ENVIRONMENTAL RISK FACTORS FOR CHILDHOOD ASTHMA INTERVENTIONAL EFFECT OF ERADICATING INDOOR ALLERGENS

Submitted by
Mahmoud Awad El sayed El Shourbagy
B.Sc.Pharma., Faculty of Pharmacy , Cairo University , 2005

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Science

Department of Environmental Medical Science
Institute of Environmental Studies and Research
Ain Shams university

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This Thesis Towards a Master Degree in Environmental Science

Has been Approved by:

Name

Signature

1. Prof. Dr.Mahmoud Serry Al-Bukhari

Prof.& Head of Department of Environmental medical Science
institute of environmental studies and research
Ain shams university

2. Prof. Dr. Ahmed Esmat Shoman

Professor of Community environmental & occupational medicine
Faculty of medicine
AinShams University

3. Prof. DR. Rashwan Mohamed Farage

Professor of Medical Biochemistry
Faculty of medicine
AinShams University

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Under the supervision of

1. Dr.Mahmoud Serry Al-Bukhari

Prof.& Head of Department of Environmental medical Science

institute of environmental studies and research

Ain shams university

2. Dr. Howayda Mohamed Kamal

Prof. of immunity and clinical pathology

Faculty of medicine

Banha university

2014

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Mahmoud Awad ELShourbagy

ABSTRACT

Children with asthma are exposed to multiple indoor allergens in their homes and many environmental risk factors that induce asthma symptoms. Reductions in these asthma triggers have been difficult to achieve and remediation intervention for single allergen have seldom been associated with decreased morbidity from asthma. The objective of this study was to determine whether a collaborative reduction for multiple asthma triggers present in indoor environmental could improve asthma related outcomes using environmental intervention for indoor allergens.

One hundred children with atopic asthma (age range 5-11 years), were enrolled in a controlled trial of an environmental intervention that lasted for six months and included education and remediation for exposure to multiple allergens. Home environmental exposures and asthma related complications were assessed six months after effective intervention; Children were randomly divided into two groups, an intervention group and a control group. The intervention group had fewer days with symptoms than did the control group during the intervention period ($P<0.001$) with a significant decline in admissions to emergency departments, hospitalization as well as decline in level of home allergens as *D.Pteronyssinus* and reduced complications of asthma. In conclusion, reducing exposure to indoor allergens significantly enhances quality of life for childhood asthma, as well as decreasing asthma symptoms.

Childhood asthmatics are commonly exposed to multiple allergens which may contribute to the increased asthma-related complications. Asthma management guidelines have stressed the need for environmental control measures but there is limited evidence of their efficacy (NHLB, 1997). Previous studies of environmental interventions for patients with asthma

have focused on single allergens such as dust mites rather than on multiple exposures encountered in many patients with childhood asthma. Measures to avoid exposure to dust mites , including bedding encasement, have reduced the levels of exposure to these allergens, but their clinical effectiveness remains a maker of controversy, (carter MC et al,2001).Exposure to cockroach allergens may aggravate asthma but reducing allergens levels has had no apparent clinical benefit.

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List of Abbreviations

Abb.	Full term

ABPA……..Allergic bronchopulmonary aspergillosis
ACTH……..Adrenocorticotropic hormone
Arg……...Arginine
BAL..…..……..Bronchoalveolar lavage
BHR ……..……..Bronchial hyperreactivity
BHR……...…..Bronchial hyperresponsiveness
Bla g1……..…..Blatella germanica (a common cockroach)
cAMP……..…..Cyclic adenosine monophosphate
CFC……..Chlorofluorocarbon
CO……..…..Carbon monoxiade
CYP……..Cytochrome P450
Der F1……...Dermatophagonides pternonyssinus
Der P1……...Dermatophagonides farina
DPI……...Dry powder inhaler
EIB……...Exercise-induced bronchospasm
EPA …….....Environmental protection agency
FDA…….....Food and Drug Administration
FeNO……...Fraction of exhaled nitric oxide
FEV1……...Forced expiratory volume in 1 second
FVC…….....Forced vital capacity
GINA……..Global intuitive for asthma
GINA……..Global Initiative for Asthma
Gln…….....Glutamine
Glu…….....Glutamic acid

List of Abbreviations

Abb.	Full term

Gly…….....Glycine
GM-CSF…….....Granulocyte-macrophage colony-stimulating factor
HFA……..…..Hydrofluoroalkane
IAQ …….....Indoor air quality
ICAM-1…...…...Intercellular adhesion molecule 1
ICSs…….....Inhaled corticosteroids
IgE…….....Immunoglobulin E
IL…….....Interleukin
iNOS……...…....Inducible nitric oxide synthase
MDI……..…...Metered-dose inhaler
MMAD…..……..Mass median aerodynamic diameter
NAEPP.....National Asthma Education and Prevention Program
NANC..... Nonadrenergic, noncholinergic
NCICAS.....National cooperative inner city asthma study
NO.....Nitrogen oxide
NO.....Nitric oxide
PAF.....Platelet-activating factor
PEF.....Peak expiratory flow
PKA.....Protein kinase
RSV.....Respiratory syncytial virus
T cells.....Thymically derived lymphocytes
VCAM-1.....Vascular cell adhesion molecule 1
VIP.....Vasoactive intestinal peptide
VOC.....Volatial organic compound
WHO.....World health organization

Introduction

INTRODUCTION

People in modern societies spend the vast majority of their time–*approximately 90%* –in indoor environments, including homes, workplaces, schools, and public spaces such as restaurants and malls. Roughly 66% of that indoor time is spent in homes ***(Leech JA et al., 2002).*** Hence, indoor environmental quality in the home has a significant impact on public health and well-being. Indeed, indoor pollution has been ranked by both the U.S. Environmental Protection Agency (EPA) Science Advisory Board and the Centers for Disease Control and Prevention as a high environmental risk ***(Leung R et al., 1997).***

Although globally the greatest health risks are associated with particulate pollution from indoor biomass burning that kills an estimated 1.6 million people per year ***(World Health Organization, 2002),*** the indoor environmental risks that are the focus of this article are related specifically to indoor air quality (IAQ) in higher-income countries. In this setting, indoor chemical contaminants include environmental tobacco smoke (ETS), nitrogen dioxide from space heaters and poorly ventilated furnaces, carbon monoxide, volatile organic compounds (VOCs), phthalates, and pesticides. Biological contaminants include antigens from house dust mites, molds, rodents, cockroaches, and animal dander. Dampness and endotoxins have also been implicated in health risks associated

with indoor environments ***(Institute of Medicine (IOM) 2000, 2004; Thorne 2005).***

Indoor air pollutants in the home may lead to the development and/or exacerbation of a variety of diseases and symptoms. Some known and postulated adverse health effects associated with poor indoor air quality are allergies, asthma, infection, hypersensitivity pneumonitis, inhalation fevers, mucosal irritation, central nervous system effects, psychological effects (including depression), dermatitis, and even some forms of cancer ***(IOM 2000, 2004).***

Asthma and allergic conditions in particular are believed to be associated primarily with exposure to contaminants common in indoor rather than outdoor environments ***(IOM, 2000).*** The IOM has concluded there is sufficient evidence of a causal relationship between asthma development and exposure to house dust mite ***(IOM, 2000).*** Substantial evidence indicates that children exposed to indoor air mold in the first years of their lives have a significantly higher probability of developing asthma ***(Jaakkola et al., 2005).*** There is sufficient evidence of a causal relationship between asthma exacerbation and exposure to cats, cockroaches, house dust mite, mold, and ETS in preschool-age children ***(IOM, 2000).*** There is also increasing evidence that pollutants from vehicle traffic infiltrates indoors, adding to the risk of asthma and exacerbations ***(McConnell et al., 2006).***