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Assessment of Cr, Cd and Pb Levels in Tobacco Leaves and Selected Cigarette Samples from Ilorin Metropolis Kwara State, Nigeria

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ABSTRACT: The levels of Cr, Cd and Pb in tobacco leaves and some cigarette samples from Ilorin metropolis, Kwara State, Nigeria were collected and analyzed after wet digestion with a freshly prepared 65% HNO_3 and35% HCl using atomic absorption spectrophotometry Model No PM 8251 single pen recorder. The results obtained reveal the presence of Cr and Cd in all samples including tobacco leaves. However, Pb was not found in all the samples within the limit of determination. The concentration ranges of Cr and Cd in the samples are 60-100 µg/g and 4-20 µg/g respectively, which was found to be lower than the WHO standard.

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In recent time, the rate of consuming tobacco products and number of smokers have been increasing steadily world over. Tobacco (*Nicotiana tabacum* L.), a commercial plant possesses leaves used in producing cigarette. It naturally accumulates high concentration of heavy metals in the leaves, particular cadmium (Kaličanin and Velimirović, 2012; Ajab *et al.,* 2014). Most heavy metals are toxic, while some are non-essential (e.g Cd, Pb, Cr) to plant and human (Verma *et al.,* 2010). These heavy metals are highly hazardous and carcinogenic even in trace concentration. Heavy metals mostly result to damaging human health (Sharma and Dubey, 2005; Lugon-Moulin *et al.,* 2006). Bone and kidney diseases' resulting from cadmium and lead is accompanied with neurological disorders (Nnorom *et al.,* 2005). Metabolic disorder is accompanied with excess copper and zinc and potentially results to death (Stojanovic *et al.,* 2004; Zhang *et al.,* 2005). Tobacco smoke is one of the main sources of heavy metals in our environment. Smokers and non-smokers inhale these heavy metals through cigarette smoking which is the major source of intake. Heavy metals accumulation in tobacco plants occurs from complex interaction between soil and plant and also depends on soil type, pH value, water quality used for irrigation, type of tobacco plant and metal chemical composition (Golia *et al.,* 2008). During tobacco plant production, fertilizers and pesticides that contain high metal concentration are used by farmers in large amount and assist pollution of agricultural soil and plants (Karaivazoglou *et al.,* 2007; Lecours *et al.,* 2012). pH, soil type, organic matter solubility are factors that govern adsorption and distribution of heavy metals (Noler 2006).About 443,000 deaths were recorded per year in United States which was caused by smoking cigarette. Nicotine addiction results from related diseases, which leads to inhaling various toxicants in cigarette smoke and heavy metals repeatedly (Family Smoking Prevention and Tobacco Control Act, 2009).Usually, cigarette is made up of tobacco, paper and additives. About 600-1400 additives on exposure to heavy metals such as lead, mercury and cadmium are used in manufacturing of cigarette and contains environmental contaminant which is a serious growing problem all over the world (Nnorom *et al.,* 2005). For different brands of cigarettes, tobaccos are cut and mixed based on recipes for tobacco production. This brand recipe contains ingredients and flavors which gives each brand its rare characteristics when added to the tobacco (Jack *et al.,* 2004). This research work reports the Cd, Cr and Pb concentrations in seven cigarettes and tobacco leaves sold in Ilorin, Kwara State.

MATERIALS AND METHODS

Sample Collection: Five packs of seven brands of cigarettes each were purchased in five different locations within Ilorin metropolis, Kwara State. The areas are; Malete, Agbo Oba, Yakuba, Oja Oba and Offa Garage. Tobacco leaves was obtained from a

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farm in Malete community. The samples were listed in table 1:

Preparation of Reagent: A 65 mL of concentrated nitric acid was measured into a 100 mL standard volumetric flask and 35 mL of concentrated hydrochloric acid was added gently so as to prepare 65/35% (v/v) HNO_3 and HCl solutions which was used to digest all the samples collected respectively.

Table 1: Brand name, Country of manufacture and Sources of cigarettes

Brand name	Country of manufacture	Sources
Benson and Hedges Switch	Nigeria	Local
London Menthol	Nigeria	Local
St. Moritz	Nigeria	Local
Pall Mall	Nigeria	Local
Oris	UAE	Local
Edge	Korea	Local
Chesterfield Mint	Switzerland	Local
Tobacco Leaves	Nigeria	Local

Sample Digestion: A 5 g of the cigarette samples each was weighed and dried in an oven at a temperature of 105 °C for 1 hour and then cooled in a desiccators.The digestion of the samples was carried out by using wet digestion method (Noler e*t al,* 2006). A 5 g of the cigarette samples each was treated with 45 mL of freshly prepared 65/35 %(v/v) HNO_3 and HCl, the mixture was heated gently to boiling on a hotplate for 15 min until the sample had completely bleached. The mixture was cooled and diluted with 20 mL deionized water which was then filtered into 100 mL volumetric flask. The resulting solution volume was made up to the mark with deionized water. Atomic Absorption Spectrophotometer (AAS) was used to analyze the heavy metals (Cd, Pb and Cr) present in the digested samples (Noler e*t al,* 2006).

RESULTS AND DISCUSSION

Table 2 shows that sample A7 contains more cadmium with 4.5 µg/gcompare to sample A1 and A3both having 1.2 µg/g, while sample A2, A4, A5, A6 and A8 contains 1.04, 1.18, 0.96, 0.78 and 0.56 µg/g respectively. Cadmium content in all the samples are below WHO recommended value for daily and weekly intake (see Table 3) except for sample A7 with cadmium content within the WHO permissible limit. Also, chromium content (7.94 µg/g) in sample A3 is higher compare to sample A1, A2, A4, A5, A6, A7 and A8 with4.98, 4.44, 7.54, 7.66, 7.36, 5.28 and 6.46 µg/g respectively. Chromium content in the samples is within the standard regulatory limits of heavy metals in plants as shown in table III and within WHO recommended value for daily and weekly intake. Lead was not detected in all the samples. It can be deduced that the concentration of cadmium content in all the samples analyzed is lower when compared with the results of similar research on cigarettes (Muller *et al.,* 2000).

Table 2: Chromium, Cadmium and Lead Concentration in Digested Samples

S/N	Sample ID	Cr (µg/g)	Cd (µg/g)	Pb (µg/g)
1	A1	4.98±0.12	1.20±0.02	ND
2	A2	4.40±0.02	1.04±0.02	ND
3	A3	7.94±0.06	1.20±0.02	ND
4	A4	7.54±0.10	1.18±0.12	ND
5	A5	7.66±0.05	0.96±0.01	ND
6	A6	7.36±0.04	0.78±0.01	ND
7	A7	5.98±0.02	4.50±0.07	ND
8	A8	6.46±0.02	0.56±0.02	ND

A1 = Pall Mall, A2 = Chesterfield, A3 = Benson and Hedges, A4 = London Menthol, A5 = St Moritz, A6 = Edge, A7 = Oris, A8 = Tobacco leaves, ND = Not detected.

Table 3: Standard Regulatory Limits of Heavy Metals in Plants (Muller *et al.,* 2000).

Metals	Concentration (µg/g)
Cd	0.1-1.5
Cr	0.1-1.5
Pb	0.05-3.0

Table 4: WHO/FAO Heavy Metals Daily and Weekly Permissible Intake

Metals	Daily intake (µg/g)	Weekly intake (µg/g)	References
Cd	0.2-1.0	3-5	WHO
Cr	0.2-1.0	3-5	WHO
Pb	5	25	FAO/WHO

*Conclusion***:** The study revealed normal concentration levels of Cd and Cr in cigarettes and tobacco sold in Ilorin metropolis, Kwara State Nigeria for daily and weekly intake. Lead (Pb) was not detected in all the samples investigated. Therefore, smokers of cigarettes in Ilorin metropolis are exposed to hazards of these metals than non-smokers. Thus, more efforts should be made by creating awareness on the dangers of cigarettes smoking and discourage its consumption.

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