

THE IMPACT OF WORK REST SCHEDULING ON PROLONGED STANDING  
ACTIVITY IN A MALAYSIAN ELECTRONIC COMPANY

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To my beloved parents and family

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## ABSTRACT

In industrial workplace, standing working position is present in most of production processes. The application of work standing activity allows worker to work in higher degrees freedom and puts the worker at flexible working style. However problems may appear when worker are exposed to long standing activity. The static contraction occurred particularly at the back and legs can result in reduced the muscle performance. As in electronic companies, workers are exposed to prolonged standing activity and the increasing demands condition creates a forceful working condition that increases the formation of muscle fatigue. Published articles have been reviewed this condition and it was proven that muscle fatigue has been one of the important of the issue to be addressed in prolonged standing activity for Malaysia's manufacturing industry. It has been proposed that fatigue reduction can be done by promoting the suitable work rest setting that meets with the requirement of workplace and as well as the worker itself. As there is a less number of study covers in the impact of work rest scheduling in promoting muscle fatigue improvement for electronics industry, this project has been made in order to fill with this research gap. Basically, this study is a case study based which aim to highlight the impact of two settings on work rest schedule (frequent-short; infrequent-long) in reducing the body discomfort. An exploratory survey was made at the initial stage of research to identify the level of muscle discomfort followed by the experimental stage to recommend a work-rest schedule that decreases fatigue and improves body comfort. Main findings show that infrequent-long promotes lesser muscle efforts compared to frequent short. The frequent short rest for 5 minutes (2X5 minutes) at first half of working day did not adequately promote reduction of muscle fatigue. It was recommend promoting more frequent rest (more than 2 times at the half of the day) and deciding for more than 5 minutes rest at each break slot so that the adequate muscle fatigue recovery could be formed.

## ABSTRAK

Bekerja dalam keadaan berdiri dilihat terlibat dalam hampir kesemua operasi pengeluaran. Hal ini telah membenarkan pekerja untuk bergerak bebas serta fleksibel dalam melakukan pekerjaan. Akan tetapi, masalah akan timbul sekiranya pekerja terdedah kepada aktiviti berdiri yang terlalu lama. Kejadian penguncupan statik berlaku terutama di bahagian belakang badan dan kaki menyebabkan prestasi otot menjadi berkurangan. Dalam industri elektronik, pekerja kebiasaannya terdedah kepada aktiviti berdiri yang berpanjangan dan trend peningkatan permintaan dari pelanggan menghasilkan suasana kerja yang tertekan, sekaligus meningkatkan risiko keletihan pada otot. Jurnal-jurnal terdahulu telah memantau permasalahan ini dan ternyata keletihan otot menjadi salah satu isu di industri pengeluaran Malaysia. Cadangan memperbaiki keletihan pada otot dapat dilaksanakan dengan mengenal pasti tetapan waktu rehat bekerja yang bersesuaian dan menepati ciri-ciri tempat bekerja dan pekerja itu sendiri. Disebabkan kekurangan jurnal mengenai tetapan cara kerja sebagai pembaikan keletihan otot, jurnal ini akan mengkaji kesan tetapan waktu rehat bekerja sebagai langkah membuka ruang kepada jurang penyelidikan. Secara asasnya, kajian ini merupakan kajian kes industri yang menekankan impak terhadap dua jenis tetapan rehat bekerja (kerap-pendek, tidak kerap-panjang) dalam mengurangkan masalah keletihan otot. Satu kajian penerokaan juga dijalankan pada peringkat permulaan kajian bertujuan bagi mengenal pasti tahap ketidak selesaian badan pekerja diikuti dengan kajian eksperiment bagi mencadangkan waktu rehat yang dapat mengoptimumkan kadar keletihan pada otot serta meningkatkan keselesaan badan. Dapatan utama menunjukkan tetapan rehat tidak kerap-panjang menghasilkan purata penggunaan otot yang rendah berbanding kerap-pendek. Tetapan rehat kerap-pendek selama 2X5 minit pada setengah hari bekerja dilihat tidak cukup untuk mengurangkan kadar keletihan pada otot. Oleh itu, ianya dicadangkan supaya frekuensi slot berehat pada tetapan kerap-pendek dapat ditingkatkan kepada lebih 2 kali pada setiap setengah hari dan keputusan untuk meletakkan rehat lebih dari 5 minit di setiap slot rehat wajar dilakukan supaya pemulihan keletihan otot yang mencukupi akan dapat dibentuk.

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## **CHAPTER 1**

### **INTRODUCTION**

This chapter describes the general background of this research which consists of an overview of problem statement and research objectives to be achieved at the end of the research implementation. There are also some research limitations that are highlighted in the scope of research. Generally this chapter consist of nine sections which are introduction, background of problem, problem statement, scope, research objective, research hypothesis, significance of research, and the expected outcomes to be achieved.

#### **1.1 Introduction**

Ergonomic can be defined as the study of work where it covers the science of fitting task/job to people who work on it. The fitting of task to people is very important as it may help in reducing ergonomic stress and prevent any potential ergonomics disorders such as carpal tunnel syndrome and musculoskeletal disorder. Moreover, ergonomics highlights the study on improving work environment so that the worker performance could be enhanced consistently. Fatigue is one of the suitable examples that is due to poor working environment and will significantly reduce the company productivity. Fatigue happens when work exceed the physical limit and abilities of a worker during his/her working activities. As a result, it will increase the exertion on human physiological and may also result to the risk of muscle trauma. A possible intervention in ergonomics to reduce the physiological strain is to redesign activity–rest schedules (Kakarot, Mueller, & Bassarak, 2012).

Apart from redesigning of tools, methods, workstations and layout to minimize factors that can cause fatigue, effective work-rest schedule is another economic optional and easy to implement where fatigue recovery can happen without involving any implementation cost.

## **1.2 Background of Problem**

Nowadays, manufacturing sector in Malaysia shows the growth in terms of its productivity and increasing demand due to the globalization factor. The growth of manufacturing industries in Malaysia is expected to help create employment opportunities and improve the economy towards developing a high income nation. However, this rapid development may also create a bigger risk of workplace injuries and accidents. The nature of the changes in demand as mentioned above probably has greatly increased the pressure in company production level. It is also involves many of adjustment on job load and job scope. This situation will produce the high stress working environment and affects the work to become overburden. Workers will experience stress when the demands of their job are greater than their capacity to do the job. Similarly, the poor working environment also influence the stress level of worker. The extreme temperature working environment may expose to a higher risk of human physiology such as poor blood circulation and high energy expenditure. As the effect to this condition, worker will be easily exposed to fatigue problem and if it is maintained for a long time, it may lead to serious physical accident and diseases. Previous study also proved that fatigue is one factor that leads to workplace accident apart from poor body posture and poor working environment. For example, Zakaria *et al.* (2012) found that the factor for workplace accident was coming from the stress and fatigue. Hence, the study of effects on fatigue and its continuous improvement plan need to be implemented so that the risk of serious fatigue diseases may be reduced significantly.

### 1.3 Problem Statement

The increasing demands in current manufacturing situation increase the challenges for the manufacturer to produce product at the right quantity with optimum time. As in many manufacturing industry sectors, the electrical industry has been exposed to many of ergonomic risk factor such as improper working posture, excessive time for working hour and repetitive task that may lead to prolonged illness. In Malaysia scenario, electronics industry shows a positive growth in Malaysian manufacturing sector and has been recorded as the main contributor to Malaysia's exports. Taking some insight on this industry, it may be characterized into two major processes which are known as wafer fabrication and semiconductor assembly. Within these both factories, semiconductor assembly line shows higher exposure to occupational hazard including ergonomic hazards such as static work, prolonged standing, awkward posture and repetitive motions. The similar scenario can be seen from fabrication process where workers involved greatly with high risk job and extensive prolonged standing activity. Although fabrication process built with automation system but there is still a demand for manual operation that will involve worker/operator intervention to perform the task. It was revealed that prolonged standing for handwork (fabrication) process has affected the operators to muscle fatigue problem (Abdol Rahim *et al.*, 2010).

Apart from that, the study performed by Abdullah & Abd Rahman (2009) has shown that operators working in semi-conductor industry were exposed to extremely high ergonomics risk factors. They also highlighted the needs on some approaches for reducing this problem such as redesigning of workstation and promoting shorter work duration. Most of Malaysian research focuses mainly in promoting the guidelines for muscle fatigue such as energetic requirement (Ahmada *et al.*, 2012) time-to-fatigue in stamping industry (Halim *et al.*, 2012). However, there are only a few studies that cover work-rest scheduling impact for fatigue improvement in Malaysia. Looking at this opportunity, this project will basically focus on reducing muscle fatigue through the implementation of promoting adequate work rest period for operator that highly involved with standing activity.

## 1.4 Objectives

The objective of this project is aim:

1. To identify the current situation of fatigue level for prolonged standing activity in industrial workplace.
2. To conduct experiment analysis on muscle activity for prolonged standing with different work-rest setting.
3. To recommend a work-rest schedule that decreases fatigue and improve body comfort.

## 1.5 Scope

The project is expected to measure the fatigue level of workers involved in electronics industry. Therefore, the project scope may be listed as below:

1. The study will cover specific type of work only (work related to standing activity)
2. Involve experimental works in industrial setting using two concept of work rest setting (short-frequent vs long-infrequent).
3. Due to the time constraints allocated to this project completion time and limitation on equipment availability, the experiment will be done at one electronic company in Malaysia.
4. Assessing muscle fatigue for lower extremities. Lower muscle shows higher risk of discomfort in standing activity (SJ Sartika & SZ Dawal, 2012).
5. Measure the impact of different work rest schedule using following measurement:
  - a. Physiological recording (Electromyography)
  - b. Psychophysical Perception (Discomfort Questionnaire)



## **1.6 Research Hypothesis**

It is expected that different work-rest schedules will have different impact on workers' fatigue and performance. Study by Dieen & Vrieling (1998) stated that it is more effective to apply short-frequent breaks compared to long-infrequent breaks but there were some study found it in the opposite point of view. Hence this study will discuss the relevancy of this view in accordance with the nature of prolonged standing work in electronic company. The null hypothesis and the alternative hypothesis can be written as follows;

Ho: short and frequent rest will have better impact in term of fatigue recovery for standing activity.

Ha: short and frequent rest has no significant impact in term of fatigue recovery for standing activity

## **1.7 Significance of the Research**

The significant of this project can be discussed into two major contribution which are contribution to researchers and contribution to industry. The contribution to researcher or practitioner comes with the proposal on the introduction of new guideline on designing work rest schedule for prolonged standing activity in electronic industry. It is also may increase the number of study on work rest scheduling for Malaysian perspectives and hence may increase the number of research references for work rest scheduling study. Regarding to its relevance aspect to industry, this project may help to assist the company/industry to maintain their worker health and as well as optimizing their worker performance. Moreover, it is expected that this project may provide a data bank for the company record whereas in the future these data may be very useful for their internal ergonomics improvement programme.

## **1.8 Expected Outcome**

The expected outcome of this project will initiated with some information on the level of fatigue for worker population in selected Malaysia's electronic industry. It also targeted that this research will introduce the design of suitable rest period for work related to standing activity in electronic industry. Moreover, it is expected that this research will discuss further on suitable type of work rest setting (short-frequent vs long-infrequent) that may improve muscle fatigue for standing activity.

## **1.9 Master Project Gantt Chart**

This Gantt chart will be very useful to assist the activities to be done at each week and to ensure the project to be at its milestone. It will explain clearly the flow of entire project and activities involved at every week for this whole semester. The master project 1 Gantt chart involves the stages of project proposal where it will covers until chapter 3 which is methodology chapter. Meanwhile, master project 2 will covers the topic related to result that obtained from the expected methodology. The further discussion will also covers on Chapter 5 and conclusion will be made at the end of it. Below is picture of the Gantt chart for Master Project 1 followed by Gantt chart for Master Project 2.



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