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Analysis of the Presence of Trace Metals in the Palms of Beedi Rollers in Manglore

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Abstract: ***Introduction: Beedi causes health risks to those who involve in its manufacturing. Toxic metals are released into the ambient air during Beedi making. Beedi rollers are exposed to unburnt tobacco, mainly through the cutaneous and nasopharyngeal route. They are affected by respiratory disorders, skin diseases and gastrointestinal illness. Aim: To quantify the toxic trace metals present in the palms of the Beedi rollers. Methodology: Swabs from the palms of beedi rollers collected using sterile cotton swab dipped in saline water. After collection swabs stored in sterile container and transferred to lab for analysis. The analysis of the samples has been carried out using ICP - OES at KONSPEC PVT LTD, Mangalore.0.37 gm. swab was weighed and transferred to MDS (Microwave Digestion System) vessel.2ml Hydrogen peroxide and 2ml Nitric acid added to the vessel and after few minutes it was subjected for microwave digestion. After digestion the sample was cooled and diluted to 20ml. The digested samples were subjected for ICP - OES analysis Results: The different toxic metals found were Barium, Copper, Chromium, Lead, Nickel and Arsenic. The highest concentration was for Barium, Copper and Chromium which was 22PPM, 3.9PPM, and 2.4PPM respectively. Barium and Chromium are known to be dermal irritants and Lead, Nickel and Arsenic are potential carcinogens. Conclusion: It was realized from this research that most of the heavy metal contents measured were higher than the recommended permissible limit with the exception of Cobalt and cadmium.***

Keywords: Beedi rollers, Trace metals, Occupational health, Tobacco industry, Public health

1. Introduction

India is the third largest producer and sixth largest exporter of tobacco. It is estimated from the annual survey of industries data that almost 85% of employees of tobacco manufacturing industries are employed in the beedi industry. Since beedi rolling is largely considered to be a cottage industry, it generates much more employment at the manufacturing stage[1].

Beedi rolling is one of the principle occupation of women residing in coastal Karnataka.

This has become instrumental in generating supplementary income to the family. A large part of this industry is unregulated and home based. They ignore the health problems arising out of beedi rolling and never seek medical help due to fear of loss of daily wages. Most of these female beedi workers are in reproductive age group and exposed to the harmful effects of tobacco. These women roll Beedi for an average of 8 hours per day and they do not use any kind of protective equipment, hence are exposed to tobacco either by inhalation or dermal contact.

Moreover due to lack of awareness, there is a tendency for them to consume or feed food without washing their hands. This may result in ingestion of the toxic metals. Though there are enough literature on the occupational hazards commonly seen among beedi rollers, there is no evidence regarding the toxic metals present on their dermal surface. Hence the aim of the study is to analyze the toxic metals present in the palms of Beedi rollers. This baseline data will enable to develop strategies to reduce their exposure to tobacco products.

Objective
To quantify the amount of Arsenic, Barium, Cadmium, Nickel, Lead, Cobalt, Copper and Chromium present in the palms of Beedi rollers.

Study Design
An in - vitro study

Study Setting
Beedi rollers residing near to the research institute.

Sampling Method
Convenience sampling

2. Methodology

The samples from the palms of Beedi rollers were collected using sterile cotton swab dipped in saline water. After collection swabs were stored in sterile container and transferred to lab for analysis. In the lab 2 ml of Hydrogen peroxide and 2ml of Nitric acid was added to the sample and then it is transferred to Microwave digestion system vessel (MDS). Along with two sample vessel six blank vessels were also kept and later they are transferred to MDS rotor. The rotor was placed in the digestion unit and samples were subjected for microwave digestion.

After the digestion sample was cooled and diluted to 20ml using distilled water. The analysis of the sample was done using ICP - OES (Perkin Elmer (optima 7000DV) equipped with two monochromators: (i) spectral range 160 - 460 nm with nitrogen purged optics and (ii) spectral range 240 - 790 nm with air purged optics, was used. The solution to analyze is aspirated to the machine and conducted by a peristaltic pump though a nebulizer into a spray chamber. The produced aerosol is lead into an argon plasma. Plasma is the

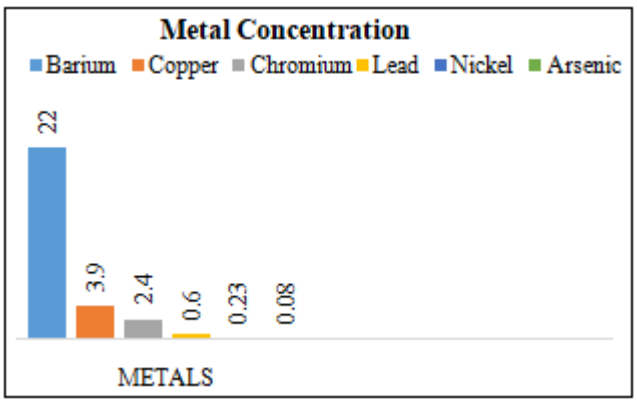
fourth state of matter, next to the solid, liquid and gaseous state. In the ICP - OES the plasma is generated at the end of a quarts torch by a cooled induction coil through which a high frequency alternate current flows. As a consequence, an alternate magnetic field is induced which accelerated electrons into a circular trajectory. Due to collision between the argon atom and the electrons ionization occurs, giving rise to a stable plasma. In the torch desolvation, atomization and ionizations of the sample takes place.

Due to the thermic energy taken up by the electrons, they reach a higher "excited" state. When the electrons drop back to ground level energy is liberated as light (photons). Each element has its own characteristic emission spectrum that is measured with a spectrometer. The analytical operational parameters were optimized with the aim to achieve the lowest possible limit of detection. It was operated under suitable conditions including choosing the suitable wavelength for each element (Cd 214.439 nm, Pb 220.353 nm, Co 238.892, Ni 231.604 Cu 324.754 nm, Ar 228nm, Ba 455.404nm, Cr 357.86,) The light intensity on the wavelength is measured and with the calibration calculated into a concentration in parts per million (ppm). The results were obtained after analysis.

3. Result

The different toxic metals found were Barium, Copper, Chromium, Lead, Nickel and Arsenic. The highest concentration was for Barium, Copper and Chromium which was 22PPM, 3.9PPM, and 2.4PPM respectively. Led 0.6, Nickel 0.23 and Arsenic 0.08. Cadmium and cobalt were not found in the tested samples.

Element	Concentration in PPM
Barium (Ba)	22
Copper (Cu)	3.9
Chromium (Cr)	2.4
Lead	0.6
Nickel	0.23
Arsenic	0.08
Cadmium	Not Detected
Cobalt	Not Detected



4. Discussion

An in - vitro study was conducted among the beedi rollers residing near to the research institute. Due to frequent exposure to tobacco dust and other harmful substances, beedi rolling is regarded as a dangerous industry that poses major health risks to those who work in it. The beedi workers are compelled to work nonstop for hours because of their low socioeconomic standing and unfavorable environmental conditions. Since they are continuously in contact with the toxic chemicals in tobacco, it can cause harmful effects to their health. The present investigation attempted to analyze the toxic metals present in the palms of beedi rollers.

The most abundant metal found in the tested sample is Barium. Barium is a dermal chemical irritant and may cause dermal lesions[2]. Chronic inhalation can cause benign granulomatous pneumoconiosis and when ingested orally it can cause tachycardia and hypertension[3]. Copper was the second most abundant metal found in the samples. Trace amount of copper is required in human body for the synthesis of hemoglobin and several hormones. But if very large dose is consumed, signs of acute toxicity including vomiting and diarrhea. Inhaling copper dust for long period of time can cause eosinophilia or pulmonary fibrosis[4]. Copper was shown to more strongly induce pulmonary inflammation than other transition metals on a per mass basis when tested in rats[5]

Chromium is known to cause oral and epidermal allergic contact dermatitis as well as pulmonary sensitization. There are limited reports that elevated chromium exposure may also result in contact allergic sensitization[6]. Chromium concentrations have been reported to be significantly higher in all five lobes of smokers' lungs than in nonsmokers' lungs[7]. Chromium toxicity can lead to vomiting, diarrhea, blood loss into the digestive tract and cardiovascular shock followed by liver and kidney necrosis (WHO, 1988). The concentration of lead found in the samples was 0.6ppm. Lead is classified as an IARC group 2A probable human carcinogen[8]. Lead accumulates over the lifetime in bone. Even at adult blood lead concentrations that are considered to be acceptably low (< 10 µg/dL), associations between lead concentration and elevations in systemic blood pressure and decrements in glomerular filtration rate have been reported[9].

Increased lead accumulation in the blood and in amniotic fluid of women, and in the cord blood of newborn babies has been associated with smoking. Elevated blood lead levels in U. S. children have also been associated with second - hand smoke exposure[10, 11]. Lead concentrations have also been reported to be significantly higher in four of five lobes of smokers' lungs. Lead has been reported at higher concentrations in the exhaled breath condensate of study subjects with COPD.

Although both cobalt and nickel are nutritionally required at trace concentrations, nickel is an IARC group 1 carcinogen, and cobalt is an IARC group 2b possible human carcinogen. In tested samples Cobalt was not detected but the concentration of Nickel was present around 0.23ppm. They are related immunologically in causing metal sensitizations including epidermal and oral allergic contact sensitizations, contact dermatitis inflammations, pulmonary inflammations and pneumoconioses, and asthmatic conditions[12]. Once sensitized to one of these metals, immunological cross

sensitization to the other is often observed, since they share an endothelial inflammatory activation pathway. Like many of the other metals, nickel bio accumulates. Nickel concentrations have been reported to be significantly higher in all five lobes of smokers' lungs compared to nonsmokers' lungs[13]. Nickel has been reported as present in significantly higher concentrations in placenta samples of smokers than in placenta of non - smokers, affirming systemic absorption from the lungs[14].

Arsenic is an IARC group 1 human carcinogen[15]. The analysis of trace metals from the palms of Beedi rollers revealed the presence of Arsenic in trace amounts (0.08%). Arsenic is readily absorbed as a consequence of oral or inhalation exposure and has been associated with toxicities related to and causing vasoconstriction and other cardiovascular effects, lung cancers, dermal cancers, and dermal sensitization. Correlations between arsenic exposure and biomonitoring levels are difficult, since arsenic is rapidly cleared from the blood with a half - life of three to four hours[16, 17].

5. Conclusion

It was realized from this research that most of the heavy metal contents measured were higher than the recommended permissible limit with the exception of Cobalt and cadmium.

Exposure to unburnt tobacco via cutaneous or nasopharyngeal route result in significant uptake of these metals. These exposures may have significant health ramifications including increased inflammatory and fibrotic lung diseases and cancers, oral inflammatory diseases, Skin diseases, asthma, suppression of immune resistance, and possibly other pathological consequences.

6. Recommendations

Create awareness among Beedi rollers regarding adverse effects of their occupation and safety measures that has to be taken

There is a need to provide alternative livelihood options from the point of view of economic viability and skills of women.

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