

Heat Stress among Traffic Police Officers at North Khartoum Locality, Sudan

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Abstract: Thermal stress is an important factor in many work situations; it can seriously affect the health and productivity of the individual. Underlying the effects of thermal environment are the feelings of discomfort and physiological responses to heat. Sudan is subject to severe thermal conditions during the summer months. One of the most direct outcomes of excessive exposure to heat is a rise in core body temperature. **Aims:** The aim of this study was to evaluate thermal stress based on the WBGT index among Traffic Police Officers at North Khartoum Locality. **Material and Methods:** This is across sectional study conducted in April 2013. The data on thermal stress was collected using a heat stress monitor (Heat Stress Meter HT30, Made in China) with digital read out was used; Wet Bulb Globe Temperature was chosen to represent the thermal environment. The study cover 17 workstations and 18 traffic police officers at main road cross at North Khartoum Locality. The outdoor scale was used in this research, as the jobs studied were located outdoors. **Results:** WBGT values at the five sites ranged from 23.15 to 26.40 °C with values 26.40 °C being consistently recorded, particularly at site five. Heat stress exceeded the national and international recommended limits based on the WBGT index in 33.3% of cases of workstations, 88.9% of Police Traffic Officers have Knowledge of health effects of hot environment, First aid for heat-related disorders training among Police Traffic Officers was 38.9%. **Conclusion:** All Traffic Police Officers (33.3%) were under heat stress risk because WBGT above 25 °C. First aid for heat-related disorders training among Police Traffic Officers was low. Our findings indicate that the majority of Police Traffic Officers 88.9% have Knowledge of health effects of hot environment.

Keywords: Heat stress, WBGT, Traffic Police, Khartoum

1. Background

The normal human internal temperature ranges from 36–38°C (37°C = 98.6°F). Limits for efficient thermoregulation are 35–40°C. In a resting adult, the normal heat production is approximately 60–70 kcal/hr/m² of body surface or 100 kcal/hr [5]–[8]–[16]. Inadequate thermal stress may cause discomfort and adversely affect the performance, safety, and harm to health [13]. There are various effects of high temperature on the worker as well as a number of factors that affect the individual's response to exposure to high temperatures. Among the important factors are the age of the individual, the surface-area-to-weight ratio of the individual, and the acclimatization that the individual has attained [12].

Heat stress results in physiologic responses of increased temperature, increased heart rate and increased sweating [11]. Environmental temperature, humidity and solar radiation are factors contributing to heat stress. The wet bulb globe temperature (WBGT) is an index of heat stress that incorporates these three factors [5]. This standard provides a simple convenient method, and uses the wet bulb globe temperature (WBGT) heat stress index to assess hot environments [7].

The WBGT can be calculated or obtained from heat stress monitors and is used to help prevent heat stress related illness [11]. The classical clinical description of heat stroke is the triad of hyperpyrexia, central nervous system (CNS) dysfunction, and anhydrosis. Anhydrosis is not a diagnostic requirement, however, and may appear as a later finding when volume depletion is severe. Classical heat stroke, as

opposed to exertional, will often develop over days of heat stress [11].

Table 1: TLVs for Heat Exposure [Values are given in °C and (°F) WBGT] [1].

Hourly Activity	Work Rates		
	Light	Moderate	Heavy
100% Work	30.0 (86.0)	26.5 (80.0)	25.0 (77.0)
75% Work; 25% Rest	30.5 (87.0)	28.0 (82.5)	26.0 (79.0)
50% Work; 50% Rest	31.5 (89.0)	29.5 (85.0)	28.0 (82.5)
25% Work; 75% Rest	32.0 (89.5)	31.0 (88.0)	30.0 (86.0)

Thermal Stress in 1997 TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices, ACGIH Worldwide, 1997.

2. Material and Methods

This a cross sectional study was cover 17 measurement points and 18 traffic police officers at main road cross at North Khartoum Locality. The outdoor scale was used in this research, as the jobs studied were located outdoors. Wet Bulb Globe Temperature was chosen to represent the thermal environment. WBGT is a function of all four environmental factors (air temperature, air movement, radiant temperature and air humidity) affecting human environmental heat stress [2]. The data on WBGT was collected using a heat stress monitor (Heat Stress Meter HT30, Made in China) which provides digital readouts of ventilated wet bulb temperature (WB), dry bulb temperature (DB), globe temperature, calculated mean radiant temperature and WBGT.

The WBGT value used in the standard is a weighted average, over time and space, and is measured over a period of maximum heat stress. The weighting for spatial variation is given by:

$$WBGT = \frac{WBGT\ head + 2 \times WBGT\ abdomen + WBGT\ ankles}{4} \quad (1)$$

Questionnaire collect data as the average fluid consumption per shift, Knowledge effects of hot environment.

3. Results

Table 2: Summary of Wet Blub Globe Temperature (WBGT) from the field study

WBGT	WS 1	WS 2	WS3	WS 4	WS 5
WBGT neck	23.65	23.70	22.60	23.32	25.73
WBGT abdomen	24.20	24.12	23.10	23.85	26.43
WBGT ankle	24.80	24.67	23.80	26.78	27.00
WBGT total	24.21	24.15	23.15	24.45	26.40

*WS: Workstation

Table 3: Distribution of Police Traffic Officers according to site of working

Workstations	Number of Police Traffic Officers	%
Workstation 1	2	11.1
Workstation 2	3	16.7
Workstation 3	1	5.6
Workstation 4	6	33.3
Workstation 5	6	33.3
Total	18	100.0

Table 4: Knowledge of health effects of hot environment among Police Traffic Officers

Knowledge of health effects	No	%
Yes	16	88.9
No	2	11.1
Total	18	100.0

Table 5: Health effects fatigue, mood and headache among Police Traffic Officers

Health effects	No	%
Fatigue	18	100.0
Mood	18	100.0
headache	7	38.9

Table 6: The average fluid consumption per shift among Police Traffic Officers

Water intake	No	%
Less than 5litre	7	38.9
5litre and more	11	61.1
Total	18	100.0

Table 7: Frist aid for heat-related disorders training among Police Traffic Officers

First aid	No	%
Yes	7	38.9
No	11	61.1
Total	18	100.0

4. Discussion

The purpose of this study was to assessment heat stress among traffic police officers. Mean environmental conditions for workstation1 to 5 during the monitoring

periods of this study were as follows: WBGT values at the five workstations ranged from 23.15to 26.40 C° with values. 26.40 C° being consistently recorded, particularly at workstation 5. The study findings illustrate that heat stress exceeded the national and international recommended limits based on the WBGT index in 33.3% of cases of workstations compare to 80.0% [10]. All Traffic Police Officers (66.7%) work in workstation 1 to 4 were not under heat stress risk because WBGT under 25 °C and this agree with [11] who mentioned that if the WBGT reference value of 25°C is not exceeded, it could be concluded that heat stress was not a risk in that environment. Current ISO7243 guidelines have identified a WBGT of 30°C as a threshold leading to a significant reduction in work performance and as a temperature warranting greater break frequency during work periods [5]. Nevertheless, in our participants, working in conditions >30°C WBGT (Table 2). According to the NIOSH criteria not exceeds the recommended exposure limit [9].All Traffic Police Officers at North Khartoum Locality worked heavy work and when take in account WBGT threshold limit value all Police Traffic Officers in points 5 (WBGT= 26.40) must work 75% and take rest 25%. There is evidence that the thermal stress encountered in many work environments may negatively affect various aspects of human performance and behavior [4]. For much of the time, these values exceeded the acceptable limit for acclimatized persons to perform heavy work without work/rest cycling. This finding contradict results of [2].The present study found that 88.9% of Police Traffic Officers have Knowledge of health effects of hot environment and this is good according to [3] who found that “involuntary dehydration” did not occur in well informed workers. These workers must not only be aware of the inherent dangers of their occupation but also the dangers imposed by the environment. Inadequate thermal stress may cause discomfort and adversely affect the performance, safety, and harm to health [15].

Where exposure to heat stress is necessary or unavoidable, care should be taken to ensure adequate replacement of fluid and electrolytes [5].The findings of the present study were that the average fluid consumption per shift among Police Traffic Officers less than 5litre (38.9%) and 5litre and more (61.1%).All worked more than 8-h work shift. Our study illustrated that 38.9% First aid for heat-related disorders training among Police Traffic Officers was low.

5. Conclusion

All Traffic Police Officers (33.3%) were under heat stress risk because WBGT above 25 °C. all Police Traffic Officers in workstation 5 (WBGT= 26.40) must work 75% and take rest 25%. First aid for heat-related disorders training among Police Traffic Officers was low. Our findings indicate that the majority of Police Traffic Officers 88.9% have Knowledge of health effects of hot environment. First aid for heat-related disorders training among Police Traffic Officers was low.

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