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TEST PROTOCOL VALIDATION FOR THERMAL ENVIRONMENT AND COGNITIVE PERFORMANCE

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ABSTRACT

Heat exposure may change cognitive performance. An excessive mental load, combined with high temperature and humidity can lead rapidly to a state of fatigue. This study aims to validate a test protocol to evaluate the evolution of the fatigue with the variation of temperature and humidity. For protocol validation, tests were performed in order to verify the reproducibility of the results. It was obtained a validated protocol that ensures the desired results. It is expected that it will be a tool to predict fatigue in the workplace caused by different conditions of temperature and humidity.

Keywords: test protocol, thermal environment, cognitive function, heat.

INTRODUCTION

Thermal environment is a key factor to control in the occupational setting. In response to different thermal environments, humans have distinct physiological and behavioral responses to both heat and cold (Parsons, 2003). Under extreme conditions of heat and humidity, fatigue settles quickly, so the risk of failures and accidents is a constant threat to those who are in these conditions (Shin-ichi Tanabe, Naoe Nishihara, & Haneda, 2007). The cognitive component of this exposure has so far been poorly studied (Pilcher, Nadler, & Busch, 2002). However, are known interactions between concentration and cognitive ability. When extreme environmental conditions occur in the workplace, not only the productive activities are committed, but also the physical integrity of the worker by his lower ability to react to unexpected situations (Akimoto, Tanabe, Yanai, & Sasaki, 2010). In this context, this study intends to propose a protocol for assessing the cognitive capacity variation with changes in temperature and humidity, establishing a relationship between cognitive and physiological response.

METHODOLOGY

The validation of a protocol is done by testing its performance, according to predetermined criteria, aiming to confirm whether it is appropriate for the intended use, ensuring reproducibility of results. In this sense, and once selected the equipment for assessing the physiological and cognitive response (Costa & Baptista, 2013), the necessary tests were performed to confirm the experimental reproducibility for each variable for different conditions of temperature and humidity.

The validation process has four phases. The first one consists in guaranteeing the ethical reference; the second, proceeded to the test and validation of each device separately at different temperatures and humidities; the third, defining of the criteria, and selection of the volunteers; finally, in the fourth phase, pilot tests were conducted in order to assess and validate the protocol as a whole, taking into account the objectives established.

RESULTS AND CONCLUSIONS

The protocol includes a set of procedures performed in a climatic chamber properly tested for this purpose (Guedes, Costa, & Baptista, 2012). The assays were performed in three temperature ranges (low, medium and high) for two humidity levels and by one hour each, where it was simulated a sedentary activity. In this situation, different parameters were monitored: skin temperature (ISO9886, 2004), internal temperature (Costa, Guedes, & Baptista, 2012); brain activity (EEG), electrodermal activity (EDA), muscle activity (EMG), and even the frequency and heart rate variability through electrocardiogram (ECG). Were also used two subjective assessment questionnaires: one for evaluation of thermal sensation and another to evaluate the workload, NASA TLX (Staveland & Hart, 1988).

At the end of this work, all the procedures were tested.

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