VENTILATORY FUNCTION IN MALAY OFFICE WORKERS IN MALAYSIA

Abu Bakar Che' Man
H H Lim

Industrial Hygiene Division
Factories and Machinery Department
Malaysia

and

Department of Social and Preventive Medicine
Faculty of Medicine
University of Malaya
Kuala Lumpur

Abu Bakar Che' Man, BE(Hon) (Newcastle), MSc(Pittsburgh), AIHA

H H Lim, MBBS, MPH, DIH(England)

SYNOPSIS

A study was carried out to determine ventilatoy capacity (Forced Expiratory Volume or FEV_1, and Forced Vital Capacity or FVC) in apparently normal Malay office workers in Malaysia. The subjects, 78 males and 113 females, were interviewed using a standardized questionnaire to exclude those with symptoms or past history of cardiopulmonary disease. Measurements of age, height, weight, FEV_1 and FVC were made on each subject; the FEV_1 and FVC were measured using Vitalograph spirometers. The mean FEV_1 and FVC for males were 3.35 litres and 3.76 litres, respectively. For females, the mean FEV_1 and FVC were 3.46 and 2.72 litres, respectively. Height was positively correlated with FEV_1 and FVC ($p<0.01$). However, the correlation with age was not significant at the 1% level. Regression equations for predicting FEV_1 and FVC of Malay male and female office workers were computed. The implications of the findings are discussed, and compared with other studies in Singapore and Britain.

INTRODUCTION

Tests of lung function are important ancillary investigations in the diagnosis and management of many pulmonary diseases, including those which are occupationally related such as byssinosis and pneumoconiosis. Normal values for ventilatory function are ordinarily based on data from healthy populations. Such data are used to derive regression equations for predicting expected lung volumes and capacities for a particular age, sex and height. Measures of ventilatory function such as vital capacities also vary in different ethnic groups and with athletic conditioning or strenuosity of occupations (1, 2).

In Malaysia there has been very little research done to establish normal values for ventilatory function. The purpose of this study is to determine ventilatory capacity (Forced Expiratory Volume in one second, or FEV_1, and Forced Vital Capacity, or FVC) in apparently healthy Malay office workers engaged in light or sedentary work (3). This study thus constitutes part of a general survey by the Factories and Machinery Department to establish normal ventilatory function values for Malaysians of different ethnic origins. The data obtained can then be used as a control to assess lung function in various occupational groups.

MATERIALS AND METHODS

The study population consisted of 78 Malay males and 112 Malay females employed in various Government offices in Kuala Lumpur and Selangor. All of them were involved in light or sedentary office work for at least one month. The subjects were interviewed using a standard questionnaire to exclude those with symptoms or past history of cardiopulmonary diseases, and also those with previous history of exposure to pneumoconiosis-producing dusts. Nine females were excluded from the survey in this way.

The subjects were also interviewed on their smoking habits, and categorised into three groups accordingly; nonsmokers were those who had never smoked or had given up smoking completely; light to moderate smokers were those who smoked 10 or less cigarettes per day; heavy smokers were those who smoked more than 10 cigarettes per day.

Height was recorded in centimetres and weight in kilograms, while exact age was recorded in years on the day the lung function measurements were made.

The FEV_1 and FVC were measured using Vitalograph Spirometers, the instruments being calibrated before the survey was conducted. The measurements were made in air-conditioned rooms between 8 am and 4 pm to minimise the effects of diurnal variation.

The subjects were tested in a standing position with the chin slightly elevated and the neck slightly extended; no nose clips were used (4). They were instructed to take a maximal inspiration and then blow into the apparatus as hard, fast and completely as possible without interruption. At least three forced expirations were made. The expirations were judged unacceptable when full inspiration was not attained, maximal effort was not utilized, expiration discontinued before five seconds or before obvious plateau occurred on the volume-time curve, subject coughed during test, leakage occurred around mouth-piece, subject hesitated at the start of expiration, and when there was excessive variability between the three acceptable curves. (Variation between the two largest FVC AND FEV_1 curves should not exceed 10% or ± 100 ml, whichever is greater). The average of the three acceptable measurements was taken. All measurements were corrected to body temperature, ambient pressure and saturated water vapour (BTPS).

RESULTS

The age distribution of the 104 female and 78 male workers is shown in Table I. There were no workers aged above 40 years in the study population. The distribution of the workers according to their smoking habits is shown in Table II. There were no smokers among the 104 females, while 33 out of 78 males (42.3%) said they were nonsmokers.

Table III shows the mean values for age, height, weight and ventilatory function in the Malay male and female workers. The mean FEV_1 and FVC for males were 3.35 litres and 3.76 litres, respectively. For females, the mean FEV_1 and FVC were 2.46 and 2.72 litres, respectively.

The correlation coefficients between the physical variables (age, height and weight) and ventilatory function (FEV_1 and FVC) are summarized in Table IV. There was positive correlation of height with FEV_1 and FVC for both males and females ($p < 0.01$). However, the correlation between age and ventilatory function was not significant at the 1% level although a negative relationship was indicated. Height and weight were positively correlated ($p <$

Table I

Age and sex distribution of Malay office workers

Age group (years)	Female		Male	
	No. of workers	%	No. of workers	%
20 — 24	33	31.7	30	38.5
25 — 29	43	41.4	31	39.7
30 — 34	23	22.1	14	17.9
35 — 40	5	4.8	3	3.9
Total	**104**	**100.0**	**78**	**100.0**

Table II

Distribution of Malay office workers according to smoking habits

Smoking habit	Female		Male	
	No. of workers	%	No. of workers	%
Non-smoker	104	100	33	42.3
Light to moderate (< 10 cigarettes/day)	0	0	11	14.1
Heavy (> 10 cigarettes/day)	0	0	34	43.6
Total	**104**	**100.0**	**78**	**100.0**

0.01), but there was no significant correlation of weight with FEV_1 and FVC ($p > 0.01$). There was strong positive correlation between FEV_1 and FVC in both males and females ($r = 0.89$ and 0.92, respectively).

Other studies have consistently shown that age is negatively correlated with FEV_1 and FVC (5, 6). The failure to demonstrate correlation of age with ventilatory function in this study is probably due to the fact that there were no workers aged above 40 years in the study population, while the FEV_1 and FVC measurements were found to peak around 25 — 30 years of age. Thus, in the light of this, only the variable height was used to compute regression equations for FEV_1 and FVC.

In addition, among the males, there was no statistically significant difference between the mean FEV_1 and FVC of smokers and non-smokers (standardized to the average age and height of the males), ($p > 0.01$). The smokers and non-smokers have therefore been combined to derive the regression equations for the male workers.

The overall regressions for the Malay male and female office workers are given in Table V.

Table III

Mean values for age, height, weight and ventilatory function in Malay office workers

Measurements	Female				Male			
	No. of workers	Mean	S.D.	C.V.	No. of workers	Mean	S.D.	C.V.
Age (yrs)	104	27.0	3.6	13.3	78	26.7	3.8	14.3
Height (cm)	104	153.9	5.2	3.4	78	165.6	5.2	3.1
Weight (kg)	104	50.6	10.1	20.0	78	58.8	9.0	15.3
FEV_1 (ℓ)	104	2.46	0.38	15.4	78	3.35	0.41	12.2
FVC (ℓ)	104	2.72	0.45	16.5	78	3.76	0.46	12.2

S.D. = Standard deviation
C.V. = Coefficient of variation

Table IV

Correlation coefficients between physical variables (age, height and weight) and ventilatory function

Measurement	FEV_1	FVC	Age	Height	Weight
a) Females					
FEV_1	1.00				
FVC	0.92	1.00			
Age	-0.21*	-0.21*	1.00		
Height	0.48	0.53	0.12*	1.00	
Weight	0.07*	0.21*	0.36	0.48	1.00
b) Males					
FEV_1	1.00				
FVC	0.89	1.00			
Age	-0.13*	-0.02*	1.00		
Height	0.59	0.51	-0.28	1.00	
Weight	0.09*	0.19*	0.03*	0.27	1.00

*Not significant ($p > 0.01$)
Other correlation coefficients shown are significant at the 1% level

Table V

Regression Equations for FEV_1 and FVC of Malay office workers aged 20 — 40 years

a) Female
$FEV_1 = 0.0037\ Ht - 3.174$ ($r = 0.48$, $p < 0.01$)
$FVC = 0.046\ Ht - 4.285$ ($r = 0.53$, $p < 0.01$)

b) Male
$FEV_1 = 0.047\ Ht - 4.438$ ($r = 0.59$, $p < 0.01$)
$FVC = 0.046\ Ht - 3.840$ ($r = 0.51$, $p < 0.01$)

DISCUSSION

Findings from the present study suggest that ventilatory function (FEV_1 and FVC) in these subject are related to height but not to age, between the age range 20 — 40 years. As noted earlier, the failure to demonstrate linear relationship between age and ventilatory function may be due to the absence of subjects aged above 40 years in the study population. On the other hand, there is growing evidence from prospective studies that the decline in ventilatory function with age may not be as linear as is implied in existing regression equations (4). This underlines the necessity to apply regression equations with great caution.

Comparison with other studies showed that ventilatory function (FEV_1 an FVC) of the males in the present study were rather similar to Malay males inSingapore(2) although the latter were industrial workers engaged in more strenous activity (Tables VI and VII). On the other hand, Chinese males in Singapore (6) engaged in sedentary jobs seemed to have slightly lower FVC and FEV_1 than the Malay males in the present study. When compared with Caucasians however (5), the Malay males appeared to have rather lower FVC and FEV_1 values.

For the female workers, ventilatory function in Malays in the present study was more or less similar to that of Chinese females in Singapore (6).

CONCLUSIONS AND RECOMMENDATION

The study showed that ventilatory function in Malay office workers in Malaysia was linearly correlated with height, but not with weight or age between the ages 20 — 40 years. There was also no significant difference between the mean FEV_1 and FVC of smokers and non-smokers. Further studies to determine ventilatory function in Malays above 40 years, and in other ethnic groups in Malaysia are recommended.

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Table VI

Comparison of predicated FEV_1 for Malay workers using mean age and height values from present study

Investigator	Ethnic group and no. of subjects	Prediction formula	Predicted mean (litres)	Observed* mean (litres)	Predicted minus observed mean
Males					
Zee *et al*(2)	69 Malays (Singapore)	0.048 Ht — 0.024 Age — 3.98	3.328	3.350	-0.022
Da Costa *et al*(6)	134 Chinese (Singapore)	0.0267 Ht — 0.0189 Age — 0.774	3.143	3.350	-0.207
Cotes *et al*(5)	275 British	0.0346 Ht — 0.033 Age — 1.12	3.728	3.350	+0.378
Females					
Da Costa *et al*(6)	73 Chinese (Singapore)	0.0170 Ht — 0.0175 Age + 0.232	2.375	2.46	-0.084

* Observed mean is that of present study

Table VII

Comparison of predicated FVC for Malay workers using mean age and height values from present study

Investigator	Ethnic group and no. of subjects	Prediction formula	Predicted mean (litres)	Observed* mean (litres)	Predicted minus observed mean
Males					
Zee *et al*(2)	69 Malays (Singapore)	0.056 Ht — 0.017 Age — 5.13	3.690	3.76	-0.07
Da Costa *et al*(6)	134 Chinese (Singapore)	0.0409 Ht — 0.0105 Age — 2.761	3.732	3.76	-0.028
Cotes *et al*(5)	275 British	0.0508 Ht — 0.032 Age — 3.02	4.538	3.76	+0.578
Females					
Da Costa *et al*(6)	73 Chinese (Singapore)	0.0271 Ht — 0.0101 Age — 1.141	2.757	2.72	+0.037

* Observed mean is that of present study

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