UNIVERSITI PUTRA MALAYSIA

RISK FACTORS OF OCCUPATIONAL STRESS AMONG NONDESTRUCTIVE TESTING RADIOGRAPHERS IN SAUDI ARABIA

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By

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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January 2018

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Introduction: The non-destructive testing field is one of the critical fields supporting the oil and gas industry in Saudi Arabia. Due to the working conditions experienced by the employees of this sector, especially radiographers, the conditions of the workplace affect them and cause considerable job stress. As such, there is a need to undertake an in-depth study of the association between occupational stress and the sources of stress. The aim of this study was to determine the association between workplace stressors, personal stressors, and occupational stress level among radiographers in a non-destructive testing company in Saudi Arabia.The methodology adopted is a cross-sectional study conducted at five non-destructive testing companies in Saudi Arabia. A total of 112 employees were selected as the sample. A questionnaire was used to determine the socio-demographic and occupational backgrounds.The social and psychological characteristics of the respondent's job were determined using the JCQ (Job Content Questionnaire). Salivary alpha-amylase assay kit was used to analyse the salivary alpha-amylase levels as an indicator of occupational stress. The results showed that the response rate was 100%. Cronbach's alpha coefficient for the English version of JCQ was acceptable ($\alpha = 0.70$). The majority of the respondents were Indians (33.0%), followed by Filipinos (24.11%), Saudi Arabians (17.0%), Jordanians (16.1%), Pakistanis (6.3%), and others (3.6%). Most of the respondents were on night shift (60.7%) and worked overtime (72.3%). The mean value of salivary alpha amylase activity among workers was 72.34±11.39 U/ml during pre-shift and 94.09±15.95 U/ml post-shift. Paired sample t-test showed the mean exposed group differed significantly from the non-exposed group ($t=8.48$, $df= 46$, $p<0.05$; 95% Cl: 15.47 - 25.10).The prevalence of occupational stress among the exposed group was 88.0% and non-exposed group 58.0 %. The group who were exposed to heat stress had high prevalence of occupational stress level of 61.4%.This findings of this study showed that there was high prevalence of occupational stress among industrial

radiographers. Workplace stressors associated with occupational stress among these workers suggest that the safety and health precautions of workers performing radiography wok are important and should be addressed.

Keywords: Occupational stress, work-place stressor, Radiographers, alpha amylase activity, JCQ, non-destructive testing.

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

FAKTOR RISIKO STRESS PEKERJAAN DALAM KALANGANJURURADIOGRAFI UJIAN BUKAN-PEMUSNAH DI SAUDI ARABIA

Oleh

KHALAF ALSHARAFAT

Januari 2018

Pengerusi : Profesor Madya Shamsul Bahri Mohd Tamrin, PhD
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Pengenalan: Bidang ujian bukan-permusnah adalah salah satu bidang kritikal yang menyokong industri minyak dan gas di Arab Saudi. Kerana keadaan tempat kerja yang dialami oleh pekerja sektor ini, terutama jururadiografi, situasi tempat kerja mempengaruhi mereka dan menyebabkan tekanan kerja yang besar. Oleh itu, terdapat keperluan untuk menjalankan kajian mendalam mengenai hubungan antara tekanan pekerjaan dan penyebab-penyebab tekanan. Tujuan kajian ini adalah untuk menentukan kaitan antara penyebab tekanan tempat kerja, penyebab tekanan peribadi, dan tahap tekanan dalam kalangan jururadiografi dalam syarikat ujian bukan-pemusnah di Arab Saudi. Metodologi yang digunakan adalah kajian keratan rentas yang dijalankan di lima syarikat ujian bukan-pemusnah di Arab Saudi. Sebanyak 112 pekerja dipilih sebagai sampel. Soal selidik digunakan untuk menentukan latar belakang sosio-demografi dan pekerjaan. Ciri sosial dan psikologi pekerjaan responden ditentukan dengan menggunakan JCQ (Job Content Questionnaire). Kit ujian alfa-amilase air liur digunakan untuk menganalisis paras alfa-amilase air liur sebagai penunjuk tekanan pekerjaan. Keputusan menunjukkan bahawa kadar tindak balas adalah 100%. Koefisien alpha Cronbach untuk versi bahasa Inggeris JCQ boleh diterima ($\alpha = 0.70$). Majoriti responden adalah orang India (33.0%), diikuti oleh orang Filipina (24.11%), Arab Saudi (17.0%), Jordan (16.1%), Pakistan (6.3%) dan lain-lain (3.6%). Kebanyakan responden bekerja shif malam (60.7%) dan bekerja lebih masa (72.3%). Nilai min aktiviti alfa-amilase air liur dalam kalangan pekerja adalah 72.34 ± 11.39 U/ml semasa pra-shift dan 94.09 ± 15.95 U/ml selepas shift. Ujian t-sampel berpasangan menunjukkan kumpulan terdedah berbeza tinggi dengan kumpulan tidak terdedah ($t = 8.48$, $df = 46$, $p < 0.05$; 95% Cl: 15.47 - 25.10). Kekerapan tekanan pekerjaan dalam kalangan kumpulan terdedah adalah 88.0% dan kumpulan tidak terdedah 58.0%. Kumpulan yang

terdedah kepada keadaan tempat kerja yang panas mempunyai tahap tekanan pekerjaan yang tinggi iaitu 61.4%. Penemuan kajian ini menunjukkan terdapatnya tekanan kerja yang tinggi dalam kalangan jururadiografi perindustrian. Penyebab tekanan tempat kerja yang berkaitan dengan tekanan pekerjaan untuk pekerja menunjukkan bahawa langkah berjaga-jaga untuk keselamatan dan kesihatan pekerja yang menjalankan kerja-kerja radiografi adalah penting dan perlu ditangani.

Kata kunci: Tekanan kerja, penyebab tekanan kerja, Jururadiografi, aktiviti alfa-amilase, JCQ, ujian bukan-pemusnah.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science.. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

≥	Equal or more than
<	Less Than
%	Percentage
P	Significant value
et al	And others
SD	Standard deviation
CI	Confidence interval
SPSS	Statistical Package for Social Science
NDT	Non-Destructive Testing
RT	Radiographic Testing
PT	Penetrant Testing
MT	Magnetic Testing
UT	Ultrasound Testing
dB(A)	Decibel (A)
sAA	Salivary alpha-amylase
JCQ	Job Content Questionnaire
WHO	World Health Organization
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
ASI	American Institute of stress
IAEA	International Atomic Energy Agency
PPE	Personal Protective Equipment
SR	Saudi riyal

CHAPTER I

INTRODUCTION

1.1 Background of the study

Non-destructive Test and Evaluation (NDT) is aimed at extracting information on the physical, chemical, mechanical or metallurgical state of materials or structures. This information is obtained through a process of interaction between the information-generating device and the object under test (Prasad et al., 2011). Non-destructive testing (NDT) plays an important role in the quality control not only of the finished products, but also of half finished products as well as the initial raw materials. NDT can be used at all stages of the production process (Lavender, 2001). The significance of NDT inspection of industrial plants and engineering structures in the power plants, petroleum and chemical processing industries, and the transport sector cannot be refuted. Using state-of-the-art technology to assess current conditions, service suitability, and the remaining life of the equipment. The NDT exam provides some insight into data to help develop a strategic plan to extend plant life (Gardner et al., 2013).

The field of Non-Destructive Evaluation (NDE) or Non-Destructive Testing (NDT) involves the identification and characterization of damages on the surface and interior of materials without cutting apart or otherwise altering the material (Lockard, 2015).

In other words, NDT refers to the evaluation and inspection process of materials or components for characterization or finding defects and flaws in comparison with some standards without altering the original attributes or harming the object being tested (figure 1.1), NDT techniques provide a cost-effective means of testing of a sample for individual investigation or may be applied on the whole material for checking in a production quality control system (Newswire, 2013).

Figure 1.1 : Non-Distractive Test (NDT)

One of the most techniques used in NDT is Radiography which is based on the transmission of X-rays or gamma-rays through an object to produce an image on radiographic film (Figure 1.2). This method is used for inspecting several types of welded assemblies such as pipe-lines, boilers, pressure vessels etc. Inspected zones may present multifarious defects such as porosity, inclusions, cracks, lack of penetration, lack of fusion etc , Evaluated by the NDT criteria (Nafaa,2004) .

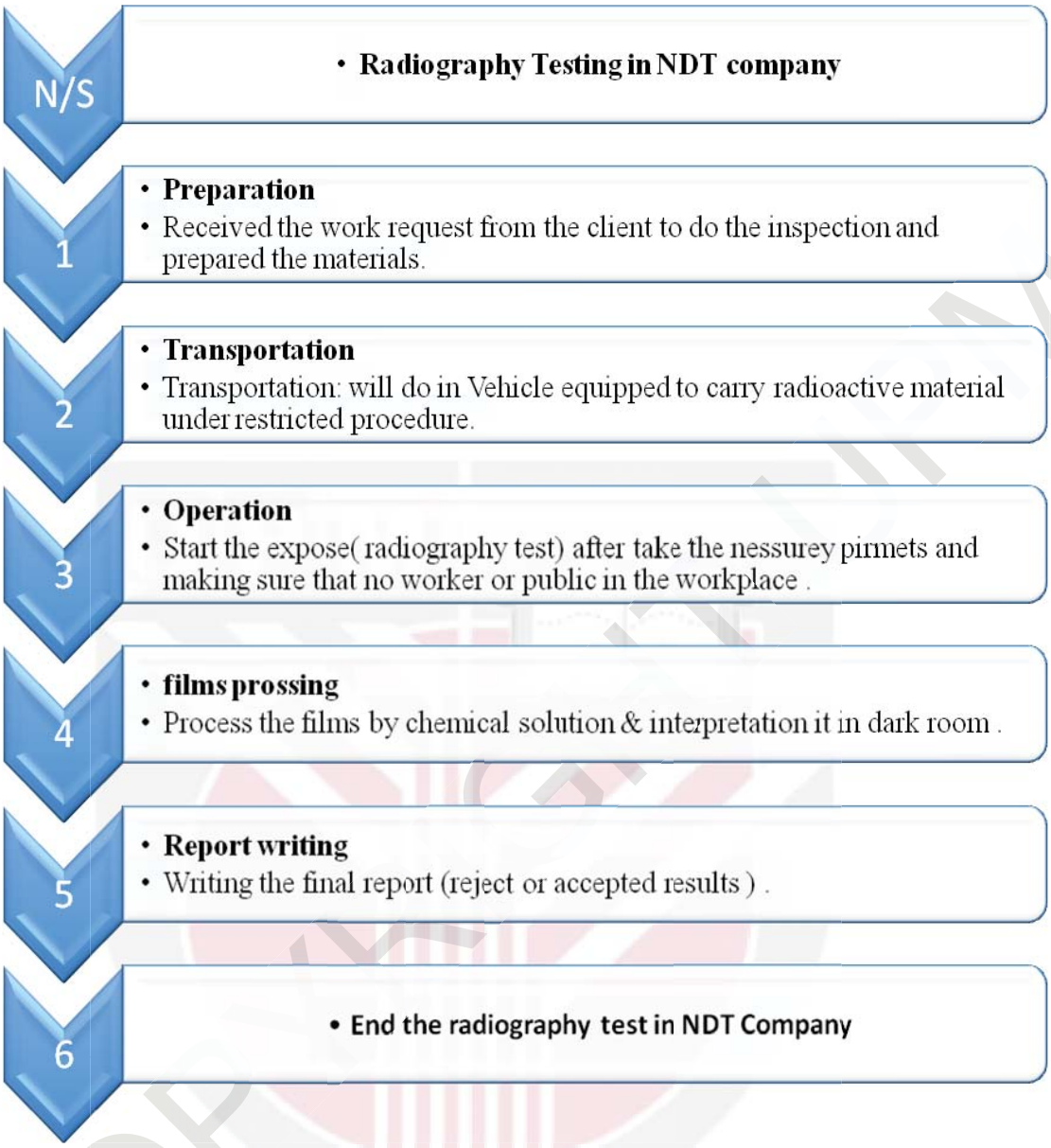

Figure 1. 2 : Radiography Testing Flow Chart

Occupational stress is considered a vital global problem that received great attention in many countries. This is because the negative stress impacts at work may increase the physical, physiological, psychosocial factors. Stress at work may lead to poor work performance, low productivity and high accident/incident and injury rate (ILO, 2012). Hence it is vital to optimize work condition and organization. Lee (2013) notes that work-related stress has become a major concern and suggests employers recognize that it can lead to health problems. In fact, occupational stress is a psychosocial hazard that poses a threat to the health of the organization (NIOSH, 1999).

1.2 Problem Statement

The importance of assessing occupational stress has emerging almost every job and position. In the United States, the cost of stress has been calculated at US$350 billion (about £220 billion) per year and £25.9 billion in the U.K annually (Azagba & Sharaf, 2011). The job stress is responsible for 19% of absenteeism cost, 40% of turnover cost and 60% of workplace accidents (Tangri, 2003). Most studies have focused on health care and education; however, no sufficient attention is given to industrial radiographers working in non-destructive testing companies specifically to study and investigate the level of occupational stress among the radiographers in these companies. The nature of the climate in the Kingdom of Saudi Arabia is very special because of the severity and high temperatures and dust storms, the length of the distances between work sites all these factors and other factors are considered to be reflected on Physical and psychological abilities of industrial radiographers.

In Saudi Arabia, the nature of work as a non-destructive radiography technician requires physical and psychological training; every site in the oil and gas plants faces a lot of risk such as (Chemical, Heat, Noise, Radiation) all of this factors will be as a hazard for the workers . Due to the nature of the work, especially the working conditions of the work environment and in the field of non-destructive radiography technology face a lot factors that are not specifically known yet.

1.3 Study Justification

Saudi Arabia has 18% of the world's oil reserves, and is the largest oil exporter. The oil and gas sector accounts for about 50 per cent of the gross domestic product, or 85 per cent of export earnings. Because of the importance of the oil and gas sector in Saudi Arabia, there could be those radiologists in occupational stress non-destructive testing whom the occupational stress affects their performance and inevitably exert an impact on the yield of organization.

It is in view of this that this study attempts to further explore this area that has not been reported anywhere in the related literature so far. The outcome of the study will be helpful to the management to allocate more capable workers that are in critical situation and also will give clear view to ministry of health on the health of these workers and their level of job stress.

1.4 Conceptual Framework

Figure 1.3 shows the conceptual framework that is given the start point of the study and guides the researcher to move in the correct direction toward the study target.

i. The independent variables in this study are the personal stressor and work place stressor.
ii. The dependent variable is occupational stress.

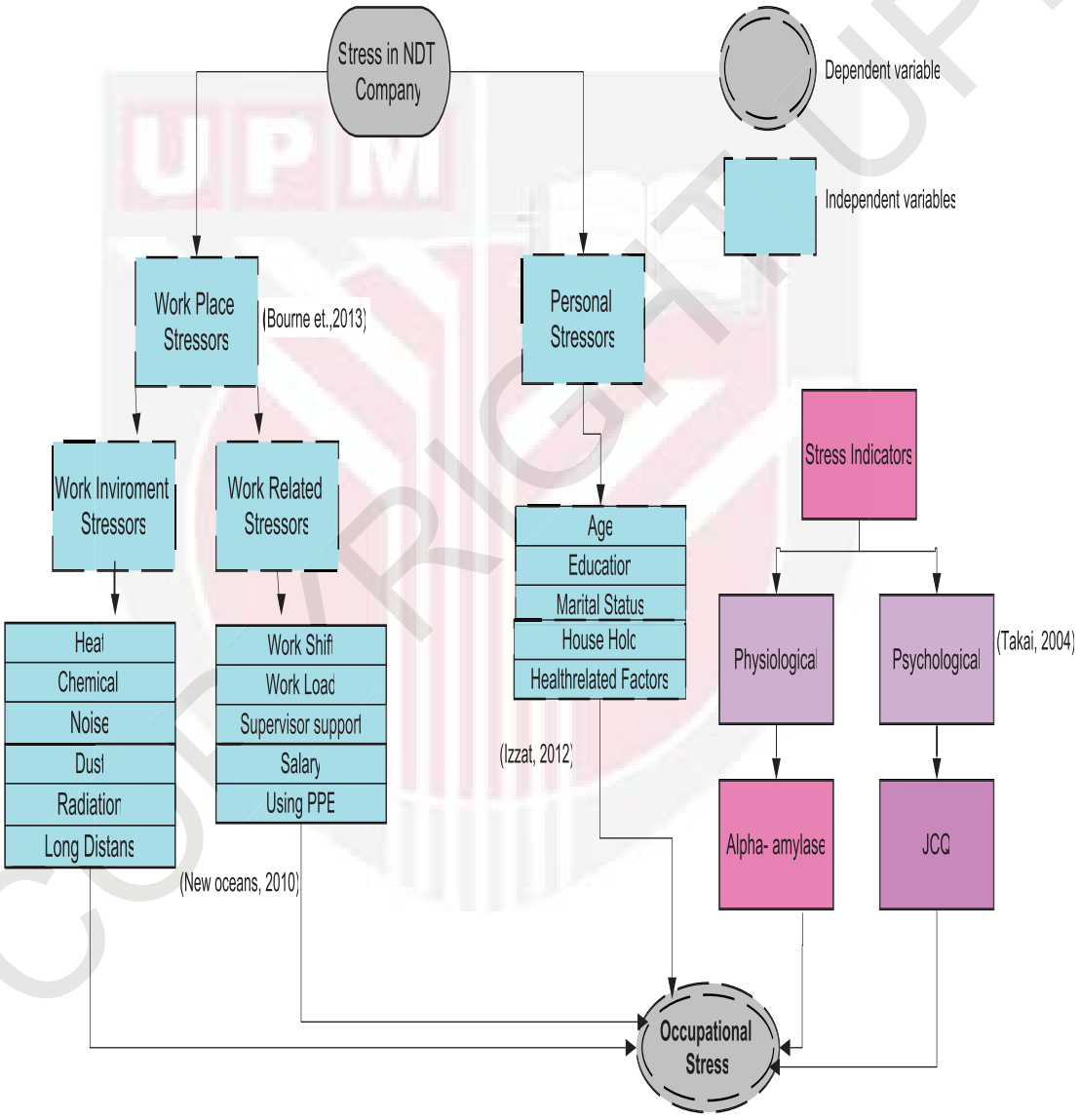

Figure 1.3 : Conceptual frameworks

1.5 Research Objectives

1.5.1 General Objective

To determine the association between workplace stressors, personal stressor and Occupational stress level among radiographers in a non-destructive testing company in Saudi Arabia.

1.5.2 Specific Objectives

I. To determine the social demographics factors of radiographers in a non-destructive Testing company in Saudi Arabia.
II. To determine the prevalence of occupational stress among radiographic workers in a non-destructive testing company in Saudi Arabia.
III. To determine the cumulative of α-amylase activity (U/ml) for exposed and non - exposed groups.
IV. To compare the prevalence of occupational stress between the exposed and non-exposed groups.
V. To determine the association between workplace stressors, personal stressor and

Occupational stress level (JCQ and Salivary α-amylase activity (U/ml)) among radiographers in a non-destructive testing Company in Saudi Arabia.

VI. To determine the relationship between stress indicators (JCQ and Salivary α- amylase activity) among the occupational stress of radiographers.

1.6 Research Hypotheses:

i. There is significant difference in prevalence of the occupational stress between the exposed and non- exposed groups.
ii. There is significant relationship between stress indicators, JCQ with

Salivary α-amylase activity (U/ml).

iii. There is significant relationship between stress indicators, (JCQ, Salivary α-amylase activity (U/ml)) and the stress factor.

1.7 Definition of Variables

1.7.1 Conceptual definition

1.7.1.1 Occupational Stress

The national Institute for Occupational safety and Health (NIOSH, 1999) defines occupational stress as “harmful physical and emotional reactions that occur when work demands do not match the workers' abilities, resources or needs”. Stress in the work place can have many origins or a times come from one single event. It can have impact on both employees and employers alike (Canadian Centre for Occupational Health and Safety, 2008).

1.7.1.2 Workplace Stressor

Operating pressure sources are chemical or biological agents, environmental conditions, external stimuli or events that stress the organism's pressure source (NIOSH, 1999). Work stress can be defined as "prerequisites at work or part of the organization that needs an adaptive response" (Chang, 2006).

1.7.1.3 Alpha amylase

Salivary alpha-amylase (sAA) is one of the major salivary proteins or enzyme (Zakowski, 1985). Recent studies have found alpha-amylase as a digestive enzyme and marker of SNS activity. The enzyme digests the starch by hydrolyzing the starch linkage and allows the organism to use the stored starch as an energy source (Rohleded *et al*., 2009). Acinar cells release saliva products after neurotransmitter stimulation (Behringer *et al*., 2012). This enzyme is a biological indicator of stress response and has been proposed to indicate stress-responsive physical changes in psychophysiological research and clinical practice (Nater, 2006). Evidence indicates the relationship between intra-individual changes in sAA and physical and psychological stressors (Strahler *et al*., 2010).

1.7.2 Operational definition

1.7.2.1 Occupational stress

Occupational stress measured using JCQ . The JCQ is a self-administered standardized instrument designed to measure social and psychological characteristics of jobs. The best-known scales are (a) decision latitude, (b) psychological demands, and (c) social support—are used to measure the high-demand/low control/ low-support model of job strain development. The demand / control model first predicts the stress-related risks and, secondly, the active-passive behaviour-related work.

Other aspects of work demands are assessed as well: (d) physical demands and (e) job insecurity. The instalment has a recommended length of 49 questions (Karasek *et al*., 1998).

1.7.2.2 Workplace Stressors

Work place stressor measured by a questionnaire distributed to respondents to determine the most important work place stressor they are exposed to in the workplace from their perspective such as Heat, Noise, Radiation and Chemical.

1.7.2.3 Alpha amylase

The salivary sample were taken from the respondents following the instruction of salimentary oral swab, the taken saliva was kept in specific condition of -20 °C at most for two months using the salimentary storage tube. The samples taken from the respondent were analysing using the salivary α–Amylase assay kit according to manufacturer's manual.

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