



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**REDESIGN of UTEM CAFETERIA WORKSTATION for WORK
POSTURE IMPROVEMENT UTILISING ERGONOMICS
SIMULATION SOFTWARE**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka
(UTeM) for the Bachelor Degree of Manufacturing Engineering

(Manufacturing Management) with Honours.

by

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is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.). The member of the supervisory is as follow:

.....

(Dr. Isa bin Halim)

ABSTRAK

Dalam perkhidmatan makanan komersial, pekerja dapur terdedah kepada pelbagai faktor risiko ergonomik. Kajian ini memberi tumpuan kepada aktiviti harian pekerja dapur di kafeteria UTeM. Di samping itu, kajian ini juga menganalisis kesan faktor risiko ergonomik tentang postur pekerja semasa menjalankan aktiviti harian di dapur. Tujuan kajian ini adalah untuk mencadangkan reka bentuk tempat kerja baru di kafeteria UTeM untuk mengurangkan ketidakselesaan fizikal di kalangan pekerja dapur. Objektif utama projek ini adalah untuk menentukan ketidakselesaan fizikal yang mempengaruhi postur bekerja semasa melakukan aktiviti harian di tempat kerja. Ketidakselesaan fizikal ditentukan melalui sesi temu bual, pemerhatian tempat kerja termasuk kajian literatur dan kajian soal selidik. Kajian ini menyimpulkan bahawa kebanyakan responden sering menghadapi kesakitan teruk di bahagian belakang badan. Ini adalah disebabkan oleh aktiviti harian semasa bekerja, yang kebiasaannya melibatkan tugas yang berulang-ulang sepanjang waktu bekerja. Kesan kepada setiap faktor risiko ergonomik semasa melakukan aktiviti harian ditentukan dengan menganalisis postur pekerja menggunakan Risk Rapid Upper Limb Assessment (RULA). Berdasarkan keputusan yang diperolehi bagi pekerja lelaki dan perempuan, jumlah skor untuk semua postur bekerja di kawasan memasak dan tempat membasuh pinggan adalah berisiko tinggi dan memerlukan penambahbaikan segera. Reka bentuk ruang kerja baru di kafeteria UTeM mampu meningkatkan keselamatan dan kesihatan pekerja dapur. Hal yang demikian, telah dibuktikan melalui pengurangan jumlah skor bagi setiap postur bekerja untuk kedua-dua jantina serta pulangan pelaburan yang positif. Sementara itu, projek ini juga mencadangkan siasatan lanjut bagi menganalisa aktiviti otot semasa mengendali bahan memasak semasa melakukan aktiviti bekerja dalam postur berdiri yang berpanjangan, dengan menggunakan surface electromyography (sEMG).

ABSTRACT

In commercial food services, the kitchen workers are exposed to various risks factors. The most common ergonomics risk factors are awkward postures, repetition of the body movement, heat stress, prolonged standing, poor lighting and vigorous vibration. These ergonomics risk factors may lead to work-related musculoskeletal disorders (WMSDs). This study focuses on kitchen workers daily activities at UTeM cafeteria. In addition, this study analyses the impact of ergonomics risk factors on worker's postures while performing kitchen daily activities. The aim of this study is to propose a new workstation design at UTeM cafeteria to minimise physical discomfort among kitchen workers. This project started with determining the physical discomfort which influenced worker working posture while performing daily kitchen activities. The physical discomfort was obtained through interview session, workplace observation, literature review and questionnaires survey. This study concluded that most of the respondents always faced severe pain in their upper back and lower back. This is due to kitchen daily activities usually involving repetitive and forceful task where kitchen workers are required to perform the task in prolonged working hours hence lead to the development of muscle fatigue. The effect of ergonomics risk factors on the working posture of UTeM cafeteria kitchen workers while performing daily kitchen activities is determined by analysing the worker posture using Rapid Upper Limb Assessment (RULA). Based on the result obtained, the total score for all working posture for current cooking area involving male and female kitchen workers are high and required immediate improvement. The new design of UTeM cafeteria workstation developed by this study has a sustainability element since it improves the safety and health of the kitchen workers as it can be seen through the reduction of the Rapid Upper Limb Assessment (RULA) score and positive return of investment (ROI). Meanwhile, this project also suggested further investigation analyse muscle activity while handling cooking materials in prolonged standing posture using surface electromyography (sEMG).

DEDICATION

Special dedication to my beloved parents and friend.

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LIST ABBREVIATIONS

WMSDs	-	Work Related Musculoskeletal Disorders
PPE	-	Personal Protective Equipment
WELS	-	Workplace Exposure Limit
UTeM	-	Universiti Teknikal Malaysia Melaka
RULA	-	Rapid Upper Limb Assessment
NBM	-	Nordic Body Map
QFD	-	Quality Function Deployment
HOQ	-	House of Quality
CBA	-	Cost and Benefit Analysis
cm	-	Centimetre
mm	-	Millimetre
R&R	-	Rawat dan Rehat
SPSS	-	Statistical Package for Social Science
VOC	-	Voice of Customers
SEMG	-	Surface Electromyography

CHAPTER 1

INTRODUCTION

Chapter 1 explains the background of the study, problem statements, objectives, and scope of the study. This study focuses on kitchen workers daily activities at UTeM cafeteria. In addition, this study analyses the impact of ergonomics risk factors on worker's postures while performing kitchen daily activities. The aim of this study is to propose a new workstation design at UTeM cafeteria to minimise physical discomfort among kitchen workers.

1.1 Background of Study

The food service industry in Malaysia is generally divided into two major sub-sectors which are the commercial food services and non-commercial food services. The commercial food services are those whose primary business is food and beverage services. Meanwhile, the non-commercial food is a self-operated food service such as hospitals, and hotels (Chandran , 2010).

In commercial food services, the workers are exposed to various risks factors. The most common risk factors are awkward postures, repetition of the body movement, heat stress, prolonged standing, poor lighting and vigorous vibration. These risk factors may lead to work-related musculoskeletal disorders (WMSDs).

Work-related musculoskeletal disorders (WMSDs) are a group of painful disorders of muscles, tendons, and nerves. WMSDs arise from arm and hand movements such as bending, straightening, gripping, twisting, clenching and reaching. These common

movements are not particularly harmful however it may become hazardous in some working situations which require continual repetition, working in a forceful manner, the speed of the movements and the lack of time for recovery (Canadian Centre for Occupational Health and Safety, 1997).

There are three possible controls in reducing the risks in daily working activities such as engineering controls, administrative controls, and personal protective equipment (PPE). Engineering controls describe the control of risks by application of engineering design. The workstation for critical operation is redesigned by inducing automation system to reduce the exposure of the risks toward the operators.

Besides that, administrative controls such as work rotation, training, and good housekeeping also can be utilised in order to control the risks associated with daily working activities. Work rotation is a common a method in the industry to reduce the time of risk exposure among the operators by following the normal working workplace exposure limits (WELS). Furthermore, PPE such as hand glove, safety helmet, safety boot, and goggles should be made as a compulsory resort under the industry's safety policy.

According to Hughes *et al.* (2007), the control of risks is crucial to secure and maintain a healthy and safe workplace which complies with the relevant legal requirements. In order to improve the occupational health and safety among the kitchen worker, all possible risk factors contribute to physical discomfort experienced by worker should be determined. Generally, physical discomfort is increased during manual material handling, hence the tendency of a person to experience postural stress is higher as the loads increased. Based on general lifting technique guideline, loads should be positioned as close to the body as possible in order to minimise energy expenditure during carrying.

1.2 Problem Statement

Currently, there are many work-related-injuries that have been reported involved the commercial kitchen worker which resulting both direct and indirect losses. Generally, the injuries might be the consequent result of repetitive lifting daily routine and working environment. Based on the statistical analysis, 12285 cases are reported to SOCSO from the year 2009 until 2014 (Social Security Organisation; 2009-2014). There are 8910 accident cases reported in male compare the female which is 3375 cases. Whereby, the number of accidents occurs involves commercial kitchen worker had increased uniformly from the year 2009 to 2014, according to the Accommodation and Food Services as depicted in Figure 1.

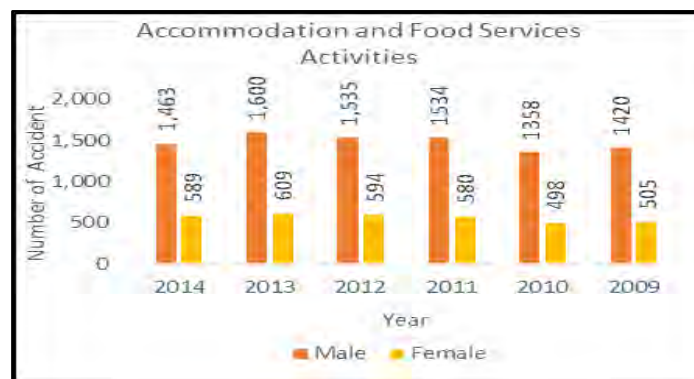


Figure 1: Number of Accidents According To Accommodation and Food Services Activities
Source (Annual report from SOCSO)

Manual handling is widely applied in the commercial kitchen since most of the equipment in the kitchen is not automated. According to Wu, (2000), lifting equation is developed to estimate the recommended weight limit for a worker in performing manual lifting tasks. However, the number of work-related injuries associated with manual lifting is continuously increased, even though the guidelines for safe weight limits for manual handling is provided. The kitchen worker is an explicit job that requires the workers to focus throughout the operation because the workers require repeating the similar procedures in countless time.

1.3 Objectives

Based on the issues mentioned above. This project is carried out to achieve the following goals are as listed below:-

1. To determine physical discomfort experienced by UTeM cafeteria workers while performing daily kitchen activities.
2. To analyse working posture of UTeM cafeteria workers while performing daily kitchen activities.
3. To propose a new workstation design and layout at UTeM cafeteria.

1.4 Project Scope and Limitation

This study is conducted in order to propose an improvement on workstation design at UTeM cafeteria. The research focuses on physical discomfort encountered by the kitchen workers while performing the daily task in various job assignment. The physical discomfort considered in this study is based on data gathered from a questionnaire distributed among UTeM cafeteria kitchen worker. This research is conducted among UTeM cafeteria kitchen worker who is healthy and good physical, without any musculoskeletal injuries. The questionnaire data gathered from subjects for both females and males between 20 to 50 years old, as it indicates the highest population in Malaysia Industries (Department of Statistics of Malaysia, 2010).

The data obtained will be used to propose new workstation design at UTeM cafeteria. The proposed solution will be simulated using DELMIA V5 and will be validated by using DELMIA Human Task Simulation.

1.5 Project Significant

This research provides advantages for both safety and health institution and worker safety practitioners. For the safety and health institution, the proposed solution on the new workstation design can be utilised and implemented by authorities to improve work quality among the worker. In addition, for a worker safety practitioners, the findings of this research can be used to enhance the safety of the employee in term of repetitive handling task, and elimination of manual material handling that lead to musculoskeletal disorder (MSD). The method, data, and propose solution developed through this research can be deployed by the academicians for further research, on the identification and elimination of other risk factors associated with worker daily activities, in order to reduce the work-related-injuries.

1.6 Organisation of the Report

Chapter 1 of this study includes background study of study, problem statement, objective, scope and limitation and significant of this project. The objective of this research is to propose new workstation design at UTeM cafeteria to minimise physical discomfort experienced among workers. The project scope and limitation are important in order to determine the constraint of this study.

Chapter 2 will cover on the literature review in order to provide supporting data, extracting the discussion of the research and to compare the methodology applied for the previous studies. Moreover, in this section the detailed research of various types of published work, books, and other related sources are clarified in order to support information for this study.

Chapter 3 explains the basic research methodology and all of the variables determined from the fundamental approach will be used in order to achieve all the objectives of this research.

Chapter 4 presents the results and discussions of the study. This chapter presents the proposed design of a new workstation design and layout at UTeM cafeteria.

Chapter 5 concludes the findings and recommendations of this research based on the data obtained through all the method applied in this study.

1.7 Summary

Manual handling is widely applied in the commercial kitchen since most of the equipment in the kitchen is not automated. Postural stress is increased during manual material handling. The aim of a research is to develop an improved design of working environments which impose low postural stress on workers. Hence, through this study, the new workstation design proposed is simulated using DELMIA V5 and the validation is made by using DELMIA Human Task.

CHAPTER 2

LITERATURE REVIEW

Chapter 2 describes the study of an ergonomic approach related to the project. This chapter proceeds with a fully-referenced review from related literature. The literature review that caters the information based on the objectives of this project. Mainly, the process of gathering data and information are gained from various sources such as books, journals, research papers, and articles. The purpose of the review are to determine the following information:-

- (a) Basic theory on how to determine physical discomfort.
- (b) Technique and procedure for analysing the working posture of workers in order to reduce physical discomfort.
- (c) A feasible method to develop new workstation design.

2.1 Posture Practiced in Commercial Kitchen Activities

There are few common postures practiced in kitchen activities that contribute to a variety of injuries such as WMSDs and low back pain. Table 2.1 shows the common postures practiced by the kitchen workers while performing daily activities and the source of this information was extracted from the training manual of Health and Safety Authority (HAS) which entitled “Ergonomics in the Workplace.