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Ventilatory function test values of healthy adult Jordanians

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ABSTRACT A sample of 144 male, and 117 female healthy adults was selected to determine the normal ventilatory functions for Jordanians. Forced vital capacity, FEV_1, and FMF 25-75% were determined using a dry bellows spirometer. Linear regression curves and nomograms were constructed for predicted values. Jordanian values for FVC and FEV_1 were similar to those of Caucasians living in the western hemisphere.

In the assessment of lung function the measures of forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), and forced mid-expiratory flow rate (FMF 25-75%) are most commonly used. Such measurements, to be of any value, must be compared with expected normal values of the subject. These values may be influenced by a number of factors especially sex, height, age, usual habitat, and ethnic and racial origin of the subject. Hence it is necessary to know the normal ranges of these measurements for each racial group, taking all the other variables into consideration.

In Jordan, a homogeneous racial and ethnic community, no such measurements have so far been reported. Our purpose here is to record values for ventilatory functions in a group of healthy adult Jordanians and to describe nomograms from which expected normal values can be predicted.

Methods

A group of 261 Jordanian adults (117 women and 144 men) ranging in age between 20 and 60 years were tested. Their age distribution is shown in the table. They were selected at random from university students and employees as well as healthy relatives accompanying patients to the University Hospital outpatient department.

The subjects were healthy non-smokers receiving no medications and with no history of any respiratory or cardiovascular disease. No subject employed at

Table *Age distribution of subjects tested*

Age (yr)	*Women*	*Men*
20–29	58	79
30–39	29	33
40–49	16	17
50–59	13	11
60+	1	4
Total	117	144

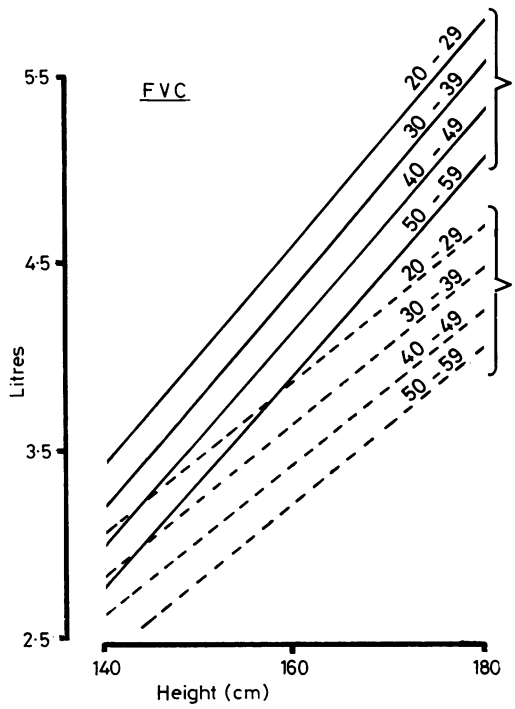

Fig 1 *Relationship of FVC to height in different age groups for male and female healthy adult Jordanians.*

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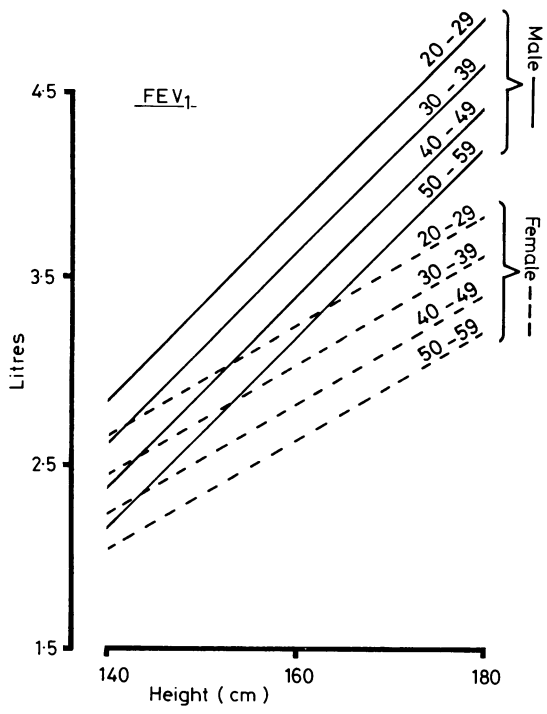

Fig 2 *Relationship of FEV_1 in different age groups for male and female healthy adult Jordanians.*

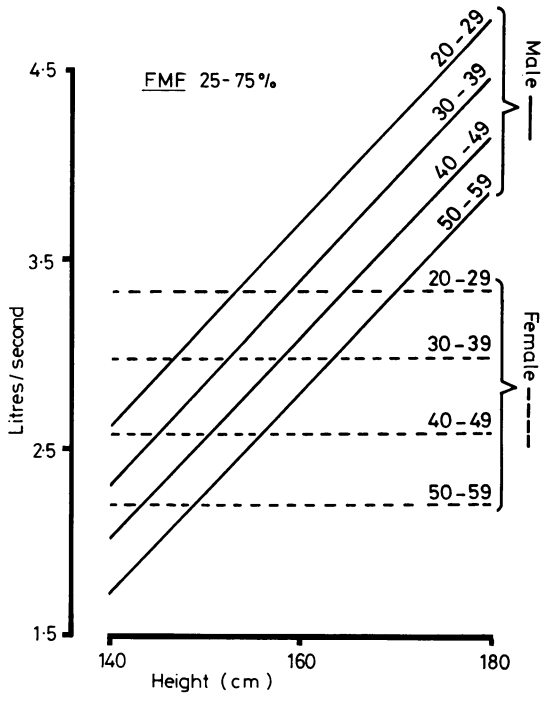

Fig 3 *Relationship of FMF 25-75% in different age groups for male and female adult healthy Jordanians.*

any time in wood or metal work, mining, poultry or other forms of farming, or building and construction was included in this study. All the subjects tested were living in the Amman area which is 774 metres above sea level.

The FVC, FEV_1, FMF 25-75%, and FEF 200-1200 ml were determined in the standing position without nose clip for each subject by means of a Vitalograph dry belows spirometer (Vitalograph Ltd, Buckingham, England). The spirometer was calibrated regularly. After training, the best of three measurements was used. All figures for pulmonary function in this study were taken directly from the standard recording paper of a vitalograph spirometer which is calibrated to provide BTPS corrected values. The temperature in the laboratory was 20 ± 2° throughout the study.

Results

The measurements of FVC and FEV_1 were related to sex, age, and height for both men and women. These relationships are shown in figs 1 and 2. Similar relationships for FMF 25-75% in different age groups are shown in fig 3.

The relationship between the height, age, and measured lung function values were obtained by applying multiple linear regression analysis by computer (NCR century 251). From the values calculated through the multiple regression equations, nomograms were drawn. The linear relationship between the different lung function tests values and the height and the age of the male and female Jordanians were as follows:

Men		*Standard deviation*
FVC (l)	= 0·059 (Ht/cm) − 0·024 (age) − 4·171	± 0·548
FEV_1 (l)	= 0·052 (Ht/cm) − 0·027 (age) − 3·703	± 0·460
FMF (l/s)	= 0·055 (Ht/cm) − 0·030 (age) − 4·387	± 1·018
Women		
FVC (l)	= 0·043 (Ht/cm) − 0·019 (age) − 2·536	± 0·449
FEV_1 (l)	= 0·031 (Ht/cm) − 0·023 (age) − 1·124	± 0·377
FMF (l/s)	= 0·001 (Ht/cm) − 0·038 (age) + 4·127	± 0·743

Nomograms from these equations are shown in figs 4 and 5.

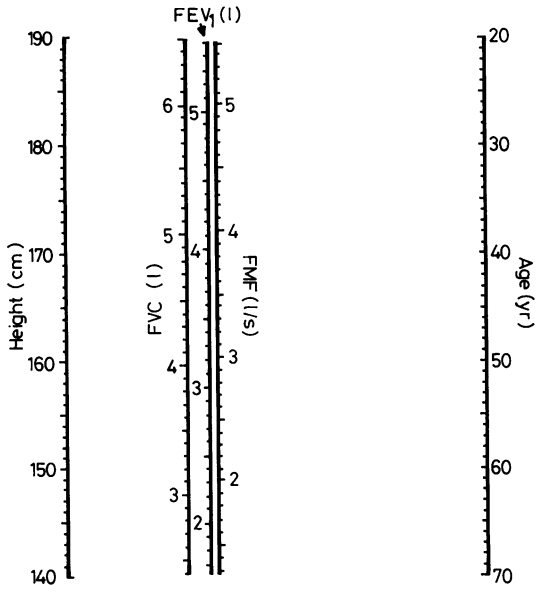

Fig 4 *Nomograms for healthy adult Jordanian men.*

Discussion

In this study we looked at a selected sample of healthy non-smoking subjects. Since environmental factors as well as cardiopulmonary disease may influence the functions studied, we felt the criteria for selection in the study avoided any misleading conclusions.

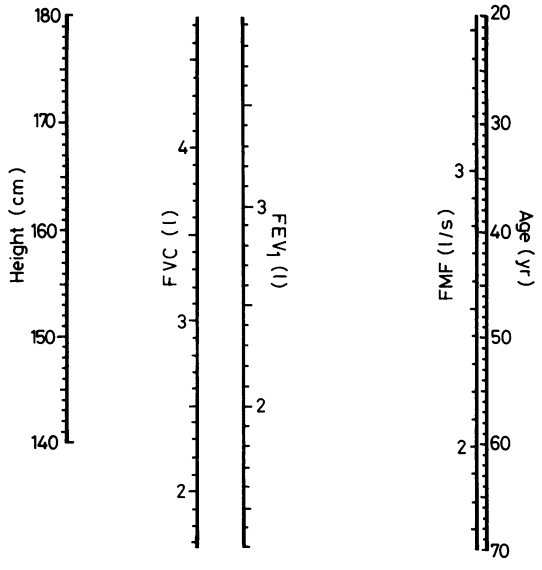

Fig 5 *Nomograms for healthy adult Jordanian women.*

In considering the anthropomorphic indices we came to a similar conclusion as others—namely, that height and age, rather than weight correlate with changes of pulmonary function values.[1-5] In 1978 Williams *et al*[6] carried out a comparative analysis of vital capacity in different ethnic groups. He concluded that the values for Americans as reported by Kory *et al*[4] were greater than those of Pakistanis and Indians. Similarly Cotes *et al*[7] concluded that Caucasians had higher spirometric values than other ethnic and racial groups such as Indians, the Maori of New Zealand, and members

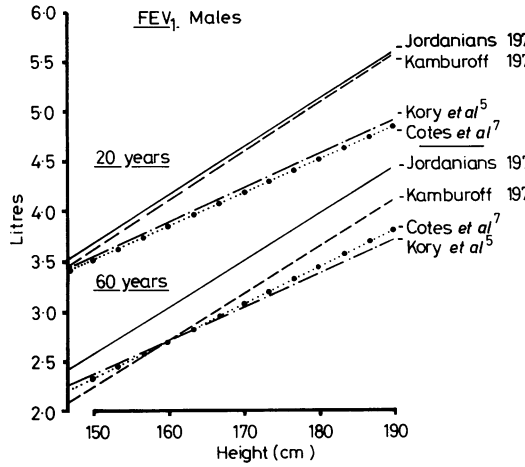

Fig 6 *Comparison of the FEV_1 values in men in relation to height in two age groups (20 and 60 years) with those reported by Kory,[5] Cotes et al.,[7] and Kamburoff et al. Figures for Kamburoff et al supplied by the manufacturers of Vitalograph.*

of some African races. In addition Woolcock *et al*[8] suggested that Europeans have greater ventilatory capacities than Africans, Indians, Bantu, and Chinese. Thus the general impression in the literature is that members of the Caucasian race living in the western hemisphere are at an advantage in regard to ventilatory function compared with other racial and ethnic groups.

In our attempt to compare our results with those reported in the literature, FEV_1 was taken as an index. Figure 6 shows that Jordanians compare closely with the measurements in Europeans. Because our subjects were almost all Arabs, those values could also be taken to represent the Arab values.

One explanation for the excellent values of FVC and FEV_1 could be the result of the strict criteria observed in choosing a sample of non-smokers.

Another reason may be the lack of atmospheric pollution. Amman is a non-industrial, mountainous city, 774 metres above sea level, so high altitude and physical activity[9] might also have produced a favourable effect on FVC and FEV_1.

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References

[1] Hutchinson J. On capacity of lungs and on respiratory functions with views of establishing a precise and easy method of detecting disease by spirometer. *Trans Med Chir Soc London* 1846;**29**:137.

[2] Du Bois D, Du Bois EF. Clinical calorimetry. A formula to estimate the approximate surface area if height and weight be known. *Arch Intern Med* 1916;**17**:863-71.

[3] West HF. Clinical studies on respiration. *Arch Intern Med* 1920;**25**:306-16.

[4] Hepper MGG, Fowler WS, Helmholz HF. Relationship of height to lung volume in healthy men. *Dis Chest* 1960; **37**;314-20.

[5] Kory RC, Callahan R, Boren HG, Syner JC. The Veterans Administration. Army co-operative study of pulmonary function. Clinical spirometry in normal men. *Am J Med* 1961;**30**:243-58.

[6] Williams DE, Miller RD, Taylor WF. Pulmonary function studies in healthy Pakistani adults. *Thorax* 1978;**33**: 243-9.

[7] Cotes JE, Rossiter CE, Higgins ITT, Gilson JE. Average normal values for forced expiratory volume in white Caucasian males. *Br Med J* 1966;i:1016-9.

[8] Woolcock AJ, Colman MH, Blackburn CRB. Factors affecting normal values for Ventilatory lung function. *Am Rev Respir Dis* 1972;**106**:692-709.

[9] Cotes JE, Saunders MJ, Adam JER, Anderson HR, Hall AM. Lung function in coastal and highland New Guineans comparison with Europeans. *Thorax* 1973; **28**:320-30.