

CARDIO RESPIRATORY RESPONSES IN FACTORY WORKERS OF NORTH DELHI BELONGING TO VARYING NUTRITIONAL BACKGROUND

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(Received on May 25, 1987)

Summary : Healthy males having similar socio-economic and cultural background and differing in food intake (1808.4 Cal/day to 2591.0 Cal/day) and their nature of work form the basis of this report. They are drawn from 54 non-factory workers (Gr-I), 33 tobacco workers (Gr-II), 110 metal workers (Gr-III), 18 plastic workers (Gr-IV) and 12 rubber workers (Gr-V) of 22.1 to 28.6 [mean] years old. Lung functions (FVC, FEV₁ & PEFR) alongwith B. P., pulse rate (PR) and Hb were measured. Their height (Ht), weight (Wt), body surface (BSA), Quetlet Index (QI), skin fold thickness (SFT), calorie intake (CI), monthly income and smoking history were worked out. Among factory workers Ht, Wt, BSA, Hb PR, FVC, FEV₁ were found higher in Gr-II, whereas the SFT, QI, PEFR and CI are higher in Gr-V as compared to other groups. The FVC, FEV₁ and PEFR are higher in non-factory workers as compared to factory workers.

Key words : Quetlet Index cardio-respiratory functions skin fold thickness

INTRODUCTION

The rapid development and diversity of industries over the years have dramatically increased the number of substances both organic and inorganic, in the form of dust, vapours and fumes which may be the potential hazards to the development of respiratory ailments in people at work (1). A number of other factors like racial descent, socio-economic and nutritional status also play a major role in influencing cardio-pulmonary functions in human beings (5, 6).

MATERIAL AND METHODS

Two hundred twenty seven healthy males were studied, they were divided in five groups [54 non-factory workers (Gr-I), 33 tobacco workers (Gr-II), 110 metal workers (Gr-III), 18 plastic workers (Gr-IV) and 12 rubber workers (Gr-V)]. The mean age of these subjects

varied between 22.1 to 28.6 years and most of the workers were moderate smokers. All the subjects were screened by clinical examination and questioned regarding their cardio-respiratory or nutritional disorder of past and present.

The physical parameters include Ht, wt (without shoes), BSA and QI were worked out. The anthropometric measurements were carried out by measuring SFT at biceps, triceps, mid axillary area at xyphoid level and subscapular of right side by using UNA calipers, similar to those used by other workers (4) with the following specifications constant jaw pressure of 10 gm/mm², caliper face 30 mm² total area and slide bar of adjustment to maintain constant pressure. The right upper arm circumference was also measured.

Calorie intake of individuals was assessed by interview technique, actual food consumption, money spent on food items, members and pattern of family.

Smoking habits were worked out by noting duration, brand and number/day.

The working included nature of the work, duration, number of hours per day and the posture to carry it out.

Cardio-pulmonary assessment included blood pressure (BP), measured by using mercury manometer, Hb, estimated by Sahli's methods and pulse rate. The lung functions included FVC, FEV₁ and PEFR measured by using Morgan's portable spirometer. The procedure was explained, nose clip was applied and maneuver was repeated thrice. The most correct reading was noted. All the results were analysed to compare the factory workers with the non-factory workers and presented in the form of Table (I) and percentage difference diagrams (Figs. 1, 2, 3, 4).

RESULTS

Among all the groups the values of BSA and QI are higher in Gr-I subjects (non-factory workers) whereas the results of arm circumferences and SFT are high in Gr-V subjects (Table I and Fig. 1 and 2). Of the pulmonary functions studied (Table I and Fig. 3), the FVC, FEV₁ and PEFR are high in Gr-I (non-factory workers) subjects. Amongst factory workers the FVC and FEV₁ are high in Gr-II (Tobacco workers) whereas the PEFR values are better in Gr-V (rubber workers). Hb values are high in non-factory workers though the calorie intake/day was highest in Gr-V (2591.015) and lowest in Gr-I (1803.315) subjects (Fig. 4). On further statistical analysis when Group III and IV are compared for QI. The group V shows the significant difference of having higher values ($P < 0.1$) as compared with Group III. Hb values shows significant difference ($P < 0.05$) when compared in Gr-I to Gr-III and

TABLE I : Physical, Calorie intake and Lung Function Parameters.

S. No.	Parameters	Gr. I n=54 Mean±SD	Gr. II n=33 Mean±SD	Gr. III n=110 Mean±SD	Gr. IV n=18 Mean±SD	Gr. V n=12 Mean±SD
1.	Age (years)	28.60±10.87 (37.65)*	25.80±0.91 (3.52)	26.87±1.52 (5.65)	22.13±1.26 (5.01)	26.20±0.48 (1.83)
2.	BSA (M ²)	1.62±0.32 (19.75)	1.60±0.03 (1.81)	1.51±0.34 (22.51)	1.52±0.92 (1.31)	1.51±0.15 (9.93)
3.	Quetlet Index	2.03±0.25 (12.31)	1.96±0.06 (3.06)	1.81±0.12 (6.62)	1.90±0.24 (12.63)	2.02±0.14 (6.93)
4.	Arm Circumference (cm)	23.97±1.86 (7.75)	24.30±0.39 (1.60)	24.05±2.24 (9.31)	24.30±0.39 (1.60)	24.31±1.15 (4.73)
5.	Total skinfold thickness (mm)	27.7±4.97 (17.94)	28.80±4.90 (17.01)	28.07±4.30 (15.31)	30.61±2.43 (7.93)	33.40±4.00 (11.97)
6.	Calorie intake/day	1808.39±536.046 (29.64)	2053.0±486.0 (23.67)	2048.20±555.51 (27.12)	2135.0±456.0 (21.35)	2591.0±565.0 (21.80)
7.	FVC (L)	3.33±0.75 (22.52)	2.95±0.64 (21.69)	2.61±0.48 (18.39)	2.74±0.41 (14.96)	2.65±0.61 (23.01)
8.	FEV ₁ (L)	2.82±0.70 (24.82)	2.69±0.54 (20.07)	2.41±0.40 (16.59)	2.58±0.36 (13.95)	2.08±0.56 (26.92)
9.	PEFR (L/min)	370.16±60.47 (16.33)	333.40±57.4 (17.21)	343.73±89.51 (26.04)	356.70±65.0 (18.22)	359.66±66.24 (18.41)
10.	Hb (gm%)	13.70±1.35 (9.85)	11.30±5.66 (50.08)	10.42±1.52 (14.58)	11.10±1.40 (12.61)	10.50±1.30 (12.38)

*Coefficient variations in the paranthesis.

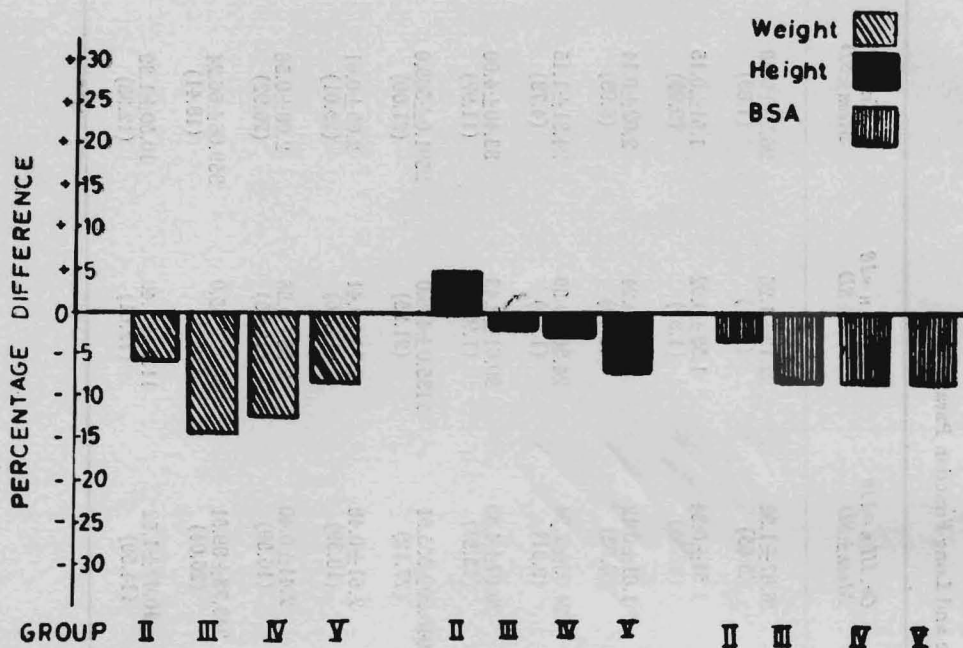


Fig. 1 : Difference in weight, height and body surface area (BSA) of factory workers expressed as a percentage of those of non-factory workers.

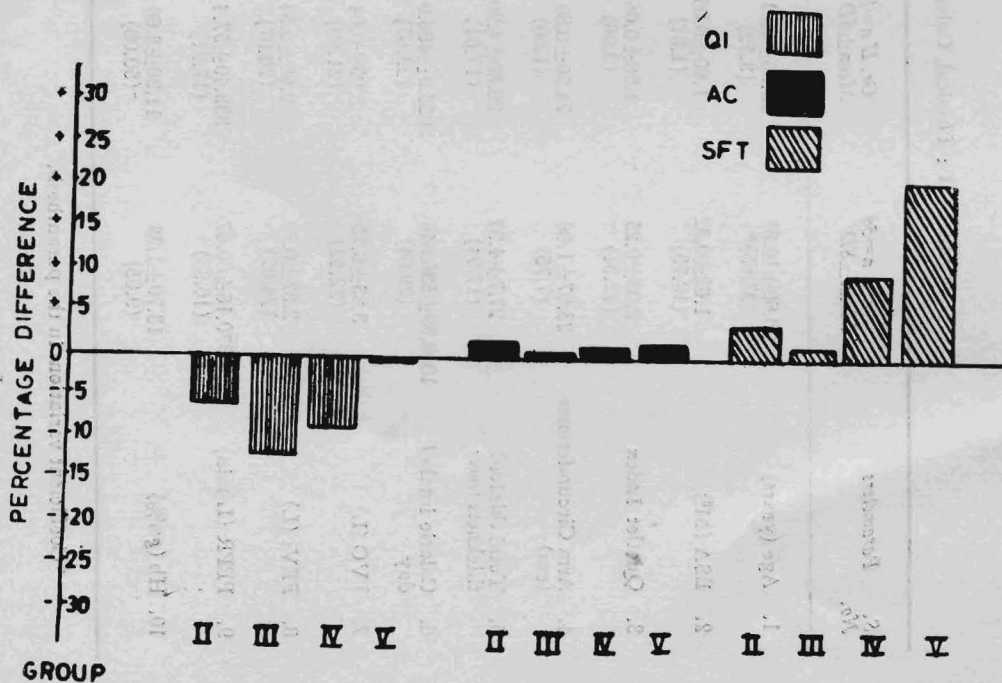


Fig. 2 : Difference in Quetlet index (QI), arm circumference (AC) and skin fold thickness (SFT) of factory workers expressed as a percentage of those of non-factory workers.

Gr-I to Gr. V. The coefficient variation (CV) has been worked out for each parameter and as it is visible from Table I that age, QI and SFT of Gr-I subjects shows much variations as compared with others, whereas Gr. III depicts variation for BSA values. On viewing the lung function values of CV, the Gr. V subjects have shown a large variation as compared with other groups.

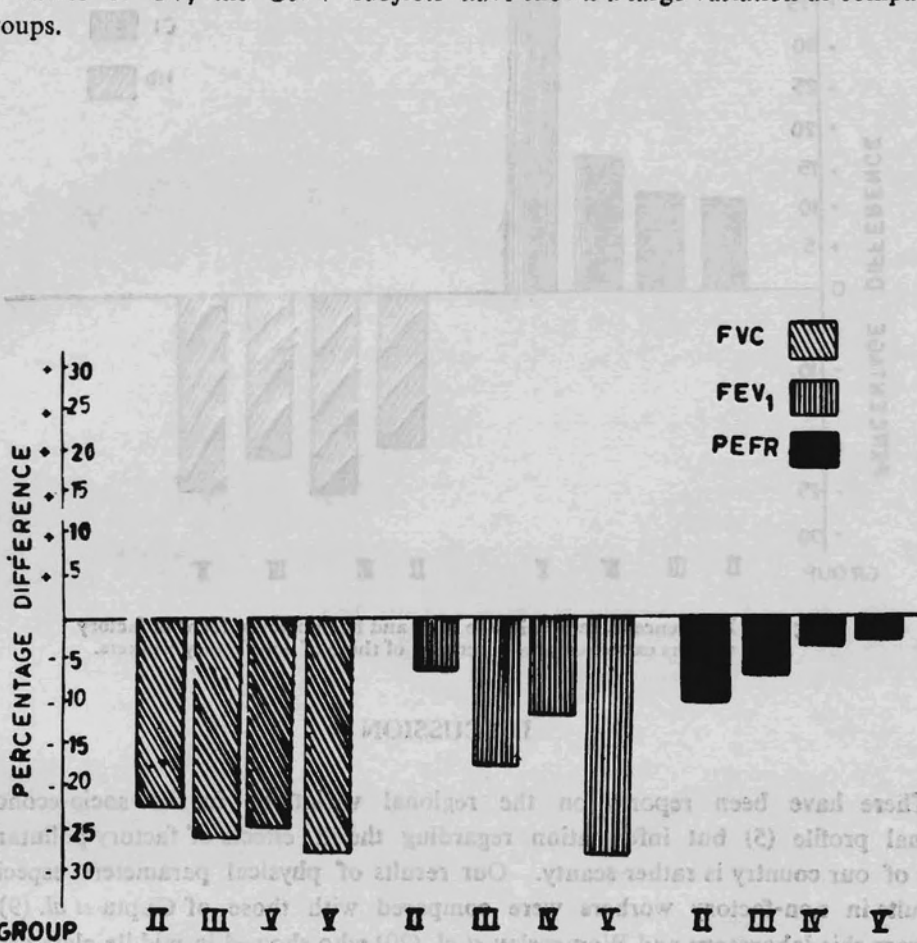


Fig. 3 : Difference in forced vital capacity (FVC), forced expiratory volume in first second (FEV) and peak expiratory flow rate (PEFR) of factory workers expressed as a percentage of those of non-factory workers.

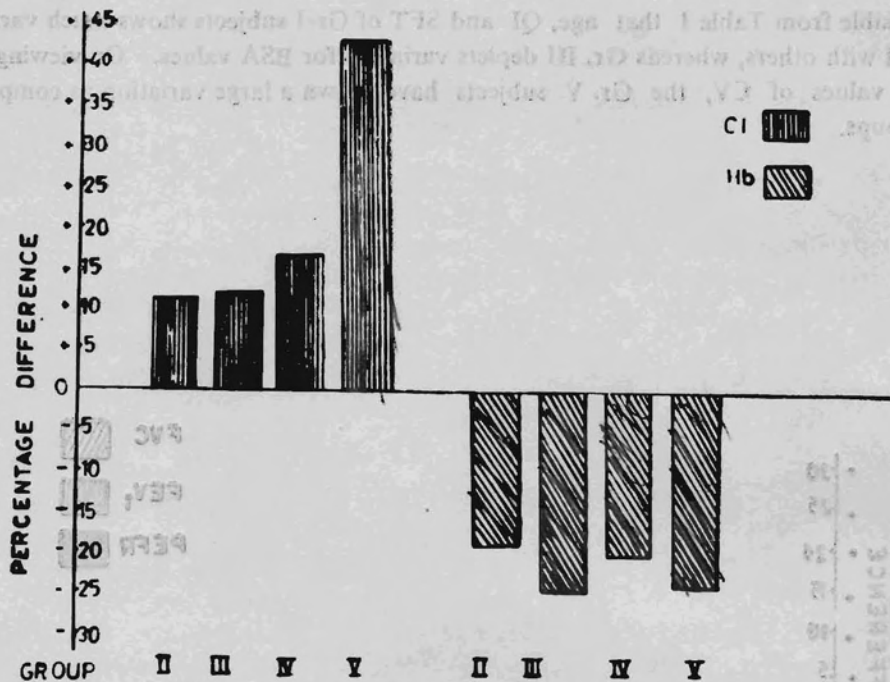


Fig. 4 : Difference in calorie intake (CI) and haemoglobin (Hb) of factory workers expressed as a percentage of those of non-factory workers.

DISCUSSION

There have been reports on the regional variations in the socio-economic and nutritional profile (5) but information regarding the ill effects of factory pollutants in the workers of our country is rather scanty. Our results of physical parameters especially the SFT results in non-factory workers were compared with those of Gupta *et al.* (9) reported earlier from this laboratory and Womensley *et al.* (20) who showed in middle class group of 20-29 years of age, 49 mm. Our results were lower as compared to those reported by Gupta *et al.* (9) and Womensley *et al.* (20), which could be attributed to higher subcutaneous fat (20) and high calorie intake (9) found in them. However, further comparison of results of our factory workers could not be done since comparative studies by others are lacking.

The FVC, FEV₁ and PEFR of Gr-I were compared with Gupta *et al.* (9) and Mahajan *et al.* (12) reported earlier from this lab and in Haryanvi subjects respectively. Though the Ht and Wt of Gr-I subjects were higher and lower with those reported by Gupta *et al.* (9) and

Mahajan *et al.* (12) respectively, our FEV₁ and PEF_R values were higher than their subjects. This could be attributed to the different socio-economic, regional factors and high calorie intake.

Our results on factory workers were also compared with those who were exposed to the dust of slate pencil, talc and asbestos (9, 18). Their results of VC and FVC in symptomatics and with 5 to 10 year duration exposure are lower than ours which could be explained on the basis of the pollutants and other factors. It is a well known fact that the dust of stone, slate pencil, talc and asbestos are hazardous and produce more severe changes in the lungs (8, 13). On comparison of our factory workers with other racial groups like with Gupta *et al.* (10) reported in Iraqi workers of cement and shoe factories, our results of FVC and FEV₁ were in general towards lower side which could be related to high values of BSA of Iraqi subjects (1.7 to 1.8 M²) than ours (1.5 to 1.6 M²). Body built of an individual influences the lung volume and capacities (17). On comparison with Western and European population, Barhrad *et al.* (3) reported in Textile workers, Farhang *et al.* (17) in Welders, Mustafa *et al.* (15) and Baker *et al.* (18) in Sisal workers, Muske *et al.* (14) and Sparrow David (19) in fire fighters, lower values of FVC and FFV₁ were found in our factory workers. This could be because of difference in racial and environmental factors apart from the pollutants to which they are exposed. Since the information regarding physical parameters and nutritional profiles have not been reported by other workers, it is difficult to give satisfactory reasons based on them. The CV (Coefficient variance) values by enlarge showing more variation in lung functions of Gr-V, and this may be because of their less in number.

In conclusion it could be stated that racial, environmental, and socio-economic profiles alongwith the factory pollutants do have effects on vital functions of an individual. Our present study is the part of an on-going project in which about two thousand workers of different factories are being assessed with Morgan's electronic lung function machine and oxyllog which are more sensitive and complete units. The factory pollutants are being analysed in quality and quantity by installing handy volume samplers and high volume samplers. We are quite hopeful that the results of such study would highlight various factors by which workers are affected.

ACKNOWLEDGEMENTS

The authors are grateful to Council of Scientific and Industrial Research for financial assistance for this work and to Mr. M. S. Balachandran for secretarial assistance.

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