

SPIROMETRIC DATA IN SOUTH INDIAN SUBJECTS 60-80 YEARS OF AGE

S. MEENAKSHI

*Institute of Physiology and Experimental Medicine,
Madras Medical College, Madras - 600 003*

(Received on July 18, 1983)

Summary : Forced expiratory and inspiratory vital capacities and the timed expiratory and inspiratory volumes and forced expiratory and inspiratory flow rates were determined in 50 old men and women between 60-80 years of age. Some of the ratios between expiratory and inspiratory volumes and flow-rates that have been found to be useful for detecting some forms of ventilatory defects are also given.

Key words :	FEVC	FEV ₁	FEFR
	FIVC	FIV ₁	FIFR

INTRODUCTION

Tests of Ventilatory function are increasingly used by the Clinicians for assessment of patients with respiratory diseases. Although there are numerous reports on normal values in adults, data on older subjects are scanty and these are limited to subjects upto about the age of 60 years (3, 12) except in the case of PEFr (4,11). Even western literature data in this age group are fewer compared to reports in the younger subjects (7, 10). As older subjects are highly susceptible to respiratory diseases, normal range of values in this age group will be of value to the clinician for diagnosis and treatment of chest diseases.

Most spirometric data pertain to the forced expiratory vital capacity and the timed volumes and flow-rates derived therefrom and forced inspiratory vital capacity has received little attention. Mc Neill *et al.* (8), observed that a greater understanding of the underlying abnormal mechanisms in the lungs can be obtained from a study of both inspiratory and expiratory spiograms. This study was undertaken to determine timed volumes and flow rates from forced expiratory vital capacity (FEVC) as well as forced inspiratory vital capacity (FIVC) in healthy men and women over 60-80 years of age.

MATERIAL AND METHOD

Studies were conducted on 50 subjects (25 males and 25 females) between 60-80 years of age. They were inmates of Friends in Need Society - Home for the aged.

All subjects were healthy and free from respiratory disorders. In all subjects height, weight and body surface area were recorded.

Spirometry was performed using Toshniwal's Expirograph which is a 9 litre closed circuit water sealed spirometer; both inspiratory and expiratory tracings were recorded. The conventional forced expiratory manoeuvre was recorded with the speed of the Kymograph drum adjusted to 1200 mm/mt. The best of the three tracings in each subject was used for calculating the values.

The forced inspiratory vital capacity (FIVC) was also recorded in each subject. In this the subject takes a deep inspiration after forcible expiration. Forced expiratory volume for 1 sec (FEV₁) and forced inspiratory volume for 1 sec (FIV₁) were measured from the FEVC and FIVC tracings respectively.

Forced expiratory flow rate (FEFR) and forced inspiratory flow rate (FIFR) between 25-75%, 70-80%; and 75-85% of FEVC and FIVC respectively were also calculated. All gas volumes were converted to BTPS. The peak expiratory flow-rate was determined using a wright Peak Flow Meter.

RESULTS

The normal values with standard deviation are shown separately for men and women between 60-69 and 70-80 years (Tables I and II). The ratios between corresponding expiratory and inspiratory volumes and expiratory and inspiratory flow-rates were also calculated. The FEVC, FEV₁ and mid-expiratory flow-rate observed in this study in subjects above 60 years are lower than the values reported in South Indian men and women around 50 years of age (12, 13). The predicted values obtained by the formulae of Singh (personal communication) for men 20(Ht-age) +700 and women 15(Ht. -age) +300

TABLE I. Mean values and physical measurements.

Group	Men				Women			
	Age	Ht (cm)	Wt (kg)	BSA(mt ²)	Age	Ht(cm)	Wt(kg)	BSA(m ²)
60-69	64.2	162.7	46.4	1.470	63.7	151.7	48.9	1.395
SD ±	5.5	5.3	3.2	0.045	5.5	5.6	4.0	0.045
70-80	73.2	158.8	50.0	1.486	75.6	146.5	48.7	1.364
SD±	5.0	5.5	3.4	0.039	4.6	5.7	4.1	0.038

are found to be very close to the observed values in this study. In the case of PEFR the prediction formulae by Singh *et al.* (11) and Jain *et al.* (4) give a higher values compared to our study for this age group. The values obtained by applying the prediction formulae of Malik *et al.* (6) are closer to the values in this study.

TABLE II: Mean values with S.D.

Age		Men		Women	
		60-69	70-80	60-69	70-80
No. of subjects		15	10	13	12
PEFR	Lit/mt	310	280	265.4	226.8
SD		27.5	28	26.8	19.9
FEVC	Lit	2.674	2.435	1.776	1.612
SD		0.423	0.382	0.410	0.300
FEV ₁	Lit	2.061	1.833	1.403	1.009
SD		0.307	0.298	0.320	0.295
FEV ₁	%	77	75	78.8	74.4
SD		6.6	7	6	5
FEFR	Lit/Sec	1.583	1.448	1.181	1.058
SD		0.417	0.282	0.404	0.304
FEFR	Lit/Sec	0.801	0.723	0.570	0.648
SD		0.209	0.144	0.219	0.188
FEFR	Lit/Sec	0.619	0.561	0.503	0.554
SD		0.165	0.102	0.180	0.174
FIV ₁	Lit	2.498	2.507	1.565	1.442
SD		0.497	0.300	0.391	0.296
FIV ₁	Lit	2.192	2.172	1.206	1.152
SD		0.349	0.202	0.325	0.280
FIV ₁	%	87	86.7	87.9	79.8
SD		5.7	6.5	6.6	4.5
FIFR	Lit/Sec	1.701	1.613	1.446	1.335
SD		0.320	0.226	0.398	0.285
FIFR	Lit/Sec	0.905	0.789	0.725	0.756
SD		0.199	0.183	0.123	0.197
FIFR	Lit/Sec	0.741	0.660	0.581	0.627
SD		0.133	0.124	0.160	0.160

DISCUSSION

Based on a study in men and women over 60 years of age Mandi *et al.* (7) established that decrease in VC was more definite in old age. The data of Schmidt *et al.* (10) in subjects between 55-94 also show that FVC, FEV₁ and expiratory flow decline with age. The findings of this study are consistent with the above observations. In both men and women all the functional values are lower in 70-80 year old subjects compared to the subjects of 60-69 years of age (except the end flow rate in women). The FEVC is slightly higher than FIVC in all groups except in men between 70-80 years of age. The percentage of volumes blown out in the initial 1 sec during inspiratory manoeuvre is more than during expiratory manoeuvre. The inspiratory flow rates over the middle and late portions of FIVC are greater than the corresponding flow rates in FEVC. This is as expected from observations of others (5, 9).

It has been shown that the ratios of corresponding parameters from FEVC and FIVC such as

$$\frac{FEV_1}{FIV_1}; \quad \frac{V50 \text{ Exp.}}{V50 \text{ Insp.}}; \quad \text{and} \quad \frac{FEFR \text{ 25-75\%}}{FIFR \text{ 25-75\%}}$$

are useful for detection of some features of ventilatory defects. The ratios which are approximately 0.9 in normal subjects are found to be increased in upper airway obstruction and reduced in emphysema and asthma (2, 9). These ratios were also examined in the subjects studied and the values are generally similar to those of others. The ratios of

$$\frac{FEV_1}{FIV_1} \quad \text{and} \quad \frac{FEFR \text{ 25-75\%}}{FIFR \text{ 25-75\%}}$$

are approximately 0.9 in men. In women

$$\frac{FEFR \text{ 25-75\%}}{FIFR \text{ 25-75\%}} \text{ is about } 0.83 \quad \text{and} \quad \frac{FEV_1}{FIV_1} \text{ is about } 1.1.$$

$$\text{In case of ratios } \frac{FEV_1\%}{FIV_1\%}; \quad \frac{FEFR \text{ 70-80\%}}{FIFR \text{ 70-80\%}} \quad \text{and} \quad \frac{FEFR \text{ 75-85\%}}{FIFR \text{ 75-85\%}}$$

the values in all the groups are about 0.9. Since these values appear more consistent, this ratios may be of greater value in older subjects.

Bhalla *et al.* (1) have found that PEFR is very helpful in separating upper airway

MMFR

obstruction from peripheral airway obstruction. However, the value of PFEFR in this

MMFR

study is 3.74 in both males and females which is higher than the value, 2.58 noted by Bhalla *et al.* (1) The difference may be because of different apparatus used for determination of PEFR. The data given in this paper on ventilatory values in subjects over 60 years which includes not only expiratory but also inspiratory volumes and flow rates may be of use in assessing lung function in aged patients.

ACKNOWLEDGEMENTS

I thank Prof. Dr. H.D. Singh, Retired Dean, Kilpauk Medical College, Madras for the help and guidance given to me and the authorities of "Home For the Aged" and the subjects for their co-operation. The permission granted by Dean, M. M. C. and the facilities provided by the Director, Institute of Physiology are also gratefully acknowledged.

REFERENCES

1. Bhalla J.S., J.S. Guleria and J.N. Pande. Physiological Characteristic of upper airway obstruction. *Ind. J. Med. Res.*, **69** : 476-481, 1979.
2. Clerk, T.J.H. Inspiratory obstruction. *Brit. Med. J.*, **3** : 682-684, 1970.
3. Jain, S.K. and C.K. Gupta. Lung function studies in healthy men and women over forty. *Ind. J. Med Res.*, **55** : 612-619, 1967.
4. Jain, S.K., R. Kumar and D.A. Sharma. Peak expiratory flow rates (PEFR) in healthy Indian adults - A statistical evaluation. *Lung India*, **1** : 88-91, 1983.
5. Jordanoglou, J. and N.B. Pride. A comparison of maximal inspiratory and expiratory flow in health and lung disease. *Thorax*, **23** : 38-45, 1968.
6. Malik, S.K., S.K. Jindal, V.L. Jindal and S. Bansal. Peak expiratory flow in healthy adults. *Ind. J. Ches. Dis.*, **17** : 166-171, 1975.
7. Mandi, A., E. Lengyal and M. Csukas. Evaluation of respiratory function tests. Aged persons abstracted in *Excerpt. Med. Ches. Dis.*, **30** : 1, 1976.
8. McNeill, R.S., G.D. Malcolm and W. Rhind Brown. A comparison of expiratory and inspiratory flow rates in health and in chronic pulmonary disease. *Thorax*, **14** : 225-231, 1959.
9. Miller, D.R. and R.E. Hyatt. Obstructing lesions of the larynx and Trachea and Physiological characteristics. *Mayo. Clin. Proc.*, **44** : 145-165, 1969.
10. Schmidt, C.D., M.L. Dickman and R.M. Gardner. Spirometric standards for healthy elderly men and women. *Am. Rev. Resp. Dis.*, **108** : 933-939, 1973.
11. Singh, H.D. and S. Peri. Peak expiratory flow-rate in South Indian adults. *Ind. J. Physiol. Pharmac.*, **23** : **4**, 315-320, 1979.
12. Singh, H.D., D.L. Abraham and N.J. Antony. Expiratory flow-rates and timed expiratory capacities in South Indian men. *J. Ind. Med. Asso.*, **54:9**, 412-415, 1970.
13. Singh, H.D., K.S. Bageerathi and K. Meenakshi. Expiratory flow rates and timed expiratory capacities in South Indian Women. *Curr. Med. Pra.*, **19:9**, 418-428, 1973.