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NEW SUBSTANCES ABUSED IN MUBI, NORTH EAST NIGERIA

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ABSTRACT

Recent increase in the use of novel psychoactive and aphrodisiacs substances by some residents of Mubi and its environs with a corresponding potential risks effect on public health necessitated the evaluation of the safety of Maggi cubes in Coca cola, lizard waste solution and marsh gas. The chemical compositions and toxicological effects of these new substances of abuse were investigated in male Sprang Dawley rats. Solutions of the abused substances were prepared and were administered (3 mg/ml) to20 male rats orally for 30 days. The abused substances were investigated for the presence of alkaloids and biochemical effects on the body and organ weights, and liver function using standard methods. The three test samples showed reduced acidity from coca cola> marsh gas > lizard waste > distilled water. Elemental analysis showed presence of Cu, Zn and Fe within a range of 0.022 – 0.112ppm and Cu, Zn, Mg and Pb from 0.012 – 0.216ppm in maggi/coca cola and lizard waste solutions, respectively. All the substances were devoid of alkaloids. Significant ($p<0.05$) decreases were observed in body and organ weights for lizard waste treated rats compared to the control group. The maggi/coca cola group showed reduced body weights also. Significant ($p<0.05$) decrease was observed in the plasma aspartate aminotransferase (AST), alanine aminotransferase (ALT), and total bilirubin (TB) levels in all the treated animals compared to control group, while albumin (ALB) levels were slight increased. Coca cola/maggi, marsh gas and lizard waste solution showed decreased acidity levels compared to the control group. Likewise there were significant ($p<0.05$) differences in the weights of the organs of animals treated with the abused substance when compared to the control. The pattern of the results from the liver test and effect on various organ weights revealed the possible toxicity accompanying the use of these substances.

KEYWORDS: New substances, Maggi, Lizard, Marsh, Liver function

INTRODUCTION

The abuse of licit and illicit substances represents a major public health problem around the world. The costs of this problem to the society includes premature deaths, lost human potentials, drug-related illnesses, accidents, violent behaviours and crimes; loss of productivity and economic costs related to health care (UNODC, 2013). Several factors such as complex interactions of biochemical, psychological, physiological and sociological factors leading to substance abuse and addiction are yet

to be completely understood (U.S. Congress, 1994). Statistics showed that globally between 162 million and 324 million people aged 15-64 used an illicit drugs in 2012 (UNODC, 2014), among the predominant drug substances abused around the world are cocaine, heroin, atropine, amphetamine, marijuana, alcohol and tobacco (Slavit *et al*., 2009, UNODC, 2014). Medical experts have attributed several conditions such as mental illnesses, cardiac arrest stroke, cognitive underdevelopments, short term memory and a host of other chemically identifiable problems to substance or drug abuse (Savage *et al*., 2008).

The abuse of pharmaceutical agents such as Diazepam, Benelyn, Codeine, Rophynol and Tramal or Tramadol is quite popular among unemployed youths, people involved in strenuous activities such as farmers in some villages around Mubi, secondary school students and that of our Ivory towers are not spared as investigation has revealed that students in our higher institutions are fast neck dip in the practice, for the pleasure of getting 'high' as reported by Osa-Edoh and Egbochukwu (2012), who observed that drug abuse is not limited to any social and economic group. These "weird substances" was later observed to be among the substances that were been abused in Mubi town. Others include lizard waste (White portion), maggi cubes dissolved in soft drinks (Coca-Cola) and the sniffing of marsh gas from waste dumps or drainages (personal communication, 2012). Though it looks creepy, the lizard waste has traditionally been used (in mixture with some other substance) to treat wounds or boils on the skin by traditional medicine practitioners in Mubi and some other parts of the North Eastern Nigeria.

Coca-Cola has been in the market since the 1940s; however, its use with a soup seasoning/flavour enhancer (Maggi cube) as an abused substance is a new development. Locally this mixture is used as a first aid treatment for diarrhoea before seeking for proper treatment. The source or origin of this remedy is yet to be ascertained.

Marsh gas is known to be produced in marshy areas such as gutters, sewers or sewage or refuse dump. It is a product of microbial degradation of organic components; its use on initiation by drug users to attain a ''high'' is still not fully understood.

There is a paucity of information with regards to the justification of the use of these substances to get 'high' hence the chemical composition of these substances and their biochemical effects on laboratory rats were investigated to ascertain the possible consequences of the use of these substances and the potential risks it may pose to the consumer's health and public safety.

MATERIALS AND METHODS

Lizard wastes were collected from Mubi and its environs, Maggi cubes (Nestle Nigeria Plc) and Coca-Cola (Nigerian Bottling Company Plc),were purchased from ADSU, mini market. Marsh was collected from waste dump near Mubi River, and was transferred into a plastic bucket with a good cover to fit.

Sample Preparation

Maggi cubes Solution

Two cubes of Maggi cubes (8g) were dissolved with 50Cl of coke (coco-cola product) in beakers. The solution was stirred for about 40 mins until the cubes dissolved completely. The solution was transferred into a round bottom flask and stored in a refrigerator at 4ºC until needed.

Lizard Waste Solution

Half-tea spoon of lizard waste (4g) was weighed on a digital scale and dissolved in 250 ml distilled water in a beaker. The solution was stirred for about 40 minutes. It was filtered and stored at 4ºC in a refrigerator.

Marsh Gas Sample

Half-bucket of sample moist marsh gas was collected from a waste dump and the top of the bucket was tightly covered to prevent gas from escaping out. This was kept in a cold dried place until needed for further use.

Determination of Acidity of Samples

Acidity of samples was determined using titration. Lizard waste solution or Maggi solution was placed in a burette and titrated against 25ml of 0.2M NaOH a conical flask, phenolphthalein was used as indicator. The titration was repeated 3 times until the end point was reached. For the marsh gas, some quantity of the marsh was collected into a conical flask and sealed with a stopper. A moistened blue litmus paper was placed on the top of the conical flask after lifting the stopper slightly, such that gas liberated from the flask comes into contact with the litmus papers (Holding and Collee, 1971).

Determination of the Chemical Compositions of Abused Substances

The chemical compositions of the substances abused by some residents of Mubi were investigated by modified qualitative tests for alkaloids as these groups of compounds are known to have strong physiological activity. The Wagner's, Mayer's, Hagger's (Picric acid test), Dragendroff's and Tannic acid test were used to check for alkaloids (Dethe *et al*., 2014).

Biochemical Studies

A total of 20 male sprang Dawley rats were used for this study. The rats were housed in groups of five each, in metal cages. They were kept at the Biological Sciences Department, Animal House and fed with animal feed and water *ad libitum*. The rats were divided into four groups, Group 1 served as control**,** while rats in groups 2, 3, and 4 were orally administered 1 ml of Maggi cube/ Coca-Cola solution, Lizard waste solution or marsh gas, respectively. Each group received the respective treatment for 30 days.

The rats were weighed before the commencement of treatment and weekly throughout the duration (30 days) of the study**.** On the 31st day, after treatment, the animals were put under light chloroform anaesthesia and dissected. Blood samples were collected by cardiac puncture into EDTA bottles for estimation of biochemical parameters and the

organs such as the liver, brain spleen, heart and kidney were excised, washed with normal saline and weighed. The plasma samples were analysed for Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Albumin (ALB) and Total Bilirubin (TB). The levels of biochemical parameters (ALT, AST, ALB and TB) were estimated using the VITROS DT 60 Chemistry Analyzer Model 2004 (Ortho-Clinical Diagnostics, Inc. U.S.A) (Orthodox-Clinical Diagnostics, 2004).

Statistical analysis

Results are expressed as Mean ± SD, n= 5. The presence of significant differences among means of groups was determined by One-way Analysis of Variance (ANOVA), using Graph Pad Prism 5 (GraphPad Software, San Diego, CA, USA). Differences were considered to be significant if $P < 0.05$.

RESULTS

Results of the chemical analysis for alkaloids in samples showed that alkaloids were absent in all the samples using all the standard qualitative tests for alkaloids.

Table 1: Results of the pH analysis of the abused Substances

Sample	pH of sample
Coca-Cola/Maggi cube solution	4.6
Lizard waste solution	7.04
Marsh Gas	6.1
Control (Distilled Water)	7.2

Table 2: Result of the elemental analysis of the sample A and B(ppm)

Element	Maggi-Coca-Cola Solution	Lizard waste solution
Cu	0.022	0.012
Fe	0.016	ND
Zn	0.112	0.12
Mg	ND	0.823
Pb	ND	0.216

Table 3: Results of the Body Weights (g) of rats

Day(s)	0	4	8	12	16	20	25	30
Control	198.0± 12.6	201.7± 12.1	198.0± 10.7	199.9± 09.3	201.0 ± 11.2	207.3± 10.2	210.1± 08.6	216.5± 11.9
Marsh Gas	165.6 ± 17.5	166.4 ± 17.1	167.2 ± 17.2	167.8 ± 17.5	168.8 ± 16.7	169.6 ± 17.4	169.6 ± 17.4	169.8 ± 17.2
Coke/Maggi	188.0 ± 15.6	186.7 ± 15.8	185.5 ± 15.6	184.7 ± 16.8	183.0 ± 15.8	181.9 ± 15.9	177.7 ± 14.9	159.7 ± 15.0
Lizard waste	203.3 ± 22.1	200.9 ± 22.5	196.6 ± 22.9	190.6 ± 24.2	189.4 ± 24.4	188.1 ± 24.3	187.0 ± 24.3	185.7 ± 24.3

Results are presented as mean ±SEM. Means with * are significantly different from control (P<0.05).

Table 4: Result of Organ weights (g)

Organ	Control	Marsh Gas	Coca Cola/Maggi	Lizard Waste
Heart	1.32 ± 0.05	1.77± 0.05*	2.25± 0.20*	1.78 ± 0.23*
Kidney	1.72 ± 0.07	1.81 ± 0.01	1.72± 0.07	1.72 ± 0.07
Lung	1.60 ± 0.05	1.33 ± 0.07*	1.31 ± 0.08*	1.48 ± 0.17
Liver	6.51 ± 0.07	7.47± 0.56*	7.00 ± 0.38	6.45± 0.11
Brain	1.69 ± 0.04	1.77± 0.02	1.85 ± 0.09	1.81 ± 0.04
Spleen	1.60 ± 0.08	1.33± 0.08	1.31± 0.05	1.38 ± 0.04

Results are presented as mean ± SD. Means with * are significantly different from control (P<0.05)

Table 5: Results of the liver function of rats

Parameters	Control	Marsh Gas	Coke/Maggi	Lizard Waste
ALT(IU/l)	201.6 ± 49.4	19.6 ± 1.54*	18.6 ± 7.59*	68.9 ± 15.9*
AST(IU/l)	143.3 ± 35.5	26.3 ± 2.44*	24.4 ± 9.61*	63.8 ± 12.1*
ALB(IU/l)	1.57 ± 0.28	1.65 ± 0.06	1.36 ± 0.32	1.81 ±0.07
TB(mg/dl)	61.0 ± 0.74	3.54±0.55*	3.50 ± 0.20*	10.8 ± 0.01*

Results are presented as mean ± SD. Means with * are significantly different from control (P<0.05). **ALT**: Alanine amino transferase. **AST**: Aspartate aminotransferase, **ALB**: Albumin. **TB**: Total bilirubin

DISCUSSION

Substance abuse is a global phenomenon, and occurs in almost every country. Specific substances abused vary from country to country and from region to region in the same nation (UNODC, 2014). The chemical and biochemical analysis of Maggi cubes/Coke Solution, Lizard Waste Solution and Marsh Gas samples in Mubi and environs was performed using rat model. This was to understand the possible toxicological effects of these substances on the consumers' health. The pH analysis of the samples indicated that Maggi cube/Coca-Cola solution and marsh gas are acidic with pH of 4.6 and 6.1 respectively, while the pH of the lizard waste was neutral (Table 1).

Alkaloids are the most common group of compounds usually used as central nervous system stimulants especially in sports (Avois *et al*., 2006). Being abused substances that are used for attaining physiological ''high'', results of their alkaloid and nitrogenous base content when compared with quinine as standard drug, were negative. This early findings cast some doubts at the possibility of attaining the desired physiological effects as indicated by users during our field survey. The present line of evidence indicate that the consumption of these substances may be playing a placebo effect in the minds of the consumers of these substances as its effect may have been initiated and maintained by expectations of psychological high and changes in motivation/emotion associated with the consumption of these substances. Similar effects have been found on placebos user in trial experiments for pain relief (Luana and Fabrizio, 2005; Price *et al*., 2008). Many consumers of these substances also consume Indian hemp and abuse cough syrups which may be where they derive the 'high' effect they sought for.

The sniffing of the marsh gas which basic chemistry has shown to be methane (Godi *et al.,* 2013) and has been reported to be useful clinically (Wenwu *et al*., 2012) also comes with other known problems with regards to the health of the consumer, primarily the exposure to 'night air' or 'miasmic pathogens' known to cause cholera and other disease symptoms that are comparable to 'black death' (Sterner, 2007).

Elemental analysis of Maggi-Coca-Cola and lizard waste solution showed the presence of Cu, Fe, Zn, Mg and Pb in varying concentrations (Table2).The presence of these heavy

metals particularly in the lizard waste is of particular concern due to the persistence of these metals and their non-degradable nature. Lead (Pb) exposure from this source is of concern as it could lead to a host of neurological and reproductive problems when consumed over an extended period (Needleman *et al*., 1999).

The body weights of the animals treated with the abused substances over a period of thirty days showed significant ($P<0.05$) weight loses compared to the control group (Table 3). The percentage decrease in the body weight was remarkable in all the treated groups up till the seventh week and could be attributed to the suppression of the animals' appetite by these substances leading to reduced food intake. This lowering of body weight is synonymous with substance abuse as shown previously and could be indicators of adverse effect by any substance (Fareo, 2012).

Table 4 shows the effects of these substances on the organ weights of the animals, group treated with the abused substances showed significant weight difference compared to the control. Most toxic agents enter the liver where they are detoxified but in most cases, the liver function is impaired as a result of accumulation of these toxic substances for a period of time sufficient for it to manifest its toxicity (Lee, 2003). The three substance showed significant ($P<0.05$) alteration in the liver function (as indicated by liver marker enzymes) of the various groups when compared to the control. Markers such as alanine-aminotransferase (ALT), aspartate aminotransferase (AST), and total bilirubin (TB) were significantly reduced (Table 5). The TB levels were doubled in the marsh gas and Coca-Cola/Maggi fed group, while the level was significantly ($P<0.05$) lowered in the lizard waste treated group. This agrees with previous studies on the biochemical status of an abnormal liver (McClatchey, 2002).

The economic conditions as well as strong regulation and control of illicit drugs in Nigeria may have fuelled the abuse of other licit and illicit substances as alternatives by illicit drug users, other young and older people seeking for performance enhancing substances (aphrodisiacs) thus leading to what may have led to the development of 'new' substances of abuse. The term 'new' does not necessarily refer to new inventions but rather substances that have recently become available to users by trial and error. For instance, animal dung used as substance of abuse in Nigeria is rather recent as alcohol has been the main substance abused initially; Indian hemp (Marijuana) and rubber cement/adhesive solution took prominence much later.

CONCLUSION

This study has shown that the abused substances possess some adverse effect in the rat model. The rats exhibited signs of lack of wellbeing after they were subjected to these substances, a reduction in body weight and restlessness.

It is known that the abuse of marijuana and alcohol is popular in this part of the world. However, Lizard waste, Maggi cube solution and marsh gas have entered the list of

abuse substances among youths as discovered in this investigations.

We are handicapped by our inability to establish the origin for the use of these substances. Though we postulate that the reasons for the use of these substances by youths are because of poverty and unemployment and probably government regulatory agencies are succeeding in reducing the quantity of hard drugs in circulation, hence the desperate search for alternatives. The search for alternative substance of abuse will continue as such, government agencies, parents and guardians of kids must work extra hard to make sure our young people do not end up into wasted generations.

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