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ABSTRACT

Lead and Copper were determined in Mainpuri Tobacco (Kapoori) samples collected from different stations of Mainpuri district of U.P. The concentrations of metals were determined by using Atomic Absorption Spectrophotometer (AAS). The resulting levels of the metals were compared to the daily consumption of the tobacco product and also compared to the provisional tolerable intake limits determined by the FAO/WHO. The reliability of data was assured by analysing standard reference materials.

Keywords: Metals, Mainpuri Tobacco AAS.

INTRODUCTION

Kapoori (Mainpuri Tobacco) is one of the products of tobacco. This preparation is very popular in Mainpuri district of UP and nearby areas and consumed much like chewing tobacco. A survey has reported that about of 3500 individuals in Mainpuri, 7% of the villagers used this product[1]. Like chewing tobacco it is considered responsible for oral cancer and other severe negative health effects.

The different constituents of kapoori are tobacco, finally cut areca nut, camphor, peppermint, cardamom, clove, and slaked lime. Alkaloids present in areca nut are known to give rise to carcinogenic nitrosamines and the World Health Organization (WHO) has recently evaluated areca nut as a human carcinogen[2].

About four thousand chemicals (organic as well as inorganic) are identified in tobacco and classified in different groups according to their health hazards index by International Agency for Research on Cancer (IARC)[3-4]. Some metals, constituting the inorganic constituents of tobacco, prove to be highly toxic even at low levels to its users as they get easily incorporated into user's body[5,6]. Lead[7-10], is declared as human carcinogens by IARC.

MATERIAL AND METHOD

Sample Collection

Mainpuri tobacco (Kapoori) is a non-branded local smokeless tobacco product of Mainpuri district of U.P. Therefore different Kapoori samples were purchased from different shops of Mainpuri district. Total 10 forms of Kapoori samples were collected and mixed together to obtain a representative sample of that product. The date of purchase and name of manufacturer were recorded. Manufacturer name have not been disclosed in this paper due to legal requirement.

Sample Digestion

A weight of 0.5 g of air-dried tobacco sample was placed in a PTFE vessel and allowed to digest with a mixture of HNO₃ and HCl (8:2 V/V) by heating the PTFE vessel on the water bath shaker for five hours at 105°C. After cooling 10 ml de-ionized water was added, the solution was filtered through a whatmann filter paper (grade 1) in to a 25 ml volumetric flask; and made to the mark with de-ionized water[11].

Elemental Analysis

Metal concentration in the digest was determined by Atomic Absorption Spectrophotometer (AAS). The flame condition and graphite furnace were optimized for maximum absorbance and linear response with the

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aspiration of known standard. The standards were prepared from 1000-ppm stock solution. Standard operating conditions for the analysis of Lead and Copper using AAS are given in the table-1.

Table-1: Standard operating conditions for the analysis of heavy metals using Atomic Absorption Spectrometry.

Metals	Wavelength (nm)	Lamp Current (mA)	Flame	Slit width (mm)
Pb	283.3	12	Air-acetylene	0.7
Cu	324.8	30	Air-acetylene	0.7

RESULTS AND DISCUSSION

The metal analysis of Mainpuri tobacco samples has yielded very useful information about the indirect intake of heavy metals. In Mainpuri tobacco samples, the levels of Cu, and Pb, exceeded the average daily intake values of consumption. Exposures to each of these were calculated using an average consumption of 50 gram per day based on our survey. The daily intake was calculated as shown below:

Daily intake ($\mu\text{g}/\text{day}$) = Metal concentration in Kapoori sample ($\mu\text{g}/\text{g}$) x Daily intake of Mainpuri tobacco.

The observed daily intake of these elements was compared with the provisional tolerable daily intake (PTDI) recommended by the Food and Agriculture Organization (FAO/WHO) and Food and Nutrition Board of NAS/NRC as shown in table -2:

Table-2: Permissible Tolerable Daily Intake Levels as per FAO/WHO Recommendations

Metals	PTDI for a 60 kg adult	Reference
Pb	214($\mu\text{g}/\text{day}$)	FAO/WHO
Cu	300 ($\mu\text{g}/\text{day}$)	FAO/WHO

The provisional tolerable daily intake of Cu[12] based on body weight for an average adult (60 kg body weight) is 3 mg/day or 300 $\mu\text{g}/\text{day}$. The Cu levels were found to be higher in two samples (sample no: A and J- 6.750 $\mu\text{g}/\text{g}$ and 6.32 $\mu\text{g}/\text{g}$), as shown in table-3, when an average 50 gm consumed per day. As per earlier studies the average daily exposure from air food and water for a person weighing 70 kg and drinking 1.5l of water per day, eating 1.5 kg of food per day. And inhaling 2 cm^3/day is 0.01-0.06 $\mu\text{g}/\text{kg}$ 3.14 $\mu\text{g}/\text{kg}$ and 3.77 $\mu\text{g}/\text{kg}$ body weight per day, respectively[13].

Copper is essential element in human metabolism but copper in smokeless tobacco may be responsible for the fibrosis in mouth cavities[14]. Early symptoms of chronic copper poisoning including pre cancerous oral lesions (leukoplakia-small white patches) and sores in the mouth or tongue followed by oral sub mucous fibrosis and difficulty in opening the mouth fully. Abnormal accumulation of copper in the tissue and blood causes Wilson disease. Most of the absorbed copper is stored in the liver and bone marrow. Acute exposure to copper causes vomiting, bloody diarrhea, hypertension and cardiovascular collapse[15].

Table-3: Observed Levels of Lead and Copper in Mainpuri Tobacco Samples in µg/g.

Mainpuri tobacco samples	A	B	C	D	E	F	G	H	I	J
Pb	0.365	4.421	0.293	0.237	5.237	0.349	0.237	0.488	0.571	0.858
Cu	0.576	2.695	6.758	4.466	2.270	4.753	2.270	3.416	2.747	6.321

Table-4: Observed Daily Intake Level of Heavy Metals in µg/day* from Mainpuri tobacco.

Mainpuri tobacco samples	A	B	C	D	E	F	G	H	I	J
Pb	18.25	221.5	14.65	11.85	261.75	17.45	11.85	24.40	28.55	42.90
Cu	28.80	134.75	337.90	223.30	113.5	237.65	113.5	170.8	137.35	316.05

*Daily intake levels calculated considering a consumption of average 50 gm per day.

Lead is one of the limited classes of element that can be described as purely toxic. Most other elements though toxic at high concentration are actually required nutrient at lower levels. There is no exposure level below which lead appears to be safe. However, The FAO/WHO established a PTDI of Pb in adults of 60 kg as 214 µg/day. According to the joint FAO/WHO Expert Committee on Food Additives (JECFA)[16], the accumulation of Pb-40% from dietary sources, 10% from food and drinking water. And up to 50% from inhalation of Pb compounds. As per earlier studies Pb was found in all Kapoori samples and at higher level in two samples (sample no: B and E- 4.421 µg/g and 5.237 µg/g), as shown in table-3, when an average 50 gm consumed per day. Lead absorption constitutes serious risk to public health. It induces increased blood pressure and cardiovascular diseases in adult as well as liver and kidney dysfunction[17]. Lead is particularly dangerous for the young age group, as chronic exposure resulting in the lowering of the IQ and poisoning effect on the brain may not be reversible[18-20].

CONCLUSION

In conclusion the results represent the considered levels of Lead and Copper in Mainpuri tobacco

samples, which if consumed in excess would prove harmful for consumers.

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