

**ASSESSMENT OF PHYSICAL ERGONOMICS RISK FACTORS AND
THEIR EFFECTS ON QUALITY IN MEDICAL LABORATORIES**

Submitted By

Wael Mohamed Ahmed Hamed

M.B.B.Ch., Faculty of Medicine, Cairo University, 1994
Master of (Radiology), Faculty of Medicine, Al Azhar University, 2003

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Doctor of Philosophy Degree
In
Environmental Science

Department of Environmental Medical Sciences
Institute of Environmental Studies and Research
Ain Shams University

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APPROVAL SHEET

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DECLARATION

I declare that this thesis is my own work except for quotations and summaries which have been clearly acknowledged. It is being submitted for the degree of Doctor of Philosophy at the Institute of Environmental Studies and Research - Ain Shams University. It has not been submitted for any other degree in any other University.

Wael Mohamed Hamed

Cairo, January 2015

ABSTRACT

Introduction: Medical Laboratory workers are exposed to many physical ergonomic risk factors and ergonomic stressors during routine laboratory work that may result in formation of work related musculoskeletal disorders and affect quality in work environment.

Objective: The aim of this study is to identify the different physical ergonomics risk factors that workers may be exposed to them in medical laboratories, association with laboratory ergonomic stressors, occurrence of work related musculoskeletal disorders and assess effects on quality in medical laboratories.

Subjects and methods: This study is Descriptive cross-sectional study for 80 workers in medical forensic laboratories in Cairo. The collected data from designed Questionnaire, clinical examination and investigations were processed and analyzed.

Results: Neck and upper extremity musculoskeletal disorders were found among 42.5% of the sample size, related to age, work period , awkward body position with non ergonomic chair and contact stress. Back musculoskeletal disorders were found among 31.3% of the sample size, related to work period, static posture due to insufficient leg room and awkward body position with non ergonomic chair .Lower limbs musculoskeletal disorder related to height, weight, static posture due to insufficient leg room and no lab bench anti-fatigue mat. Laboratory workers have little awareness with ergonomic principles .These factors decrease safety, productivity and quality of life in the laboratory work environment.

Conclusion: The most notable result from the study was repetitive movement is the main physical ergonomic risk factor poses significant risk for occurrence of musculoskeletal disorders in medical laboratories,

due to exposure to many ergonomic stressors, like, repetitive nature of pipetting, prolonged awkward postures at a microscope, opening and closing vial caps, microtome work, standing at laboratory workbenches, non ergonomic chair and using computer.

Recommendations: Ergonomic design of the laboratory. Medical laboratory workers must be aware with the protective measures to eliminate or reduce ergonomic stressors during routine laboratory procedures through ergonomic training program. Providing management leadership and employee involvement in the identification, correction and elimination of such risk factors.

Keywords: Ergonomic risk factor, Musculoskeletal disorders, Quality, Medical laboratories.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
CTS	Carpal Tunnel Syndrome
CLSI	Clinical and Laboratory Standards Institute
CTDs	Cumulative Trauma Disorders
FTEs	Full-Time Equivalent Employees
ISO	International Organization for Standardization
NCCLS	National Committee for Clinical Laboratory Standards
NIOSH	National Institute of Occupational Safety and Health
QWL	Quality of Work Life
REM	Rapid Eye Movement
RSIs	Repetitive Strain Injuries.
BLS	U.S. Bureau of Labor Statistics
WMSDs	Work-related Musculoskeletal Disorders
VDTs	Video Display Terminals

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INTRODUCTION

Ergonomics is the science of fitting the work-place conditions and job demands to the capabilities of the working population. The goal of ergonomics is to make the work place more comfortable and to improve both health and productivity. To meet these goals, the capabilities and limitations of workers and their tools, equipment and furniture are considered in conjunction with how they relate to particular tasks (*University of Minnesota Duluth Environmental Health and Safety Office ,2000*). Ergonomics should be considered in the work system design so as to reduce or eliminate problems (*Shikdar,2004*)

Physical ergonomics is concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity. (Relevant topics include working postures, materials handling, repetitive movements, work related musculoskeletal disorders, workplace layout, safety and health (*International Ergonomics Association,2014*).

Physical risk factors for the development of musculoskeletal disorders in medical laboratories are mechanical overload, repetition frequency, exposure time and posture (*Luttman et al., 2014*).

Laboratory researchers are at risk for repetitive motion injuries during routine laboratory procedures such as pipetting, working at microscopes, operating microtomes, using cell counters and video display terminals. Repetitive motion injuries develop over time and occur when muscles and joints are stressed, tendons are inflamed, nerves are pinched and the flow of blood is restricted. Standing and working in awkward positions in laboratory hoods/biological safety cabinets can also present ergonomic problems .The main ergonomic stressors during routine laboratory workers are; Pipetting, Microscopy, Microtome Work,

INTRODUCTION

Laboratory Workbenches. Micro-Manipulation, Fine Motor Skills, Overhead Lifting, Cryostat Work, Computer Screens and Non Ergonomic Chair. The workers must be aware with the protective measures to eliminate or reduce ergonomic stressors during routine laboratory procedures (*NIESH, 2014*).

The term musculoskeletal disorders denote health problems the locomotor apparatus, i.e. of muscles, tendons, the skeleton, cartilage, ligaments and nerves. Musculoskeletal disorders include all forms of ill-health ranging from light, transitory disorders to irreversible, disabling injuries. WRMSD divided into: Neck disorders, upper-extremity disorders, back injuries and lower-extremity disorders..Back injuries (e.g. lower back pain, disc degeneration, and herniation) have the highest proportion (approximately 60%). The second position is taken by injuries of the neck and the upper extremities (e.g. pain syndromes of the neck, shoulders, arms, “tennis elbow”, tendinitis and tendovaginitis, carpal tunnel syndrome, syndromes related to cumulative traumata, the so-called cumulative trauma disorders (CTDs) or repetitive strain injuries (RSIs)), followed by injuries of knees (for example, degeneration of menisci, arthrosis) and hips (e.g. arthrosis). It is generally accepted that working conditions and workload are important factors for the development and continuance of these disorders (*Luttman., et al., 2014*).

Cytotechnologists suffer from musculoskeletal disorders commonly associated with poor ergonomic design in the workplace. Among the symptoms presented are headache, neck pain and stiffness, pain of the lower and upper back, and upper-extremity discomfort. Neurological symptoms, such as numbness, tingling, and/or pain in the hand and fingers, are often associated with repetitive motion (*Thompson et al.,2003*).