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A REVIEW ON: HEAVY METALS IN CIGARETTE

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ABSTRACT

Metals are essential for a number of physiological processes in the human body, but can also be detrimental to our health when the concentration is not within the WHO/FAO/JECFA recommended permissible limits. The contents of selected Heavy Metals in tobacco and cigarette brands sold in the Wa Municipality of Upper West Region of Ghana were determined by Atomic Absorption Spectrometry (AAS). Average concentrations of Arsenic, Lead, Cupper, Iron, Zinc, Manganese, Cadmium, Nickel, Chromium and Selenium in tobacco and different cigarette brands were determined and compared to WHO/FAO/JECFA or other regions permissible limits of the Daily Intake or Provisional Tolerable Weekly Intake of tobacco and cigarettes. The results obtained in this study estimate the mean of Lead, Manganese and Cadmium was slightly higher than the recommended permissible limits of WHO/FAO/JECFA and other regions and the necessary conclusions were drawn.

1. INTRODUCTION

The heavy metals are widely dispersed in the environment, and at excessive levels, are very toxic to humans [1]. Chronic exposure to these substances may also be hazardous. Although these metals occur naturally, exposure may be increased by human activities that release them into the air, soil, water and food, and by-products that contain heavy metals. Certain plants also have the ability to accumulate heavy metals that have no known biological function [2]. Tobacco plant is amenable to absorb and accumulate heavy metal species from the soil into leaves [3]. Tobacco plants transport metal ions from the soil through the roots into the leaves [4], [5]. Trace amounts of heavy metals accumulate in the leaves, and they are known to transfer in trace quantities from the cured and processed tobacco to mainstream cigarette smoke. These metals include cadmium, lead, arsenic, iron, copper, chromium, nickel, and selenium [6], [7], [8]. The most abundant redox inactive metals in cigarette smoke generally are cadmium, lead and arsenic.

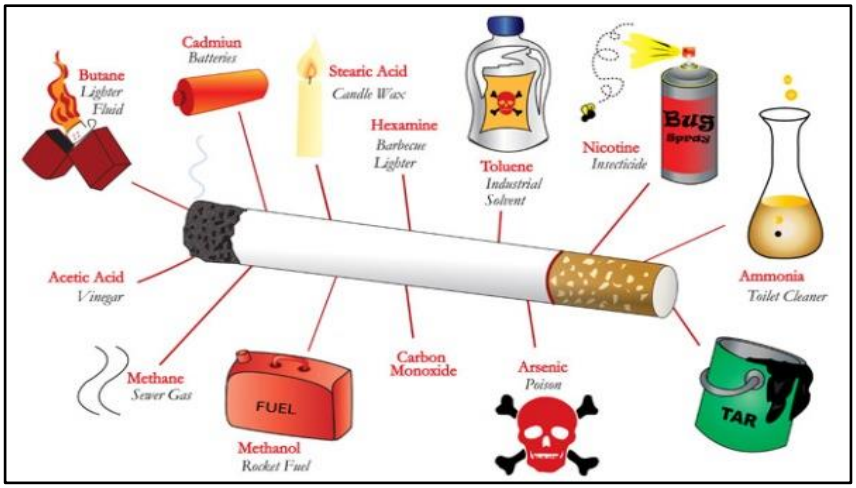

Figure 1: Chemical and Toxic metals in Cigarette

Chronic exposure to lead can result in decreased neurological performance. In pregnant women, exposure to high lead levels may cause miscarriage, and chronic exposure may affect the development of the foetus. Methyl mercury may cause numbness and tingling and in the extremities, blurred vision, deafness, lack of muscle coordination and intellectual impairment, as well as adverse effects on the cardiovascular, gastrointestinal and reproductive systems [9]. Tobacco smoking has been identified as a major serious Public health issue and contributes to high mortality and morbidity of both smokers and passive smokers. Some surveys clarified that the contents of certain chemicals especially cadmium in fats, blood and liver tobacco smokers are much higher than those of non-smokers [10], [11], [12]. Tobacco kills approximately 6 million people and causes more than half a trillion dollars of economic damage each year [13].

Heavy Metals Present in Cigarette

1. Cadmium (Cd)

Cadmium is one of the most concerning heavy metals found in cigarette smoke. It is primarily a byproduct of industrial activities, such as mining and smelting, and it accumulates in tobacco plants through contaminated soil and fertilizers. Studies have shown that smokers have higher levels of cadmium in their kidneys and lungs compared to non-smokers [21]. Long-term exposure to cadmium can lead to kidney damage, lung cancer, and osteoporosis [15].

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2. Lead (Pb)

Lead is another heavy metal commonly found in cigarette smoke. Tobacco plants absorb lead from soil, water, and air, contributing to its presence in cigarette products. Lead exposure is particularly dangerous because it can accumulate in the body over time, causing neurological damage, especially in children. In adults, chronic exposure to lead can result in high blood pressure, kidney disease, and cardiovascular problems [17].

3. Arsenic (As)

Arsenic, a well-known carcinogen, is present in tobacco plants due to the use of arsenic-based pesticides and environmental pollution. The combustion of tobacco releases arsenic into cigarette smoke, which is then inhaled by smokers. Arsenic exposure is linked to skin, lung, and bladder cancers, and it can also cause cardiovascular diseases and diabetes [20].

4. Nickel (Ni)

Nickel is found in cigarette smoke as a result of its presence in soil and air pollution, particularly in industrial areas. Nickel is a potent carcinogen and has been associated with lung cancer in smokers. It also poses risks for respiratory diseases, kidney damage, and cardiovascular disorders[16].

5. Chromium (Cr)

Chromium, particularly in its hexavalent form (Cr(VI)), is a toxic metal that can cause lung cancer and

respiratory diseases when inhaled. Tobacco plants absorb chromium from contaminated soil, and smoking is a major source of chromium exposure. Hexavalent chromium is a known human carcinogen, and chronic exposure through smoking can lead to both cancer and other systemic health issues [14].

Health Implications of Heavy Metal Exposure from Smoking

Heavy metals in cigarette smoke contribute significantly to the harmful effects of smoking. The inhalation of these metals can lead to a variety of chronic health conditions:

Cancer:

Metals such as cadmium, arsenic, and chromium are well-established carcinogens. Exposure to these metals through smoking increases the risk of lung cancer, bladder cancer, and other forms of cancer [15].

Cardiovascular Disease:

Lead and cadmium have been linked to an increased risk of cardiovascular diseases. Studies suggest that smoking leads to the accumulation of these metals in the cardiovascular system, which contributes to high blood pressure, atherosclerosis, and an increased risk of heart attack and stroke [21].

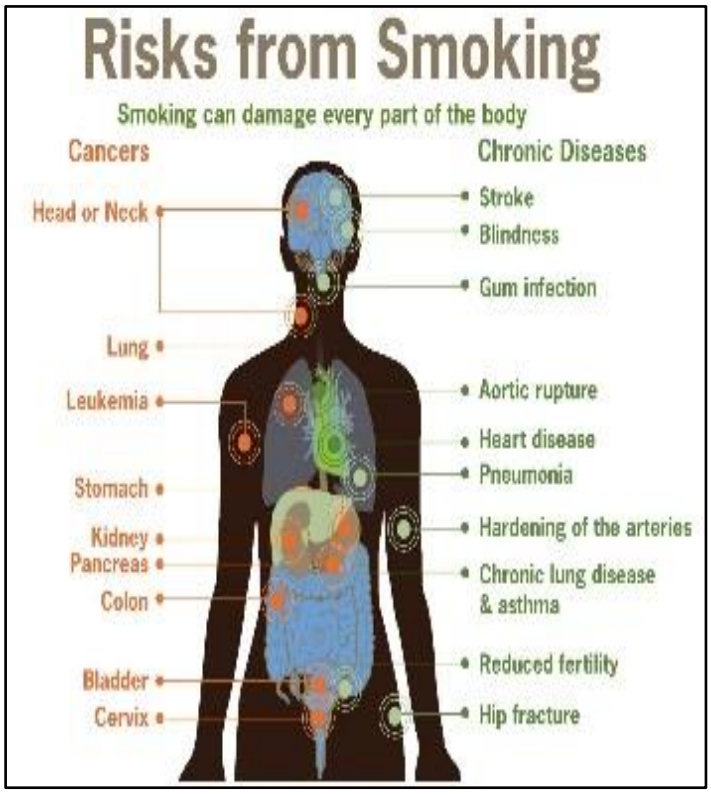

Figure 2: Risk factors

Kidney Damage:

Cadmium is particularly toxic to the kidneys, and smoking has been shown to accelerate kidney dysfunction. Smokers with high cadmium exposure are at greater risk of developing kidney disease, particularly in later stages of life [19].

Neurological Impairment:

Lead exposure from smoking is associated with cognitive decline and other neurological effects, especially in children and pregnant women. In adults, lead has been linked to increased risk of dementia and reduced cognitive function [17].

Sources of Heavy Metals in Cigarettes

The primary source of heavy metals in cigarette smoke is the tobacco plant itself. These metals are absorbed from the environment during cultivation, particularly from contaminated soil, water, and air. Industrial pollution and the use of pesticides also contribute to the accumulation of heavy metals in tobacco plants. During the manufacturing process, tobacco may be further contaminated, and although some metals may be removed during processing, many remain in the final product.

Cigarette smoke contains fine particulate matter that delivers these toxic metals directly to the lungs, where they are absorbed into the bloodstream. Once in the body, these metals can accumulate in organs, contributing to chronic disease over time [18].

2. CONCLUSION

The presence of heavy metals in cigarette smoke is a significant health concern. These metals -cadmium, lead, arsenic, nickel, and chromium—pose serious risks to smokers, contributing to a range of diseases, including cancer, cardiovascular disease, kidney damage, and neurological disorders. The accumulation of these metals in the body over time highlights the long-term health dangers of smoking, emphasizing the need for continued public health efforts to reduce smoking rates and educate the public about the risks associated with tobacco use.

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