

Respiratory function among Malaysian aboriginals

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Respiratory function tests have been performed on 43 Malaysian aboriginals. The forced vital capacity and forced expiratory volume in one second (FEV₁) were considerably below, and the peak expiratory flow rate (PEFR) slightly below, the predicted values. The FEV₁ and PEFR decreased more rapidly with advancing age than predicted from western standards. These findings may be due to physiological differences or may be the result of chronic purulent bronchitis which is common among the aboriginals.

The aboriginals of the Malay peninsula are descendants of prehistoric migrants, who came almost certainly from the main Asian land mass to the north. They probably arrived over a prolonged period, each group being driven into the mountainous deep jungle by later migrants (Fig. 1). Their culture and the medical services available to them have been described (Bolton, 1968). They lead active lives as hunters and shifting cultivators, and still use blowpipes with poisoned darts to secure game. Children of both sexes begin smoking home-grown tobacco early in life, and we

have seen children refreshing themselves at their mothers' breasts between puffs on a home-rolled cigarette. As some areas where they live are over 3,000 ft (914 m) above sea level, they have fires burning in their long houses at night for warmth. However, more smoke than heat results, so their air passages are insulted by irritants by both day and night. Chronic productive cough is almost universal and tuberculosis common, but only five cases of carcinoma of lung have been found in 15 years among a population of 50,000, and all those with carcinoma had smoked imported western-style tobacco. Respiratory function tests have not hitherto been done on these people, but

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FIG. 1. *Aboriginals gathered at a helicopter landing pad in the deep jungle.*

they would be of general interest as well as being helpful in determining the effects of treatment of their respiratory complaints.

MATERIAL AND METHODS

All testing was done at the Aboriginal Hospital at Gombak near Kuala Lumpur, Malaysia. This hospital is reserved for aboriginal patients and their relatives. Respiratory function tests were performed on:

(1) members of the staff of the hospital: these were all aboriginals who had been born and raised in the jungle and had since been recruited to the hospital staff. They were generally better nourished but less active than their jungle compatriots. In this group there were 23 males;

(2) patients who had been admitted for non-respiratory complaints. They were all fully active at the time of testing;

(3) relatives who had come to hospital with patients to avoid family separation. There were 17 males and three females in groups 2 and 3.

The subjects were asked their ages but as they have a poor idea of time, ages must be regarded as approximate only. All subjects had chest radiographs to exclude tuberculosis.

The Vitalograph dry spirometer and the Wright peak flow meter were used with the subject sitting. Instruction and practice sessions were given before



FIG. 2. Respiratory testing at Gombak Hospital.

the test runs. Testing was done until two similar readings were obtained and the higher of these was used for analysis. A vocal and often derisive gallery of spectators helped to encourage maximal effort among the subjects (Fig. 2). The Orang Asli are all very small in stature compared with Caucasians. The average height of the males was 158 cm and of the females 144 cm. No standards of respiratory function are available for people of this stature and the Caucasian standards have been extrapolated, using the formulae given by Ferris, Anderson, and Zickmantel (1965). The Spearman rank correlation has been used to test correlation between various parameters.

RESULTS

Details of the age, sex, height, weight, and respiratory function tests are given in the Table.

FORCED VITAL CAPACITY (FVC) The measured FVC was compared with that predicted from the formulae of Ferris *et al.* (1965). The measured

TABLE
RESULTS OF RESPIRATORY FUNCTION STUDIES

Age (yr)	Sex	Weight (kg)	Height (cm)	Status	FEV ₁ (litres)	FVC (litres)	PEF (l/min)
17	M	54	163	Patient	2.61	3.05	506
21	M	42	155	"	2.45	2.84	409
28	M	52	151	"	1.74	2.13	404
30	M	59	166	"	3.17	4.08	409
30	M	52	154	"	2.69	3.28	409
31	M	46	147	"	2.00	2.38	445
35	M	45	160	"	1.97	2.94	368
35	M	42	142	"	1.58	2.18	363
36	M	40	146	"	2.35	2.64	430
37	M	45	160	"	1.87	2.74	276
38	M	55	161	"	2.81	3.40	502
38	M	50	155	"	1.51	1.89	409
42	M	41	147	"	2.10	2.70	225
48	M	52	155	"	1.41	1.52	266
50	M	36	154	"	0.61	1.53	174
60	M	51	160	"	1.33	2.35	240
69	M	37	150	"	0.92	1.53	159
26	F	44	140	"	0.89	1.34	192
34	F	35	137	"	1.05	1.20	235
42	F	52	154	"	1.46	1.64	390
20	M	57	165	Staff	3.05	3.92	460
20	M	49	160	"	1.84	2.10	429
21	M	46	158	"	3.20	3.53	471
21	M	51	158	"	2.35	2.84	471
21	M	57	163	"	2.86	3.71	440
24	M	45	158	"	2.40	2.76	466
24	M	49	158	"	2.30	2.86	276
24	M	50	165	"	3.27	3.58	572
25	M	45	150	"	1.46	1.64	384
25	M	67	164	"	2.97	3.17	522
26	M	50	158	"	2.76	3.15	527
26	M	51	158	"	2.38	2.71	522
27	M	68	165	"	3.12	3.81	491
27	M	49	158	"	2.23	2.71	532
27	M	55	165	"	3.15	3.56	480
27	M	56	163	"	2.69	3.17	471
28	M	50	154	"	2.20	2.76	481
29	M	65	166	"	1.74	2.25	399
30	M	64	166	"	2.92	3.41	562
31	M	52	160	"	2.15	2.46	516
33	M	51	163	"	2.90	3.41	455
34	M	73	168	"	2.61	3.12	471
36	M	64	163	"	1.92	2.27	471

The values for respiratory flow measurements have been corrected for temperature but not for atmospheric pressure.

value was invariably lower than the predicted value (mean 78%, S.D. 14%) but in male patients and relatives, who were the only group with sufficient numbers and age range for correlations, there was no significant correlation between age and the measured/predicted ratio of the FVC ($R_s = -0.219$, 17 subjects, $P > 0.1$).

FORCED EXPIRATORY VOLUME, 1 SECOND (FEV₁) The measured FEV₁ was always lower than the predicted value (mean 68%, S.D. 16%). Among the male patients and relatives, the ratio of measured/predicted values was significantly and negatively correlated with age ($R_s = -0.439$, $P < 0.05$). The FEV₁ in this group therefore decreased more rapidly with age than in the Caucasian standards.

PEAK EXPIRATORY FLOW RATE (PEFR) The measured PEFR varied widely (mean 87%, S.D. 19%) and in some subjects exceeded the predicted value. Among the male patients and relatives, there was a significant negative correlation between the measured/predicted PEFR ratio and the age of the subject ($R_s = -0.523$, $P < 0.05$), suggesting a more rapid decline with age among the aboriginals.

RELATIONSHIPS AMONG THE RESPIRATORY FUNCTION TESTS The PEFR and FEV₁ were highly correlated ($R_s = 0.920$, $P < 0.01$) and the PEFR also correlated with the FEV₁/FVC ratio ($R_s = 0.551$, $P < 0.05$).

DISCUSSION

The most notable feature of the respiratory function tests is that most results fall well below the predicted level. The formulae which have been used give lower predicted values for subjects of this small stature than do other published standards (Baldwin, Courmand, and Richards, 1948; Miller, Johnson, and Wu, 1959; Korey, Callahan, Boren, and Syner, 1961). These relatively poor performances may be due to (1) invalid extrapolation of prediction formulae to subjects of this small stature, (2) failure of the subjects to achieve maximal effort during testing, and (3) true biological differences between Caucasians and this group of aboriginals.

Most published series include a few subjects as small as the aboriginals, but the small numbers at the ends of the distribution give low reliability of

the predictive equations in this region. Other studies (Kamat, Krishnarwamy, Sarma, and Ranganathan, 1967; Johannsen and Erasmus, 1968), which were done among subjects of small stature, also found low relative values.

It has been suggested that the 'stem length' may correlate better with respiratory function than 'height'. The stem length of these subjects was not measured, but in another group of aboriginals the ratio of sitting height/standing height was 54% for both males and females, which is similar to that for most adults of Caucasian origin.

A spirometer is an unfamiliar piece of equipment to most people, but the aboriginals, with their jungle background, may adapt less rapidly than mechanically sophisticated western peoples. However, the technique which gives the best results with the Peak flow meter is similar to that required to give maximal range with a blowpipe while hunting. The 'cheer squad' probably ensured maximal effort in all the subjects whose results are given here.

Although the FEV₁/FVC ratio is within the normal limits for Caucasians, it does fall more rapidly with age than predicted. The present data are not enough in themselves to determine whether this decline is due to physiological differences or to pathological changes but the frequency of cough with sputum suggests that the latter is more likely.

The Malayan aboriginals are one of the few peoples who still lead a jungle existence, and they have many peculiarities apart from their respiratory function. For example, gout and haemoglobinopathies are common, but degenerative cardiovascular disease is rare. As a group, they would repay further study, provided that this could be done sympathetically so as to preserve their culture and their dignity.

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