

The recent initiative by the Fédération Equestre Internationale (FEI) to evaluate the ability of horses to compete in thermally stressful conditions, such as those expected to be encountered at the 1996 Olympic Games in Atlanta, USA (Jeffcott 1994), has highlighted the need to establish an objective means of quantifying the effective heat load imposed by the weather. Experience has demonstrated that it is essential to relate the microclimatic conditions on the course to the duration and severity of the competition, including such factors as ground conditions and fitness and ability of horses and riders, in any proper assessment of the effects of the thermal stresses. The information is required in a form to enable course designers and officials to take due cognisance of the local

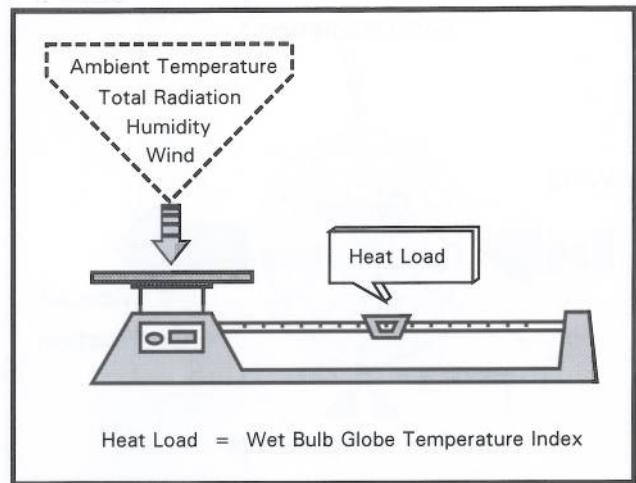


Fig 1: Environmental factors determining the Wet Bulb Globe Temperature (WBGT) Index.

environmental conditions, both for planning purposes and management of the event.

The Wet Bulb Globe Temperature (WBGT) Index (Schroter and Marlin 1995) offers a means of quantifying the effective heat load experienced by horses and riders. In addition to the effects of ambient temperature and humidity, the Index takes account of wind strength and radiation, particularly solar

TABLE 1: Summary of climatic conditions at various sites during competitions

Location	Ambient temperature (°C)	Relative humidity (%RH)	Wet bulb temperature (°C)	Globe temperature (°C)	WBGT Index
3DE, World Games, Kentucky, USA 1978 (FEI)	29.4	70	25	{41.9}	30.1
3DE, European Championships, Frauenfeld, Switzerland 1983 (U)	27.5	38.3	17.9	42.5	25.3
3DE, World Games, Sweden 1990 (FEI)	26.8	36	17	{42}	24.5
3DE, Barcelona Olympics, Spain 1992 (FEI)	29	46	20.3	{45}	27.7
3DE, World Games, Holland 1994 (FEI)	32.2	38	21.5	{45}	28.6
3DE, Burghley, England 1994 (U)	23	42	20	34.5	24.4
3DE, Chatsworth, USA 1994 (U)	35	42	24.6	47.5	31.5
3DE, Badminton, England 1995 (U)	28.1	39	20.5	37	25.5
3DE, Young Riders' Chicago USA 1995 (U)	32.7	71	28.2	50	34.7
3DE, Atlanta Cup, Atlanta USA 1995 (U)	29.2	67	24.8	38.9	30

{ } = globe temperature was not reported, this was estimated from weather conditions. (FEI) = official FEI records; (U) = unpublished data; 3DE = 3-day-event.