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PULMONARY FUNCTIONS OF THE ELDERLY INDIAN SUBJECTS : TRENDS OF DECLINE WITH AGE

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Abstract : Respiratory Functions mainly vital capacity, FEV_1, MBC and breath holding time, of 400 healthy elderly persons, 328 men and 72 women, aged 60+, sedentary and belonging to upper middle class from Bombay were studied.

The findings are examined in each sex in 5 yearly age groups and are obviously low.

An attempt is made to link the age-wise averages of VC in younger subjects in India reported by other workers with our data on elderly. The values from Northern groups are comparatively much higher than those from the rest of India.

The connecting link in graphs shows a sudden fall when the data of northern Indians and that of our elderly are joined, but it is smooth when those of rest of India are connected.

Key words : respiratory functions vital capacity effects of aging

INTRODUCTION

References are scarce in literature regarding pulmonary functions of elderly Indians. Some respiratory efficiency tests of 400 healthy elderly persons – 328 men and 72 women, upper middle class, from Bombay, were studied.

METHODS

All tests were carried out in uniform conditions regarding time, place, posture, rest, etc. A thorough history, clinical examination, with routine laboratory tests, and skiagram of chest (A P.) were taken of all the subjects. They reported in the morning to the laboratory, where after adequate rest, their records of *vital capacity* (vc), *forced* expiratory *vol* for one sec. (FEV_1) were made on BMR graph paper on a drum moving at a speed of 1 inch per sec., with the subjects in standing position. Dentures were taken out by subjects, while the above functions were examined, since it was found that the dentures interfered with their performance (Table I).

Maximum Breathing Capacity (MBC) in l/min was estimated by asking the subject to breathe forcibly and rapidly into a Wright's respirometer for 15 secs and multiplying the result 4 times. Only 130 (112m, 18f) elderly persons could undertake this exhausting procedure satisfactorily.

Similarly *40mm Hg test* could be satisfactorily performed by 230 (206m, 24f) subjects only.

Breath holding time of all subjects was noted in seconds.

TABLE I : Age, Sex and basic measurements of subjects.

Age (years)	60—64		65—69		70—74		75+		*Total*	
Sex	M	F	M	F	M	F	M	F	M	F
No of Subjects	125	55	103	12	16	5	39	—	328	72
Ht. (Cms)	167.5	150.6	163.2	149.3	167.7	149.3	159.2	—	165.1	150.0
Wt (Kgs)	62.8	59.9	59.1	52.1	57.8	45.5	54.2	—	59.7	57.5
SA (m^2)	1.67	1.52	1.61	1.45	1.67	1.36	1.51	—	1.63	1.49

RESULTS AND DISCUSSION

Vital capacity is the most common of pulmonary functions examined in laboratories. Friction of the instrument is apt to give some lower results particularly, if the aged are not able to ventilate well. Our observations were carried out on a BMR apparatus, adopted for the purpose, offering little resistance. It recorded even a change of 20 ml of air.

TABLE II : Respiratory functions of elderly subjects.

Age (years)	60—64		65—69		70—74		75+		*Total*	
Sex	M	F	M	F	M	F	M	F	M	F
VC (in ml) n=400	2240	1540	1990	1330	2060	1460	1960	—	2140 (n=328	1500 n=72)
VC/HT (ml)	13.79	10.30	12.97	8.82	12.50	10.18	11.91	—	12.8	9.8
VC/SA (ml)	1351	988	1274	911	1260	1077	1230	—	1279	992
FEV_1 (%)	73.7	77.8	70.8	83.9	68.5	83.2	67.3	—	71.1	79.2
MBC (l/min) n=130	85.3	66.8	73.4	60.0	79.9	50.0	69.9	—	79.2 (n=112	65.4 n=18)
Breath Holding (secs) n=400	39.9	36 9	40.3	31.4	42.6	28.0	41.0	—	39.0 (n=328	35.4 n=72)
40mm (Hg) test (secs) n=230	20.61	16.61	20.63	15.20	19.55	20.00	19.53	—	20.32 (n=206	16.46 n=24)

In elderly (60+) men the average VC was 2140±392 ml and in elderly women 1500±611 ml only.

The VC was about 50% more in men than in women in all age subgroups.

Bhargava *et al* (1) reported VC 2260±82 ml. in men 56–65 yrs. (n=20) and in women of same age group 1875±165 ml (n=20), in Bhopal.

Meenakshi (2) reported VC 2674±423 ml in men 60–69 yrs (n=15) and 2435±382 ml. in 70–80 yrs (n=10) and in women 60–69 yrs (n=13) 1776±410 ml and in 70–80 yrs (n=12) 1612±300 ml in inmates of an elderly home in Madras.

Hutchinson (3) who first devised the method of estimation of VC was impressed by it's dependence on the size of the individual. Myers (4) and Dreyer *et al* (5) obtained better correlation of VC values with standing height or surface area (SA) of the subjects and put forth the following relationship (6).

	Men	*Women*	*Athlets*
VC ml/Ht cms	25.0	20.0	29.0
VC ml/SA m^2	2500	2000	1800

Comparing the findings in elderly subjects in the present series, the values are found as under :

	Men	*Women*
VC ml/Ht cms	12.8	9 8
VC ml/SA m^2	1279	992

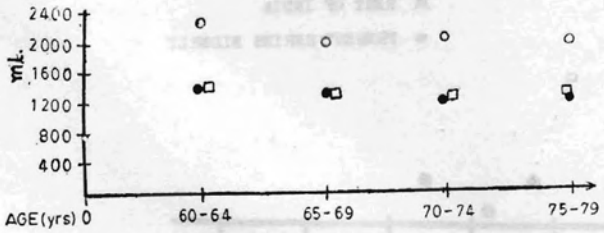


Fig. I : O VC (ml) ● VC/Ht (ml) □ VC/SA (ml) of elderly men in 5 yearly age groups.

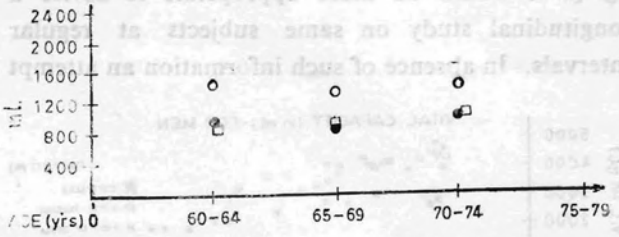


Fig. II : O VC (ml) ● VC/Ht (ml) □ VC/SA (ml) of elderly women in 5 yrly. age groups

Evidently, the findings in elderly are much lower, hardly half of the values mentioned by Dreyer *et al* (5) in European subjects.

Statistically, the formulae of relationship arrived at regarding VC (ml) and SA (m^2) in our subjects are :

(a) VC (ml) and SA (m^2)

In Men VC (ml) = 0.46 (SA m^2) ± 2121.75
In Women VC (ml) = 0.13 (SA m^2) ± 1489.80

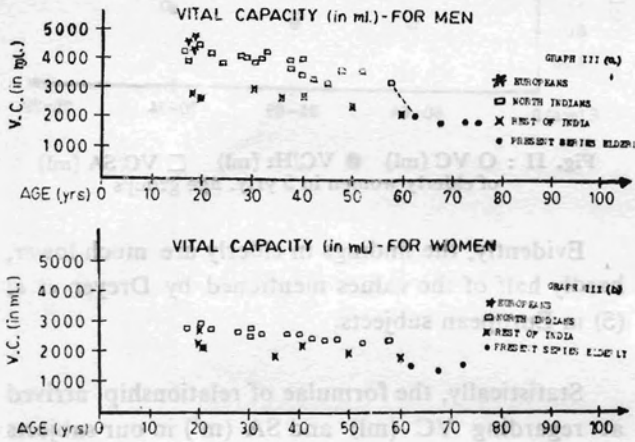
(b) regarding VC (ml) and standing ht (cms) are :

In Men VC (ml) = 0.46 (ht cms) ± 2048.96
In Women VC (ml) = 0.29 (ht cms) ± 1449.11

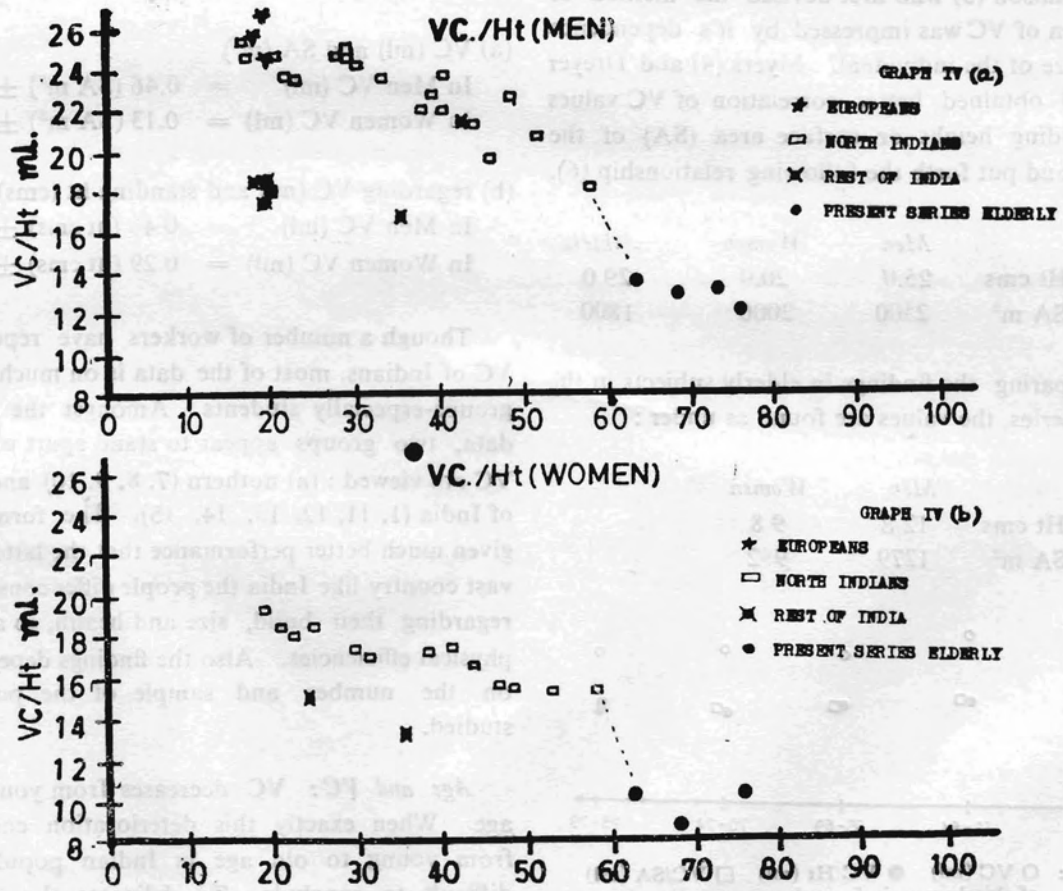
Though a number of workers have reported on VC of Indians, most of the data is on much younger groups-especially students. Amongst the reported data, two groups appear to stand apart when their VC are viewed : (a) nothern (7, 8, 9, 10) and (b) rest of India (1, 11, 12, 13, 14, 15). The former have given much better performance that the latter. In a vast country like India the people differ considerably, regarding their build, size and health, so also their physical efficiencies. Also the findings depend much on the number and sample of the population studied.

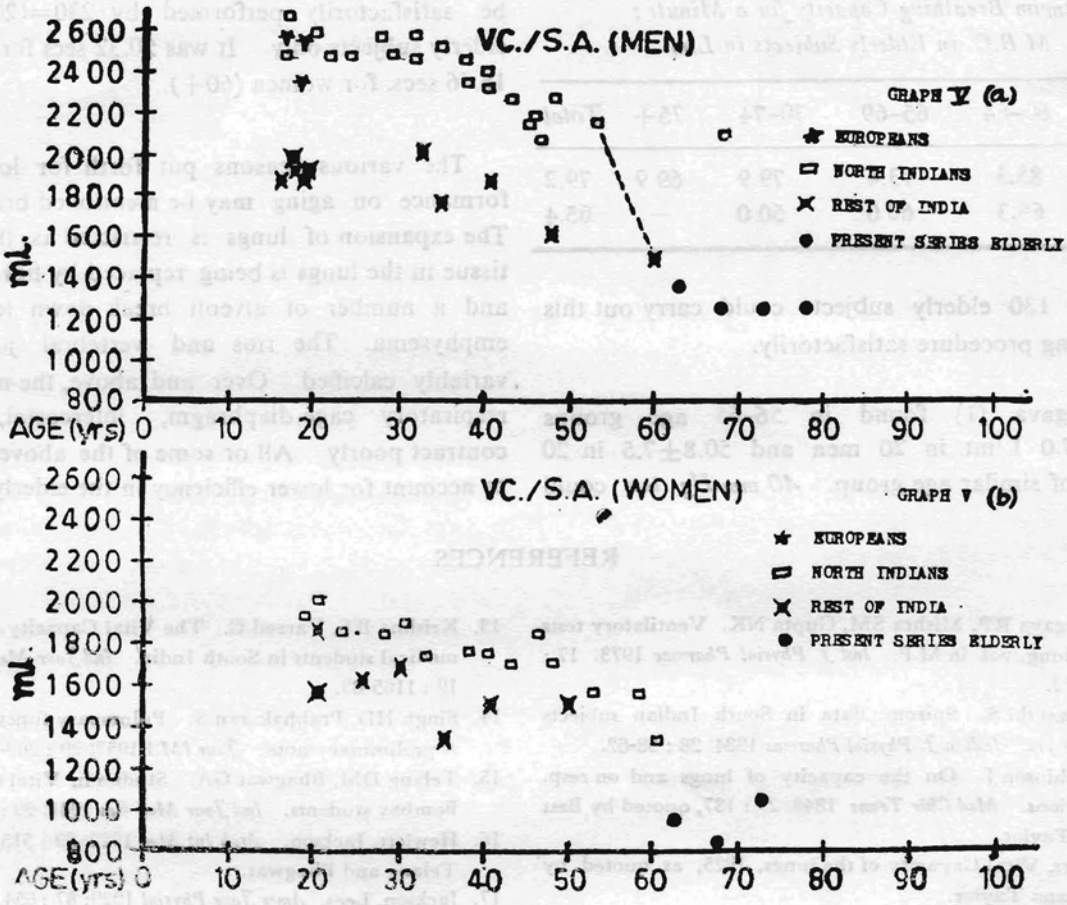
Age and VC : VC decreases from youth to old age. When exactly this deterioration commences from young to old age in Indian population is difficult to conclude. To delineate the effects of

aging, it would be more appropriate to devise a longitudinal study on same subjects at regular intervals. In absence of such information an attempt is made to guess transition of values from young to elderly as obtained in present series (Graphs III, IV, V).



The connecting bridge is even and smooth, when the data of Western, (12, 15) Central (1), Southern (13, 14) and Eastern (11) Indians are linked with those of elderly in Bombay, in this series. This is not so when the data of Europeans (16, 17, 18) and Northern (7, 8, 9, 13) Indian subjects are joined with the curves of elderly (Graph III). In the latter case, the link indicates a sudden fall in VC on aging, which gives an impression that at the age of 60 – a notable deterioration takes place. Therefore, the former representation, regarding transition of pulmonary efficiency with age in Western Indians, seems more acceptable.





VC and Sports: The minimum requirement regarding VC for Royal Air Force recruits (15) is 3400 ml. Telang and Bhagwat (15) examining Indian Olympic athletes of age 17–23, obtained 3327±606 ml and Ambegaokar and Dixit (19) 3380±158 ml in Indian Hockey players. Lakhera *et al* (20) obtained VC 5360 ml in Indian swimmers.

West (21) obtained more than 20% difference between sedentary and athletic groups. All the elderly subjects here were sedentary.

Breath holding time was averagely 39.0±19.2 secs in the elderly group. 17 subjects amongst these elderly practising pranayama showed 64.5±13.7 secs indicating considerable improvement in breath holding capacity as a result of performing pranayama over several years (22).

Makavana (23) reported in 25 subjects (20–50 yrs) breath holding time 59.64±11.5 sec in pranayama group, whereas it was 41.00±5.4 secs in control group of 15 subjects of similar ages.

FEV_1

In this series of elderly, men showed averagely *FEV_1*%—71% and women 79.2%— which figures are fairly satisfactory (24).

Maximum Breathing Capacity for a Minute: M.B.C. in Elderly Subjects in L/mt.

Age	60–64	65–69	70–74	75+	*Total*
Men	85.3	73.4	79.9	69.9	79.2
Women	66.3	60.0	50 0	—	65.4

Only 130 elderly subjects could carry out this exhausting procedure satisfactorily.

Bhargava (1) found in 56–65 age groups 63.87±7.0 L/mt in 20 men and 50.8±7.5 in 20 women of similar age group. *40 mm Hg test* could be satisfactorily performed by 230=(206m 24f) elderly subjects only. It was 20.32 secs for men and 16.46 secs. for women (60+).

The various reasons put forth for lower performance on aging may be mentioned briefly here. The expansion of lungs is restricted as the elastic tissue in the lungs is being replaced by fibrous tissue and a number of alveoli break down leading to emphysema. The ribs and vertebral joints are variably calcified. Over and above, the muscles of respiratory cage-diaphragm, intercostal, scalini contract poorly All or some of the above are apt to account for lower efficiency in the elderly.

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