

Effect of Tobacco as Fumigant on Lungs and Intestine of *Rattus rattus*



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Abstract : After treatment of tobacco fumes for 1, 3 and 6 months the histological examination of the vital parts of *Rattus rattus* i.e. body-lungs, stomach and intestine, reveals few changes such as the loss of lung tissues with signs of emphysema, bronchoconstriction in the lungs. The body weight increases and the lung weight were significantly suppressed. The lungs showed wall thickness were decreased. The stomach showed ulcer margin hyperemia and some animals showed apoptic cells in the mucus layer. Intestinal mucosa showed drastically stimulated and was devoid of villi. In large intestine no significant change was observed.

Key words : *Nicotiana tabacum*, *Rattus rattus*, Hyperplasia, Emphysema, Intestinal mucosa.

The smoking of tobacco dried and cured tobacco leaves of plant *Nicotiana tabacum* in the form of cigars, cigarettes, bidis etc. is very toxic to the body. Smoke of tobacco contains about 300 compounds such as - nicotine, CO, HCN, polycyclic aromatic hydrocarbons, certain other stimulant product etc. Two different types of tobacco usage smoking, chewing & snuffing, have been seen all over the world.

A strong association exist between cigarette smoking and several diseases namely - cancer of the lung, bronchitis and emphysema, cancer of the larynx, oral cavity and oesophagus, stomach, intestine, duodenum and pancreatic ulcers, cancer of kidney, bladder, coronary artery disease, leukaemia, etc.

Chronic obstructive pulmonary diseases (COPD), comprised of pulmonary emphysema, chronic bronchitis, structural and inflammatory changes of small air ways, is a leading cause of morbidity and mortality in the world, (Yoshida and Tuder, 2004)

Material and Methods

Exposure of rat (*Rattus rattus*) with the

toxicants for 1, 3 and 6 months were selected for the histological study. This study was carried out in the Environmental Research Lab, Agra College, Agra on eighty rats of both sexes aged 3-4 weeks and weighing 50-100 gms. The animals were housed in cages which were kept in a room where temperature was maintained around 22°C by the use of coolers or room heaters as and when required. The rats were divided into the following groups:

- (1) Normal control rats to be followed throughout the duration of experiment - 15
- (2) Toxicity group - 45

Tobacco fumes administered group was further subdivided into three subgroups of 15 each according to the dose (50mg/alternate day) and period of tobacco administration (1, 3 and 6 months).

At 3 weeks of age, half of the animals in each group were individually housed in 225 cm³ columns and tobacco smoke of 15 filter cigarette (Hilite: tar, 19 mg/puff; nicotine, 1.3 mg/puff;) All the animals were weighed regularly and were watched for general well-

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being during the period of administration of tobacco. After feeding the animals for different ppm and different duration were sacrificed by cervical dislocation, simultaneously one animal from respirator and one from wire cage for the same duration and dose sacrificed at same time after examination externally than a midline incision making upto the peritonium which was open into the line of skin incision. At the end of experiment affected rat were dissected to take out-lungs and intestine for examine which were fixed in 10% buffered Bouin's solution for paraffin embedding. After proper fixation the tissue were washed in running tap water for 10 hrs. dehydrated with series of 30%, 50%, 70%, 90% and 100% alcohol and xylol for embedding in paraffin block preparation. Section of 5 thickness were cut and stained by Hematoxylin/Eosin. Detailed histopathological studies of control & treatment section were made in the light microscope using oculometer.

Results

The observations were carried out on two groups of animals, as already stated in the material and methods.

Lung : For the first 1 month on the toxic diet the rats grew at an identical rate to that of controls and the food intake of the two groups was the same. After 1 month, the rate of growth was consistently lower than that of the control animals, At 3 months, the experimental animals were weighing approximately 2 to 4% lesser, at 6 months they weighed 6 to 8% lesser.

After administration of tabacco fumes for 1 month, 2 animals showed broncho-constriction (Fig. 1). 3 animals out of 15 animals showed loss of lung tissue.

After 3 months 14 animals out of 15 showed loss of lung tissue. 7 out of 15 animals, showed hyperplasia and tumor. Some animals showed signs of emphysema. The lungs showed wall thickness were decreased. After six months some animals died and 3 animals

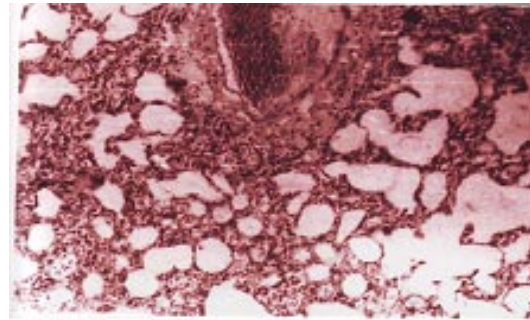


Fig. 1 : Lung showing broncho-constriction of rat lung.

showed loss of cilia and mucus gland hyperplasia (Fig.2).

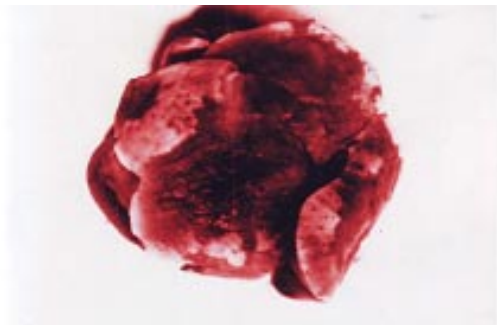


Fig. 2 : Lung (on gross) showing hyperplasia

(a) Stomach : At six months 3 animals showed ulcer margin hyperemia and 5 animals showed apoptic cells in the mucus layer. There was no neutrophil in filtration in gastric mucosa.

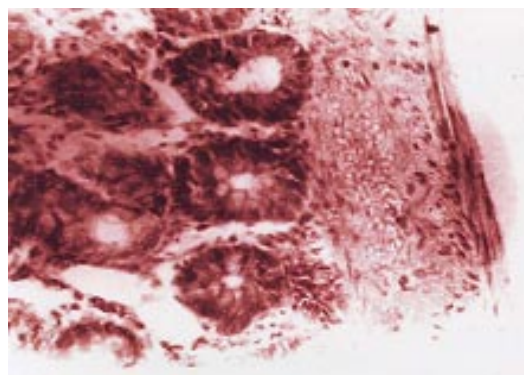


Fig. 3 : Intestine showing drastically stimulated area

(b) Intestine : On gross examination small intestine measured 25 cms. in length and varied in diameter from 0.4 cm to 0.8 cm. Intestinal mucosa in these animals showed drastically stimulated (Photoplate No.3). In large intestine no significant change was observed.

Discussion

The epidemiological studies and experiments on various animals and human beings have proved beyond doubt that tobacco is a health hazard. The U.S Surgeon General's report of 1964 forced various countries to consider corrective actions for control of the tobacco usage. The thickness of the alveolar wall decreases, suggesting a loss of the lung tissue component of the alveolar wall, and is supported by the view of Nilsson and Henriksson (1990) that the effect of irradiation on pulmonary tissue differed markedly between rats depending on the exposure to tobacco smoke. Broncho-constriction has most commonly been attributed to the effect of the smoke-evoked inflammatory response; since such a response can be detected in lavage fluid in experimental condition (Wright and Harrison, 1990). The down regulation of epidermal protein kinase C is associated with epidermal hyperplasia and tumor promotion (Hensen *et al.*, 1990) as observed in the rat lung exposed to tobacco fumes in the present study. In the present study findings signs of emphysema was found and is in accordance to the findings of Eidelman *et al.* (1990) which proposes that in emphysema produced by tobacco smoke, the elastin is destroyed in similar proportion to the rest of the pulmonary parenchyma.

According to Potten (1992) cigarette smoking is a major risk factor for cancer and also affects the incidence and healing of peptic ulcer. In the present experiment, tobacco fumes exposure markedly increased apoptosis in the rat gastric mucosa in a dose and time-dependent manner. The apoptotic bodies were observed

on the top and at the bottom of the gastric mucosa. On the surface of gastric mucosa, there were also many attached apoptotic cells in the mucus layer which were not included in the counts apoptotic cells in the gastric mucosa and gains support of Wang *et al.*, (2000).

Tobacco smoke with high nicotine content has a significantly greater inhibitory effect in attenuating the hyperemia than tobacco smoke with low nicotine content and is in accordance to (Chujoh and Nakazawa, 1981). The effect of tobacco smoke was an intestinal mucosal enzymes. The digestive enzymes-lipas, amylase etc of small intestinal mucosa were drastically stimulated by the administration of smoke at the higher dose, present finding gains support of (Prabhu *et al.*, 1995). In large intestine no significant change was observed. Hsieh and Chen (2002) reported that formation of 8 nitroguanine in tobacco cigarette smokers and in tobacco smoke exposed Wistar rats could induce DNA damage by exo and endogenous NO_(x)

Recent study of Yao (2008) reported that the effect of cigarette smoke (CS) is believed to be strain dependent, because certain mouse strains are more susceptible or resistant to development of emphysema.

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