PEAK EXPIRATORY FLOW RATE IN SOUTH INDIAN ADULTS

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Summary: Peak Expiratory Flow Rate (PEFR) was measured with a Wright Peak Flow Meter in 851 healthy men and women of two categories; Group I - students and staff of the Medical College constituting the middle income group, and Group II - healthy individuals from the poorer class with an income of less than Rs. 200/- per month, forming the lower income group. In both categories women had much lower values than men, and in both sexes the values in the subjects of the poor income group was significantly lower. The PEFR was found to correlate best with height in subjects below 30 years, and with age in older subjects. The mean values, standard deviations and regression equations are given for the different groups. Present values are also compared with some western and Indian data.

Key words: peak flow rate ventilatory function

INTRODUCTION

The Peak Expiratory Flow rate has received general acceptance as a useful test of ventilatory capacity (21). Since the apparatus is small and portable, and does not require electric power to operate, it is spacially suited for use not only at the bed side of the patient but in epidemiological surveys Though spirometric ventilatory indices in Indian subjects have been well reported, data on Peak Flow Rates are very few (11,12,13,17,18,20). The present study was undertaken to determine the normal values of Peak Expiratory Flow Rates (PEFR) in South Indian adults.

MATERIAL AND METHODS

Healthy subjects (472 men and 379 women) from 17 to 70 years of age and belonging to two categories were investigated. The first category (Group I) were medical students, staff of medical college and hospital and retired officials, all from the middle income group. The second category (Group II) comprised of healthy individuals from the poorer class, who came to the general hospital outpatient or wards to look after their sick relatives or friends, and these formed the lower income group. The monthly income of subjects of this group is less than 200.00 per month.

The subjects were asked to take a full and deep inspiration and then blow out fast and forcefully into the Peak Flow Meter. The highest of the three readings after one or two practice trials, was taken as Peak Flow. Height in (*cm*) and weight in (*kg*) were

measured in each subject and the Body surface area (BSA) in square meters was read off from a nomogram based on DuBois formula.

RESULTS

The mean values and standard deviations of the physical measurements and peak flow rates are summarized in Table I. Men have higher PEFR than women in both groups, the average difference being about 140 lit/min. In both sexes, subjects of the poor income group have significantly lower values than subjects of the corresponding age of the middle income group. Peak flow declines with age beyond the third decade. There is a significant positive correlation of PEFR with height in most groups, but is better in subjects under thirty. Body surface area and weight do not show consistant relation with PEFR. There is a high

TABLE I : Mean values and standard deviations of physical measurements and PEFR..

Sex	Age group	Group I					Group II				
		n	Age	Height cms	Weight kgs	PRER lit/min	n	Age	Height cms	Weight kgs	PEFR lit/min
Males	17—29	99	21.8 3.7	167.6 6.7	54.7 8.4	513.0 57.9	68	24.3 3.4	161.6 6.1	48.4 6.8	463.0* 81.4**
	30—39	40	34.6 2.6	164.7 5.5	61.8 10.9	485.0 56.4	51	33.4 2.9	162.4 5.5	59.7 8.1	452.0 74.4
	40—49	69	44.5 2.6	164.4 6.0	65.0 9.5	473.0 61.5	37	43.2 2.3	162.9 5.6	61.9 9.3	428.0 90.3
	50—59	48	54.1 3.1	164.3 6.3	62.0 13.2	468.0 81.9	12	52.4 2.7	161.2 4.5	59.6 6.8	416.0 82.7
	60+	38	64.9 4.2	164.8 6.5	59.8 8.4	431.0 68.8	10	64.1 3.6	162.1 5.0	54.9 9.2	352.0 49.0
Females	17—29	106	20.6 2.4	154.5 4.5	45.7 6.5	359.0 48.8	100	23.4 3.2	147.5 6.3	41.5 6.3	324.0 53.7
	30—39	26	34.2 3.1	152.9 8.8	53.6 10.9	361.0 63.2	52	32.9 2.6	148.9 7.0	42.2 7.5	318.0 53.0
	40—49	23	44.0 2.6	151.6 5.9	57.1 8.8	333.0 61.1	26	43.1 2.6	146.3 5.9	44.4 6.6	292.0 34.2
	50—59	12	53.8 2.9	153.0 3.2	55.7 4.4	330.0 68.8	14	52.4 2.4	146.9 6.4	42.2 9.9	268.0 59.6
	60+	10	63.2 2.2	153.1 2.9	54.7 5.9	293.0 48.6	10	63.6 3.0	149.8 3.9	45.8 3.6	244.0 41.5

*Mean : **Standard deviation

Group I — Middle income group
Group II — Lower income group

negative correlation with age in subjects over thirty. Regression equations and correlation coefficients are given in Table II. A comparison of the values of observed in this study with the predicted values from other workers is shown in Table III and IV.

TABLE II : Correlations and regression equations.

Subjects	Age group in years	Correlation of PEFR with		Regression equations	S.E.E.
		Age	Height		
Males : Group I	17—29	0.2691	0.3164	PEFR = 2.74 Ht+53.4	52.1
	30 & above	—0.3249	0.2880	PEFR = 567—2 Age	63.6
Males : Group II	17—29	0.1523	0.4233	PEFR = 5.67 Ht—453	66.8
	30 & above	—0.3393	0.0579	PEFR = 554—3 Age	78.9
Females : Group I	17—29	—0.3111	0.4333	PEFR = 4.65 Ht—360.2	43.9
	30 & above	—0.3574	0.3422	PEFR = 438—2.24 Age	61.4
Females : Group II	17—29	—0.2499	0.3429	PEFR = 2.95 Ht—110.3	50.5
	30 & above	—0.4632	0.1865	PEFR = 395—2.37 Age	47.3

S.E.E. — Standard Error of Estimate
Group I — Middle income group
Group II — Lower income group

TABLE III : Comparison of the present data with other's values (Males).

Age group	Income group	n	Age*	Height* cms	Predicted from the formulae of						Flint & Khan observed value British (8)	Present study
					Kamat et al. South India (12)	Basavaraju & Parvati S. India (2)	Malik et al. N. India (17)	Cookson et al. Rhodesian Africans (6)	Ferris et al. American (7)	Leiner et al. American (16)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
17—29	I	99	21.8	167.6	555	457	476	529	539	607		513
	II	68	24.3	161.6	524	426	449	509	504	579		463
	I & II	167	22.8	165.2	542	445	465	521	525	596	557	493
30—39	I	40	34.6	164.7	516	458	459	494	494	566		485
	II	51	33.4	162.4	508	462	450	491	486	560		452
	I & II	91	33.9	163.4	512	460	454	492	489	562	545	467
40—49	I	69	44.5	164.4	494	425	434	471	468	539		475
	II	37	43.2	162.9	490	429	430	469	464	537		428
	I & II	106	44.1	163.9	492	426	433	471	466	538	513	459
50—59	I	48	54.1	164.3	473	393	402	450	444	515		468
	II	12	52.4	161.2	463	399	392	447	433	509		416
	I & II	60	53.8	163.7	471	394	400	449	442	514	483	458
60+	I	38	64.9	164.8	452	358	371	428	420	489		431
	II	10	64.1	162.1	443	360	359	423	409	483		352
	I & II	48	64.7	164.2	450	358	368	427	417	493	375	415

*Mean values : I — Middle income group : II — Lower incomegroup

TABLE IV :- Comparison of the present data with other's values. (Females). (Headings as per Table III)

(1)	(2)	(3)	(4)*	(5)*	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
17—29	I	106	20.6	154.5	392	309	313	470	383	430		359
	II	100	23.4	147.5	369	280	302	440	357	407		324
	I & II	286	22.0	151.1	378	295	308	455	371	419	413	342
30—39	I	26	34.2	152.9	361	281	327	415	355	410		361
	II	52	32.9	148.9	351	284	316	408	345	401		318
	I & II	78	33.3	150.2	354	283	319	411	348	404	387	332
40—49	I	23	44.0	151.6	339	254	301	375	334	396		335
	II	26	43.1	146.3	325	257	287	363	320	383		292
	I & II	49	43.5	148.8	330	256	294	369	327	389	330	312
50—59	I	12	53.8	153.0	323	228	280	342	322	389		330
	II	14	52.4	146.9	308	232	264	330	306	375		268
	I & II	26	53.1	149.7	316	230	271	335	313	381	319	297
60+	I	10	63.2	153.1	308	202	274	307	306	379		293
	II	10	63.6	149.8	296	201	264	296	295	370		244
	I & II	20	63.4	151.5	302	202	269	302	301	375	265	269

*Mean values I — Middle income group : II — Lower income group

DISCUSSION

Peak flow values in this study are lower than observed in British and American subjects (4,6,7,8,16,18), and the formulae given by Gregg and Nunn (10), and Leiner *et al.* (16) give high estimates of PEFR. It is however interesting to note that the formulae of Ferris *et al.* (7) give values close to ours, and making allowance for height reduces the differences when compared with the data of Brooks and Waller (4). Flint and Kahn (8) have not given regression equations, but it is apparent from their studies in British subjects, that the PEFR in their subjects is not much higher if allowance is made for height (Table III and IV). The higher PEFR values in Western subjects appears to be partly due to their bigger physical build. Both male and female Zimbabwian Africans have higher values (6), but after making allowance for height the differences are negligible in men and older women, but still somewhat higher in younger women. Compared to other Indian data the mean values in our subjects of the lower income group agree very closely with the data of Malik *et al.* (17). The populations in both the studies are of the same category, and values very near our mean are obtained by applying their regression equations in our subjects. But from their formulae it is not easy to calculate expected values as they involve regression coefficients not only for height and age, but also for the square and cube of age, with regression coefficients to the fourth and sixth decimal points respectively. The simpler formulae given in this paper may be more suitable for routine use. The brief report of

Basavaraju and Parvathi (2), on subjects from Banglore does not give mean values, but their formulae underestimate the Peak Flow when applied to our subjects in all groups.

Gupta *et al.* (11) have recently reported peak flow rates with other lung function parameters in Rajasthani subjects. Their mean value of 488.55 l/min in men between 17 and 27 years, and 454.0 l/min in older subjects between 28 and 40 years, are lower than the values in our subjects of Group I, but quite close to the values in subjects of Group II. In females of the younger age group, their mean of 393.65 l/min is substantially higher than our values of 357 l/min; in older women however, their value of 362.9 l/min is almost identical with our value of 361,0 l/min. Our values in the subjects of Group I are very close to the mean values reported by Kamat *et al.* (14) in South Indian men below 45 years, and women below 30 years. Their older subjects have somewhat lower mean probably because the number of subjects in these groups are very few. However, the peak flow values reported more recently by Kamat and associates (13) are higher, and may be partly due to the fact that their group includes athletes, factory workers, police and army personnel. Their mean value of 553 l/min in young adult men is almost identical with the value of 550 l/min. noted in a group of Indian sailors posted in United Kingdom (20), and 556 l/min found in doctors and university teachers in Chandigarh (17). It is however, evident from this study that subjects from the lower income group who form the bulk of population that seek treatment in the general hospitals, have significantly lower peak flow values than medical students, doctors etc. This fact should be taken in to consideration when assessing the ventilatory function of a patient by comparing the test value with the expected value.

Although initially some doubts were expressed about the usefulness of the Peak Flow Meter (3), many studies have shown that it is a satisfactory index of airway obstruction (9,15,21). The peak flow meter has been utilized by two groups of physicians in India, in their studies on byssinosis in textile workers in Madras (1) and Bombay (12). In view of its many advantages a wider use of the Wright Peak Flow Meter is recomended. The instrument is small, portable and lighter than the smallest spriometer. The test is simple to perform, and though similar to forced vital capacity, the effort need not be maintained till the end of expiration, and a poor terminal effort will not affect the peak flow value. It takes a shorter time to perform and a spot reading can be taken directly from the dial of the instrument. It does not require electric power. These advantages make the Peak Flow Meter ideal for surveys in rural areas.

ACKNOWLEDGEMENTS

This investigation was aided by a grant from the Tamil Nadu State Research Committee, and conducted at Kilpauk Medical College, Madras-600 040.

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