



TOXICITY OF TRACE METALS PRESENT IN SMOKELESS TOBACCO PRODUCTS

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ABSTRACT

Increase use of Tobacco Products is associated with many health problems; hence there is need for research into the heavy metals contents of smokeless tobacco products. In this study ten brands of smokeless tobacco products (STPs) commonly used were investigated. Samples collected were analyzed for heavy metals concentration by AAS. Over the years the research was focused only on toxic organic components while a little attention is given towards the toxic effects of heavy metals. There is no doubt that organic toxins are responsible for myriads problems effecting human's health but the clinical effects caused by heavy metals in tobacco use cannot be ignored when humans are easily exposed to tobacco products. When these trace metals are present in higher concentration in human body then they causes a number of diseases like oral, lungs, larynx, pharynx, esophagus, breast, stomach and kidney cancer. This is the leading cause of death in developing countries. Trace metals such as Cr, Cd, Pb, Ni, and Hg were analyzed and the concentrations of these are above permissible limits. The conc. of these metals i.e. Cr (0.216-0.845), Cd (0.00-0.644), Pb (0-0.522), Ni (0.614-2.014) and Hg (0.031-0.064). The concentration of Chromium and Nickel are above the permissible limit in all the samples.

KEYWORDS

Heavy Metals, Tobacco, Chronic Exposure, Toxicity, Cancer

INTRODUCTION

People are generally not exposed to the pure metallic form of metals but more usually to multielement compounds mainly salts. Mostly transition metals forms co-ordination compounds with various ligands e.g. carbon monoxide (CO), ammonia (NH₃), cyanogens (CN). Some metals can also form organometallic compounds in which metal is bounded to carbon of some organic group. Some metals act as coenzymes for enzymes. Dysfunction in these enzymes activities may result from deficiency but also from high doses of essential metals¹. Transition metals show a change in their oxidation states as they are electronically stable in more than one².

Metals toxicity is a major medical concern. Of particular concern are "Heavy metals", which occurs in the earth crust³. Metals generates many of their deleterious effects through the formation of free radical resulting in DNA damage, lipid peroxidation, depletion of proteins, sulfhydryls (e.g. glutathione) and other effects⁴.

Smokeless tobacco products (STPs) is a broad term that encompasses many different types of tobacco products used both orally and nasally⁵. The use of smokeless tobacco products is growing due to unsupported perception of safety, indoor smoking bans, ability to conceal use, increased social acceptance, and reported "positive" physiological effects, such as relaxation and diminished hunger⁶. The extent up to which STPs endangers human health is an ongoing subject of debate.

There is no entirely safe way to use tobacco, regardless of whether it is smoked, chewed, applied on gums and teeth, or mixed with other ingredients⁷. Poisons in tobacco smoke damage the DNA or changes occur in it. DNA is the "instruction manual" that controls the normal growth and function of cell. When DNA is damaged cell begin to grow out of control and cause a tumor⁸. India has one of the highest rates of oral cancer in the World, with about 50% of oral cancer by the use of STPs⁹.

Secondhand smoking also known as environmental tobacco smoke, this causes diseases and premature death in non-smokers. Globally about one-third adults are regularly exposed to passive smoking or secondhand smoking. The GATS-India showed that 52% of adults (rural-58%, urban-39%) were exposed to

secondhand smoke at homes. Secondhand smoke (sidestream smoke) is more toxic than mainstream tobacco smoke¹⁰.

MATERIALS AND METHODS

Study Area:-

To determine the toxicity of trace metals in tobacco, samples were collected from two different sites during 2015. The sites are as Agra district of UP and Rajouri district of J&K.

Sampling:-

Ten different brands of STPs were taken from the local markets of the two different sites (Agra (UP) and Rajouri (J&K) India. These samples were selected on the basis of popularity among the peoples especially the teenage community, representing a large and uniform pool. The products collected for analysis represents the commonly used brands, such as the popular **Naswar, Nevla, Rajhans, Kuber, Safal, Chaini, Tulsi, Baba, Goldmohar and Mainpuritobacco**, which are chewing tobacco products that have become more popular, especially among teenagers and young adults in many states of India.

Sample preparation:-

The samples were categorized as samples 1-10 respectively. Some quantity of each sample was put in petri dishes and 5g of each sample measured using an electronic weighing balance into beakers. 50ml of diluted 0.1 nitric acid (HNO₃) obtained from 65% concentrated HNO₃ was poured into the beakers and then stirred using a stirrer until the sample was totally dissolved. Sample was then transferred into a digestion bottle and placed in an oven at a temperature of 110°C for 2 hrs. After 2 hrs the sample from the oven was brought out and allowed to cool at room temperature. The supernatant layer was removed using a clean filter paper of 110 mm. The sample was then analyzed using the Atomic Absorption Spectrophotometer¹¹ having Model No. Analyst-100 of Perkin Elmer from Department of Chemistry, St. John's College, Agra.

RESULT & DISCUSSION

In India, the consumption of smokeless tobacco products (STPs) is widespread because it is inexpensive, widely available, heavily advertised, and has complete social acceptance. In this study we target the determination of heavy metals in STPs.

Lead has been known to increase the rate of hemolysis, suppress cognitive development, cause renal tumors, hypertension and negatively impact on male reproductive system. Lead is classified by International Agency for Research on Cancer (IARC) as group 2A carcinogen probable human carcinogen. In this context, the samples such as Baba, Gold Mohar, Mainpuri and Tulsi have a higher concentration of lead.

Cadmium is an IARC group I human carcinogen and is highly toxic to kidney, bone and the nervous, respiratory and the circulatory systems. Cadmium is typically among the highest concentrations of the toxic and carcinogenic metals found in tobacco. Mainpuri tobacco has the highest concentration of Cd as compare to other samples.

Chromium (VI) is known to cause oral and epidermal allergic contact dermatitis as well as pulmonary sensitization. Since Cr (III) is poorly absorbed by any route, the toxicity of chromium is mainly attributable to the Cr (VI) form. The samples such as Naswar, Nevla, and Rajhans tobacco have the lowest concentration of chromium.

IARC has classified methyl mercury as "possibly carcinogenic to humans" (Group 2B). The inhalation of elemental mercury vapours can cause neurological and behavioral disorders, such as emotional instability, memory loss, neuromuscular changes and headaches. All the samples have concentration higher than permissible limits

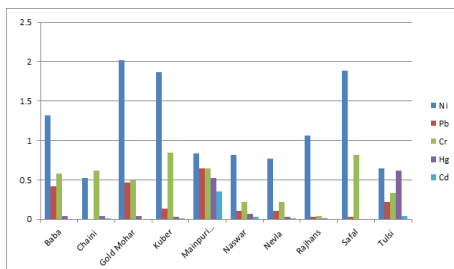
Nickel is an IARC group I carcinogen. Nickel is one of many carcinogenic metals known to be environmental and occupational pollutants. First, nickel causes essential metal imbalances. It severely disrupts enzymes action and regulation. All the samples have a higher concentration of Nickel.

OBSERVATIONS

Comparative analysis of metals in samples in ppm

Samples	Pb	Cd	Cr	Hg	Ni
Permissible Limit	0.2	0.1	0.5	0.01	0.06
1. Baba	0.421	0	0.580	0.041	1.321
2. Chaini	0	0.010	0.614	0.040	0.524
3. Gold Mohar	0.469	0	0.494	0.040	2.014
4. Kuber	0.138	0.005	0.845	0.034	1.871
5. Mainpuri	0.522	0.644	0.644	0.035	0.833
6. Naswar	0.105	0.0321	0.216	0.064	0.821
7. Nevla	0.105	0.016	0.216	0.032	0.765
8. Rajhans	0	0.002	0.037	0.034	1.066
9. Safal	0	0	0.814	0.031	1.881
10. Tulsi	0.332	0.062	0.646	0.040	0.221

Comparative (Column Diagram) analysis of metals in samples



CONCLUSION

Tobacco is a killer plant, whether smoked, chewed or snuffed. Evidently, the health burden contributed by heavy metals content in tobacco must be a subject of eminent concern because the clinical effects they cause are equally devastating as those caused by organic toxins present in tobacco. It is very important to note generally all the selected brands of smokeless tobacco products (STPs) gave high concentration of heavy metals. India has a major target of the multinational cigarette companies. India is the major player in the international tobacco market. Cigarettes smoking is responsible for more than 4 lac death each year, or one in every five death. Additionally, if current pattern of smoking persist, over five

million people currently younger than 18 will die prematurely from tobacco related disease. Therefore it is important to reduce the amount of tobacco use throughout the world. We need to increase the awareness of the public not only about the harmful effects caused by tobacco use and the complication it may cause. It is important to discuss the consequences of the cancers and other complications which arise from tobacco use to help spread the message of how dangerous tobacco can be.

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