RESPIRATORY HEALTH OF RICE MILLERS IN KELANTAN, MALAYSIA

Razlan Musa[1], Lin Naing[1], Zulkifli Ahmad[1] and Yassin Kamarul[2]

[1]Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, Malaysia; [2]Department of Health, Kelantan, Malaysia

Abstract. A cross sectional study was carried out to evaluate the effect of rice husk dust in rice millers in Malaysia. Altogether 69 workers participated in this study. They were interviewed using standardized questionnaires and lung function tests were performed. Chest tightness was among the common symptoms (34.9%) complained by workers. Age, duration of employment and smoking status were among the factors associated with respiratory symptoms ($p < 0.01$). Lung function tests revealed some degree of impairment compared to the healthy population.

INTRODUCTION

Malaysia is a major rice growing country. There is a significant proportion of the population working in this agriculture sector. The cultivation of rice is done in irrigated fields. The crop is harvested, dried and milled. A large amount of dust is generated, especially during the milling activities.

Rice mill workers are potentially exposed to organic and inorganic dusts and synthetic chemicals that may have adverse effects on respiratory health. Several reports have suggested that unprotected dust exposures in agricultural settings may lead to pulmonary fibrosis (Glyseth *et al*, 1984; Green *et al*, 1990; Sherwin *et al*, 1979).

There have been many reports on health effects of grain dust exposure. Grain dust has a long history of association with disease, and its adverse effects on various organs such as eyes, nose, skin, lung and the airways have been described (Hurst and Dosman, 1990). Asthma has been well documented as being a result of exposure. However, few studies have been reported on the effect of rice husk dust exposure. Rice husk is known to have a high silica content. (Standards and Industrial Research Institute of Malaysia, 1983). This biogenic silica may cause pulmonary disease resembling asbestosis, namely pleural thickening, fibrosis and possibly bronchogenic carcinoma. (Newman, 1986). Since the preliminary report by Lim *et al* (1984), there were limited local data published. Thus we conducted a cross sectional study of respiratory symptoms and pulmonary function of rice mill workers.

MATERIALS AND METHODS

The study population consisted of all workers employed at the biggest rice mill in Kelantan. Altogether there were 85 workers employed at the time of study period, only 69 workers were recruited for this study.

The subjects were interviewed by using a standard questionnaire which was based on the British Medical Research Council questionnaire (1966) on respiratory symptoms. The questionnaires were pertaining to the respiratory symptoms, past medical history, smoking and occupational history. Lung function was measured with spirometer (Microlab 3300 series). Each subject was asked to inhale deeply in standing position with the nose clamped, blow rapidly and completely as possible. The procedure was explained and demonstrated to each subject. At least three measurements were taken on each subject. Only the best blow was recorded and printed. Result were automatically corrected to body temperature. Height and weight were recorded to nearest 0.5 cm and 0.5 kg respectively. Data analysis was done by Epi Info software. (Dean *et al*, 1990). Sample proportions are compared by chi-square test. Student's *t*-test is used to compare means of quantitative variables. The significant level used for evaluating the test of significance is set at 0.05. The results of lung function were compared to healthy Malaysian standard (Singh *et al*, 1993).

RESULTS

Sixty-nine workers (63 males and 6 females)

with mean age of 40.17 years ± 8.86 (SD) were assessed. Mean duration of employment was 12.42 (± 7.31 SD) years. There were 58.7% of male workers who were current smoker. Since there was only a small number of femal (6) workers, they were excluded from further analysis.

Respiratory symptoms

Symptoms were grouped into 4 main categories namely morning cough, morning cough with phlegm, chest tightness and shortness of breath. Chest tightness was the most common symptom (34.9%) claimed by the workers, followed by morning phlegm (31.7%), shortness of breath (31.7%) and morning cough (19.0%) (Fig l).

Each of the symptoms was analyzed whether it had relationship with age group, duration of employment and smoking by univariate analysis. It revealed that both age (RR = 4.35, p = 0.010) and duration of employment (RR = 4.52, p = 0.012) had significant relationship with shortness of breath whereas smoking had relationship with moming phlegm (RR = 3.68, p = 0.023) and moming cough (RR = 5.56, p = 0.023) (Table l).

Lung function

Mean value for forced expiratory volume (FEV) was low compared to predicted value of healthy Malaysian population. However the difference was not statistically significant (p = 0.07) whereas for the FVC, the difference of the mean was statistically significant (p < 0.00l) (Table 2).

The FEV_1, FVC and FEV_1/FVC were further analyzed to find out relationships with age, dura-

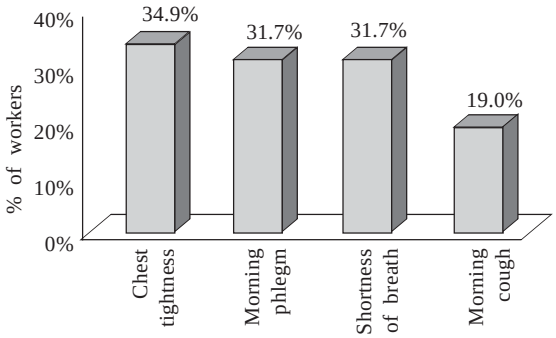

Fig 1–The distribution of symptoms experienced by workers.

Table 1
Relationship between each respiratory symptom and age, duration of employment and smoking[a].

	Age group[b]	Duration of employment[c]	Smoking[d]
Chest tightness	χ^2 = 3.742l df = 1, p = 0.053	0.049, 1, 0.825	0.328, 1, 0.567
	RR = 2.73 (95%CI : 0.97 - 7.7)	1.12 (0.41 - 3.05)	1.34 (0.49 - 3.64)
Morning phlegm	0.369, 1, 0.543	0.487, 1, 0.485	5.175, 1, 0.023
	0.72 (0.25 - 2.06)	0.69 (0.24 - 1.96)	3.68 (1.16 - 11.72)
Shortness of breath	6.64, 1, 0.010	6.317, 1, 0.012	0.461, 1, 0.497
	4.35 (1.36 - 13.90)	4.52 (1.32 - 15.48)	1.44 (0.50 - 4.14)
Morning cough	0.003, 1, 0.956	0.019, 1, 0.889	5.156, 1, 0.023
	0.97 (0.28 - 3.35)	1.09 (0.31 - 3.86)	5.56 (1.12 - 27.65)

[a]Chi-square tests and Relative Risk (RR) calculations; [b]Age group: 40 and below versus 41 and above; [c]Duration of employment: 11 and below versus 12 and above; [d]Smoking: yes versus no

Table 2
The pattem of FEV_1 and FVC.

Parameters	Rice mill worker	Malaysian healthy population	Mean difference	p-value
FEV_1	2.56	2.69	0.1305	p = 0.076
FVC	2.76	3.47	0.7032	p < 0.001

Table 3
Relationship between each respiratory function parameters and age, duration of employment and smoking.

	Age (years)	Duration of employment (years)	Smoking (yes /no) *t*-test
FEV_1	F = 9.923, p = 0.002[a]	1.755, 0.190[a]	
	β =-0.024 (95%CI: -0.04,-.01)[a]	-0.185 (-0.47, 0.09)[a]	*t* = 4.360, p = 0.041
	β =-0.024 (95%CI: -0.04,-.01)[b]	NS[b]	
FVC	15.262, 0.000[a]	5.464,0.022[a]	
	-0.027 (-0.04, -0.0l)[a]	0.309 (-.57, -0.045)[a]	*t* = 5.400, p = 0.023
	-0.027 (-0.04,-0.01)[b]	NS[b]	
FEV_1/FVC	0.282, 0.597[a]	2.769, 0.101[a]	
	0.073 (-0.20, 0.35)[a]	3.961 (-0.79, 8.71)[a]	*t* = 0.029, p = 0.864
	NS[b]	NS[b]	

[a]simple linear regression
[b]multiple linear regression (independent variables: age and duration of employment)

tion of employment or smoking. It revealed that in regression analysis, age had significant relationship with FEV_1 (β = -0.024, p = 0.002) and FVC (β = -0.027, p = 0.000). Duration of work had also significant relationships with FEV_1 (β = -0.020, p = 0.041) and FVC (β = -0.021, p = 0.023) in univariate regressions. However, when the age was adjusted, the relationship of duration of employment with FEVI and FVC were no more signiflcant. Smoking had significant relationships with FEV 1 and FVC in independent Student's *t*-test (Table 3).

DISCUSSION

In this cross-sectional study, the tightness of chest appeared to be the most common symptom among the rice mill workers but it was not associated with duration of employment, smoking or age. The second most symptom, shortness of breath had a significant relationship with the duration of employment. It revealed that the symptom was more common (4.5 times) in the group of more than 11 years of employment than that of 11 years and less.

In the overall study group, the FVC was significantly reduced, but FEV_1 was almost found to be significant, when comparing to Malaysian healthy population standards. However, the duration of employment did not appear to worsen the respiratory function. Generally, the respiratory function of the whole study group was impaired compared to the healthy population. The result supports the other studies in various populations of rice mill workers or farmers (Bhat and Ramaswamy, 1991; Lim *et al*, 1984; McCurdy *et al*, 1996; Singh *et al*, 1988; Ye *et al*, 1998) which revealed impaired respiratory functions among these workers. However, this study fails to reveal clear picture of obstructive respiratory impairments and relationship with duration of exposure as suggested in these other studies. This might be due to the inadequate duration for the appearence of obstructive pathology and majority of workers in this study fell in a narrow range of duration of employment.

It has been known that rice husk has a high silica content, therefore it is used for its abrasive action as detergents, dyes, and even as cleansing agent for jet engines. (Standards and Industrial Research Institute of Malaysia, 1983). Lim and colleagues (1983) reported that, under the electron microscope, the rice husk was found to be covered with small needlelike hairs that project outwards as sharp, elongated spines, which were about 200-300 in length, and about 30-40 μ in diameter at the base, tapering into sharp ends (Lim *et al*, 1984).

Not only for non specific irritative effects of the rice husk exposure on the respiratory system, it was suggested that it could cause keratoconjunctival irritation, corneal scars, chronic conjunctival inflammation, pterygium formation and pruritus. (Lim *et al*, 1984). In addition, allergic nature of reactions such as nasal catarrh, occupational asthma, eosinophillia, allergic inflammatory reactions of pulmonary tissues were suggested to be related with rice husk exposure (Lim *et al*, 1984; Singh *et al*, 1988).

Chest radiological abnormalities were as high as 15% among rice millers, which were opacities consisting fine nodulation in the lower and midzones of the lungs. These were suggested as early stages of silicosis in radiological findings and also possibly the evidence of extrinsic allergic alveolitis. (Lim *et al*, 1984). Lim and colleagues (1984) studied on various clinical symptoms and signs, hematological and radiological findings among rice mill workers in Malaysian population, and proposed "Rice Millers' Syndrome", as they found distinctive clinical, hematological and radiological findings among workeri (Lim *et al*, 1984). Although, later studies (Bhat and Ramaswamy, 1991; Lim *et al*, 1984; McCurdy *et al*, 1996; Singh *et al*, 1988; Ye *et al*, 1998) also revealed similar findings, not many studies have been conducted.

From this study, it seems that there is an impairment of the lung function for rice millers and it indicates further extensive epidemiological and pathological studies for the health and safety of the rice mill workers.

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