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A STUDY OF PULMONARY FUNCTIONS
AMONG ELECTRICAL ARC WELDERS

THESIS

Submitted for Partial Fulfillment of
The Master Degree in Occupational Medicine

By

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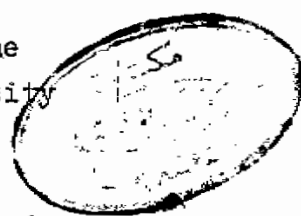
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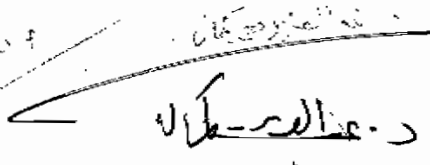
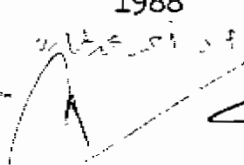
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سُبْحَانَكَ لَا إِلَهَ إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ
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List of abbreviations (Cotes, 1975)

Abbreviation	Index
FVC	Forced vital capacity.
FEV ₁	Forced expiratory volume in the first second.
PEFR	Peak expiratory flow rate.
PVC	Predicted vital capacity.
FEF _{25-75%}	Forced expiratory flow in the middle two quarters of the forced vital capacity.

FEV₁% : Percentage of FEV₁ its normal predicted value of the male Egyptian industrial workers.

PEFR% : Percentage of PEFR from its normal predicted value of the male Egyptian industrial workers.

M.R.C. questionnaire: Medical Research council questionnaire.

INTRODUCTION

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Welding is an industrial process of joining metal pieces by the application of heat by a wide variety of methods such as the use of electrical arc. Several gases and fumes are generated during the welding processes depending upon the metal used and the process itself. These gases and fumes are considered a potential hazard for the respiratory system(Keiming et al., 1983).

Some of these studies have shown an impairment in pulmonary functions among the electrical arc welders most probably due to inhalation of gases and fumes liberated during the welding process, however, other studies did not demonstrate an impairment in the lung function (Mur et al., 1985; Anti-Poika et al., 1977).

Variations in the results of these studies were - probably due to different types of welding processes and the use of developed devices as the automatic and semi-automatic welding machines which lead to less exposures and minimal amounts of gases and fumes liberated during the welding process(Keiming et al., 1983).

In Egypt, industry is developing now and the electrical arc welding is widely used either separately or as a step in a variety of industries. However some welders are still using the manual procedures in electrical arc welding in the small, undeveloped private industries and as a step of different industries in large factories.

To the best of my knowledge, no studies have been conducted in Egypt - to investigate the effect of welding processes on the ventilatory functions and chest symptomatology of the electrical arc welders.

AIM OF THE WORK

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The aim of this work is:

1) To determine the effect of exposure to welding process on the ventilatory functions of a group of Egyptian electric arc welders.

2) To determine wheather the occurance of respiratory symptoms are different in the electrical arc welders than among the control groups.

The manual electrical arc welding consists of the electrodes which contains a core of metal and a covering composed of alloys of different elements such as iron, chromium, nickel and zinc with some minerals, attached with a high voltage electrical source. When used it produces a high temperature by the electrical current melting the electrode, leads to joining the metal process together (Chamberlan, 1983).

Another methods of the welding processes such as atomic hydrogen welding using tungsten electrodes and spark erosion machine (Chamberlan, 1983).

In flash welding method, both ends of the metal pieces are brought in contact then a great current is passed melting the metal ends together (Chamberlan, 1983).

These welding processes are the first step in various industries as steel constructions, motor car industry, and ship building (Stern, 1980).

As the technology develops more welding processes are progressed and introduced in different industries

radiation which is emitted during welding processes causes cataract (Chamberlan, 1983).

B) Effect on the skin:

The exposure to very high temperature during welding process in closed spaces as tanks - can cause any form of heat disorders as heat exhaustion, heat syncope, heat stroke, also accidental burning of the skin, if the skin comes in contact with the hot welded materials, this burn can take any form such as erythema, vesicles and bullae (Stern, 1980).

The presence of chromium in the core or the covering materials of the electrodes is considered a hazardous material due to the formation of the hexavalent chromium in the considerable amount in the fumes which liberated during the welding process. So the exposure of the face to these fume of the chromates may cause allergic contact dermatitis (Cronin, 1980).

The sporadic contact of the welding fumes to the skin of a sensitive man was considered the cause of repeated episodes of hand eczema (Shelly , 1964).

Actinic keratosis, and a metastising squamous cell carcinoma were reported following the exposure to the radiation emitted during the electro-welding. (Cronin, 1980).

C) Mutagenic and carcinogenic effect:

Some studies have proved that the radiations, gases and fumes liberated during the welding processes may cause genotoxic and mutagenic effects on the chinese hamster lung cells (Baker et al., 1986).

D) Renal effect:

The chronic exposure to welding gases and fumes may cause renal troubles in form of glomerulonephritis or interstitial nephritis (Hagberg et al., 1986).

Pulmonary Function Testing

Assesment of the lung functions is an important part in the preplacement medical examination and in the periodic medical examination, also assesment of the hazardous effect in any industry containing a respirable harmful materials such as in welding processes.

It is also used in the comparison between groups and in the epidemiological studies for early detection of the hazardous effect in the reversible stages. Also it is used with the environmental measurements to measure the safety values as the maximum allowable concentrations and the threshold limit values for the hazardous materials-as the gases and fumes liberated during the welding processes.

* Factors affecting the normal values of the pulmonary function:

The pulmonary functions are affected by age, sex, body size, ethnic group, Anthropometric variation that occurs due to difference in lung size, also the altitude as well as the degree of physical activity can affect the pulmonary functions (Woolcock et al., 1972).

* Effect of smoking on pulmonary function:

The exposure to air pollutants can affect the pulmonary function also the smoking habit is one of the most leading causes of the chronic air flow obstruction including all the values of the indices of the forced expiratory flow. The impairment of the pulmonary