



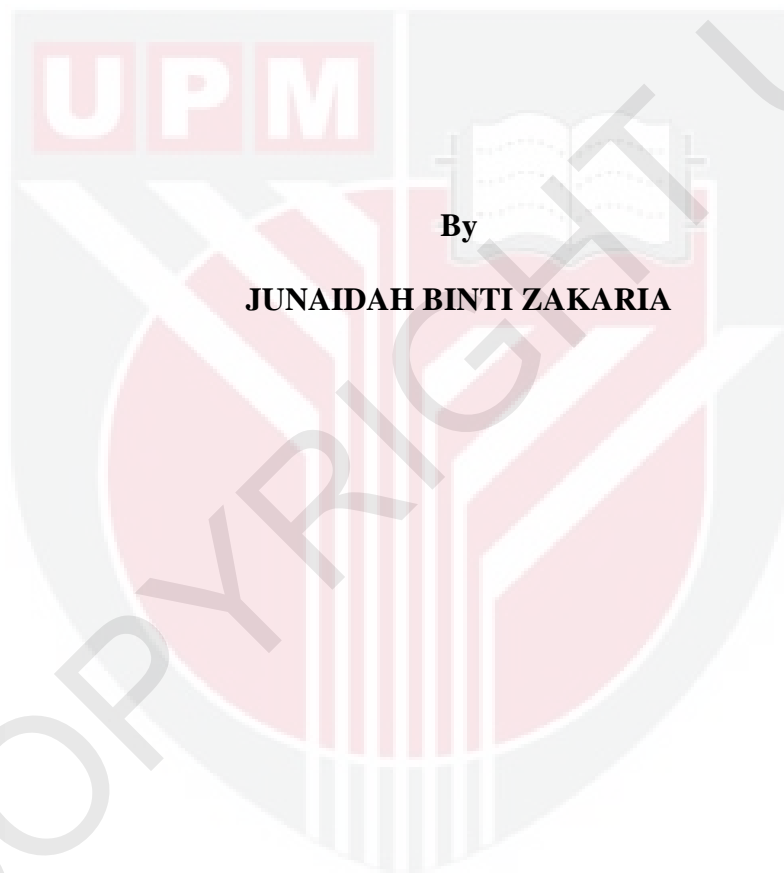
UNIVERSITI PUTRA MALAYSIA

**AMBIENT AIR POLLUTION AND ITS ASSOCIATION WITH THE
RESPIRATORY HEALTH OF ASTHMATIC PRIMARY SCHOOL
CHILDREN IN SELECTED URBAN, RURAL AND INDUSTRIAL AREAS IN
SELANGOR AND KUALA LUMPUR**

JUNAIDAH BINTI ZAKARIA

FPSK(m) 2010 30

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By

JUNAIDAH BINTI ZAKARIA

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Master of Science**

December 2010

Abstract of thesis presented to the senate of University Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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CHILDREN IN SELECTED URBAN, RURAL AND INDUSTRIAL AREAS IN
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JUNAIDAH BINTI ZAKARIA

December 2010

Chair: Prof. Zailina binti Hashim, PhD

Faculty: Faculty of Medicine and Health Sciences

Background: The influence of air pollution on asthma and allergies still remains a debate. Many researches have shown that air pollution could affect the respiratory health especially for susceptible groups such as asthmatic children. A cross-sectional comparative study was intended to analyze the association of air pollution and respiratory health in asthmatic children from January to December 2008.

Objective: The main objective of this research was to study the association between air pollution exposures with the respiratory health among asthmatic primary school children living in selected urban, rural and industrial areas in Selangor and Kuala Lumpur.

Methodology: A total of 207 respondents involved in this study, 87 were children from urban area, 67 children from industrial area and another 53 from rural area. The selection of respondents was based on purposive sampling method, only asthmatic children who had been diagnosed by a physician were involved. Health records of

the children were obtained from the school administration. Respondents were children from Standard 2 to Standard 5, with informed consent from their parents. A modified ISAAC Questionnaire translated into the Malay language was administered and completed by parents. Peak expiratory flow (PEF) readings were measured using a peak flow meter mini weight model AFS CE 0120 on Monday, Wednesday and Friday before and after school. Urine samples were collected to measure the oxidative stress (8-OHdG) levels among respondents. Continuous ambient air pollutants (PM₁₀, CO, SO₂, and NO₂) data monitored by Alam Sekitar Malaysia were obtained from the Department of Environment. The 8 hours indoor air pollutants (PM₁₀, PM_{2.5}, CO, SO₂ and NO₂) were measured by using Giliair air sampling pump. The standard NIOSH methods were referred to in the measurement.

Results: The prevalence of asthma from students' health record was higher in urban and industrial children than those of the rural children. In 2008, the annual mean PM₁₀ concentrations were slightly higher than the Malaysian Ambient Air Quality Guideline (MAAQG) in the industrial area (64.922µg/m³) and the PM₁₀ for urban and rural area were 48.687µg/m³ and 23.464µg/m³ respectively. Sulfur dioxide was significantly higher in the industrial area with a mean of 0.003ppm compared to the urban area of 0.002ppm, whereas, higher levels of CO were recorded in urban area (1.305ppm), followed by industrial area (0.873ppm) and rural area (0.680ppm). Similarly, higher levels of NO₂ were recorded in urban area (0.029ppm), followed by industrial area (0.021ppm) and rural area (0.010ppm). For household indoor air quality, there were significant differences in the PM₁₀, PM_{2.5} and CO concentrations whereby PM₁₀ were the highest among industrial houses with a mean of 0.0071µg/m³ followed by the urban with 0.0042µg/m³ and the rural area with

0.0012 $\mu\text{g}/\text{m}^3$. Indoor carbon monoxide was highest in the urban houses with a mean concentration of 0.204ppm. There was an association between the prevalence of respiratory and allergy symptoms with locations. Urban children have a higher count of symptoms for difficulty in breathing, ($\chi^2=9.34$, $p<0.001$) chest tightness, ($\chi^2=9.66$, $p<0.05$) and wheezing ($\chi^2=12.01$, $p<0.05$). Allergy symptoms were also higher among urban children such as skin rashes, nasal symptoms and itchy with watery eyes and nose. Results showed a significant influence of days within week and PEF reading before and after school. The oxidative stress (8-OHdG) was high among the urban children with a mean (5.072ng/mg creatinine) followed by industrial children (3.587ng/mg creatinine) and rural children (3.090ng/mg creatinine). The severity of asthma among respondents was classified according to PEF variability, day and night symptoms and respiratory scores. Most of the children had mild asthma and moderate asthma. From the logistic regression, fathers' education, PEF variability and allergy to pollen significantly influenced the frequency of asthmatic attack among respondents. Factors which significantly influenced the asthma severity were PM_{10} and allergy to pollen.

Conclusion: The air pollutants were higher in the urban and industrial area. This study shows that the asthmatic children who live in urban and industrial areas have greater risk of developing severe asthma due to exposure to air pollutants.

Keywords: *asthma, school children, air pollutants, peak expiratory flow, 8-OHdG and severity.*

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

**PENCEMARAN UDARA AMBIEN DAN KAITANNYA DENGAN
KESIHATAN RESPIRATORI KANAK-KANAK ASMA SEKOLAH RENDAH
DI KAWASAN BANDAR, LUAR BANDAR DAN INDUSTRI TEPILIH DI
SELANGOR DAN KUALA LUMPUR**

Oleh

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Pengerusi: Prof.Zailina binti Hashim PhD

Fakulti: Fakulti Perubatan dan Sains Kesihatan

Latar Belakang Kajian: Pengaruh pencemaran udara terhadap pesakit asma dan alahan masih sering menjadi isu perdebatan. Kebanyakan penyelidikan yang telah dijalankan menunjukkan pencemaran udara boleh menjejaskan kesihatan respiratori terutamanya bagi kumpulan-kumpulan rentan seperti kanak-kanak yang menghidap asma. Satu kajian keratan rentas perbandingan telah dijalankan untuk mengkaji perkaitan di antara pencemaran udara dan kesihatan respiratori kanak-kanak yang menghidap asma bermula Januari sehingga Disember 2008.

Objektif: Objektif utama kajian adalah untuk mengkaji perkaitan di antara pendedahan pencemaran udara dengan kesihatan respiratori kanak-kanak sekolah rendah yang menghidap asma yang tinggal di kawasan bandar, luar bandar dan industri di Selangor dan Kuala Lumpur.

Metodologi: Seramai 207 responden terlibat di dalam kajian ini di mana 87 adalah dari kawasan bandar, 67 dari kawasan perindustrian dan seramai 53 dari kawasan

luar bandar. Pemilihan responden adalah berdasarkan kepada persampelan bertujuan di mana hanya kanak-kanak yang didiagnosa asma oleh doktor terlibat di dalam kajian ini. Buku rekod kesihatan pelajar diperolehi daripada pihak pengurusan sekolah. Responden merupakan kanak-kanak yang sedang menduduki Tahun 2 hingga Tahun 5 dan telah mendapat kebenaran daripada ibu bapa. Borang kaji selidik terubahsuai yang diadaptasi dari 'ISAAC Questionnaire' dan diterjemah dalam versi Bahasa Melayu telah dilengkapi oleh penjaga. Bacaan PEF diambil pada hari Isnin, Rabu dan Jumaat sebelum dan selepas waktu persekolahan, menggunakan peak flow meter mini weight model AFS CE 0120. Sampel urin diambil untuk mengukur paras tekanan oksidatif (8-OhdG) di kalangan responden. Data kepekatan bahan pencemar udara berterusan bagi PM₁₀, CO, SO₂, dan NO₂ diperolehi daripada Jabatan Alam Sekitar Malaysia. Pengukuran aras pencemar di dalam rumah bagi PM₁₀, PM_{2.5}, CO, SO₂ dan NO₂ juga dijalankan di rumah-rumah responden selama 8 jam menggunakan pam persempelan udara model Giliair. Kaedah piawai dari NIOSH telah dirujuk dalam pengukuran ini.

Hasil Kajian: Kes asma yang diperolehi dari buku rekod kesihatan pelajar menunjukkan kadar prevalens yang lebih tinggi di kalangan kanak-kanak yang tinggal di kawasan bandar dan di kawasan industri berbanding kawasan luar bandar. Paras kepekatan tahunan PM₁₀ di kawasan industri bagi tahun 2008 telah melebihi panduan yang ditetapkan oleh Malaysian Ambient Air Quality Quality Guideline (MAAQG) iaitu sebanyak (64.922 $\mu\text{g}/\text{m}^3$) diikuti kawasan bandar 48.687 $\mu\text{g}/\text{m}^3$ dan di kawasan luar bandar sebanyak 23.464 $\mu\text{g}/\text{m}^3$. Sulfur dioksida mencatatkan bacaan tertinggi di kawasan industri iaitu sebanyak 0.003ppm diikuti 0.002ppm di kawasan bandar. Bagi bahan pencemar CO, bacaan tertinggi direkodkan di kawasan bandar

dengan purata sebanyak (1.305ppm), diikuti (0.873ppm) di kawasan industri dan bacaan terendah adalah di kawasan luar bandar iaitu sebanyak (0.680ppm). Kepekatan bahan pencemar NO₂ juga dicatatkan tertinggi di kawasan bandar iaitu sebanyak (0.029ppm), diikuti (0.021ppm) di kawasan industri, dan (0.010ppm) di kawasan luar bandar. Terdapat perbezaan yang signifikan pada paras kepekatan bahan pencemar di dalam rumah bagi PM₁₀, PM_{2.5} dan CO bagi ketiga-tiga kawasan. PM₁₀ adalah tertinggi di kawasan industri 0.0071 µg/m³ diikuti rumah di kawasan bandar sebanyak 0.0042µg/m³ dan 0.0012µg/m³ di kawasan luar bandar. Bahan pencemar CO adalah tinggi bagi rumah di kawasan bandar, dengan mencatatkan bacaan purata sebanyak 0.204ppm. Terdapat hubungan yang signifikan antara prevalens simptom respiratori dan alahan di kalangan kanak-kanak dengan lokasi kajian. Kanak-kanak di kawasan bandar menunjukkan bilangan simptom tertinggi berbanding kanak-kanak di dua lagi kawasan kajian bagi sesak nafas ($\chi^2=9.34, p<0.001$), ketat dada ($\chi^2=9.66, p<0.05$), dan dada berbunyi ($\chi^2=12.01, p<0.05$). Simptom hidung, ruam dan mata gatal dan berair juga mencatatkan prevalens tertinggi di kalangan kanak-kanak bandar. Terdapat pengaruh yang signifikan bagi faktor hari dan bacaan PEF sebelum mula waktu persekolahan dan selepas waktu persekolahan. Paras 8-OHdG adalah tinggi di kalangan kanak-kanak bandar (5.072ng/mg keratinin) diikuti industri (3.587ng/ mg keratinin) dan luar bandar (3.090ng/mg keratinin). Tahap kekejasan asma di kalangan responden diklasifikasi menggunakan maklumat dari bacaan *PEF variability*, simptom malam dan siang dan juga jumlah simptom respiratori yang dialami oleh responden. Kebanyakan kanak-kanak tergolong di dalam kelas asma sederhana dan asma ringan. Daripada analisis regresi yang dijalankan, faktor yang mempengaruhi bilangan serangan asma di kalangan responden adalah tahap pendidikan bapa, *PEF variability* dan alahan kepada debunga.

Manakala faktor yang mempengaruhi kekejasan asma di kalangan responden adalah PM_{10} dan alahan kepada debunga.

Kesimpulan: Kepekatan bahan pencemar udara adalah lebih tinggi di kawasan bandar dan industri. Kajian ini menunjukkan bahawa kanak-kanak yang menghidap asma dan tinggal di kawasan bandar dan industri adalah berisiko tinggi untuk mendapat kondisi asma yang serius disebabkan pendedahan kepada bahan pencemar udara.

Kata Kunci: asma, kanak-kanak sekolah, bahan pencemar udara, peak expiratory flow, 8-OHdG dan kekejasan.

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I certify that a Thesis Examination Committee has met on 17 December 2010 to conduct the final examination of Junaidah binti Zakaria on her thesis entitled “Ambient Air Pollution and its Association with the Respiratory Health of Asthmatic Primary School Children in Selected Urban, Rural and Industrial Areas in Selangor and Kuala Lumpur” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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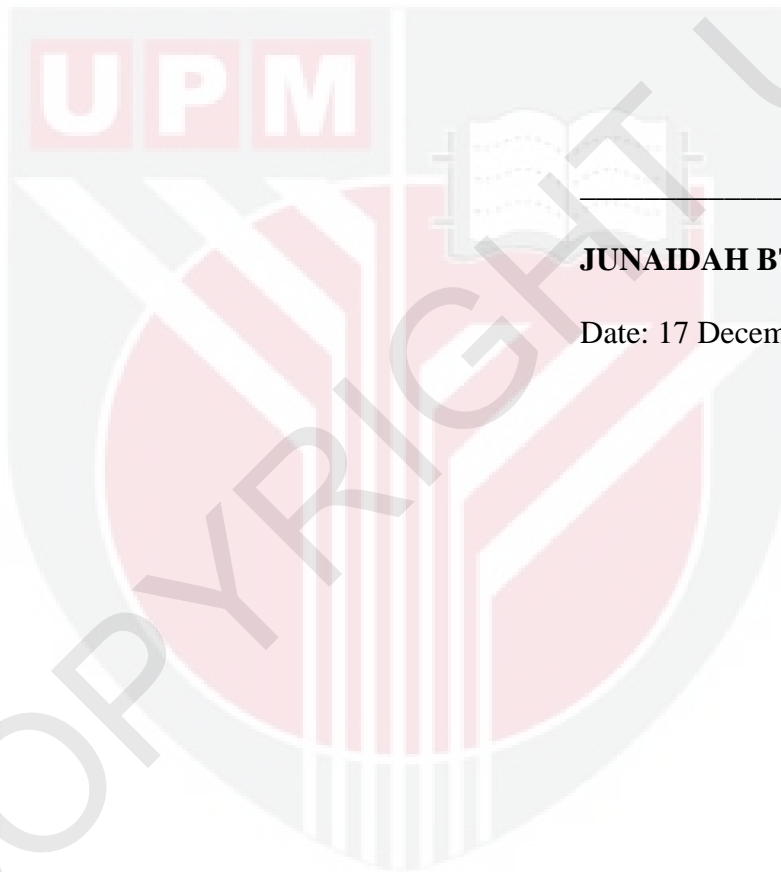
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any degree at Universiti Putra Malaysia or at any other institution.



JUNAIDAH BT. ZAKARIA

Date: 17 December 2010

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