

Study variables : The following variables were studied.

Peak Expiratory Flow Rate : The Peak Expiratory Flow Rate has been the dependent variable for the study and was measured in liters per second, using computerized spirometer Autospirr (Japan). It was measured before lunch between 10 am and 1 pm. Three readings were recorded, while subject was standing and the highest of the three values obtained was treated as one's Peak Expiratory Flow Rate (PEFR).

Profusion of opacities : X-ray chest PA view of 353 quarry workers could be taken at 300 ma. These were read by (A) the first author, a Medical Scientist trained for the purpose and (B) another reader, a Radiologist. The profusion of opacities (henceforth referred as profusion) was recorded from these radiographs on the scale 0/0 to 3/3 as per International classification of Radiographs of Pneumoconiosis provided by ILO, 1980 (9). First number in profusion was taken as profusion of pneumoconiotic opacities in the radiograph.

Other independent variables were recorded as below:

Age : Age was recorded in completed years.

Height : Height was taken with an anthropometric rod, while subject was standing erect on a plane platform without shoes.

Variables pertaining to work-history :

Duration of work : The number of years, since one started the work in quarry was considered as the duration of work.

Duration of exposure : Product of average number of months per year one worked in quarries and number of years since starting the work was taken as duration of exposure.

Nature of job : Workers were awarded the scores as follows, according to their nature of job:-

Unskilled worker	- 1
Hole maker	- 2
Stone cutter	- 3

This system of scoring grossly depends upon gradation of exposure to dust in ascending order of magnitude.

Age at beginning : Age at time of beginning the work in quarries was also recorded, in completed years for each subject.

Variables pertaining to smoking-history :

Biri smoked per day : For each worker, the average number of biries smoked per day were recorded as Biri smoked per day.

Duration of smoking : Duration of smoking in completed years was recorded as duration of smoking.

Biri year : Product of the average number of biries smoked per day and the duration of smoking in years, was taken as Biri Year.

Statistical analysis :

Sixty-seven subjects were excluded from the study whose radiographs showed mottled opacities with hazy poorly defined limits or cavities showing area of translucency with moderate thick wall or irregular radiolucence; as these were taken the signs of tuberculosis. The final analysis thus, was subjected to 286 quarry workers, obtained after excluding 67 above such workers from 353 for whom X-ray chest taken at 300 ma was available.

Pearson correlation and step-wise regression analysis were used to investigate the relationship between PEFR of the sand stone quarry workers and the factors pertaining to demographic, anthropometric, work-history and smoking-history. The PEFR of these workers was also compared with healthy adults in the area.

RESULTS

The mean, standard deviation (SD) and coefficient of variation (CV%) of the studied

variables are given in Table I. The mean PEFR among these workers is found significantly lower than the same in the healthy adult population in Rajasthan. The mean PEFR for the healthy adult population in Rajasthan is 6.84 litres per sec as reported by Purohit et al (7). The CV is found to be quite high with respect to smoking behaviour and profusion. Particularly, for the smoking behavior Variable-Biri year and the profusion, CV exceeds 100%.

standard errors and P-values are given in Table III. This table also reads the value of the intercept of the model and coefficient of determination R^2 . The age and profusion are found negatively associated with PEFR, height is associated positively; which is a consistent observation. The inclusion of profusion is observed from this table in addition to age and height which are the common predictors of PEFR in healthy adults.

TABLE I: Means, Standard Deviations (SD) and coefficient of variation (CV%) of the study variables.

Study variable	Mean	SD	CV%
Peak Expiratory Flow Rate (Litres per/sec)	5.06	1.80	35.60
Profusion of opacities	0.09	0.36	399.74
Age (years)	32.11	10.93	34.05
Height (cms)	164.87	5.80	3.52
Duration of work (years)	12.67	7.67	60.50
Duration of exposure (months)	104.80	69.18	66.02
Nature of job (score)	2.10	0.98	46.67
Age at beginning of work (years)	19.36	6.43	33.22
Biri smoked per day (No.)	16.05	12.94	80.62
Duration of smoking (years)	9.96	9.90	99.45
Biri year (As defined)	224.68	277.07	123.32

Table II, reads the pearson correlation coefficients of PEFR with different selected variables and indicates the significance of associations. It is observed from this table that profusion, age, height, duration of work, age at beginning of work, duration of smoking and Biri Year have significant association with PEFR. However, the variables duration of exposure, nature of job, biri smoked per day failed to establish significant association with PEFR among the said workers.

The subset of selected explanatory variables accounting for the greatest amount of variance in PEFR were identified by multiple regression analysis following forward selection procedure. All variables related significantly to PEFR as determined from simple correlations, were considered for the multiple regression model. The subset of predictors for PEFR included only age, height and profusion. The values of their regression coefficients together with their

TABLE II: Pearson correlation coefficients of peak Expiratory Flow Rate (PEFR) with selected attributes. Peak Expiratory Flow Rate

Attributes	Peak Expiratory Flow Rate Pearson coefficients of correlation
Profusion	- 0.150*
Age	- 0.303*
Height	+ 0.167*
Duration of work	- 0.269*
Duration of exposure	- 0.273
Nature of job	- 0.012
Age at beginning of work	- 0.196*
Biries smoked per day	- 0.046
Duration of smoking	- 0.241*
Biri year	- 0.212*

*P<0.01

DISCUSSION

The working in sand stone quarries does effect the PEFR with a shift towards lower mean value of the parameter is another

TABLE III: Stepwise multiple regression analysis for Peak Expiratory Flow Rate with selected explanatory variables.

<i>Variables entering the model, at termination of stepwise regression process</i>	<i>Peak Expiratory Flow Rate</i>		
	<i>Regression coefficient</i>	<i>Standard error</i>	<i>P value</i>
Age	- 0.050	0.009	P<0.01
Height	+ 0.056	0.017	P<0.01
Profusion	- 0.567	0.275	P<0.05
Intercept	- 2.576		

Percent of variation attributable to the regression ($R^2\%$) = 13.86

confirmation in line of such results (10). Among the variables studied, as noted from Table I profusion and smoking behavior variable - Biri year in particular have figured with as high as above 100% CV. This is an indication that the distribution of these variables in quarry workers confirm to aggregative type of distributions- a sign of clustering phenomenon or to say the presence of admixtures in the working population by these two attributes. The sharp differences could be thought to exist (say, between silicotics/non-silicotics and regular/irregular smokers in the working population).

From Table II, it is observed that profusion, age, height, duration of work, age at beginning of work, duration of smoking and biri year are significantly associated factors ($P < 0.01$) with the PEFR; whereas factors like duration of exposure, nature of job and biri smoked per day failed to establish their significant association.

Duration of exposure, which is defined as the product of average number of months per year one worked in quarries and the number of years since starting the work; has not turned associated significantly with PEFR, while the duration of work i.e. the number of years since one started the work figured significantly associated emphasises the fact that working in silica rich environment has a cumulative effect

(5). Of course, nature of job has not much to do, perhaps it is the environment which affects. Smoking is clearly found being associated but not mere the number of biries smoked per day. It is the duration of smoking and the Biri year i.e. prolonged regular smoking, which affects the PEFR.

The subset of predictors of PEFR included only age, height and profusion as identified by multiple regression model reported in Table III. Other variables did not emerge as significant linear contributors in PEFR prediction model, undoubtedly owing to their intercorrelation with age, height and profusion. Among the predictors of PEFR, age and height as usual, have appeared with $P < 0.01$, however the addition to this in case of quarry workers has been the profusion with $P < 0.05$. The observation that height being correlated positively, while profusion and age being negatively correlated with PEFR fall in line of expectation. The value of $R^2 = 13.86$ also suggests of not that strong linear relationship between PEFR and its identified predictors. The best fit of their relationship is under investigation.

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