UNIVERSITI PUTRA MALAYSIA

AN ERGONOMIC INVESTIGATION PERTAINING TO WORK RELATED MUSCULOSKELETAL DISORDER PROBLEMS OF INDUSTRIAL OPERATORS IN PRESSWORKING OPERATION

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Musculoskeletal disorders (MSDs) occur when there is a mismatch between physical requirements of the job and the physical capacity of the human body. Many manufacturing sector industries, especially workers from heavy industries are facing this kind of problem. MSDs have caused lost workdays, injuries, increased the total costs of workers compensation claims, and decreased employee morale, quality and productivity. Keeping these facts in view, present study was planned and investigations were undertaken, in a manufacturing industry, PHN Industry, Shah Alam, Selangor where a cross-sectional study was carried out on a group of male workers in an automotive factory. The objective of the study was to determine the

prevalence of musculoskeletal disorder and its relationship with various work -related and demographic factors.

There were two sets of studies: Qualitative study (Study-1) and Quantitative study (Study –2). Study –1 spanned over investigations related to lower back pain (LBP), neck pain, shoulder pain and wrist pain among workers associated with stamping and assembly operations in the automotive industry. A total of 72 respondents participated in the study. These respondents were selected on the basis of specific characteristics required in the sample, in terms of organismic variables.

All the respondents were, in person, interviewed , on the basis of information required in the translated Nordic's inventory system which served as a basic instrument for the qualitative investigations. Statistical analysis of the data(Study –1) showed that the prevalence of MSDs among the workers was very high with varied levels of complaints of lower back pain (93%), neck pain (65.2%), shoulder pain (25%), and wrist pain (65.3%). Thus the study provided good evidence to demonstrate the existence of MSDs among the industrial workers of the PHN Industry. The data were also analysed in terms of the relationship between MSDs and such variables as age, body mass index, and work duration. In quantitative study (study-2), the Electromyogram (EMG) data involved activity of the erector spinae muscle was measured in each respondent using muscle tester ME3000P System. It was found that there was a significant increase in the mean AEMG (Average Electromyography) readings of both the left and right erector spinae muscles after work when compared with that before the start of the work. On the other hand, there was no significant

decrease in the mean MF (Median Frequency) readings of the both left and right erector spinae muscles for both before and after work.

The mean AEMG difference (before and after) for both the left and right erector spinae muscles was high for workers who complained of lower back pain when compared to those without complaints.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia bagi memenuhi keperluan untuk ijazah Master Sains

KAJIAN ERGONOMIK BERDASARKAN KEPADA KERJA YANG BERKAITAN DENGAN MASALAH GANGGUAN MUSKULOSKELETAL DI KALANGAN OPERATOR PERINDUSTRIAN DALAM KERJA –KERJA PEMBUATAN.

Oleh

MEENALOSHINI SATGUNAM

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Gangguan muskuloskeletal berlaku bila terdapat ketidak seimbangan diantara keperluan kerja fizikal dan keupayaan tubuh badan. Kebanyakan pekerja sektor – sektor pembuatan, terutamanya pekerja dari sektor kerja berat menghadapi masalah ini. Gangguan muskuloskeletal telah menyebabkan gangguan masa kerja kerana terpaksa mengambil cuti rehat, meningkatkan bayaran pampasan pekerja yang terpaksa dibayar oleh majikan, merendahkan semangat pekerja dan juga mutu kerja.

Satu kajian keratan rentas telah dijalankan ke atas pekerja lelaki yang bekerja dikilang automotif di Shah Alam, Selangor dari 24hb Oktober hingga 7hb November 2001. Objektif kajan ini adalah untuk mengkaji gangguan muskuloskeletal dan hubungannya dengan pelbagai kriteria kerja dan faktor demografik. Sejumlah 72 pekerja dipilih untuk kajian ini.

Pemilihan responden berdasarkan kaedah persampelan dilaksanakan dnegan menggunakan senarai nama yang diperolehi daripada pihak kilang. Kesemua responden telah ditemuduga dengan mengunakan borang soal-selidik Nordic yang telah diterjemah untuk mendapatkan maklumat latar belakang dan gejala sakit otot dan rangka. Statistik menunjukkan bahawa sakit belakang bahagian bawah dikalangan pekerja kilang automotif adalah tinggi iaitu 93%, sakit leher (65.2%), sakit bahu (25%),dan sakit gelang tangan (65.3%). Kajian ini telah membuktikan kehadiran sakit muskuloskeletal dikalangan pekerja industri automotif di Shah Alam. Data yang diperolehi juga telah dikaitkan dengan umur, index jisim badan, dan tempoh bekerja. Semssa ukuran kuantitatif (kajian-2) dijalankan, pengukuran aktiviti otot erektor spinae telah dilakukan keatas setiap responden dengan mengunakan Muscle Tester ME3000 System. Terdapat peningkatan yang signifikan bacaan purata AEMG otot erektor spinae selepas kerja. Manakala tidak terdapat penurunan yang signifikan bacaan purata MF otot selepas kerja. Purata AEMG kiri dan kanan bagi pekerja yang mempunyai gejala sakit belakang bawah adalah tinggi berbanding pekerja yang tidak mempunyai gejala sakit belakang bawah. Ujian statistik menunjukkan bahawa terdapat perbezaan yang signifikan bacaan min AEMG bag sebelah kanan tetapi bagi sebelah kiri ujian statistik menunjukkan tidak terdapat perbezaan yang signifikan antara pekerja yang mempunyai gejala dan tidak

mempunyai gejala sakit belakang bahagian bawah. Ujian statistik menunjukkan bahawa tidak terdapat perbezaan yang signifikan bacaan purata MF bagi kedua – dua bahagian iaitu sebelah kiri dan kanan .

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NOMENCLATURE

EMG	:	Electromyography
AEMG	:	Average Electromyography
MF	:	Median Frequency
BMI	:	Body Mass Index
L4	:	Lumbar 4
L5	:	Lumbar 5
Kg	:	kilogram
μV	:	Microvolt
Hz	:	Hertz
S.D.	:	Standard Deviation
S.E	:	Standard Error of Mean

CHAPTER ONE

INTRODUCTION

Ergonomics or human factor engineering is a multidisciplinary activity to assemble information on people's capacities and capabilities for use in designing jobs, products, workplaces and equipment. The term ergonomics and human factors Engineering are often used simultaneously. Both describe the interaction between the operator and the job demands and both are concerned with trying to reduce human stresses in the workplace. In layman's term, ergonomics deals with the interaction between three main components; human, machine and the environment.

As a discipline, it takes as its starting point, the constitution of the individuals features (anatomical, biomechanical, physiological, psychological and social) within the work system. Ergonomics seeks to design worksystem so that it will better fit the needs of the individual.

To study the ergonomic problems in a given complex work environment, the best way to seek a satisfactory solution would be to consider the whole problem following the systems approach that assumes that each part of the worksystem may have an effect on each other. It is convenient to consider the worksystem in terms of

five main areas: task or work, machine or equipment, environment, personnel and organisation.

1.1 Musculoskeletal Disorders(MSDs)

As regards, the work-related disorders, these are typically conditions of multiple aetiology in which nature of work is a significant contributory factor and results in disorders that may occur in a wide variety of working population. Low back pain, for example, is common among labourers, nurses, truck drivers, and office workers; repetitive strain injuries occur in production line workers and keyboard operators. The identification of underlying risk factors may be a complex problem. – both epidemiologically and ergonomically.Work related musculoskeletal disorders may result from single episodes of exertion or the cumulative overuse or a combination of both. Cumulative overuse may be due to working postures, strenuous physical activity, repetitive motions or any combination of these characteristics.

Low back pain is the most common of the work related musculoskeletal disorders, and in common economic terms is very costly. Back pain may be due to a number of causes: For example, postural abuse which is mainly due to poor standing posture, whereby the person is slump in one way or another, sagging, losing muscle tone, hanging on the hip and spinal elements, mistreating and stressing all the structures in and around the motion segment, etc are the ones being commonly reported in the literature.

1.2 Problem Statement and Objectives

Work related musculoskeletal disorders occur when there is a mismatch between the physical requirements of the job and the physical capacity of the human body. More than 100 injuries can result from repetitive motions that produce wear and tear in the body. Back pain, wrist tendinitis and carpal tunnel syndrome may all stem from work related overuse. Specific risk factors associated with MSDs include repetitive motion, heavy lifting, forceful exertion, contact stress, vibration, awkward posture and rapid hand and wrist movement resulting in the rising costs of lower back disorders (Bigos *et al*, 1986). Many researchers have stressed the rising costs of low back disorders and its burden on the industry (Mitla et al., Sommerich and Marras, 1992; Kumar and Garrand, 1992; Ayoub, 1992). According to one of the recent report by Chaffin (1997),manual material handling(MMH) injuries comprised 52% of all work related injuries in the United States, disabled 5 million workers and costing approximately 100 billion dollars a year.

In 1998, more than 647,000 American workers experienced serious injuries due to overexertion or repetitive motion on the job. These work-related musculoskeletal disorder (WMSD) accounts for 34% of lost workday injuries. WMSDs cost employer an estimated $15 billion to $20 billion in workers compensation costs in 1997 and $45 to 60 billion more in indirect costs(Bernard B. et al.,1994).