



A Comparative Study of Cigarette and Bidi Smoking on Total Red Blood Cell Count, Packed cell Volume and Hemoglobin Concentration

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ABSTRACT

The effect of cigarette and bidi smoking on certain hematological parameters such as total red blood cell count, packed cell volume and hemoglobin concentration was studied in 90 healthy male subjects. The values of all three parameters were significantly higher in smokers as compared to non-smokers. Moreover, the increase in these parameters was found to be more in cigarette smokers as compared to bidi smokers though the difference was significant only in packed cell volume and total red blood cell count.

Key words: Packed Cell Volume (PCV), Total RBC Count and Hemoglobin (Hb) Smoking

INTRODUCTION

There are certain specific differences between cigarettes and bidi. In bidi, the tobacco is loosely packed in inside a leaf (Kendu Leaves, *Diosphyrous melanoxylon*) while in cigarette, tobacco is more compactly packed in thin paper. The nicotine content of bidi tobacco ranges between 4-6% while that of popular cigarettes is up to 3%. The weight of tobacco per bidi averages between 150-240mg whereas the net weight of tobacco per cigarette is over 1 g. thus on average, Indian cigarette contains about 4 to 7 times more quantity of tobacco than an average Indian bidi. The purpose of present study is to determine the effect of smoking on various hematological parameters such as total red blood cell volume (PCV) and hemoglobin (Hb) concentration as well as to compare the effect of cigarette with those of bidi smoking.

MATERIAL AND METHODS

Male subjects belonging to similar socio-economic status with age ranging from 25-40 years were screened for the present study. Persons with any lung-associated disease such as bronchitis, tuberculosis, bronchial asthma and cardiopulmonary disease were excluded.

A total of 90 normal and healthy subjects were selected and categorized into following 3 groups.

- A. Non-smokers (NS),
- B. 30 cigarettes smokers (CS) and
- C. 30 bidi smokers (BS)

The height and weight of all the subjects were measured. Information regarding age, duration of smoking and quantity of tobacco smoked were obtained. For simplifying the study, 10 cigarettes and 10 bidis smoked per day for one year was taken 1 pack year. For the present study, both the cigarettes and bidi smokers were the individuals smoking for a duration ranging between 5-10 pack years.

The subjects were asked not to smoke for 2hrs before reporting to the laboratory in the forenoon. About 4.5ml of venous blood was withdrawn from median cubical vein of each subject and kept in a double oxalate vial. The packed cell volume was measured by Wintrobe's method. Total red blood cell was determined by haematocytometry and hemoglobin by hemoglobin meter.

Table 1. showing Characteristics of the Subjects Studied.

Variables	Non-smokers (n=30) Mean $\pm$ SD (Range)	Cigarette smokers (n=30) Mean $\pm$ SD (Range)	Bidi smokers (n=30) Mean $\pm$ SD (Range)
Age (yrs)	29.8 $\pm$ 5.02 (22-40)	30.8 $\pm$ 4.26 (25-40)	31.8 $\pm$ 5.54 (25-40)
Height (cm)	163.77 $\pm$ 4.51 (156-172)	162.89 $\pm$ 5.56 (155-180)	163.03 $\pm$ 4.60 (155-171)
Weight (cm)	58.85 $\pm$ 8.42 (52-70)	60.40 $\pm$ 2.07 (51-70)	59.66 $\pm$ 4.10 (50-67.5)
BMI (kg/m ²)	21.96 $\pm$ 3.21	22.81 $\pm$ 1.94	22.49 $\pm$ 2.0
Quantity of tobacco smoked	Not applicable	7.7 $\pm$ 3.11 (5-10)	8.46 $\pm$ 1.66 (5-10)

RESULTS

The subjects included in each group matched in their age, height and weight. The mean duration of smoking was 5-10 pack years (Table 1). The data depicted in Table 2 shows an increase in all the three haematological parameters in both smoker groups as compared to non-smokers. On comparison, the increase in more in cigarette smokers than in bidi smokers. Total RBC count and Hb level were significantly higher in both smoker groups as compared to non-smokers ($p < 0.001$). On comparison, the cigarette smokers show significantly higher RBC count and Hb level than bidi smokers ($p < 0.001$). The packed cell volume was significantly higher in cigarette ($p < 0.001$) and bidi ($p < 0.01$) smokers as compared to non-smokers. The level was significantly higher in cigarette smokers than bidi smokers ($p < 0.001$).

DISCUSSION

The present study provides the evidence for erythrocytosis with increased value of packed cell volume and Hb concentration in chronic smokers (Table 1-2, Figure 1-2). Cigarette show significantly larger increase than bidi smokers. Similar results are obtained by other workers in cigarette smokers (Whitehead et al. 1995, Smith et al, 1978, Tirlapur et al, 1983 and Eisen and Hamond, 1956). The findings of the present study show that effects of bidi smoking are similar to cigarette smoking though of lesser intensity. (Whitehead et al, 1995) in their study observed that hemoglobin concentration was significantly increased in those smoking more than 10 cigarettes per day and also there was increase in packed cell volume in smokers. (Tirlapur et al, 1983), while studying the role cigarettes smoking on various haematological parameters, suggested that SaO₂ appeared to be the most important determinant of the erythropoietic response. They also observed a tendency for packed cell volume to be higher in smokers than non-smokers which was significant in older women. (Eisen and Hamond, 1956) also concluded that packed cell volume, red blood count and Hb concentration were higher during the period of smoking than during the period of abstinence. Similar effects were observed in non-smokers after they had smoked six cigarettes.

Numerous studies have documented that excessive carbon monoxide (CO) exposure may produce polycythemia in human's as well in animals (Fogh, 1966). Excessive CO exposure is widespread and generally occurs in urban dwellers exposed to elevated CO levels produced as a level of automobile exhaust and industrial sources (Goldsmith and Landaw, 1968). The levels of carboxyHb were found to be much lower as compared to those of tobacco smokers (Lawther and Commins, 1970). With half life of the CO in the body (3-5 hrs), a progressive rise in the carboxyHb levels during the day is understandable in a person who smokes frequently and continuously (Landsaw, 1973). As the carboxyHb levels increases, it onsets a progressive hypoxemia.

Table 2. Showing the Hematological Parameters of 90 Subjects and Significance of Differences.

Haematological Parameters	Mean Values $\pm$ S.D.			Significance of Differences ('t value')		
	Non smokers (n=30)	Cigarette smokers (n=30)	Bidi smokers (n=30)	N.S V.S C.S	N.S V.S B.S	N.S V.S B.S
Total RBC Count (per c.mm of blood)	4.84 ± 0.48	7.66 ± 1.21	6.28 ± 0.62	11.86**	10.08*	5.56*
Packed Cell Volume (%)	43.95 ± 7.49	50.39 ± 2.33	48.34 ± 2.2	4.50**	3.08*	3.51*
Hemoglobin Concentration (g/100 ml of blood)	13.21 ± 0.94	15.63 ± 1.28	15.25 ± 1.25	8.35**	7.64*	1.22

*Highly significant ($p < 0.01$)

**Very highly significant ($p < 0.001$)

It has also been noticed that the functional anemia is produced when CO binds with Hb (Brody and Coburn, 1969). The portion of Hb liganded CO is unable to carry oxy gen and reduces the functional hemoglobin by the equivalent percentage of measured carboxyHb. This causes the impaired oxygenation of tissues. The same mechanism has been advocated for the cause of change in hematological parameters. (Isager and Hagerup, 1956) also estimated that about 3% of all smokers have elevated hematocrit values.

In summary we have provided the evidence that similar to cigarette smoking, bidi smoking also causes the increase in certain hematological parameters which may caused increased erythrocytosis, though effect of bidi smoking is of lesser intensity than that of cigarette smoking which could be because one average Indian cigarette contains 4 to 7 times greater quantities of tobacco packed than in one bidi.

REFERENCES

- Malik, S.K. 1947. Chronic bronchitis in bidi smokers. *Ind. J. Chest. Dis.* 1947. 16, 94-99.
- Whitehead, T.P., Robinson, D., Allaways, S.L. and Hala, A.C. 1995. The effects of cigarette smoking and alcohol consumption on blood hemoglobin, erythrocytes and leucocytes, a dose related study on male subjects. *Clin and Lab Haemat.* 17 (2), 131-138.
- Smith, J.R., Landaw, S.A. 1978. Smoker's polycythemia. *New Eng J. Med.* 1978, 298, 6-10.
- Tirlapur, V.J., Gicheru, K., Charlabous, B.M., Evas, P.J. and Mir, M.A. 1983. Packed cell volume and oxygen saturation changes in healthy smokers and non-smokers. *Thorax*, 38, 785-787.
- Eisen, M.E. and Hamond, E.C. 1956. The effect of smoking on packed cell counts, hemoglobin and platelet counts. *Canad. M. A. J.* 75, 520-523.
- Fogh, J.A. 1966. Sensitive erythropoietin assay on mice exposed to co-hypoxia. *Scan J. Clin. Invest.* 18, 33-44.
- Goldsmith, J.R. and Landaw, S.A. 1968. Carbon monoxide and human health. *Science*, 162. 1352-1359.
- Lawther, P.J. and Commins, B.T. 1970. Cigarette smoking and exposure to carbon monoxide. *Ann. NY. Acad. Sci.* 135-147.
- Landsaw, S.A. 1973. The effects of cigarette smoking on total body burden and excretion rates of carbon monoxide. *J. Occup. Med.* 15, 231-235.
- Brody, J.S. and Coburn, R.F. 1969. Carbon monoxide induced material hypoxemia. *Science*, 164, 1297-1298.
- Isager, H. and Hagerup, L. 1956. Relationship between cigarette smoking and high packed cell volume and platelet counts. *Can. Med. Assoc. J.* 75, 520-523.