Trace Metal Content in Different Brands of Cigarette sold in Samaru, Zaria, Kaduna State, Nigeria

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ABSTRACT

Five brands of cigarette were randomly sampled and analyzed for heavy metals. The brands include Aspen, Benson, Dunhill, Pall-mall and Rothmans. From the result obtained, concentration of Zinc was found to range between 11.1 - 4.15 mg/kg, concentration of Copper ranges between 13.65 - 4.55 mg/kg and Iron concentration ranges between 7.4 - 1.85 mg/kg. Nickel and Lead concentrations were found to range between 30.75 - 7.7 mg/kg and 32.6 - 17.4 mg/kg respectively. Lead was found to be highest in three brands (Rothmans, Pall-mall and Benson) respectively while Nickel was highest in two brands (Aspen, Rothmans) respectively. Generally the levels of the content of some of the metals in all the brands were low compared with the values set by world health organization (WHO) and accepted by standard organization of Nigeria (SON), it was believed that continuous bio-accumulation of heavy metals through smoking of cigarette may lead to additional health complication apart from the inherent dangers to which cigarette is known for.

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Introduction

Tobacco is a type of plant with leaves that are dried and used for smoking in pipes, cigarettes and cigars. It is also an agricultural product processed from the leaves of plant in genius ''*Nicotania*'' it can be consumed, used as pesticides and in the form of Nicotine tartorate used in some medicine [1].

The consumption of tobacco and number of smokers has been increasing steadily all over the world. The use of cigarettes constitutes one major cause of mortality and mobility in the world. In the tobacco plantation, herbicides and fungicides are used to control the various parasites and plant diseases. Tobacco smoke has toxic carcinogenic compounds containing about 400 identified chemical compounds. Cigarettes smoke is very harmful and toxic to human health of these toxic materials are heavy metals, particularly cadmium and lead inhaled through [2].

Several heavy metals found in tobacco smoke such as Cd, Cr, Pb, Fe, and Ni also accumulate in tissues and fluids through smoking [3]. Tobacco smoking is the most important single source of Cd exposure in the general population. The most important sources of Cd in humans are through smoking and food. Cadmium can enter the body through tobacco smoking, diet, drinking water, and inhaling it from the air. Small amount of Cd taken over many years may causes kidney damage and fracture of bones since Cd is mainly stored in bones, liver and kidneys [4]. Furthermore, Cd causes stomach irritation, vomiting and diarrhea. Cadmium and lead present in tobacco smoke contribute substantially to cancer risk [5].

Cigarette smoke contains substantial amounts of Cd, one pack of cigarette deposits 2-4 µg into the lungs of a smoker which means, for 20 cigarettes smoked, approximately 2-4 µg of Cd is inhaled by the smoker and as much as a microgram of Cd spreads into the environment. It was reported that the mean content in filter cigarettes tobacco sampled from Finland were 1.7 and 2..4 μg^{-1} (dry weight) for Cd and Pb respectively [6,7].

Lead is a highly toxic metal and is capable of causing serious effects on the nervous system and red blood cells. An increase of Pb levels is associated with a decrease in the intelligence quotient (IQ) levels and potential behavioral problems. A survey of middle-aged men in 24 British towns showed a strong association between blood Pb concentration, alcohol and cigarette smoking. Smoking of 20 cigarettes a day has been estimated to result in the inhalation of 1-5 µg Pb. The World Health Organization estimates 2-6 % of Pb in cigarette is inhaled by the smoker. It was reported that Pb in tobacco has been associated with impaired fetal growth and brain development [8-11].

It was revealed that the overall prevalence of smoking was 21.1 % for males and 0.9 % for females. Most smokers (78 %) were young to middle-aged ranges from (21 – 50 years old). Smoking prevalence was higher among married people, uneducated people, and those in certain occupations like manual workers, businessmen, army officers and office workers [12].

This paper reports a study on the level of some trace elements in different brands of cigarette sold in Samaru Zaria, Kaduna State, Nigeria.

Experimental

Sampling

Five different brands of cigarette with names Rothman, Dunhill, Benson, Aspen and Pall-mall were purchased randomly at Samaru, Zaria. The name of each cigarette was retained as its sample name. They were directly taken to the laboratory in their sealed packages for analysis.

Sample Pre-treatment and Analysis

The mixture was prepared by removing the papers and filters of the 5 sticks of each brand, and was labeled appropriately; care was taken to avoid any contamination.

Preparation was carried out in a clean environment, samples were weighed into a digestion flask, 10 cm^3 of HNO$_3$-HClO$_4$ acid mixture ratio (ratio 4:1) by volume was added and content mixed. The flask was placed on hot plate inside a fume cupboard. Temperature was set at 150 ^{o}C and the sample was digested for 90 minutes, 2cm^3 of HCl was added and the content was heated for 30 minute. 30 cm^3 of distilled water was added and then filtered into a 50cm^3 volumetric flask and made up to the mark. A buck scientific model 200A Atomic Absorption Spectrophometer (A.A.S) was used for the trace metal analysis [13-14].

Result and Discussion

The levels of copper, iron, nickel, lead and zinc in the various brands of cigarette sampled are illustrated in Figures 1 to 5, respectively, and a comparative data is presented as Figure 6.
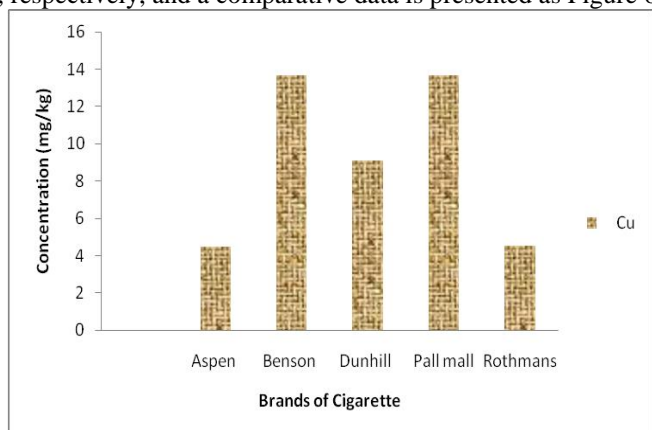

Figure 1: Concentration of Copper (mg/kg) as found in the five brands of cigarettes sold in Samaru, Zaria.
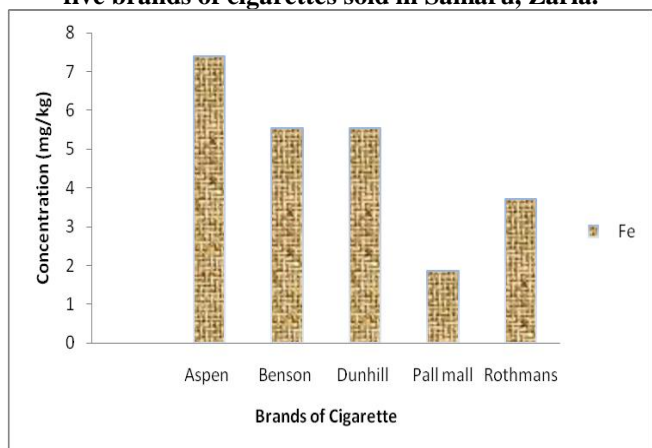

Figure 2: Concentration of Iron (mg/kg) found in the five brands of cigarette sold in Samaru, Zaria
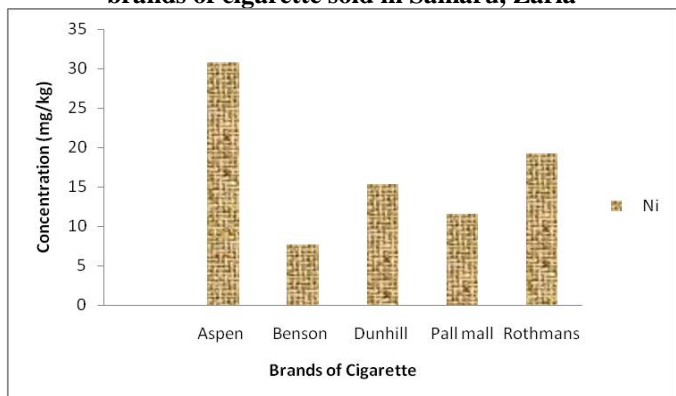

Figure 3: Concentration of nickel (mg/kg) as found in the five brands of cigarette sold in Samaru, Zaria.
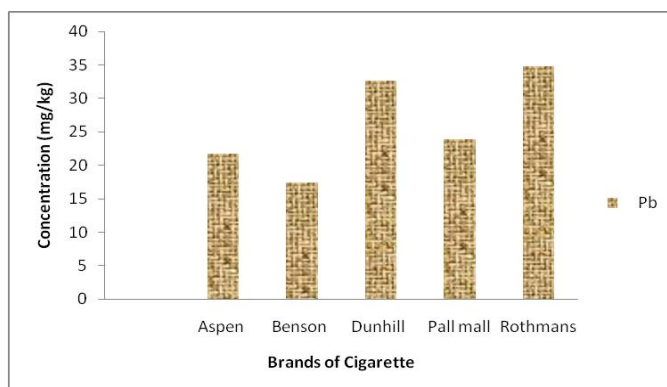

Figure 4: Concentration of lead (mg/kg) found in the five brands of cigarette sold in Samaru, Zaria.
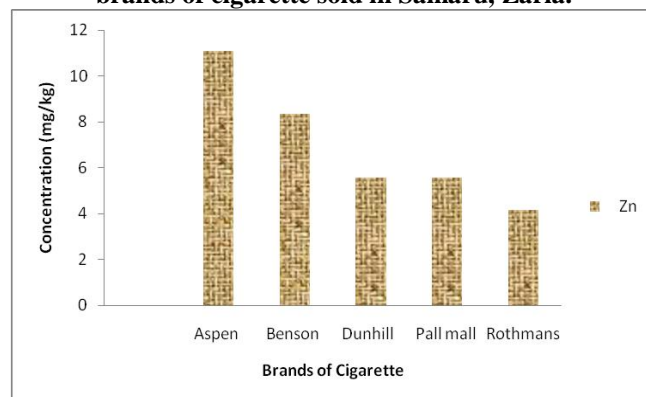

Figure 5: Concentration of zinc (mg/kg) found in the five brands of cigarette sold in Samaru, Zaria
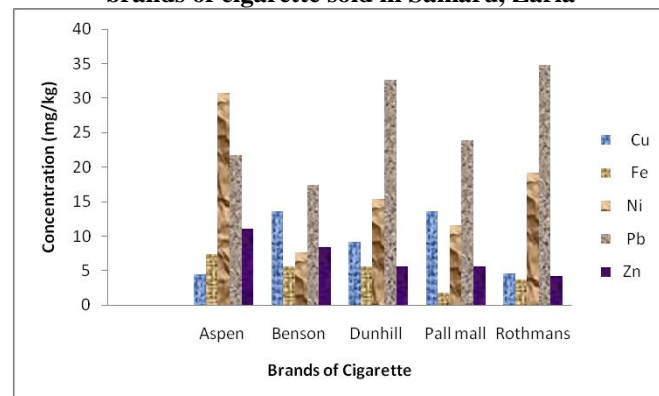

Figure 6: Comparing the concentration (mg/kg) of all the trace metals found in the five brands of cigarette sold in Samaru, Zaria

Various systems are affected by a deficiency or excess of trace element such as Zinc, Copper and Iron or by the negative effect of element that contribute to metal pollution poisoning such as Lead and Cadmium. As a consequence, any of the specific diseases caused by any of these elements may occur or they may contribute as important factors in the occurrence of various diseases [15].

From Figure 4, the concentration of Pb was seen to be highest with (34.8 mgkg^{-1}) in Rothmans followed by 32.6, 23.9, 17.4, 21.75 mgkg^{-1} for Dunhill, Pallmall, Benson and Aspen respectively. Generally high concentrations of Pb lead to a disease condition which is characterized by blindness, deafness, hypertension, impairment of kidney function and neurological disorder [16].

The levels of Copper in the five brands of cigarette were obtained as 45.5, 13.65, 9.1, 13.65 and 4.55 mgkg^{-1} for Aspen, Benson, Dunhill, Pall-mall and Rothmans respectively, while the

lowest concentration was found in Aspen with concentration of 4.5 mgkg-^{1} as shown in Figure 1. Cu is known to play essential roles in the proper functioning of various enzymes and other circular proteins may become toxic on excessive accumulation of intracellular tissues by initiating the generation of detoxification of reactive species and apoptotic [17].

Ni content of the five cigarettes was found to be 30.75, 7.7, 15.4, 11.55 and 19.25 mgkg-^{1} for Aspen, Benson, Dunhill, Pall-mall and Rothmans respectively, with the highest concentration found in Aspen and lower in Benson as in Figure 3. The results indicate higher levels of nickel when compared with the 4.01mgkg^{-1} reported by Anhwange *et al.* [11].Tobacco plants are known to absorb from the soil and accumulate it in the leaves. Continues smoking of cigarette may lead to bioaccumulation of this metal beyond threshold or critical limit, this may react with some biochemical substances in the body resulting to highly toxic compounds that may pose some health threat to individual [17].

Zn concentration in the five brands was found to be 11.1, 8.35, 5.55, 5.55 and 4.15mgkg^{-1} for Aspen, Benson, Dunhill, Pall-mall and Rothmans respectively with Aspen having the highest concentration followed by Benson as shown in Figure 5. This result is lower than 61.80 mgkg^{-1} reported for heavy metals in cigarette in literature [15-17]. Zinc is known to aid a lot of biochemical reactions in the body, for example it support healthy immune system, synthesis of DNA, alcohol and sugar metabolism [17].

The level of Fe shows that Aspen contains highest concentration of 7.4 mgkg-^{1} and lowest found in Pall-mall being 1.8 mgkg-^{1} as in Figure 2. Fe forms an important role in human metabolism and its excess may be fatal to human health. Although, clear variation could be established regarding the level of each heavy metal with cigarette brand (Figure 6), the results generally indicated the existence of all metals to significant concentrations. Therefore, samples in circulation should not be considered very suitable for consumption.

Conclusion

The study has revealed that most of the cigarettes in Samaru area contained substantial levels of trace metals. Their immediate effects are not apparent but constant bioaccumulation may result to adverse health effects. Due to large consumption of tobacco in Nigeria, a study of metals in tobacco product is desirable therefore it is necessary to measure these trace elements in tobacco for assessing the possible role they may play to cause some diseases.

Since heavy metals once absorbed, have long biological half life, the presence in tobacco may result to chronic adverse effect on the individual. It is therefore pertinent that these metals are checked during processing before final packaging.

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