RESPIRATORY SYMPTOMS AND PULMONARY FUNCTION IN MALE WOODEN FURNITURE WORKERS EXPOSED TO WOOD DUST IN KOTA BHARU, KELANTAN

by

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Dissertation Submitted In Partial
Fulfillment Of The Requirement For
The Degree Of Master Of Community Medicine
(OCCUPATIONAL HEALTH)

UNIVERSITI SAINS MALAYSIA

2006

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LIST OF ABBREVIATIONS

COPD	-	Chronic Obstructive Pulmonary Disease
DOSH	-	Department of Occupational Safety and Health
FMA	-	Factories and Machinery Act
GNP	-	Gross National Product
ILO	-	International Labour Organization
JPN	-	Jabatan Perhutanan Negeri
MC	-	Multicollinearity
MLR	-	Multiple Linear Regression
NIOSH	-	National Institute of Occupational Safety and Health
OSHA	-	Occupational Safety and Health Act
PMEM	-	Preliminary Main Effect Model
PPE	-	Personal Protective Equipment
PPSP	-	Pusat Pengajian Sains Perubatan
RFT	-	Respiratory Function Test
SD	-	Standard Deviation
SLR	-	Simple Linear Regression
SMIs	-	Small and Medium Industries
SPSS	-	Statistical Programme for Social Science
VIF	-	Variance Inflation Factor
WHO	-	World Health Organization

ABSTRAK

Tajuk: Simptom dan Fungsi Paru-Paru Dalam Kalangan Pekerja Lelaki yang Terdedah Pada Habuk Kayu Di Kota Bharu, Kelantan

PENGENALAN : Industri perkayuan seperti kilang perabut kayu adalah salah satu penyumbang utama ekonomi dan pembangunan sosial di pendalaman Kelantan. Terdapat sebilangan besar penduduk yang bekerja di kilang perabut kayu. Majoriti kilang perabut kayu kurang penyeliaan dan juga tidak mematuhi sepenuhnya akta keselamtan dan kesihatan pekerjaan 1994. Penyakit kronik saluran paru-paru tersumbat adalah salah satu penyebab utama morbiditi dan mortality di negara membangun dan maju. Pendedahan yang berterusan terhadap habuk kayu di tempat kerja akan meningkatkan susceptibiliti pekerja untuk mendapat penyakit kronik saluran paru-paru tersumbat di masa hadapan

OBJEKTIF: Kajian ini di jalankan untuk menentukan prevalen simptom paru- paru tahap pengetahuan, sikap dan amalam terhadap pendedahan habuk di tempat kerja serta mengkaji faktor-faktor yang berhubungkait dengan fungsi paru-paru dalam kalangan pekerja lelaki perabut kayu di Kota Bharu, Kelantan.

KAEDAH: Satu kajian irisan lintang perbandingan telah di jalankan terhadap 97 pekerja lelaki kilang perabut kayu dan 97 orang pekerja lelaki pejabat di Kota Bharu yang telah dijalankan di antara Mei 2005 sehingga Julai 2005. Data diperolehi dengan mengunakan borang kaji-selidik berkenaan sosio-demografik, sejarah pekerjaan, simptom penyakit paru-paru dan tahap pengetahuan, sikap serta amalan mengenai bahaya pendedahan berterusan terhadap habuk kayu di tempat kerja. Ujian funsi paru-paru juga telah dilaksanakan. Ujian 'Chi-square' dan 'independent *t*' telah digunakan untuk menentukan prevalen simptom paru-paru dan juga untuk membandingkan tahap pengetahuan, sikap dan amalan serta parameter fungsi paru-paru di antara pekerja yang terdedah pada habuk dan tidak terdedah. Regresi linear multiple (MLR) pula digunakan untuk menetukan faktor-faktor yang berhubunhgkait dengan isipadu paksaan expiratori dalam masa satu saat (FEV_1), isipadu paksaan keseluruhan (FVC) dan FEV_1/FVC di kalangan pekerja yang terdedah pada habuk kayu.

KEPUTUSAN: Prevalen simptom paru-paru adalah tinggi dalam kalangan pekerja lelaki kilang perabut kayu berbanding dengan pekeja lelaki pejabat. Simptom yang paling kerap dialami oleh pekerja yang terdedah pada habuk kayu adalah kegatalan kulit (47.4%), diikuti oleh ketat dada (39.2%), batuk pagi (35.1%) dan berkahak pagi (35.1%). Total purata markah pengetahuan yang diperolehi oleh pekerja terdedah pada habuk kayu adalah lebih rendah [95.7(10.8)] jika dibandingkan dengan pekerja yang tidak terdedah [99.8(10.3)]. Pekerja yang terdedah pada habuk kayu memperolehi total purata markah

amalan yang lebih tinggi [24.8(4.8)] jika dibandingkan dengan pekerja yang tidak terdedah [22.2(4.7)]. Tiada perbezaan ketara bagi total purata markah sikap dan 'KAP' di antara pekerja yang terdedah pada habuk kayu dan yang tidak terdedah. Kira-kira 71% pekerja yang terdedah pada habuk kayu mempunyai ujian spirometri yang tidak normal manakala hanya 24% dalam kalangan yang tidak terdedah. Daripada 69 (71.1%) pekerja terdedah pada habuk yang menpunyai ujian spirometri yang tidak normal, 30 (30.9%) menunjukkan halangan yang sedikit, 24 (24.7%) halangan yang sederhana dan 15 (15.5%) halangan yang teruk. Jangkamasa merokok ($p<0.001$), ketinggian pekerja ($p<0.001$) dan jumlah tahun bekerja ($p=0.002$), adalah faktor–faktor yang berhubungkait dengan isipadu paksaan expiratori dalam masa satu saat (FEV_1) dan isipadu paksaan keseluruhan (FVC). Hanya umur ($p=0.049$) yang berhubungkait dengan FEV_1/FVC.

KESIMPULAN: Didapati bahawa keputusan analisis menunjukkan tahap pengetahuan, sikap dan amalan mengenai bahaya habuk kayu di tempat kerja bagi pekerja yang terdedah pada habuk adalah tidak memuaskan berbanding dengan pekerja yang tidak terdedah pada habuk kayu dan pendedahan yang berterusan kepada habuk kayu di tempat kerja juga akan meningkatkan prevalen simptom dan fungsi paru paru yang tidak normal.

KATA-KUNCI: pekerja perabut kayu lelaki, habuk kayu, simptom paru-paru, prevalen, pengetahuan, sikap, amalan

ABSTRACT

TITLE: Respiratory Symptoms and Pulmonary Function in Male Wooden Furniture Workers Exposed to Wood Dust in Kota Bharu, Kelantan.

INTRODUCTION: Wood industries such as wooden furniture factory are one of the major socio-economic development of rural Kelantan. There are significant proportions of workers involved in wooden furniture factories. Majority of factories are lack of supervision by DOSH and have low compliance of the OSHA 1994 and its regulations. COPD and smoking are the leading causes of morbidity and mortality in industrialized and developing countries. Prolonged occupational exposure to wood dust at workplace can increase susceptibility of developing COPD in future.

OBJECTIVES: This research is aimed to study respiratory symptoms, level of knowledge, attitude and practice in relation to wood dust exposure and factors associated with respiratory function in male wooden furniture workers in Kota Bharu, Kelantan.

METHODS: A comparative cross-sectional study of 97 male wooden furniture (exposed) workers and 97 male office workers (non-exposed) was conducted from May till July 2005. Data was collected through a questionnaire on respiratory symptoms, knowledge,

attitude and practice of health hazards of wood dust exposure in workplace and spirometry test. Chi-square test was used to determine the significant difference in the prevalence of respiratory symptoms and independent *t* test was used to compare means of KAP score and result of respiratory function parameter between exposed and non-exposed group. Multiple linear regression was used to determine factors associated with FEV_1 in exposed group.

RESULTS: The prevalence of respiratory symptoms were significantly higher among exposed compared to non-exposed group. The most frequent symptoms among exposed group were skin itchiness (47.4%), followed by chest tightness (39.2%), morning cough (35.1%) and morning phlegm (35.1%). The mean total knowledge score in exposed group was significantly lower [95.7(10.8)] compared to non-exposed group [99.8(10.3)]. Exposed group had significantly higher mean score for total practice score [24.8(4.8)] compared to non-exposed group [22.2(4.7)]. There were no significant differences for mean total attitude and KAP scores between exposed and non-exposed group. About 71% of exposed group had abnormal respiratory function whereas only 24% of non-exposed group had abnormal respiratory function. Of the 69 (71.1%) exposed group with abnormal spirometry test, 30 (30.9%) exhibited mild restriction, 24 (24.7%) with moderate restriction and 15 (15.5%) with severe restriction. Duration of smoking ($p<0.001$), height ($p<0.001$), duration of work ($p=0.002$) and number of cigarettes smoke perday ($p=<0.001$) were significantly related to FEV_1 and FVC. Only age ($p=0.049$) was significantly related to FEV_1/FVC.

CONCLUSIONS: We therefore conclude that the level of knowledge, attitude and practice in relation to the health hazards of wood dust exposure in the exposed group was unsatisfactory compared to the non-exposed group and chronic occupational wood dusts exposure can lead to higher prevalence of respiratory symptoms and abnormal respiratory function among exposed group.

Key words: male wooden furniture workers, wood dust, respiratory symptom, prevalence knowledge, attitude, practice.

CHAPTER ONE

INTRODUCTION

1.1. Overview of Wooden Furniture Factories in Kelantan

Malaysia is one of the major wooden furniture producers in Asia (Dahlan, 2002). Malaysia exports furniture products mostly to USA, Japan and Australia. Kelantan is home to major wood industries in Malaysia. According to the Annual Report of the Forest State Department (JPN Kelantan, 2002), at the end of 2002, there was an estimated 894,271 hectares of forest area in Kelantan, which covers 60% of the total land area. The forest area is a rich source of quality timber that provides a profitable business for locals and the State government. Wood industry is the biggest source of income for the State government (40%) and provides a significant employment opportunity for the people (Dahlan, 2002). In 2002, the State government collected RM 50,455,798.42 from all wood industries compared to RM 53,925.895.00 in 2001 (JPN Kelantan, 2002). In 2002, the State government provided RM 5,828,275.00 for the development and conservation programmes for wood industries in Kelantan. Beside being the major economic contributor, wood industries are also important in the social development of rural Kelantan. (JPN Kelantan, 2002).

Sawmills, plywood factories, furniture industries, kumai wood industries and match factories are major wood industries in Kelantan. Majority of furniture factories in Kelantan are classified as small and medium industries (SMIs), that have paid up capitals of less than 25 million ringgit Malaysia (RM) and worker population of less than 100. There are significant proportions of workers in sawmills and furniture factories for example, in 2002, Kelantan has 5248 workers in the wood industries (JPN Kelantan, 2002).

Majority of wooden furniture factories are located in rural Kelantan. In Kota Bharu, there are only seven wooden furniture factories registered with Majlis Penbandaran Kota Bharu (MPKB) that are operational. For this study four wooden furniture factories in Kota Bharu were included. The factories are Hussin Musa Furniture Factory Sdn. Bhd., YunusFurniture Factory Sdn. Bhd., Mohammad Daham Furniture Factory Sdn. Bhd. and Hj Kamil Furniture Factory Sdn. Bhd. Majority of workers were permanent employees with only a small number of contract workers. Some of the workers were not only making furnitures but occasionally involved in sawing timber.

The peak activities were from March till September each year. During the monsoon seasons (October to December), their work will reduced because of poor timber supply and transportation problem. They used various machine for furniture production, such as plain machine (to make the wood surface smooth), moulding machine (to press the wood and make it stronger and also to get the desired shape), hollow chasers (to make holes) and many other smaller machines. Types of machine used are based on the types of furniture to be produced. Among all machines, the plain machine and hollow chaser produced large amounts of fine wood dust.

All working conditions in the factories were very poor and did not conform with standard of the Factories and Machinery Act 1967 and OSHA 1994. Housekeeping in the factories were unsatisfactory, the floors were slippery and very dusty. The air was full with wood dust because only a few machines have dust collectors, thereby limiting their views and made them prone to injury. The ventilation system was very poor and inadequate. The workers were rarely wearing their personal protective equipment (PPE) such as face mask or goggle. Even though there were signs prohibiting smoking and eating in workplace, yet some workers were still smoking and eating in workplaces. Almost all workers did not wear safety shoes while working and even some of them wore slippers. Despite their experiences, most workers seldom use PPE, citing discomfort as the reason.

There were a few young workers who were eager to use PPE but could not do so since their workplaces did not provide PPE due to supposedly high cost, apathy or simply lack of enforcement by the authorities. These workers used towels and handkerchiefs to protect their faces from wood dust. Majority of workers wore long sleeve shirts.

1.2. Literature Review

The respiratory system a common site of occupational disease. Urban dwellers inhale and retain as much as 2 mg of dust daily, and workers in dusty occupations may inhale 10-100 times that amount. What is remarkable is that most people never develop environmentally induced diseases despite exposure to many potentially injurious agents (LaDou, 1997). Because the respiratory system has a limited number of ways in which to respond to injury, a wide variety of agents cause only a few familiar patterns of disease. Acute responses include upper airway obstruction, bronchoconstriction, alveolitis and pulmonary edema; and chronic responses include asthma, parenchymal fibrosis and cancer. Responses to agent encountered in workplace can mimic virtually every type of pulmonary response. The specific type of response is dictated by the site of deposition of the noxious agent, the dose and duration of exposure, the susceptibility

of lung cells and the interaction between the agent and local host defense mechanisms. Because individual host factors can rarely be identified, it is essential to protect all workers from exposures that might cause disease in any of them. Among the various types of organic dust to which humans are exposed, wood dust is one of the world's most important, as it is harvested or processed in almost all countries in the world for its traditional use for fuel and construction material.

During periods of quiet breathing through the nose, virtually all particles with aerodynamic diameters in excess of 10 micrometer are deposited on the nasal mucosa. Particles between 3 and 10 micrometer in diameter can be deposited throughout the tracheobronchial tree. More central deposition is favored by high rates of inspiratory flow, by airway obstruction and by the presence of increased quantities of mucous. Particles between 0.1 and 0.3 micrometer in diameter are preferentially deposited within the alveoli. Smaller particles tend to remain in the airstream and are exhaled. A fibre (a particle whose length exceeds its width by at least 3-fold) is deposited on the basis of aerodynamic diameter rather than length, which is why fibres up to 2.5 micrometer in length are often deposited in alveoli (LaDou, 1997). At a mean exposure of around 1mg/m^3 wood dust is considered to be a mucous membrane irritant and may cause allergy, asthma, chronic obstructive pulmonary disease (COPD) and nasal cancer, mostly adenocarcinoma (Borm *et. al.*, 2002).

In the recent Global Initiative For Chronic Obstructive Lung Disease (GOLD) Guidelines, COPD is defined as a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal response of the lungs to noxious particles or gases.

In May 1996, the World Health Organization (WHO) Assembly adopted a resolution, the WHO Global Strategy for Occupational Health for All (OHA). The resolution emphasizes that the Global Strategy for OHA would contribute to global health as a vital element of the implementation of WHO Health for All Strategy. It marks a significant step forward in occupational health, as the working population seldom obtained a priority position on the health policy agenda either internationally or in many countries with serious occupational health problems.

This is so in spite of the recognition that substantial economic losses are incurred by health and safety hazards at work and by reduction or loss working capacity. It has been estimated that substantial economic losses due to occupational diseases may amount to 10 – 20% of the gross national product (GNP) in some countries (Takahashi *et. al.*, 1998). Occupational lung disease is one of the most frequently occurring, most severely disabling and most amenable to prevention of all categories of occupational diseases (LaDou, 1997). Consequently, occupational lung disease has been listed

as one of the priority areas in occupational health by the WHO, and pneumoconiosis in particular, by the International Labour Organization (ILO). In the USA, occupational lung disease is designated as one of the five major areas of concern in pulmonary medicine by a task force appointed by the National Institute of Health. Recent prevalence estimates suggest that about 15 million Americans have COPD (Ramsey, 2003). In the developing countries where mining, forestry and mineral extraction constitute the backbone of economic development, the occurrence of pneumoconiosis is high and increasing trend (Takahashi *et. al.*, 1998).

As tobacco consumption continues to rise in this part of the world, a continuously expanding COPD patients is anticipated. Unfortunately, the worldwide distribution of occupational lung diseases cannot be quantified because comparable national statistics do not exist. Enhanced transmission of data and collaboration with the primary health care system in disease surveillance, research and information transfer and promotion of education and training at all levels of prevention served as an effective vehicle towards the prevention of occupational lung diseases. Respiratory Function Test (RFT) is also routinely used in industry as part of a respiratory surveillance program for workers with potential exposure to airborne pulmonary hazards.

Exposure to work place pollutants such as wood dusts, organic dusts and other gases have been associated with work-related respiratory diseases and disabilities. In recent years, several reports have found associations between work in dusty environments and COPD through community studies, cross sectional and longitudinal studies. Poor work place setting, knowledge, attitude and lack of standard practice guidelines such as not wearing personal protective equipment (a respirator) significantly contributes towards ill health in workers (Rastogi *et. al.*, 1989). Occupational exposure to wood dust is known to be associated with various health effects, notably skin and respiratory diseases (Dino *et. al.*, 1992).

It was suggested that the dust exposure in this work setting may have non – specific irritative effects as well as allergic effects in the respiratory system. Ige and Onadeko (2000) found a high prevalence (57.4%) of respiratory symptoms, principally cough, chest tightness and sputum production in workers exposed to wood dust in Nigeria. Fatusi *et. al.* (1996) reported that although 94% of the workers were aware of the potential hazards of exposure to saw dust, less than 20% wore protective masks. Lung function parameters were also significantly lower in exposed workers than those in non- exposed workers.

Mengesha (1998) reported that the mean lung function indices, including FEV_1, FVC, Peak Expiratory Flow at 25-75% and PEFR, in subjects exposed to all dusts in general decreased markedly, with dust concentration being more important than duration of exposure and about 38.4% of the dust-exposed subjects developed corresponding respiratory illnesses including chronic cough (24.7%), chronic bronchitis (21.8%) and bronchial asthma (24.2%). In conclusion, occupational wood dust exposure might cause not only respiratory symptoms but poor respiratory function, despite a relatively low exposure level. However, little research has been conducted on the effects of occupational wood dust exposure on the respiratory system of wooden furniture factory workers in Malaysia.

1.3. Classification of Occupational Respiratory Diseases

Occupational respiratory diseases can be divided into two categories, acute and chronic (LaDou, 1997).

Acute occupational respiratory diseases can be classified into :

1. Inflammatory disorder of upper respiratory tract
2. Airway disorder e.g. occupational asthma, airway irritation syndrome, byssinosis
3. Hypersensitivity disorder of lung parenchyma e.g. pneumonitis, metal fume fever, polymer fume fever
4. Toxic pneumonitis or pulmonary oedema
5. Pleural effusion

Chronic occupational respiratory diseases can be classified into :

1. Interstitial disorder or pneumoconiosis e.g. asbestosis, silicosis, coal worker peumoconiosis, wood dust pneumoconiosis and other pneumoconioses
2. Granulomatous disease e.g. pulmonary tuberculosis

3. Chronic beryllium disease
4. COPD e.g. chronic bronchitis and empysema
5. Chronic pleurae diseases e.g. atelectasia, and diffuse malignant mesothelioma
6. Carcinoma of the respiratory tract e.g. lung cancer and nasal cancer

1.4 . Introduction to Respiratory Function Test (RFT)

Respiratory function test provide quantitative information about respiratory physiology. When used in conjuction with the clinical and occupational history and chest x-rays, they can help determine the nature and severity of occupational lung disease e.g. byssinosis wood dust pneumoconiosis (David *et.al.*, 1996). Lack of patient cooperation, poor testing method and unreliable equipment can cause misleading results. There are several method can be used for testing respiratory function . Forced spirometry measurements is one of the method used to detect abnormal respiratory function. There are seven important spirometry measurements are used in assessment of respiratory function impairment.

The spirometry measurements are 1) Vital Capacity (VC), 2) Forced Expiratory Volume in One Second (FEV_1), 3) Forced Vital Capacity (FVC), 4) FEV_1 / FVC, 5) Peak Expiratory Flow at 25%, 6) Peak Expiratory Flow at 50% and 7) Peak Expiratory Flow (PEF). All the parameters are recorded in litre except for FEV_1 / FVC. The FEV_1, FVC and FEV_1 / FVC ratio are usually reduced in patient with obstructive respiratory diseases. Patients with restrictive respiratory diseases usually have a normal or increased FEV_1 / FVC ratio, however, because both FEV_1 and FVC are reduced by similar amount. Reduced Peak Expiratory Flow at 25% and Peak Expiratory at 50% indicate small airways obstruction especially at the bronchioles level. Measurement of FEV_1 usually

forms part of the pre-employment and may also be used for surveillance and clinical management (LaDou, 1997).The classification of spirometry test is based on the Global Initiative For Chronic Obstructive Lung Disease (GOLD) Guidelines :

Normal : $FEV_1 / FVC > 70\%$ with $FEV_1 > 80\%$ predicted

Mild restriction : $FEV_1 / FVC < 70\%$ with $FEV_1 > 80\%$ predicted

Moderate restriction : $FEV_1 / FVC < 70\%$ with $30\% < FEV_1 < 80\%$ predicted

Severe restriction : $FEV_1 / FVC < 70\%$ with $FEV_1 < 30\%$ predicted

1.5. Legislation

COPD is a notifiable industrial disease (Section 32) under the Third Schedule of the Factories and Machinery Act 1967 (Act 139) and Regulation and Rules

Dust diseases of the lung:

Condition of respiratory allergy of asthma or chronic bronchitis or byssinosis resulting from inhalation of dust or plant origin as cotton, wood, flax, jute, rice, husks, corks, spices, hemp, sisal, tobacco, tea, flour and the like of mineral dusts such as cement, copper, zinc or animal as bone or hair.

Occupational and Safety Act 1994 (Act 514) and Regulation

(a) Third Schedule Section 28 (1) (d)

Occupations Involving Special Risk to Health :

Any occupation involving the use or handling of, or exposure to the fumes, dust or vapour of silica, asbestos, raw cotton dust, lead, mercury, arsenic, phosphorus, carbon bisulphate, benzene, organic phosphate, nitrous fumes, cadmium, beryllium or pesticides. Penalty for failure to comply is RM 50,000 or two years imprisonment or both.

(b) Part VIII

Notification of accidents, dangerous occurrence, occupational poisoning and occupational disease and inquiry. An employer shall notify the nearest occupational safety and health office of any accident, dangerous occurrence, occupational poisoning or occupational diseases which has occurred or is likely to occur at the place of work. Penalty for failure to comply is not exceeding RM 10,000 or one years imprisonment or both.

1.6. Rationale of the study

Forest-based industries are one of the major contributors to the socio- economic development in Kelantan (JPN Kelantan, 2002) and Malaysia. Like workers in many other occupations, those in furniture factories are also exposed to various hazards. These include physical hazards (such as injuries, noise and fire), biological hazards (such as wood dust) and chemical hazards (such as wood preservatives) (Grabner and Sagl, 2002). In 2002, there were 5,248 workers involved in wood industries in Kelantan but unfortunately little is known about the health and safety of workers in furniture factories in Kelantan. Besides that, a high prevalence of pulmonary, cutaneous and ocular symptoms among wooden furniture workers have been reported in several countries such as Sudan, Taiwan and Indonesia (Fatusi *et. al.,* 1996).

COPD is one of the leading causes of morbidity and mortality in industrialized and developing countries. In 1997, COPD has been estimated to be the fourth most common cause of death after cardiovascular diseases, cancer and cerebrovascular diseases in the United States (Takahashi *et. al.,* 1998). Therefore, it is very important to determine adverse health effects among wooden furniture workers exposed to low-level wood dust in Small and Medium Industries (SMIs) in Kelantan. Furthermore, majority of SMIs in South East Asia lack supervision and have low compliance of the

Occupational Safety And Health Act and its regulations (Takahashi *et. al.*, 1998). Absence from work due to pulmonary symptoms is also an economic burden to an organizations and families (Takahashi *et. al.*, 1998). Based on research by Rastogi *et. al.* (1989), Dino *et. al.* (1992), Saou *et. al.* (1996) and Ige and Onadeko (2000), we can conclude that it is very crucial to explore this field because occupational lung diseases is one of the most frequently occurring, most severely disabling and most amenable to prevention of all categories of occupational diseases (LaDou, 1997).

CHAPTER TWO

OBJECTIVES

2.1. General

To study respiratory symptoms , level of knowledge, attitude and practice in relation to wood dust exposure and factors associated with respiratory function in male wooden furniture workers in Kota Bharu, Kelantan.

2.2. Specific

2.2.1. To compare the prevalence of respiratory, cutaneous and ocular symptoms between male wooden furniture workers (exposed group) and male office workers (non-exposed group).

2.2.2. To compare the level of knowledge, attitude and practice in relation to the health hazards of wood dust exposure between exposed and non-exposed groups.

2.2.3. To compare respiratory function status between exposed and non-exposed groups.

2.2.4. To determine factors associated with respiratory function (FEV_1, FVC and FEV_1 / FVC)among exposed individuals.

2.3. Research Hypotheses

2.3.1. The prevalence of respiratory, cutaneous and ocular symptoms is higher in the exposed group compared to the non-exposed group.

2.3.2. The level of knowledge, attitude and practice in relation to the health hazard of wood dust exposure are better in the exposed group compared to the non-exposed group.

2.3.3. The respiratory function is lower in the exposed group compared to the non-exposed group.

2.3.4. Factors associated with respiratory function in male wooden furniture workers are age, height, duration of working (duration of exposure), duration of smoking and number of cigarettes smoked per day.

CHAPTER THREE

METHODOLOGY

3.1. Research Design

This is a comparative cross-sectional study to investigate the effect wood dust exposure on respiratory system and pulmonary functions in male wooden furniture workers and office workers in Kota Bharu, Kelantan. The study participants were divided into two groups based on specific inclusion and exclusion criteria. The exposed group consisted of male wooden furniture workers exposed to wood dust, whereas the non-exposed group consisted of male office workers not exposed to wood.

3.2. Research Location

Research location was all wooden furniture factories registered with Majlis Perbandaran Kota Bharu (MPKB) in Kota Bharu, Kelantan. There are seven wooden furniture factories registered with MPKB. The factories are Hussin Musa Furniture Factory Sdn. Bhd., Yunus Furniture Factory Sdn. Bhd., Mohammad Daham Furniture Factory Sdn. Bhd., Bina Jati Furniture Factory Sdn. Bhd., Hj Kamil Furniture Factory Sdn. Bhd., Yunus Yaacob Furniture Factory Sdn. Bhd and Wong Vot Furniture

Factory Sdn. Bhd. Only four furniture factories were randomly selected and included in the study.

3.3. Reference and Source Population

All male wooden furniture workers in Kota Bharu, Kelantan are the reference population. The source population in the study was all male wooden furniture workers from four selected wooden furniture factories in Kota Bharu, Kelantan. The wooden furniture factories are Mohamad Daham Furniture Factory Sdn. Bhd. (35 workers), Yunus Furniture Factory Sdn. Bhd. (25 workers), Hussain Musa Furniture Factory Sdn. Bhd. (15 workers) and Hj Kamil Furniture Factory Sdn. Bhd. (35 workers). For non-exposed group, 97 male office workers from Ain Medicare (M) Kelantan were chosen. They were not exposed to wood dust throughout their work or during other activities such as hobby or part time job.

3.4. Sampling Frame (Eligible Population)

By using the following inclusion and exclusion criteria for both exposed and non-exposed groups, sampling frame was developed.

3.4.1. Inclusion criteria for the exposed group were:

1. Age of the worker between 18 to 56 years.
2. Duration of work in wooden furniture factory for at least one year.
3. Agreed to cooperate and willing to give informed consent.

3.4.2. Exclusion criteria for the exposed group were:

1. History of chest abnormality.
2. History of COPD or bronchial asthma.

3.4.3. Inclusion criteria for the non-exposed group were:

1. Age of the worker between 18 to 56 years.
2. Agreed to cooperate and willing to give informed consent.

3.4.4. Exclusion criteria for the non-exposed group were:

1. History of chest abnormality.
2. History of COPD or bronchial asthma.
3. History of occupational or non- occupational wood dust exposure.

3.5. Research Framework

Figure 1. Flowchart of the Study Protocol

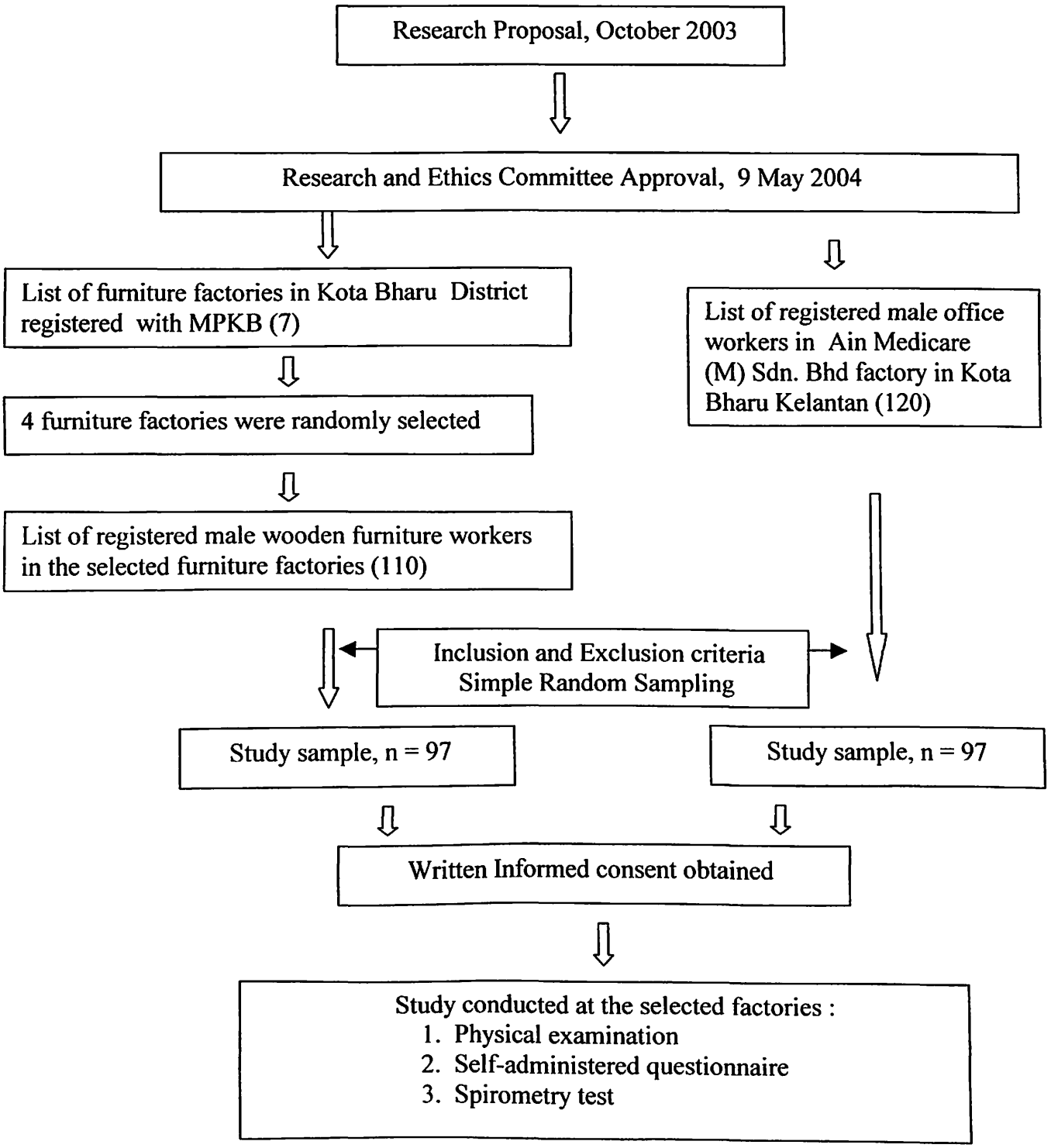

Figure 2. Conceptual Framework of Factors Contributing to Respiratory Function Results