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Smoking status and its effect on cardiorespiratory system, body dimension and plucking performance of Oraon tea garden labourers

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With 9 tables in the text

Summary: Oraon tea leaf pluckers were examined in terms of their cardiorespiratory functions which include blood pressure measurements and a number of lung function tests. Anthropometric measurements and information on smoking history were obtained. It is known from earlier studies that the individuals studied belong to more or less similar economic and nutritional background. The results suggest that smoking has an effect on cardiorespiratory functions, and may have an indirect effect on anthropometric traits, but no effect of smoking on work performance could be established from the present study.

Zusammenfassung: Teepflücker aus Oraon wurden hinsichtlich ihrer cardiorespiratorischen Funktionen untersucht, wobei Blutdruckmessungen und eine Anzahl von Lungenfunktionstests durchgeführt wurden. Außerdem wurden anthropometrische Messungen vorgenommen sowie der Raucher-Nichtraucher-Status erfaßt. Aus früheren Untersuchungen ist bekannt, daß die bezüglich dieser Fragestellung untersuchten Individuen einen mehr oder weniger gleichen ökonomischen Status besitzen sowie auch bezüglich ihrer Ernährungsverhältnisse vergleichbar sind. Die Ergebnisse zeigen, daß das Rauchen sich auf die cardiorespiratorischen Funktionen auswirkt und auch einen indirekten Effekt auf die anthropometrischen Merkmale zu haben scheint. Dagegen konnte in dieser Untersuchung kein Effekt des Rauchens auf die Arbeitsleistung nachgewiesen werden.

Introduction

In the 1920's there used to be a popular cigarette ad' that read 'Reach for a lucky instead of a sweet'. The implication was that smoking would keep the weight down, reduce food intake and substitute for a dessert. It is sometimes true that smoking helps one to stay slim by curbing appetite but at the same time it is also true that eating a meal stimulates the desire for smoking. There are two possible explanations of weight loss that could account for the effect of smoking: (1) energy utilization or metabolism might be increased by smoking, (2) food intake (especially the intake of certain types of food) may be curbed by smoking (Hebart & Kebat 1990, Strickland et al. 1992).

It is well established from the published health warnings that smoking of tobacco in the form of cigarette, *biri*[1] etc. leads to the risk of pulmonary and cardiovascular hazards. However, smoking has many actions on the brain and other excitable tissues which mostly produce pleasurable effects and can be used as a psychoactive stimulant to control one's psychological state (CPS BEST 1985). It alters blood pressure and pulse rate, by increasing or decreasing them; it stimulates or suppresses respiration, it produces arousal or behavioural depression; it improves performances and enhances mood; it stimulates or paralyzes muscles; it diminishes pain-evoked responses; and it alters the release of many hormones. Some of these effects are beneficial, some effects are harmful, and some effects neither help nor harm (Martin 1987).

It has been demonstrated that smoking is capable of inducing changes: (1) somatic (age-related body weight, body dimensions, etc.), (2) physical (body temperature, breathing, sweating, etc.), (3) physiological (metabolic, haematologic, reproductive, neurologic, etc.), (4) psychological and behavioural (attention, mood, alertness, etc.), and (5) biochemical (enzyme, tissue, sensitivity, hormone, etc.) (U.S. Dept. of Health and Public Services 1982).

Tobacco smoking has been described as a form of 'self medication', a coping strategy for everyday problems and it has been argued that it plays an important role on the improvement of mental efficiency and performance (Warburton & Wesnes 1983). The issues involving smoking and lung cancer have been reviewed (Wynder & Goodman 1983), in addition to lung cancer, smoking is considered to be a risk factor in the development of other respiratory disorders, e. g. increase in airway resistance and other structural and functional abnormalities of the lungs, different obstructive lung diseases, etc. (Jackson & Holle 1985). Smoking has also been shown to have acute and chronic effects on the cardiovascular system which include an increase in heart rate, systolic and diastolic blood pressure (Harrison 1980).

In view of the above, the objective of the present study is to investigate into the effects of smoking on the following parameters among the Oraon tea garden labourers of Birpara and Dalgaon tea gardens of Jalpaiguri district, West Bengal: (1) ventilatory capacity, (2) resting blood pressure and pulse rate, (3) body dimension, and (4) plucking performance.

Materials and methods

The present study was conducted in two tea gardens, Birpara and Dalgaon, in Western Duars, Jalpaiguri district, northern West Bengal, India. The study was restricted to one tribal group, Oraon, to eliminate the possible ethnic variation in health-related traits and/or productivity. Linguistically, the Oraons belong to the 'Kurukh' or 'Dravidian-speaking' group (Risley 1891). They were mainly brought into this area as tea labourers over the last 100 years or so from the Chotanagpur area and Santal Parganas of Bihar (Choudhary 1978).

The productive output was measured simply and accurately in terms of the amount of green tea leaves plucked during a given period. The leaves plucked by each individual labourer are weighed four times per day during the plucking season in every garden.The records of weight of tea leaves plucked per person are well maintained. Extra remuneration is paid for the amounts plucked over and above the minimal output (25 kg of green leaves) required in lieu of the statutory wage paid. Payment of extra remuneration is

[1] Tobacco wrapped in a certain type of leaf – a locally made cigarette.

likely to enhance motivation for extra plucking for most of the labourers and thereby standardize the motivational effect. The study was restricted to adults (≥ 20 years) who had been plucking leaves for more than five years. The tea garden authority believes that the period of training required to reach optimal skill in plucking is four years. The labourers, who volunteered themselves for the study were included in the sample; no statistical sampling was attempted.

Anthropometric measurements were made using one set of standard anthropometric instruments, and by the same investigator (SKR). Thirteen body dimensions were measured: stature, weight, antero-posterior chest diameter, transverse chest diameter, biacromial diameter, biilliac diameter, upper arm circumference, calf circumference, and skinfolds at the biceps, triceps and subscapular sites. Surface area (S.A.) (for males = $W^{0.425} \times H^{0.725} \times 74.66$ and for females = $W^{0.425} \times H^{0.725} \times 78.28$) and Total body fat (Body fat (kg)) = Fat% × Weight (kg)/100, where Fat% = $(4.201/D-3.813) \times 100$, and D = 1.0890–(0.0028) × Triceps skinfold thickness), and body mass index (BMI) were estimated. Blood specimens were collected by finger prick into standard heparinized microcapillary tubes, spun in a hematocrit centrifuge, and read on a microhematocrit reader. Instead of measuring the hemoglobin level, packed cell volume (PCV) was used because the latter involves lesser risk of error involved in visual color matching. PCV has a very high correlation with hemoglobin level (Bhattacharya & Majumder 1986), and therefore, provides the same information.

Lung function was assessed with a Jones Pulmonaire with autograph control and waterless spirometer. The lung function measurements were forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), forced expiratory volume in 0.7 seconds ($FEV_{.7}$) and respiration rate (RR). The subjects were instructed to stand firmly on the ground, make a maximal inspiration, place the mouthpiece in the mouth, and blow out with a maixmal expiratory effort. The readings used for the analysis were obtained after two practice attempts; the highest of three technically statisfactory efforts was used.

Systolic (SBP), diastolic (DBP) blood pressure were measured after a 15 minutes rest period, in a sitting position, on the left hand by the auscultatory method using an inflatable calf and mercury sphygmomanometer. SBP was determined at the point when the Korotkoff sounds become audible and DBP was measured when the Kortokoff sound completely ceased (Rose 1980). Pulse rate (PR) was also measured.

The relationship between age and the primary variables (i. e. different lung function measurements, blood pressure measurements and a number of anthropometric measurements), may be linear or non-linear, therefore, age^2 and age^3 were computed. Stepwise multiple regression analysis, separately for each sex, with age, age^2, age^3 and body mass index (BMI) as the independent variables and the functional measures as the dependent variables, was used to examine differences between high and low productivity groups. Standardized residuals of the primary functional variables, adjusted for the effects of significant concomitants were then computed, and comparisons between the groups were made on the basis of the means and standard deviations of the standardized residuals.

The individuals considered as smoker in the present study, who were continuing smoking of tobacco in the form of *biri*[1], cigarette, *chuta*[1], etc. for at least one year prior to the survey. Those who smoke on occasions, say once or twice a month or so (occasional smokers) and those who have left the habit of smoking (ex-smoker) since the time of survey have been excluded from the sample.

For computation of the Chi-square statistic for the systolic and diastolic blood pressures and pulse rate, the data were classified into three subgroups for each sex and both for smokers and non-smokers: (1) below normal range (2) normal range (3) above normal range. For the computation of Chi-squares relating to other parameters (PCV, FVC, FEV_1, $FEV_{.7}$, RR and plucking output) the data were classified into two subgroups on the basis of respective median values of the variables for both the sexes in smokers and non-smokers groups. The relative risk of smoking (Phi) of the blood pressure parameters and pulse rate

[1] Tobacco wrapped in a certain type of leaf – a locally made cigarette.

were not computed due to classification of data into three subgroups because relative risk is computed only for two binary variables.

The Chi-square statistic is the primary test statistic used here for studying relationships using discrete variables. The hypothesis may be stated as: the blood pressure and lung function measures are contingent upon smoking. If so, then we can test the null hypotheses: The blood pressure and lung function measures are not contingent upon smoking. Computation of Statistical index in terms of Phi coefficients have been done to measure the strength of association for two binary variables, which have clinical relevance. The values of Phi ranges from –1 to +1, the values close to zero indicate weaker associations.

It would have been better to analyse the data of smoker on the basis of duration of smoking and the number of cigarettes or *biri* or *chuta* smoked in a specific time period, (i. e. a day or a week etc.), but there are a number of difficulties in doing so for example, (1) the data on this regard were collected through individual interview and thus the changes of over- and under-reporting cannot be ruled out because of recall lapse; (2) the sample sizes of the smoker group in both the sexes are small, and thus further classification of the data for comparison, on the basis of the above parameters would obviously, decrease the number of sample sizes in each group, which perhaps create difficulty in drawing any definitive conclusion; (3) although it was mentioned earlier that individuals smoke cigarette, *biri* and *chuta* simultaneously, the length and content of tobacco varies in each type and presently we have no ready objective data on these matter, and we have presently the data on total number of smoking objects used per day, but there is no classified data on how many *biris*, how many cigarettes and how many *chutas* are smoked by any individual a day. Therefore, an attempt has been made to correlate the above data with some selected functional variables.

Results

Table 1 shows the descriptive statistics of anthropometric traits of the smoker and non-smoker groups in males. There are significant differences between the two groups in most of the traits except weight and upper arm circumference. The trend of higher mean value in case of non-smokers appears to occur for most of the parameters.

Table 2 shows the descriptive statistics of anthropometric traits of female smokers and non-smokers. There are significant differences between the two groups; out of the 13 measurements only four do not differ significantly. The trend of higher mean value among non-smoker occurs also in case of the females.

Table 3 shows the basic statistics of some cardiorespiratory fitness values of male smokers and non-smokers. Significant differences between the groups occur in blood pressures (SBP, DBP) and spirometric measurements (FVC, FEV_1, $FEV_{.7}$ and FEV%). There is no significant difference in the plucking performance.

Table 4 shows the corresponding descriptive statistics of cardiorespiratory fitness values of female smokers and non-smokers. The results are more or less similar to those of the males.

The standardized residuals of both male and female smokers and non-smokers are given in Table 5. All of the means show values close to zero and standard deviations close to one. Because the residuals are assumed to be distributed independently of the concomitants, the assumption of normality of the residuals is required for the test of significance. In males, even after eliminating the effects of all concomitant variables from the primary variables, the t-values show significant differences in FEV_1 and $FEV_{.7}$.

Table 1. Basic statistics pertaining to different anthropometric characteristics of male pluckers.

	Non-smokers n = 177		Smokers n = 50		t-Values
	Mean	STDEV	Mean	STDEV	
Age (yrs)	27.254	7.117	34.18	9.01	5.0258*
Stature (cm)	161.72	6.00	158.86	6.14	2.9199*
Weight (kg)	47.381	5.382	45.880	4.945	1.8580
Antero-Posterior Chest diameter (cm)	16.773	0.979	17.224	0.917	3.0150*
Transverse Chest diameter (cm)	24.407	1.523	23.628	1.209	3.7802*
Upper arm circumference (cm)	23.524	1.299	23.257	1.375	1.2271
Calf circumference (cm)	29.228	1.641	28.688	1.716	2.2041*
Skinfold thickness (Biceps) (mm)	0.522	0.126	0.471	0.090	3.2146*
Skinfold thickness (Triceps) (mm)	0.739	0.081	0.682	0.084	4.2701*
Skinfold thickness (Subscapular) (mm)	0.949	0.117	0.889	0.077	4.2866*
Surface area (m^2)	1.535	0.099	1.419	0.088	7.9999*
Total body fat (kg)	4.454	0.782	4.164	0.745	2.4037*
Body mass Index (kg/m^2)	18.16	1.22	17.65	1.25	2.5609*

* $P < .001$

In females, after eliminating the effects of concomitant variables from the primary variables, none of the t-values are significant.

The Chi-square statistic and relative health risk of smoking on selected variables of males are presented in Table 6. Significant values of Chi-square between smoking and lung function measures (FVC, FEV_1, $FEV_{.7}$), clearly indicate an association between the parameters. There are also risk factors in health related traits due to smoking.

Table 2. Basic statistics pertaining to different anthropometric characteristics of female pluckers.

	Non-smokers n = 117		Smokers n = 52		t-Values
	Mean	STDEV	Mean	STDEV	
Age (yrs)	28.796	8.357	39.63	9.98	6.7834*
Stature (cm)	150.22	5.29	148.74	4.67	1.7913
Weight (kg)	40.620	4.220	37.452	4.296	4.3930*
Antero-Posterior Chest diameter (cm)	15.900	1.140	16.000	0.995	0.5666
Transverse Chest diameter (cm)	22.080	1.060	21.521	1.165	2.9330*
Upper arm circumference (cm)	21.264	2.042	20.989	1.529	0.9687
Calf circumference (cm)	27.856	1.664	26.365	2.003	4.6957*
Skinfold thickness (Biceps) (mm)	0.543	0.139	0.499	0.132	1.9673*
Skinfold thickness (Triceps) (mm)	0.873	0.143	0.802	0.136	3.0827*
Skinfold thickness (Subscapular) (mm)	0.983	0.136	0.917	0.120	3.1644*
Surface area (m^2)	1.419	0.088	1.351	0.098	4.2931*
Total body fat (kg)	5.065	1.419	4.306	0.914	4.1608*
Body mass Index (kg/m^2)	18.10	1.14	17.64	1.92	3.1332*

* $P < .001$

Table 3. Basic statistics pertaining to different functional characteristics of male pluckers.

	Non-smokers n = 177		Smokers n = 50		t-Values
	Mean	STDEV	Mean	STDEV	
Systolic blood pressure (mm/HG)	125.02	11.98	131.12	19.26	2.1291*
Diastolic blood pressure (mm/HG)	74.915	9.619	79.16	9.76	2.7248*
Pulse rate (b/min)	76.441	13.090	78.22	14.01	0.8046
Packed cell volume (%)	39.144	6.775	38.47	7.38	0.5821
Forced vital capacity (l)	3.2559	0.6214	2.9166	0.5540	3.7217*
Forced expiratory volume in 1 sec (l)	2.5969	0.5404	2.2624	0.5187	3.9878*
Forced expiratory volume in .7 sec (l)	2.2978	0.5060	2.0440	0.4877	3.2220*
Respiration rate (r/min)	21.136	6.915	19.880	6.841	1.1440
Plucking output (kg/day)	37.29	15.16	33.64	11.21	1.8656
Forced expiratory volume (%)	79.639	7.867	77.23	7.38	2.0139*

* $P < .001$

Table 7 represents the Chi-square statistic and relative risk of smoking in case of females. Similar results as those of males are obtained from females also.

Let us now consider the smoker groups of both the sexes only, from Table 8, it is apparent that female smokers smoke significantly higher number of smoking objects than male smokers, the duration of smoking is also higher in case of females, although the differences are not significantly higher than males.

Table 9 shows the correlation coefficient values (r) of smoking duration and number of smoking objects with a number of functional variables. Duration of smoking has significant negative correlation with weight and lung function parameters and significant positive correlation with blood pressure measures and age, this is true for either sex of smokers. But the number of smoking objects do not show such consistent results in either sex, except the significant values of SBP.

Table 4. Basic statistics pertaining to different functional characteristics of female pluckers.

	Non-smokers n = 117		Smokers n = 52		t-Values
	Mean	STDEV	Mean	STDEV	
Systolic blood pressure (mm/HG)	125.31	17.83	134.60	27.77	2.2031*
Diastolic blood pressure (mm/HG)	79.59	12.95	84.29	15.93	1.8511
Pulse rate (b/min)	86.74	11.91	90.31	12.30	1.7324
Packed cell volume (%)	32.593	6.130	33.442	6.524	0.7859
Forced vital capacity (l)	2.0815	0.3665	1.8035	0.4588	3.8218*
Forced expiratory volume in 1 sec (l)	1.6489	0.3316	1.3327	0.4037	4.9062*
Forced expiratory volume in .7 sec (l)	1.4794	0.3056	1.2002	0.3834	4.5934*
Respiration rate (r/min)	19.407	4.770	19.096	5.549	0.3469
Plucking output (kg/day)	33.17	14.39	32.29	10.95	0.4286
Forced expiratory volume (%)	79.200	10.027	73.85	11.72	2.8244*

* $P < .001$

Table 4. Basic statistics of standard residual values of the functional characteristics of pluckers.

	Non-smokers		Smokers		t-Values
	Mean	STDEV	Mean	STDEV	
Males	n = 177		n = 50		
Corrected SBP eliminating the effect of DBP, $FEV_{.7}$, AGE^2	–0.0432	0.8862	0.153	1.345	0.9745
Corrected DBP eliminating the effect of SBP, $FEV_{.7}$, RR	–0.0218	1.0288	0.076	0.907	0.6540
Corrected FVC eliminating the effect of FEV_1, $FEV_{.7}$, SBP, BMI	–0.0167	1.005	0.056	0.790	0.5298
Corrected FEV_1 eliminating the effect of $FEV_{.7}$, FVC, SBP	0.1081	1.0731	0.3814	0.5671	2.4021*
Corrected $FEV_{.7}$ eliminating the effect of FEV_1, FVC, SBP	–0.0979	1.0748	0.3439	0.5755	3.8520*
Females	n = 117		n = 52		
Corrected SBP eliminating the effect of DBP, AGE^2	0.0210	0.9047	–0.041	1.197	0.3307
Corrected DBP eliminating the effect of SBP	–0.0027	0.9676	0.007	1.082	0.0549
Corrected FVC eliminating the effect of FEV_1, $FEV_{.7}$	–0.0649	0.9316	0.129	1.141	1.0675
Corrected FEV_1 eliminating the effect of $FEV_{.7}$, FVC, DBP	0.1052	0.9900	–0.217	1.013	1.8932
Corrected $FEV_{.7}$ eliminating the effect of FEV_1, FVC	–0.0729	1.0369	0.152	0.923	1.3856

* $P < .001$

Female data show that age has positively significant and PR has negatively significant correlation values with the number of smoking objects taken per day.

Discussion

The present study examined the effect of smoking status on cardiorespiratory functions, anthropometric traits and productive output in a tea labourer population belonging to a single ethnic group. The factors standardized in the study included climate, habitual activity, skill, motivation and test protocol.

From the results it appears that the smoking is associated with comparatively aged individuals of both the sexes. It may be argued that individuals start smoking after reaching a certain age, before which smoking is very much limited. Significant differences in respect of several anthropometric traits and consistently higher

Table 6. Chi-square (χ^2) values and relative risks of smoking on selected variables expressed as Phi(ϕ) values of males.

Variables	Chi^2	DF	Prob.	Phi	DF
Systolic blood pressure	4.949	2	0.0842		
Diastolic blood pressure	5.534	2	0.0628		
Pulse rate	2.313	2	0.3146		
Packed cell volume	0.920	1	0.3374	0.0637	226
Forced vital capacity	10.487*	1	0.0012	0.2149*	226
Forced expiratory volume in 1 sec	15.602*	1	0.0001	0.2622*	226
Forced expiratory volume in 0.7 sec	13.695*	1	0.0002	0.2456*	226
Forced expiratory volume percent	1.733	1	0.1880	0.0874	226
Respiration rate	0.322	1	0.5704	0.3767*	226
Work output (plucking)	1.733	1	0.1880	0.0874	226

* $P < .001$

Table 7. Chi-square (χ^2) values and relative risks of smoking on selected variables expressed as Phi(ϕ) values of females.

Variables	Chi^2	DF	Prob.	Phi	DF
Systolic blood pressure	3.286	2	0.1934		
Diastolic blood pressure	1.665	2	0.4350		
Pulse rate	1.758	2	0.4151		
Packed cell volume	0.001	1	0.9797	–0.0020	159
Forced vital capacity	9.911*	1	0.0016	0.2489*	159
Forced expiratory volume in 1 sec	9.969*	1	0.0014	0.2496*	159
Forced expiratory volume in 0.7 sec	8.532*	1	0.0035	0.2309*	159
Forced expiratory volume percent	4.103	1	0.0428	0.1601	159
Respiration rate	4.074	1	0.0435	0.1596	159
Work output (plucking)	0.000	1	0.9933	–0.0007	159

* $P < .001$

Table 8. Basic statistics pertaining to smoking status.

	Male n = 50		Female n = 52		t-Values
	Mean	STDEV	Mean	STDEV	
Duration of smoking (yrs.)	12.40	7.94	15.90	10.28	1.93
Number of cigarette/*chuta*/*biri* (per day)	5.82	4.19	8.75	6.99	2.27*

* $P < .005$

Table 9. Correlation coefficients of smoking status with some selected functional variables.

	Age	Weight	SBP	DBP	PR	PCV	FCV	FEV_1	$FEV_{.7}$	RR	OUTP
Male											
Duration of smoking in years	0.730*	–0.314*	0.324*	0.324*	0.056	–0.166	–0.256	–0.309*	–0.295*	–0.204	–0.082
Number of smoking objects/day	0.013	0.086	0.274*	0.182	–0.036	–0.029	0.007	–0.009	–0.009	–0.125	–0.179
Female											
Duration of smoking in years	0.667*	–0.415*	0.475*	0.306*	–0.135	0.361*	–0.356*	–0.380*	–0.367*	0.022	–0.101
Number of smoking objects/day	0.386*	–0.095	0.315*	0.243	–0.315*	0.180	–0.144	–0.251	–0.246	–0.144	0.167

* $P < .005$

mean values, especially of the calf circumference, skinfold thickness measurements on three sites, total body fat and BMI, indicate that the smoker subgroups have weaker body dimensions compared to non-smoker subgroups, which may indicate the ill health status of the smokers.

Comparing cardiorespiratory functions of the two subgroups, significant difference exists in blood pressure measurements in both sexes; consistently high mean values of systolic and diastolic blood pressures in smokers of both the sexes may indicate causal relationships, with smoking leading to ill health status. Significant differences between the smoker and non-smoker subgroups also exist in case of respiratory functions, expressed in terms of FVC, FEV_1, $FEV_{.7}$ and FEV%. The smoker subgroup shows consistently lower mean values of these parameters, indicating different lung function problems, e. g. increasing airway resistance, different obstructive lung diseases, etc. and, therefore, ill health. Although there is no significant difference between the subgroups in plucking performance (output), the non-smoker group shows higher mean values in both the sexes, possibly suggesting a better performance due to better health status. While eliminating the effect of concomitant variables from the functional characteristics, the male data do not show analogous results with those obtained from the females. The differences in residual values still exist in respect of lung function parameters of males, but not in females.

The Chi-square test and strength of association (SOA) index also show a similar pattern of association between smoking and several measures of lung function tests in both the sexes.

Considering only the smoker groups of both the sexes, it has been observed that female smokers smoke a larger number of smoking objects and the smoking habit has been of considerable period of time than male groups. The correlation coefficient values suggest that smoking for a relatively longer period reduces weight and lung capacities and at the same time enhances blood pressures. On the other hand, the number of smoking objects smoked per day may enhance blood pressures.

Comparing the present study with other studies, our results corroborate those of Keith & Driskell (1982) who found higher mean values of SBP and DBP (although not significant), and higher mean values of lung function parameters of smokers compared to the non-smokers. Marcq & Minette (1976), on the other hand, found no significant difference in lung function parameters between smokers and non-smokers but the mean values of all the parameters of lung function tests were high in non-smokers. The studies of Walter et al. (1979) show a more or less similar result as obtained by Marcq & Minette (1976). The chances of different respiratory diseases and lung cancers are very high among the passive smokers compared to non-smokers (USEPA 1992), although socioeconomic status as measured by educational levels found to be associated with respiratory problems which is independent of smoking habits and occupational airborne exposure (Burney et al. 1989). On the other hand, Lange et al. (1988) reported that high intake of salt is associated with increased levels of bronchial responsiveness, heavy alcohol consumption is an independent risk factor for airflow limitation. It has been observed that the present study population has both the characteristics of both high salt intake and heavy alcohol consumption, but the data are not readily available to test these possibilities. The studies of Thornton et al. (1994) reveal that there were a number of life style factors (controlling several background variables as possible confounders) which can be considered to be associated with both smoking and poor health. Therefore, considering the above studies, the effect of high salt intake, heavy alcohol consumption and other socioeconomic status including life style factors on lung function and blood pressure parameters cannot be ruled out.

In the present study, there are some statistically significant differences between the subgroups in respect of several parameters. The present study suggests that smoking affects the cardiorespiratory functions of the individual and anthropometric traits as well. The study also reveals that there is no consistent trend of the effect of smoking on workoutput in either sex.

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