PULMONARY FUNCTION TESTS IN NATHIAGALI NATIVES

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To compare the lung function of the people living at low and high altitude, spirometry was performed on 45 clinically healthy male subjects native of Haripur, altitude 530 m. Above Sea Level (ASL) and another 45 male subjects were studied for the same parameters from Nathiagali (altitude 2,530 m. ASL). Their age range was from 21 to 40 years. The spirometric values were significantly higher in the younger subjects from Nathiagali than their counterparts from Haripur. However, the older subjects did not show any significant differences in their spirometric values except in Forced Vital Capacity (FVC), indicating a rapid deterioration in the flow rates and expiratory' timings of the subjects living at Nathiagali. This may probably be explained as to be due to excessive exposure to cold, allergens. possibly micro-organisms and smoke from wood-fire, which produce subclinical bronchitis in this population. Further detailed investigation in the problem to determine the real cause of rapid decline in the lung *function of this population is suggested.*

INTRODUCTION

Besides body plethysmography, closing volume test and measurement of compliance which are difficult lung function tests but have their own scope in clinical procedures, spirometry is a simple, noninvasive, easy to perform and reproducible procedure proved valuable in diagnosis and prognosis of pulmonary disease, in clinical practice and occupational medicine[1]. Spirometry can predict state of lung health and monitor disease and response to therapy. This noninvasive test can be performed regularly by primary care providers in the outpatient clinics. It can identify patients at risk for lung cancer as well as heart attack and stroke. Patients with abnormal spirometric findings can be warned that airflow obstruction has begun, which may provide the motivation to quit smoking[2]. The value of spirometry is well proved in screening the patients prior to anesthesia and surgery, especially lung resection and thoracic surgery[3].

The aim of the present study was to evaluate the state of lung function in natives of Nathiagali which is situated at an altitude of 2,530 m. ASL. and to compare the same with people living at low altitude.

SUBJECTS AND METHODS

A total of 90 clinically healthy, non-smoker males aged 21 to 40 year were selected from Haripur at altitude 530 m. ASL (group A, n = 45) and Nathiagali at altitude 2,530 m. ASL (group B, n=45). The subjects from both places were further divided into age groups 21 to 30 years and 31 to 40 years and labeled as subgroup A/a and A/b, and B/a and B/b respectively.

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Only the natives of the respective areas were included in the study. Spirometry was performed on each subject. The quality of the procedure exceeded American Thoracic Society recommendations.

Forced Vital Capacity (FVC), Forced Expiratory Volume in 1st Second (FEVi), ratio of FEVi to FVC in percentage (FEVi/FVC%), Forced Expiratory Flow over the middle half of the FVC (FEF25 -75%), Forced Expiratory Time (FET), and Forced Expiratory Time for 50% and 80% of FVC ($FET_{o\cdot5}$, and $FET_{o.5}$) were calculated from the spirograms with highest sum of FEVi and FVC out of 3 acceptable spirograms[4]. The subjects from Haripur were taken as control group and the values from the Nathiagali subjects were compared with the control group for any differences in the means.

RESULTS

The results of spirometric values from the groups as a whole for the subjects from Haripur and Nathiagali are presented in Table 1.

Table 1. Spirometric values of the subjects. Mean ± (SD)

PARAMETER	GROUP A N=45	GROUP B N=45
FVC (L)	4.605 (0.581)	4.609 (0.394)
FEV_I (L)	3.854 (0.541)	3.672 (0.417)
FEV_I/FVC %	83.91 (5.166)	79.23 (5.268)
FEF25-75S (L/Sec.)	4.132 (1.034)	3.693 (1.128)
FET (Sec.)	4.304 (1.464)	4.995 (0.950)
$FET_{O.5}$ (Sec.)	0.295 (0.063)	0.345 (0.080)
$FET_{0.8}$ (Sec.)	0.868 (0.220)	1.044 (0.235)

The groups are then separated into younger and older age subgroups. The data from the younger subgroup is shown in Table 2.

Table 2. Spirometric values from younger age subgroups. Mean ± (SD)

PARAMETER	SUBGROUP A *In* n=23	SUBGROUP B/a n=24
FVC (L)	4.523 (0.750)	4.824 (0.400)
FEV_I (L)	3.874 (0.673)	4.150 (0.382)
FEV_I/FVC %	85.72 (5.696)	86.11 (5.553)
$FEF_{25-75\%}$X (L/Sec.)	4.474 (0.901)	4.990 (1.102)
FET (Sec.)	4.885 (1.201)	3.583 (1.290)
$FET_{0.5}$ (Sec.)	0.288 (0.053)	0.291 (0.088)
$FET_{0.8}$ (Sec.)	0.814 (0.197)	0.766 (0.202)

When the two groups from Haripur and Nathiagali were compared as a whole, it was observed that there were significant differences in their spirometric parameters except for the FVC, which was not significantly different in the two groups (Table 4).

The younger and older subgroups from the two places were separated and compared for mean differences (Table 5). It was noted that in the younger subjects the differences in the mean FVC, FEVi and $FEF_{25-75\%}$ are significant ($p < 0.05$) and there were no significant differences in mean FEVi/FVC%, $FET_{0.5}$ and $FET_{0.8}$. It was also seen that there were highly significant differences ($p < 0.0005$) between the FET of the two subgroups. On the other hand, when the older subgroups of the two places were compared it was noted that, except for FVC ($p<0.05$) there were no significant differences in spirometric parameters (Table 6).

Table 3. Spirometric values from older age subgroups. Mean + (SD)

PARAMETER	SUBGROUP A/b n = 22	SUBGROUP B/b n=21
FVC (L)	4.355 (0.511)	4.609 (0.394)
FEVi (L)	3.551 (0.548)	3.672 (0.417)
FEV_I /FVC %	81.24 (5.536)	79.23 (5.268)
$FEF_{25-75\%}$ (L/'Sec.)	3.584 (1.102)	3.693 (1.128)
FET (Sec.)	5.055 (1.229)	4.995 (0.950)
$FET_{0.5}$ (Sec.)	0.328 (0.064)	0.345 (0.080)
$FET_{0.8}$ (Sec.)	1.002 (0.269)	1.044 (0.235)

Table 4. Comparison of mean spirometric values between the Haripur and Nathiagali subjects. NS = non-significant

PARAMETER	MEAN DIFFERENCE	*P*
FVC	-0.004	NS
FEV_I	0.182	<0.05
FEV_I/ FVC %	4.68	<0.0001
FEF25-75%	0.439	<0.05
FET	-0.691	<0.005
$FET_{0.5}$	-0.05	<0.0005
$FET_{0.8}$	-0.176	<0.0002

Table 5. Comparisons of mean spirometric values between the younger subjects.

PARAMETER	MEAN DIFFERENCE	*P*
FVC	-0.301	<0.05
FEV_I	-0.276	<0.05
FEV_I/FVC %	-0.39	NS
$FEF_{25-75\%}$	-0.516	<0.05
FET	1.302	<0.0005
$FET_{0.5}$	-.003	NS
$FET_{0.8}$	0.048	NS

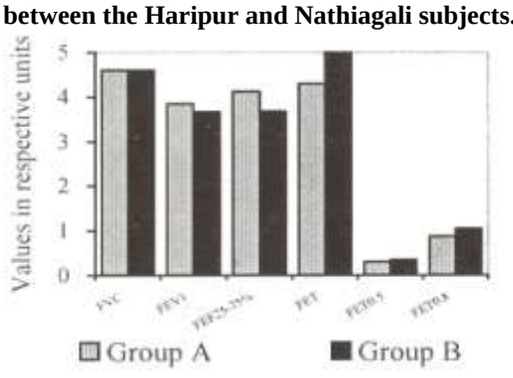
Table 6. Comparison of mean spirometric values between the older subjects.

PARAMETER	MEAN DIFFERENCE	*P*
FVC	-0.254	<0.05
FEV_I	-0.121	NS
FEV_I/FVC %	2.01	NS
$FEF_{25-75\%}$	-0.109	NS
FET	0.06	NS
$FET_{0.5}$	-0.017	NS
$FET_{0.8}$	-0.042	NS

DISCUSSION

Spirometry is a simple, noninvasive procedure proved to be helpful in routine clinical screening for the diagnosis and prognosis of pulmonary diseases. The most common and reliable parameters of spirometry are FVC and FEVi as they have less intra-subject variations[5], and they can provide much information about the state of normality or otherwise.

Figure 1. Comparison of mean spirometric values between the Haripur and Nathiagali subjects.



When the spirometric values from the younger subgroups are compared it is evident that there are significant differences in the mean FVC, FEVi, FEF25-75% ($p<0.05$), and FET ($p< 0.0005$) -of the subjects from the two places.

The work of breathing is increased by 138- 182% at high altitude. This occurs because the decrease in airway resistance due to low density of air does not compensate for the increase in ventilation[6]. The factors responsible for the increased FVC in younger age group at Nathiagali may be low density of air offering a lesser airway resistance and exposure to much physical exercise since childhood causing growth of the lungs to a bigger final size[1]. The higher FEV_I, FEV_I/FVC% and the FEF25-75% and shorter FET are for the lesser density of the air due to low barometric pressure at Nathiagali.

In the older age group subjects, these significant differences have been abolished except for the FVC, which reflects the size of the lung. The lung volumes and flow rates have been shown to decrease with increasing age towards late twenties. This effect of aging on the lung functions is universal. However, the rate of decline in the pulmonary function tests in Nathiagali people is rather rapid that in this age group there remain no significant differences between the Haripur and Nathiagali subjects except for the FVC.

A fall in FEF25-75% is an early sign of small airway obstruction when the FEV_I and FVC still remain normal[4,7,11]. A faster reduction in the $FEF_{25-75\%}$ in natives of Nathiagali indicates prevalence of small airway obstruction. Due to chronic exposure to pollens and other allergens and living in unventilated rooms using wood for fire during long winter season, asymptomatic subclinical bronchitis develops in these people which causes a rapid deterioration in their expiratory rates with advancing age[12]. This is in disagreement to the earlier work of Ayub *et al.* (1987) that suggested that the effect of age on FVC and FEVi in Pakistani males is lesser than the European and North American populations. This is because they tested the Haripur and Abbottabad population only and did not test the Nathiagali population. This finding needs further insight into the problem and in depth investigations to suggest better means of living in these areas.

CONCLUSIONS

The lung volumes and flow rates in Nathiagali natives are higher than the lowlanders. But the rapid deterioration in the expiratory flow rates in people of this area suggests prevalence of some asymptomatic, subclinical bronchitis with advancing age. Further investigation of the problem is needed.

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