ORIGINAL ARTICLE

Peak Expiratory Flow Rates Among Gujjar and Non-Gujjar Population of Kashmir Valley

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Abstract

Peak expiratory flow rates of 506 healthy adults from a rural area of Kashmir consisting of 252 Gujjars and 254 non-Gujjars are reported. There is paucity of literature an ventilatory measurements of such populations living at high attitudes and this study is first of this kind from Kashmir valley. Gujjars were found to have lower peak expiratory flow rates than non-Gujjars. Role of domestic smoke pollution (measured as time spent near fire place) and smoking in lowering the peak expiratory flow rates has also been documented.

Key Words
Peak expiratory flow rate, domestic smoke inhalation.

Introduction

Peak expiratory flow rates (PEFR) have been reported earlier from different parts of India (1) but there has been no such study in the valley of Kashmir situated at an altitude of more than 5500 feet above sea level. As reported earlier (2), there is a very high prevalence of bronchitis in Kashmir and as such a standard reference for ventilatory measurements of this population needs to be established. The present study is a part of research work on chronic respiratory diseases in a rural area of Kashmir and has tried to make out a normal range for peak expiratory flow rates in a healthy population living at a high altitude of the Himaliyan belt, and, at the same time to see the effect of domestic smoke pollution and smoking on peak expiratory flow rates.

Material and Methods

Entire healthy adult population of two randomly selected villages from a rural field practice area of Government Medical College, Srinagar, was screened. A Gujjar village with worse socioeconomic and housing conditions and another a better developed village with fair living conditions were enrolled for study. Gujjars mostly live close to the fire place in ill ventilated, single story hutments called "Kothas" whereas non-Gujjars who are mostly literate make use of better houses with modern amenities.

From a total population of 980, children below 15 years (405), acutely ill patients (15) and those diagnosed as having chronic bronchitis (43) and asthma (11) were excluded and finally 506 subjects were taken for this study.

Study population was divided into three age groups, keeping in view the anatomical and physiological development of the human body viz. a) 15-20 years, b) 21-40 years and c) > 40 years, with 133, 297 and 96 subjects respectively in each age group.

Peak expiratory flow rate was detected by Wrights Peak Flowmeter as in earlier studies (1). Best of three readings was recorded. All the subjects were ostensibly normal and free from any respiratory symptoms or signs. Mean height of the Gujjar population was 167.20$\pm$8.40cms in males and 152.00$\pm$7.32cms in females as compared to the non-Gujjar population where the mean height was 165.90$\pm$9.10cms and 153.10$\pm$6.50cms in males and females respectively, the difference between the two ethnic groups being insignificant. All statistical comparisons

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in this study have been tested with either chi-square test or student "t" test.

Results

Peak expiratory flow rates (liters per minute) among normal male subjects of both study groups and its relationship with smoking has been shown in Table 1. It was seen that non-smokers had significantly higher peak expiratory flow rates than smokers in the age groups of 20-40 years and >40 years whereas no statistical difference in peak expiratory flow rates was noted in the younger age group of 15-20 years. None of the females in the Gujjar community gave history of smoking. However effect of smoking on peak expiratory flow rates among healthy non-Gujjar females aged 21 years and above is analysed in Table 2. It has been again seen that smokers had significantly lower peak expiratory flow rate values than those in non-smokers.

Comparison of peak expiratory flow rates between Gujjar and non-Gujjar males has been exhibited in Table 3 in smokers and non-smokers separately. Higher peak expiratory flow rates is seen in non-Gujjars in all sub groups and there is statistically highly significant difference in peak expiratory flow rates between the two ethnic groups in the two age groups of 20-40 years and >40 years among both smokers and non-smokers.

Peak expiratory flow rates of non-smokers of the two study groups have been compared (Table 4). Here difference with a high statistical significance in all the age groups is evident. As seen in their male counterparts, females of non-Gujjars community depict higher peak expiratory flow rate values than in Gujjars. It is worth mentioning that among Gujjars peak expiratory flow rates is significantly lower in females who never smoked. It is clear from the above statements that peak expiratory flow rates in Gujjars in both smokers and non-smokers and in each sex is lower than that in non-Gujjars of the same hill region. As reported earlier, chronic bronchitis was seen to be more prevalent in the Gujjars population and the reasons given were that Gujjar population is more exposed to the domestic smoke population. To see the effect of domestic smoke on peak expiratory flow rate study population was further sub classed into three groups with different exposures measured by the time spent near fire place viz. <2 hours, 2-4 hours and >4 hours.

Pattern of average (mean) peak expiratory flow rates obtained after such classification in each sex of various age groups irrespective of ethnicity has been described in Table 5. It is clear that peak expiratory flow rates in males is higher in the middle age group of 21-40 years in almost all categories of domestic smoke pollution with highest figure of 560.41 liters/ minutes seen in male non-smokers aged 21-40 years, with least domestic smoke exposure of less than 2 hours, lowest peak expiratory flow rate value of 340.18 liters/minute is seen among male smokers aged above 40 years with maximum exposure of more than 4 hours. Among females, highest mean peak expiratory flow rates is noted in non-smokers aged between 21 and 40 years with a minimum exposure to domestic smoke (445.62 liters/minute) as against a lowest peak expiratory flow rate value of 280.12 liters/minute in non-smokers of more than 40 years of age but exposed to domestic smoke for a maximum period of time.

Table 1 :Effect of smoking on PEFR among normal males in Gujjar and non-Gujjar population.

Ethnic group	Age group (years)	PEFR (lit/min) Mean ± S.D.		Statistical analysis		
		Smokers	Non-Smokers	t	p	Signi--ficance
Gujjar	15-20	396.67 ±22.69	405.15 ±33.66	0.35	>0.50	N.S.
	21-40	410.22 ±25.73	455.72 ±32.11	7.14	<0.001	H.S.
	>40	345.52 ±38.62	385.12 ±41.12	2.58	<0.025	S
Non-Gujjar	15-20	430.13 ±33.83	412.32 ±22.16	1.42	>0.10	N.S.
	21-40	489.11	564.66	6.60	<0.001	H.S.
	>40	410.73	446.83	2.50	<0.025	S

S: Significant N.S. : Non-Significant H.S. : Highly Significant

Table 2 :Effect of smoking on PEFR among normal non-Gujjar females.

Age group (years)	PEFR (lit/min) Mean ± S.D.		Statistical analysis		
	Smokers	Non-Smokers	t	p	Significance
15-20	------	402.58 ±32.11	------	------	------
21-40	382.28 ±27.66	445.73 ±22.11	10.27	<0.001	H.S.
>40	310.83 ±25.95	380.98 ±31.56	4.18	<0.01	H.S.

Table 3 : Comparison of PEFR between Gujjar and non-Gujjar males in each category of smoking status.

Age group (yrs.)	PEFR(lit/min) Mean±S.D.		Statistical analysis		PEFR (lit/min) Mean±S.D.		Statistical analysis	
	Gujjar Smokers	Non Gujjar Smokers	t	p	Gujjar Non-Smokers	Non Gujjar Non-Smokers	t	p
15-20	396.67 ±22.69	430.13 ±33.83	1.25	>40 N.S.	405.15 ±33.66	412.32 ±22.16	0.82	>40
21-40	410.22 ±25.73	489.11 ±39.66	10.79	<0.001 H.S.	455.72 ±32.11	564.66 ±45.66	11.07	<0.001 H.S.
>40	345.52 ±38.62	410.73 ±43.12	4.30	<0.001 H.S.	385.12 ±41.12	446.83 ±40.6	3.92	<0.001 H.S.

Table 4 : Comparison of PEFR between normal Gujjar and non-Gujjar female non-smokers.

Age group (years)	PEFR (lit/min) Mean ± S.D.		Statistical analysis		
	Gujjar	Non-Gujjar	t	p	Significance
15-20	345.60 ±27.83	402.58 ±32.11	7.43	<0.001	H.S.
21-40	388.73 ±31.22	445.73 ±22.11	12.00	<0.001	H.S.
>40	308.55 ±33.89	380.98 ±31.56	5.20	<0.001	H.S.

Table 5 : Pattern of average PEFR in relation to smoking status and time spent near fire place (hrs./day) in each sex of various age groups irrespective of ethnicity.

Time spent near fire Place (hrs/day)	Age group (years)	Males		Females	
		Smoker	Non-Smoker	Smoker	Non-Smoker
<2	<20	430.83	400.10	-----	410.90
	21-40	480.08	560.41	425.32	445.62
	>40	414.62	440.83	330.18	380.51
2-4	<20	427.02	410.81	-----	375.12
	21-40	450.13	505.13	345.13	430.81
	>40	380.54	410.18	296.17	340.19
>4	<20	400.20	370.16	-----	360.18
	21-40	390.13	440.19	-----	360.33
	>40	340.18	360.33	-----	280.12

Discussion

Although a number of studies have been carried out in India, subjects in most of them have been professionals, hospital attendants or students. Present study is a rural based study for peak expiratory flow rate measurements in ostensibly normal subjects in relation to domestic smoke and tobacco smoking and carried out among the entire healthy adult population of two randomly selected villages of Kashmir.

Kamat SR (3) *et al* in 1967 had examined young hospital employees and students of South India who in general have better health standards than the average and recorded a lowest mean peak expiratory flow rate of 487+80 liters/minute in the age group of 15-19 years and a highest mean peak expiratory flow rate of 506+77 liters/minute in those aged 25-29 years among males. Females had a lower peak expiratory flow rate ranging from 320+71 liters/minute among elders aged more than 30 years to 374+62 liters/minute among those aged 20-24 years. Nanda PL and Sharma MM in 1988 conducted a study on 52 healthy male non-smokers aged 21-26 years and found a mean peak expiratory flow rate of 588.3+14.71 liters/minute (4). Malik (1) *et al* (1975) measured peak expiratory flow rate in 414 healthy North Indian subjects who had come to a Chandigarh Hospital to see their sick relatives. His observed mean peak expiratory flow rate ranged from 396+63 liters/minute in males aged more than 55 years and 486+68 liters/minute in males aged 25 to 29 years. Among females also lowest peak expiratory flow rate was noted in the age group of more than 50 years (252+54) and highest in those aged between 25-29 years (353+32). They have also observed that peak expiratory flow rate values in India were lower than the reported western figures but closer to those seen in other tropical countries due to ethnic variations. Vishwanathan and his co-workers (5) in 1977 estimated peak expiratory flow rate in 283 persons in Delhi which varied from 263.3 to 443.8 liter/minute in different age groups.

Amongst Western studies Greg *et al* (6) in 1973 have recorded a highest peak expiratory flow rates (liter/minute) of 623 and 470 among males and females respectively. Woolcock and his co-workers (7) in 1972 have earlier reported that the highland population of New Guinea had larger values than the coastal population for all ventilatory measurements. He has recorded a mean peak expiratory flow rate of 851 liter/minute and 415 liter/minute in males and females respectively aged 33-34 years in New Guinea high landers.

In the present study highest peak expiratory flow rate (560.41 liter/minute) has been observed in those

males who were non-smokers in the age group of 21-40 years with least exposure to domestic smoke population. Difference in the above studies could be due to technical reasons, ethnic variations and in the selection of subjects, who were villagers of a hilly region in this study.

Relationship of smoking and domestic smoke pollution with peak expiratory flow rate has been studied in detail in the present study among both sexes. Peak expiratory flow rate has been seen to be lower in smokers. A constant decrease in peak expiratory flow rate values with the increasing age (after 40 years) has been noted among both males and females. Lower values have also been seen in those exposed to maximum domestic smoke pollution. This is particularly significant in Gujjar females who never smoke but have lower peak expiratory flow rate which is inversely proportional to the time spent near fire place in the ill-ventilated single storey hutments (Kothas).

Thorning *et al* (8) in 1982 had studied pulmonary response to smoke inhalation in rabbits exposed to pine-wood smoke and noted in his experiments that inhalation of smoke can adversely affect pulmonary functions. Woolcock *et al* in 1972 have also observed that apart from ethnic variations, environmental conditions, altitude of dwellings and tobacco smoking can affect normal values for ventilatory functions.

Read (9) *et al* in 1961 had assessed ventilatory capacity in relation to smoking habits and respiratory symptoms and concluded that among males, smoking in the absence of symptoms even leads to some reduction of ventilatory capacity.

Only healthy and asymptomatic patients were included in the present study. Role of smoking in lowering the peak expiratory flow rate even in the absence of smoking is evident. Variations of peak expiratory flow rate in different age groups and in different exposures to domestic smoke pollution have also been observed.

Summary and Conclusion

Study material consisted of 506 healthy adult Gujjar and non-Gujjar Kashmiries out of a study population of 980.

It has been observed in the study that:-

- Peak expiratory flow rate is higher among non-Gujjars among both sexes.
- Smokers have lower peak expiratory flow rate than non-smokers in both ethnic groups.
- Maximum peak expiratory flow rate is seen in the middle age group of 21-40 years.
- Increase in exposure to domestic smoke pollution causes decrease in peak expiratory flow rate irrespective of smoking habits, especially in Gujjars with chronic exposure to pinewood smoke.

The overall impression obtained from the peak expiratory flow rate results is that the pulmonary efficiency of Gujjars, even when they are non-smokers and non-diseased, is lesser than non-Gujjars. It is also evident that age, sex and smoking habits have a definite role to play in lowering the ventilatory capacity. Decline in pulmonary functions in Gujjars particularly with the increasing age could possibly be due to the cumulative effects of persistent exposure to the domestic smoke and other contributory socio-economic factors.

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