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Validation of Heat Pressure Assessment (HPA) Method and WBGT index in Iranian South Oil Company

A. Biabani[1], M. Falahati[1]*, I. Alimohammadi[2], M. Zokaei[1], H. Jalilian[3], A.Dehghani[4], M. Najafi Majareh[5]

[1] Department of Occupational Health and Safety Engineering, Social Determinants of Health Research Center, Saveh University of Medical Sciences, Saveh, Iran.
[2] Occupational health research center, Faculty of Health, Tehran University of medical sciences, Tehran, Iran.
[3] Department of Occupational Health and Safety Engineering, Faculty of health, Qom University Medical of Sciences, Qom, Iran.
[4] Management of Health, Supreme Council of Iran's Free Trade, Industrial and Especial Economic Zone, Iran.
[5] HSE Management Department of Tehran Municipality, Tehran, Iran.

ABSTRACT

Introduction: Determining methods for assessing heat stress in different work environments is one of the major challenges for researchers in this field. The purpose of this study was to validate WBGT index and heat pressure assessment (HPA) by some physiological responses in Iranian South Oil Company.

Material and Methods: This descriptive-analytical study was carried out on 154 employees of Kharg, Asalouyeh and Mahshahr oil terminals recruited from three different working conditions including indoor, outdoor and rest environments in the summer. The amount of heat stress in the workplace was evaluated by WBGT index HPA method. To meet this purpose, the environmental parameters i.e., temperature, wet temperature, radiation temperature, relative humidity, water vapor pressure and air flow rate were determined. In addition to the direct reading method by the WBGT meter, ISO 7243 was used to calculate the WBGT index. In order to validate the heat stress indicators, physiological parameters of oral temperature, tympanic temperature and work metabolism were measured.

Results: The results of paired sample t-test showed a significant difference between WBGT index and HPA in indoor and outdoor environment (P<0.05). Moreover, there was a significant difference between the physiological indices of oral and tympanic temperatures and work metabolism in the indoor and outdoor environment (P<0.05). Furthermore, the correlation test was significant between WBGT index as an independent variable and HPA as a dependent variable (P<0.05) and showed a high correlation (R2=0.914) between WBGT index with oral temperature and tympanic temperature . Also, the rate of work metabolism was significantly related with the aforementioned parameters (P<0.05) and was equal to R2=0.423, R2=0.335, R2=0.552, respectively. The correlations were also significant between HPA with Oral temperature, tympanic temperature and work metabolism (P<0.05)and were equal to R2=0.632, R2=0.605, R2=0.557, respectively. The results showed also that the correlation rate between the HPA with physiological parameters is stronger than that between physiological parameters with the WBGT index.

Conclusion: This study showed that WBGT and HPA methods are useful for assessing the heat stress of Iranian South Oil Company. Also, the HPA method is more reliable for assessing heat stress in these regions.

Keywords: *WBGT, Heat stress, HPA, Physiological Parameters*

* Corresponding Author Email: *m.falahati@savehums.ac.ir*

1. INTRODUCTION

Working at high temperatures and high humidity has the potential to cause heat stress among the employees, particularly for those responsible for performinghigh physical activity tasks(1). In addition to other factors such as age, the level of fitness and general health are also the two effective determinants in this regard (2); therefore, an appropriate index should be used to measure heat stress. A study by Falahati et al. indicated that the WBGT index is the most accurate method in assessing heat stress (3). Also, in the study of Monazzam et al., the HPA method with WBGT was used together to evaluate the thermal stress of a steel manufacturing company in Iran (4).

2. MATERIALS AND METHODS

The population under study included 154 personnel

working in operational units such as industrial repair, transportation, facility and facility repair, offshore, HSE, operation and export, dock, security, laboratory, service units and the support of the oil terminals company.

3. RESULTS AND DISCUSSION

Table 1 shows the mean and standard deviation of environmental, physiological and thermal stress parameters in the indoor, outdoor and rest environmental conditions. The results of Paired sample t-test showed a significant difference between WBGT index and HPA in indoor and outdoor environments (p <0.05).The results of Table 1 also show that there is a significant difference between the physiological indices of oral temperature, tympanic temperature and working metabolism in the indoor and outdoor environment (P <0.05).

Table 1. Measurement results of thermal stress parameters and indicators

rest environment			Average difference	Outdoor environment			indoor environment			Workplace
Sd	mean	N	Sign level	Sd	mean	N	sd	mean	N	parameters
21.03	21.03	154	<0.0001	3.22	31.06	154	3.29	21.22	154	$(c^0)WBGT_{TWA}$
2.13	22.36	154	<0.0001	6.53	66.37	154	4.08	29.34	154	HPA_{TWA}
0.28	37.08	154	0.043	0.34	37.46	154	0.24	37.19	154	Oral (c0)
0.27	37.14	154	0.026	0.41	37.66	154	0.27	37.44	154	Temp (c0)
6.21	113.88	154	0.043	41.75	211.03	154	43.2	207.12	154	Metabolism (w / m2)

4. CONCLUSION

The results showed that HPA and WBGT methods were used to evaluate heat stress in the Iranian South Oil Company.

5. REFERENCES

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