

STUDY OF PHYSICAL WORKLOAD AND HEAT STRESS AMONG HOUSING  
CONSTRUCTION WORKERS

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In the name of Allah

To my beloved family  
And all my lecturers and friends

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## ABSTRACT

Construction sites are known to exhibit hot and harsh environment. Highly physical demanding task done by the construction workers made them one of the highest physical to heat stress related cases globally. Therefore, heat stress and physical workload needed to be investigated prior to numerous accidents happening in the construction site. The objective of this study is to determine the perception level of physical workload and heat stress among the housing construction workers in Malaysia. Currently, there is lacking of research for measuring heat stress and physical workload in a construction site particularly in Malaysia. Methodologically, this paper uses the perception method for measuring the physical workload and heat stress and direct measurement is used to measure heat stress level. Construction workers made up of carpenters (n=31) and bar benders (n=14) were interviewed face to face through the questionnaire. Perception level was measured using the one to five Likert Scale. The analysis done were descriptive test, Mann Whitney test, ranking of parameters by mean score, and Spearman correlation test to determine the strength of relationship between the parameters. Overall, the perception of physical workload was found to be at an average mean score of 4. However, heat stress mean score is above than average of 4.5 indicating the perception are nearing to high level of heat stress. Using the direct measurement, it is found out that, the maximum temperature in a construction site in Malaysia can reached up to 35°C. The WBGT data supports the perception of heat stress data. Among the limitations occurred by the researcher is the language barrier of the workers involved during the interviews, so the researcher tried as best to comprehend them to obtain the best result.

## ABSTRAK

Tapak pembinaan diketahui mempamerkan persekitaran yang panas dan keras. Tugas-tugas fizikal yang mencabar telah dilakukan oleh pekerja-pekerja binaan menjadikan mereka satu fizikal yang paling tinggi untuk memanaskan kes yang berkaitan dengan tekanan di peringkat global. Oleh itu, tekanan haba dan beban kerja fizikal yang diperlukan untuk disiasat sebelum banyak kemalangan berlaku di tapak pembinaan. Objektif kajian ini adalah untuk menentukan tahap persepsi beban kerja fizikal dan tekanan haba di kalangan pekerja pembinaan perumahan di Malaysia. Secara metodologi, kertas kerja ini menggunakan kaedah persepsi untuk mengukur beban kerja dan haba tekanan fizikal dan pengukuran langsung digunakan untuk mengukur tahap tekanan haba. Pekerja-pekerja binaan yang terdiri daripada tukang kayu ( $n = 31$ ) dan benders bar ( $n = 14$ ) telah ditemuramah bersemuka melalui soal selidik. Tahap persepsi diukur menggunakan satu kepada lima Skala Likert. Analisis yang dilakukan adalah ujian deskriptif, ujian Mann Whitney ranking parameter dengan skor min dan ujian korelasi Spearman untuk menentukan kekuatan hubungan antara parameter. Secara keseluruhan, persepsi beban kerja fizikal didapati pada skor min purata 4. Walau bagaimanapun, tekanan haba skor min melebihi daripada purata sebanyak 4.5 menunjukkan persepsi menghampiri ke tahap stres yang tinggi haba. Menggunakan pengukuran langsung, didapati bahawa, suhu maksimum di sebuah tapak pembinaan di Malaysia boleh mencapai sehingga  $35^{\circ}\text{C}$ . Data WBGT menyokong persepsi data tekanan haba. Antara batasan berlaku oleh pengkaji adalah halangan bahasa daripada pekerja yang terlibat semasa temu bual, jadi pengkaji cuba sebaiknya untuk memahamkan mereka untuk mendapatkan hasil yang terbaik.

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background of Study

Working or operating under high temperatures and high humidity have high potential of inducing heat stress to the workers operating under those conditions. Heat stress among construction workers are most common as they operate under the direct or indirect sunlight in a hot environment (Morioka *et al.*, 2006).

Large number of workers whom work in the agriculture field nor the construction field are the ones affected heavily by the global warming. According the World Health Organisation (WHO), heat stress is a known hazard towards workers who worked under thermal stressful areas such as the construction site. The adverse impact such as heat strain, heat illnesses, heat exhaustion, and heat stroke affects the productivity and the safety of the workers (Farshad *et al.*, 2014).

According to Dehghan *et. al* (2015), heat stress is the net heat load on the body with contributions from both metabolic heat production and external environmental factors including temperature, relative humidity, radiant heat transfer, and air movement, as they are affected by clothing. It differs with heat strain which is the

physiological response to dissipate heat and maintain a core body temperature of 37°C is referred to as heat strain.

It is found that construction industry is found to be the most susceptible to heat stress than other industries. The construction workers are needed to perform highly demanding physical tasks with various types of stress resulted from working environment factors such as the needs to do repetitive movements, awkward postures, and high pace work. Abundance of physical workload can also lead to having physiological effects on workers that lead to the reduction of work enthusiasm and productivity thus leading to an increase of accident rate globally.

On the other hand, physical workload is the measurable portion of physical resources expended when performing a given task and is affected by a range of factors such as nature of work, training, motivation, and environmental factors. According to Miller *et al.*, (2011) doing physical work generates heat production in the body thus, measures must be taken to counter the excessive heat towards body. When the workers are exposed to high temperatures together with the combination of physically demanding works, the physical stress of workers are increased in the day long operation (Yi and Chan, 2013).

## **1.2 Problem Statement**

To compare with other industries nowadays, construction industry has been identified as one of the most hazardous industries. It is because, this sector continues to register high rate of accident-related casualties. Construction workers are the most susceptible workers exposed to higher risk of fatality compared to other sectors (Aksorn and Hadikusumo, 2008).

Despite many safety precautions taken, accident related casualties at a construction site remains high throughout the years. According to the Social Security Organisation (SOCSO) Malaysia, the data taken from the year 2000-2009, it shows that accidents rate increases each year with a few declines at the year 2000-2003. In the year 2000-2009, SOCSO have reported 656,555 accidents in all industries with 42,775 accidents in the Malaysian construction industry. Most of the accidents reported in the annual report indicated that the most causes of accidents were caused by the workers itself. Early hypothesis is that the accidents are due to the hot and harsh climate in Malaysia with the abundance of work that the workers needed to complete. Therefore, it is crucial for an investigation on physical workload and heat stress in the construction site.

Thus, this research is determined to find the perception of physical workload and heat stress in the working environment. This study will also measure the heat stress level at the site.

### **1.3 Objective**

The overall goal of this study is to study the perception of physical workload and heat stress among the housing construction workers in Malaysia. Thus, the objectives are as the following;

1. To determine the perception of heat stress and physical workload among workers.
2. To measure heat stress level using the WBGT device
3. To recommend solution to address heat stress.

## **1.4 Scope of Study**

The scopes of this study are needed as to ensure that the study done are within limitations. In writing a scope of study, outlining the limitations of the research, the specific data used for the research and the theories are used to interpret the data. The scopes of study are as below:

1. The study will be done at housing construction.
2. Heat stress level evaluated using WBGT.
3. Perception of physical workload and heat stress data will be collected using questionnaire.
4. Data will be analysed using SPSS.

## **1.5 Significance of Study**

This study is done by gathering the data from the physical workload and heat stress questionnaire and from the direct measurement using the WBGT device. The data can then be analysed to determine the perception of physical workload and heat stress among the construction workers. From the analysis, it can then be used to suggest improvements and recommendations to the construction company in providing better healthcare to its workers.

## **1.6 Research Questions**

A few questions arise from this study. Research questions are needed to ensure at the end of the research, the questions are able to being answered properly using the data obtained and analysed. Among them are as follows;

1. What is the perception of heat stress and physical workload of the workers towards their working environment?
2. What can we do to improve the quality of work and productivity of the workers?
3. Is the working environment is safe for the workers to work?
4. Is the study comparable to other studies from other countries which have similar like climate to Malaysia?

### **1.7 Research Gap**

Various literature reviewing had been done and is found that most of the studies done originated from overseas. Among the 30 journals reviewed only 3 journals originated from Malaysia. Two of the research done focuses mainly on manufacturing and automotive industry. A research was done on construction site; however, the research only covers statistical data on construction site accidents obtained from SOCSO. Knowledge on correlating the aspects of physical workload and heat stress in the Malaysia country is still lacking and currently there is no studies done on the subject matter. Therefore, it is the objective of this study to find the perception of physical workload and heat stress among the construction worker

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