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ETERMINATION OF HEAVY METALS IN CIGARETTE AND BLOOD OF ACTIVE AND PASSIVE SMOKERS

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ABSTRACT

Fifteen samples of different brand of cigarette and the blood of passive and active smokers were analyzed for heavy metals. Cadmium (Cd) Lead (Pb) and Chromium (Cr) were detected in the tobacco leaf with wrapper of all the fifteen brand of cigarette analyzed. Copper (Cu) was detected in all except one with a concentration range of 0.783 ± 0.053μg/g. to 19.483 ± 0.800μg/g. The raw tobacco leaf contain 1.233 ± 0.664 of Cu and 1100 ± 0.071μg/g of Pb .The concentration of Cu in the samples studies ranged from N.D to 186.100 ± 11.653 μg/g In the ashes of four (4) brand analyzed there were reduction in the concentration of Cu with increase in the weight of the butt. Cu was detected in one of the blood sample analyzed. 2/3 of the blood samples contained (Cr) in the ranges of 0.92 to 2.156 μg/ml, the contents of the Pb, in the blood of the active and passive smokers were consistently higher than the permissive level of 0.2ppm lead. Lead concentration ranged from 0.304 to 5.656 μg / ml .
Keywords: Tobacco, organometallic, smoke, butts.

TRODUCTION

garette are defined as "a roll of tobacco wrapped in a paper or a substance containing tobacco (Baker F 00) Cigarette look deceptively simple, consisting of paper tubes, chooped up tobacco leaf and a filter at a uth end (the butt). They are highly engineered product designed to deliver a steady dose of otine,which is most toxic(Milne A 1998). Nicotine is highly poisonous alkali that occur in tobacco ve.It is a lethal substance used as a powerful agricultural insecticides, absorption of 500mg of, it kill adult a few minute (Synder 1995, Rowland 2001). In addition to tobacco leaves it contains filters made from ns which are mixed with water and various flavouring and additives to make it acceptable to the sumers (Glantz 1996). Cigarette smoking which are accepted by society as harmless and pleasurable is y connected with much health hazard such as heart and lung damage and cancers. However, many are ignorant of the fact that second-hand smoke is first hand damage (Ong ,E.k etal 2000). Researches as wn that smokers have decided to accept the eventual premature death penalty associated with smoking nsome Kuti 1999, Moon-Shang .T 1996). It now appears that smokers not only injure themselves, but n others as well as the environment as result of pollutant they exhale which is now classified as ironmental tobacco smoke(ETS). As they chose to destroy themselves, they knowingly or unknowingly y others around them along the path of destruction as non-smokers inhales this environmental tobacco ke. They are known as passive smokers (Synder C.H. 1995). These passive smokers are at a risk of tracting lung cancers from exposure to cigarette smokes from active smokers as well as the risks of other ards associated with smoking (USDHHS. 1989, Synder 1995, Olowu et al 2004). When you breath in acco smoke more that 3,700 toxic substance (many of them causing cancer) hits your lungs. Poisonous pounds like carbon monoxide, hydrogen cyanide, ammonia gas and powerful cancer causing substance as benzo(a) pyrene and formal dehyde enter your blood stream (BCMH 2000, Dube M 1982, noshng 1996). The combustion product of carbon monoxide (Co) and hydrogen cyanide (HCN) often d up the oxygen essential for continual existence in haemoglobin causing shortness of breathe, a common blem in smokers (Olowu et al 2004). The more second hand smoke your breathe, the greater your risk of normally high heartbeats, low tolerance for exercise, lower lungs capacity, worse asthma, eventual heart ck or stroke. Cigarette smoking is a huge health problem accounting for one in every five death in British umbia, for every 13seconds someone in the world dies from tobacco related illness and every year acco kills 5.600 BritishColumbia,45,000Canadians,415.000Americans,3-5million people worldwide,85 ent of all lungs cancers and 33 percent of all strokes are caused by Tobacco (BCMH 1999). ironmental tobacco smokes has been found to contribute immensely to the pollution of the environment use it contains thousands of different chemical which are released into the air as pollutant (US surgeon 4, Rowland 2001).

Determination of Heavy Metals in Cigarette and Blood of Active and Passive Smokers

The combustion of tobacco in a cigarette produce thousand of compound by pyrolysis, pyrosynthesis, and / or combustion, distributed through gaseous particulate and aerosol phase (Plunkett S, 1999 et all, Rowland 2001). Tobacco smokes is made up of side stream smokes from the burning tip of the cigarette and main stream smokes that come out directly into the environment from the filter or mouth end inhaled by smokers which is later breathe out in whatsoever form it is which further pollute the environment. Many toxins are present in higher concentration in sidestream smoke than in mainsream smokes. Typically, nearly 85% of the smoke from cigarette to the environment results from side stream smoke (USG. 1984). These numerous chemical have negative impacts on human directly and on the three minimum inputs (Air, water and food) which are necessary for life. The air is polluted, water quality is degraded and toxic chemical enters into the food chain. Among the various chemical released to the environment from cigarette are the heavy trace metal. Many trace metal are essential at low concentration for normal life but they are the main source of metal toxicity problem in the environment at high concentration (Moon- Sang T.1996, Olowu et al 2004. HSC 2000). Most organism are not adapted to deal with this metal in the environment, thus these metal are not readily biodegraded. They persist in the environment and are bioaccumulated in one or more compartments of the food chain. They also form organometallic compound, which are more toxic than their elemental or ionic form in the environment (Oyewo 1998, Ayejuyo O.O.2004 Synder 1995). Tobacco smoking over several decade is a one cause of cancer in the lungs, pancrease, bladder , oesophagus, pharyx and possibly kidney and liver. The largest single preventable cause of ill-health in the world today is smoking (Olowu et al2004, Myer 1990, Irribarren1999). The paper analyzed the concentrations of heavy metal(Ph,Cd,Cr andCu) in cigarette, blood of active and passive smokers and their health effect with a view to proffering an elaborate preventive health warning signals of the ministry of health which says that smoker are liable to die young, which also, will mount higher pressure on the public and in the public to stop the habit of smoking .

MATERIAL AND METHODS

Sample Collection and Preparation

Cigarette sample

Between one and three packets of 15 brands of cigarettes were purchased from Oke Arin market, sampling were carried out over a period of three months at monthly interval.

Raw tobacco leaves sample

Cured raw tobacco leaves were purchased from three different markets in Lagos, Ikotun, Mushin, and Igana-Iba market. The leaves were mixed together and dried in the oven at 110°C e for 2hours. The leaves were blended using Binatone blender and sieved with a plastic mesh with stalks properly discarded. The sieved leaves were then dried in the oven at 110°C until constant weights were obtained. The constant weight dried leaves were allowed to cool in the desiccator and then kept in a sealed polythene bag. Sampling was carried out over a period of three months at monthly interval.

Blood sample

Blood samples from volunteer smoker and volunteer non-smokers were collected each into a lithium Heparin bottle and stores in a refrigerator maintained at 4°C.

Sample Preparation

Cigarette Butt and Tobacco Leaves

The butt and the paper wrapper of each brand of cigarette were removed from the stick. Between 0.90g and 1.00g of samples were weighed into a 250ml beaker. 3g of the cigarette tobacco leaves and the paper wrapper of each brand were also weighed into a 250ml beaker. 3g of the raw tobacco leaves was also weighed into a 250ml beaker. 40ml of 1:1 vol/lvol concentrated Nitric acid and Hydrogen peroxide were measured into each of the beakers. Each mixtures was allowed to digest until evolution of nitric oxide ceased and a clear yellowish or colourless solution prevailed . The period of digestion varied with the - minimum being 45 minutes while some digestion were aided with warming ..Each digest was then reduced to between 5ml and 10ml by heating on a hot plate at 40°C. The solutionS was filtered into a 25ml volumetric flask. Distilled deionised water was added to make up to mark (i.e. 25ml). The sample were put in polypropylene bottle prior to AAS analysis replicate analysis were carried out on the sample.

rious ways through which Cu can get into the body(Elinder et al.1983,Davinson et al 2001,Olowu et al 04). For every sample studied, one contained Cd, Cadmium was not detected in sample A, B, C and F, the sult for A,B,andC is expected since these volunteer were neither active nor passive smoker as at the time this research. Donor F is active smoker but Cd was not detected in his blood, the donor claimed to be ing a lot of herbs. The presence of Cd in the blood of donor D and E is expected because they were ablished passive and active smoker respectively. Passive smoker D has more Cd that the active smoker E d this is in agreement with the fact that more dangers are associated with second hand smoking as the side eam smoked inhaled by the second hand smoker is more toxic than the mainstream smoke inhaled by the tive smoker (British Columbia Ministry of health 2000, Elinder et al 1984,Olowu R.A et al2004). Lead b) were found in the blood of donor. A, B, D, E, and F but the highest concentration were found in D, E d F which ranged between 2.772 to 3.656µg/ml. . A closer examination of the result revealed that donor a passive smoker has the highest value. This results is consistent with the fact that secondhand smoker are en at greater risk than active smoker (Elinder et al 1983,British Columbia Ministry of health 2000, Olowu al2004). The lead concentration of donor A and B blood sample were above the permissible limit of 2ppm (Hick J 1982) which may be attributed to the intake of Pb from other sources. Donor B has lower ad content than donor A, which may probably have been store in his brain.Lead (Pb) has be reported to be ored normaly in the brain therefore lead(Pb) measurement could reflect only recent exposure, it does not ccurately evaluate lead (Pb) concentration in the brain (Personal health lifestyle 200) Cr was detected in ur out of the six blood donor sampled analyzed ranging from 0.920 to 2.15µg/ml. The results also shows at there were other route of exposure to this metal since trace of them were detected in the passive (non moker) (Olowu et al2004, Elinder et al 1983, Davison et al 1988).

ONCLUSION

conclusion , with the result obtained from this research more effort should be made by manufacturer in efining cigarette to reduce the heavy metal content because of the risk associated with these substances to alth and to the environment in general after smoking.

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Menthol and filtered cigarette preparation

Approximately 10g of each brand of Aspen and Business club (menthol and filtered) were weighed. An improvised smoking device was used to stimulate smoking. The ashes were collected and weighed and the butt (after smoking) were collected and weighed. The ashes were poured into a 250ml beaker with 30ml of the acid mixture. 40ml of acid mixture was used for the digestion of the smoked butts. Saimples were reduced to between 5 – 10mls by heating on a hot plates at a temperature of 40°C.The sample were made up to mark with distilled deionised water after filtration into a 25ml volumetric flask. The sample were transferred into polypropylene bottles for AAS analysis.

Blood sample preparation

5ml of each blood sample was measured into a 250ml beaker, 20ml of the acid mixture (1 : 1HNO_3 and 1$HClO_4$) was used for the digestion of each samples. Each was reduced ,filtered into a 20ml volumetric flask and made up to mark and later poured into polypropylene bottles and kept for AAS analysis. The analysis was repeated for blanks for each set.. The digest were analyzed for the metal using unicam 769 model flourme atomic absorption spectrometer .The moisture and ash content were determined according to the standard method (AOAC 1982)

RESULTS AND DISCUSSION

The results obtained from the trace metal analysis of the various cigarette samples are presented in table 1-5.Table 1 shows the results of analyzed tobacco leaves and the paper wrapper. The results of analyzed cigarette butt and its paper wrapper are presented in table 2. heavy metal content of menthol and filtered brands of Aspen and Business club cigarette are presented. Table 3 and 4. the result of the blood sample of the volunteers are presented in table 5. The tables 1 and 2 show that copper (Cu) occur in high concentration in the tobacco leaves and the paper wrapper and the butt of l the entire cigarette brand analyzed. The concentration ranged from 0.225 ± 0.009 µg/g to 19.483 ± 0.833 µg/g in the leaves and 1.463 ± 0.740 µg/g to 186.100 ± 1.650 µg/g in the butt which agrees with earlier report (Odukoya 1998, Olowu et al 2004). The concentration of copper was consistently high in most brand of the cigarette. The reason for this high concentration may be attributed to the fact that copper as a metal has not been reported in any known research as being toxic(Rowland, D.W 2001). Copper is needed for some metabolic process in the body of both plant and animal therefore low concentration is considered beneficial to the body (Oyewo 1998,Ayejuyo.O.O.etal 2004). Cadmium (Cd), lead (Pb) and chromium (Cr) were not detected in the tobacco leaves of all the cigarette brand analyzed which is in contrary to earlier report carried out by some researcher in New Zealand .. In the New Zealand analysis Cd concentration was found to be 0.23 ± 0.5 µg/g and that of lead was 0.48 – 0.55 µg/g. Cd was however found to be present in the butt and paper wrapper of four out of the 15 brands analyzed. The lowest value of 0.152 ± 0.023µg/g was found in golden gate while the highest concentration of 0.738 ± 0.216 ug/g was obtained in business club menthol. The Pb content of consulate butt was 6.161 ± 1.050 ug/g, Business club (filtered brand) 4.150 ± 0.920 ug/g while aspen (menthol brand)contained Pb concentration 0.875 ±0.350 ug/g. The high concentration could be attributed to the fact that butt of cigarette were not really meant for consumption, they are there to filter some unwanted substance from the inhaled smoke (Baker F.2000) . Twenty percent of the cigarette butt analyzed were found to contain Cr. Yes butt has Cr content of 0.434 ± 0.160ug/g while consulate butt contained 4.354 ± 0.050 ug/g. the result presented on table 1 shows that raw tobacco leaves contain 1.233 ± 0.660ug/g Cu and 1.100 ± 0.070 ug/g Pb.The butt and paper wrapper of cigarette after smoking showed the precence of Cu in all except in business club (menthol) as presented in table 4, Cd and Pb were detected in the butt (after smoking) of business club brands while Cr was not detected after smoking in all the samples studied which is in agreement with earlier report (Voges E,1984, Olowu et al 2003). The data on table 3 shows the concentration of the copper (Cu), which ranges between 3.797 ± 1.635 ug/g to 6.575 ± 1.03ug/g in the ashes of the four types of cigarette. Cadmium (Cd), Lead (Pb) and chromium (Cr)were not detected in the ashes of the four sample analyzed which negates some earlier reports (Olowu et al2004, Book et al 1990). However, this is expected because in the tobacco and paper wrapper analysis of the brands, they were not detected. However, the results of the analyzed cigarette ashes were compared and lower concentration value of copper were observed in the ashes of the tobacco leaves and paper wrapper. This is expected because some of the copper must have been consumed by the smokers while some would have been discharged via smoke into the environment(USG1984,Moon-Shang1996). The data on the table 5 represent the concentration of heavy metal in the blood. The level of copper in the blood samples ranged from 0.080µg/ml to 1.830µg/ml Cu was consistently found in the blood samples investigated. Copper is needed for metabolic process in the human body therefore it is expected to be present in the blood. The was no correlation of the value obtained from smokers and non smokers as body copper level depend on the metabolic process in individual and there are

ble 2: CONCENTRATION OF HEAVY METAL IN CIGARETTE BUTT AND WRAPPER

SAMPLES	Cu (ug/g)	Cd (ug/g)	Pb(ug/g)	Cr (ug/g)
St moritz	5.600 ± 0.911	N.D	N.D	N.D
Rothmans	1.463 ± 0.743	N.D	N.D	N.D
Consulate	7.694 ± 1.215	N.D	6.161 ± 1.055	4.354 ± 0.051
Grand	186.100 ±11.652	0.288 ± 0.065	N.D	N.D
Benson & hedges	3.913 ± 0.222	N.D	N.D	N.D
Super king	105.300 ± 5.252	N.D	N.D	N.D
London	5.838 ± 0.044	N.D	N.D	N.D
Yes	166.050 ± 2.265	N.D	N.D	0.434 ± 0.164
Golden seal	19.475 ± 1.025	N.D	N.D	N.D
Gold leaf	5.863 ± 0.867	N.D	N.D	N.D
Golden gate	3.215 ± 0.029	0.152 ± 0.02	N.D	N.D
Aspen menthol	6.525 ± 0.407	N.D	0.875 ± 0.357	N.D
Aspen filtered	5.625 ± 0.624	N.D	N.D	2.163 ± 0.912
Business club menthol	N.D	0.738 ± 0.216	N.D	N.D
Business club filtered	16.075 ± 0.936	0.563 ± 0.355	4.158 ± 0.924	N.D

ABLE 3: HEAVY METAL CONCENTRATION OF ASHES OF SMOKED CIGARETTE

SAMPLES	Cu µg/g	Cdµg/g	Pbµg/g	Crµg/g
Aspen menthol	5.003 ± 1.527	N.D	N.D	N.D
Aspen filtered	3.797 ± 1.635	N.D	N.D	N.D
Business club menthol	6.575 ± 1.036	N.D	N.D	N.D
Business club filtered.	5.950 ± 0.998	N.D	N.D	N.D

ABLE 4: HEAVY METAL CONTENT OF SMOKED CIGARETTE BUTTS

SAMPLES	Cu (µg/g)	Cd (µg/g)	Pb (µg/g)	Cr (µg/g)
Aspen menthol	4.273 ± 0.082	N.D	0.499 ± 0.195	N.D
Aspen filtered	8.144 ± 0.025	N.D	N.D	N.D
Business club menthol	N.D	0.065 ± 0.011	N.D	N.D
Business club filtered	7.850 ± 0.224	0.130 ± 0.92	4.005 ± 0.154	N.D

E 5: CONCENTRATION OF HEAVY METAL IN BLOOD OF SMOKERS AND NON SMOKERS

LES	Cu (µg/ml)	Cd ((µg/ml)	Pb ((µg/ml)	Cr ((µg/ml)
ol -Do not smoke nor drink.Hate e	1.312	N.D	0.7021	1.500
ked for 20years but stoppedsmoking months ago.	0.252	N.D	0.304	1.880
not smoke but drink.Doesnot nd smokers .Stays in his to drink .	1.312	N.D	N.D	N.D
nd hand smoker .A heavy drinker ways stay in the midst of smokers n't smoke actively.	1.832	0.112	3.656	2.156
e smoker	0.080	0.044	3.2418	N.D
e smoker	1.120	N.D	2.72	0.920

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Table 1: HEAVY METAL CONCENTRATION OF CIGARETTE (TOBACCO AND WRAPPER)

SAMPLES	Cu (µg/g)	Cd (µg/g)	Pb (µg/g)	Cr (µg/g)
St moritz	N.D	N.D	N.D	N.D
Rothmans	0.783 ± 0.053	N.D	N.D	N.D
Consulate	9.408 ± 0.040	N.D	N.D	N.D
Bond	13.158 ± 1.830	N.D	N.D	N.D
Benson & Hedges	11.692 ± 0.210	N.D	N.D	N.D
Super King	0.225 ± 0.009	N.D	N.D	N.D
London	19.483 ± 0.833	N.D	N.D	N.D
Yes	14.033 ± 0.721	N.D	N.D	N.D
Gold seal	17.175 ± 2.052	N.D	N.D	N.D
Gold leaf	11.117 ± 0.586	N.D	N.D	N.D
Golden gate	13.138 ± 1.800	N.D	N.D	N.D
Aspen menthol	9.842 ± 0.027	N.D	N.D	N.D
Aspen filtered	9.133 ± 0.925	N.D	N.D	N.D
Business club menthol	8.550 ± 0.925	N.D	N.D	N.D
Business club filtered	10.483 ± 1.854	N.D	N.D	N.D
Raw tobacco leaves	1.233 ± 0.664	N.D	1.100 ± 0.071	N.D