ESTABLISHMENT OF AN INTERVENTION HEALTH EDUCATION PROGRAM FOR ENVIRONMENTAL AND HEALTH PROMOTION OF ALUMINUM WORKERS

Submitted By

Jihan Mohamed Abdel-Moneim Ragheb

M.B.B. Ch., Faculty of Medicine, Ain Shams University, 1983

Master of Environmental Sciences, Institute of Environmental Studies and Research,

Ain Shams University, 2005

A thesis submitted in Partial Fulfillment

Of

The Requirement for the Doctor of Philosophy Degree

In

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APPROVAL SHEET

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This thesis Towards a Doctor of Philosophy Degree in Environmental Sciences Has been Approved by:

Name Signature

1-Prof. Dr. Moheb Mahmoud Kamel El-Rafee
Prof. of Environmental Education and Head of Department
of Environmental Educational and Mass Communication Sciences
Institute of Environmental Studies and Research
Ain Shams University

2-Prof. Dr. El-Sayed El-Sayed Al-Okda
Prof. of Community, Environment and Occupation
Faculty of Medicine
Ain Shams University

3-Prof. Dr. Imad Eddin Abdel Meguid Alwosemy
Prof. of Curricula and Teaching Methods
Faculty of Education
Bani Swaf University

4-Dr. Mona Abdelaal Abd El Hamid
Assistant Prof. of Community, Environment and Occupation
Faculty of Medicine
Ain Shams University

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1-Prof. Dr. Maged Abd El Karim
Prof. of Community, Environment and Occupation
Faculty of Medicine
Ain Shams University

2-Prof. Dr. Moheb Mahmoud Kamel El-Rafee
Prof. of Environmental Education in Department of Environmental Educational and Mass Communication Sciences
Institute of Environmental Studies and Research
Ain Shams University

3-Dr. Mona Abdelaal Abd El Hamid
Assistant Prof. of Community, Environment and Occupation
Faculty of Medicine
Ain Shams University

2017

﴿وَقُل رَّبِّ زِدْنِي عِلْماً﴾

سورة طـــه الآيـــــه رقم ١١٤

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Really I can hardly find the words to express my gratitude to **Dr. Mona Abdelaal Abd El Hamid** *Assistant Prof. of Community, Environment and Occupation, Faculty of Medicine Ain Shams University for her continuous directions and meticulous revision throughout the whole work. I really appreciate their patience and support.*

Last but not least, I dedicate this work to my family, whom without their sincere emotional support, pushing me forward this work would not have ever been completed.

Dedication

To My Family

Contents

Abstract

Aluminum industry causes serious health effects in workers. Aluminum environmental pollution affects almost everything plants, sea life, freshwater creatures, wildlife as well as pets.

Aluminum makes up approximately 8% of all the metals in the earth, so it is considered the most plenteous one. It is widely used in industry such as food and pharmaceutical industries.

Aluminum could affect renal function as it is mainly excreted by the kidneys

Aluminum causes an oxidative stress within brain tissue**.** Some scientists claim that aluminum may lead to Alzheimer disease through the formation of neurofibrillary masses

Goal

Improve quality of life and reduction in the rate of morbidity due to aluminum exposure.

The current study included 40 workers in an aluminum factory in 6th October in Egypt with mean aluminum concentration in the different departments in the factory was within permissible exposure level "PEL". Data were collected through a previously prepared questionnaire. The studied workers have reported the exposure to aluminum inside workplace during polishing and during smelting (85 % and 82.5 % respectively). However, majority of workers also reported an extra workplace exposure to aluminum with most of them in form of using alum. Utensils followed by use of food additives containing aluminum (72.5 % and 70 % respectively).

By implementing the intervention study through the comprehensive health education program to workers in the factory,

there was a statistically significant reduction in the mean serum aluminum before and after intervention (13.95 and 13.75 ug/dl respectively) (*P<0.01*).

At the same time, the knowledge of workers toward the exposure to the extra work sources of aluminum was significantly improved as regards aluminum Contained medications 75 % and Regarding knowledge of workers toward methods of prevention of aluminum pre and post-intervention, there was an improvement mostly for health education ,usage of PPD and ventilation (100%) followed by removal of sensitive workers and isolation or substitution (55.6 % and 44.4 % respectively) (P<0.01)and aluminum Containing deodorants 72.5 % respectively (*P<0.05*).

Conclusion and Recommendations

1- The mean concentration of aluminum in study group is 13.8 ug/lit (max. 34.8 –min6)
2- Using protective equipment during work decreases the exposure to aluminum.
3- The rates of aluminum concentration are strongly related to using personal protective and increase awareness about aluminum hazards.

To identify and control occupational health effects, medical assessments should be accomplished (a) before hiring workers, (b) occasionally during employment, and (c) at the time of leaving work.

Finally Special safety precautions and educational programs are also needed to limit the aluminum exposure in this industrial group.

List of Abbreviations

AAS	:	Atomic absorption spectrophotometer
ACGIH	:	American Conference of Governmental Industrial Hygienist
ATSDR	:	Agency for Toxic Substances and Disease Registry
DALY	:	Disability adjusted life years
EPA	:	Environmental Protection Agency
FAAS	:	Flame atomic absorption spectroscopy
FDA	:	Food and Drug Administration
HECAT	:	Health Education Curriculum Analysis Tool
HRCT	:	High-resolution computed tomography
ICP-AES	:	Inductively coupled plasma-atomic emission spectroscopy
ICP-AES	:	Inductively-coupled argon plasma, atomic emission spectroscopy
IPP	:	Illness Prevention Program
IIPP	:	Injury and Illness Prevention Program
IUPAC	:	International Union of Pure and Applied Chemistry
MCE	:	Mixed cellulose ester
MSHA	:	Mine Safety and Health Administration
OHS	:	Occupational health and safety
OHP	:	Occupational health program
PEL	:	Permissible exposure limit
PPE	:	Personal protective equipment
RCRA	:	Resource Conservation and Recovery Act
SARA	:	Superfund Amendments and Reauthorization Act

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Introduction

Aluminum processing industry causes serious health effects among workers. Aluminum environmental pollution affects almost everything plants, sea life, freshwater creatures, wildlife as well as pets. Now, many of these issues have become history or have much reduced or improved in some countries due to the collaboration between the international aluminum industry and the authorities. There isn't any raw material for aluminum production as it all comes from produced parts of the world. The international aluminum industry is responsible for protection of the environment and development as shown through their efforts to reduce greenhouse gases emissions and recycling of environmental friendly aluminum metal. We no longer have environmental/ occupational health specialists' hazards and diseases in isolation of Aluminum. Now, there are update ways that keep health, safety, goodwill and management issues **(Priest, 2004).**

In acute intoxication, impaired renal function exaggerates the effect of exposure to aluminum dust especially which is very rare except in those patients due to impaired clearance of aluminum from blood **(Gupta, 2005).** In addition, aluminum could affect renal function as it is mainly excreted by the kidneys **(Rondeau et al., 2009)**.

Aluminum causes an oxidative stress within brain tissue**.** Some scientists claim that aluminum may lead to Alzheimer disease through the formation of neurofibrillary masses **(Gupta, 2005).**

Forms of aluminum that can cross the blood brain barrier which is a natural protective barrier could cause brain damage. The most dangerous of them is aluminum fluoride which is hardly excreted in urine. It may cause convulsions and poor concentration. On the contrary elemental aluminum couldn't pass this barrier and causes no damage.

Both aluminum sulfate and aluminum fluoride are used to treat many municipal water supplies. These two substances can also unite very easily in blood.

When aluminum is highly absorbed in the human body especially when combined with silicon, it harms the cerebral cortex as well as affects the function of the nerves in the way they transfer impulses to and from the brain.

In fact, people who suffer from calcium deficiency are liable to more harms especially those who are exposed to aluminum in their work for a long time as in the field of aluminum smelting plants. They are liable to serious health problems such as lack of balance, lack of concentration and fatigue. These troubles are mainly caused by the increase of the aluminum rate in the brain. **(Rondeau et al., 2009)**.

Scientist found that the human body receives 3 to 10 milligrams of aluminum daily. It has been agreed that Aluminum is the most plentiful element of metals produced. It was also noticed that Aluminum enters the gastro intestinal tract, lungs as well as skin and found with great amounts in the body tissues. Aluminum exists in