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REVIEW OF PROXIMATE ANALYSIS OF HEAVY METALS IN ACTION BITTER ALCOHOLIC HERBAL DRINKS CONSUMED IN NIGERIA

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ABSTRACT

Consumption of alcoholic herbal products from beverages or medicinal drinks contaminated with heavy metals can cause serious consequences on human health. This is a major concern for traditional and herbal medicine. The present study was carried out to analyze and quantify the levels of seven potentially toxic heavy metals namely Magnesium, lead, cadmium, copper, iron, chromium and nickel in Action Bitter alcoholic herbal bitter. Twenty one ACTION BITTER alcoholic bitter samples were previously pretreated and homogenized were digested and analyzed to obtain a concentration of *Cadmium (Cd), Chromium (Cr),Copper (Cu), Iron (Fe), Magnesium (Mg), Nickel (Ni) and lead (Pb)* using atomic absorption spectrophotometer equipped with graphite tube atomizer. The concentration obtained are *Cadmium (0.017 mg/l),Chromium (0.061 mg/l),Copper (0.056 mg/l), Iron (0.223 mg/l), Magnesium (1.118 mg/l), Nickel (0.112 mg/l) and lead (-0.073 mg/l*). The analysis of heavy metals can be useful to evaluate the dosage of herbal drinks prepared from these plants. Therefore, it is of great importance to establish universal standards and quality requirements for hazardous elements in herbal drinks so that this natural resource can continue and expand further, to benefit health globally.

Keywords: Atomic Absorption Spectrophotometer, Action Bitter, alcoholic herbal

INTRODUCTION

Consumption of bitter alcoholic herbal products from beverages or medicinal drinks contaminated with heavy metals can cause serious consequences on human health. This is a major concern for traditional and herbal medicine. The generic term applies to all bitter liquors and herbal bitters. Bitters are produced from root extracts and herbs, from the narcotic content of (primarily) tropical and subtropical plants and spices (Katalinic et al., 2006). Bitters are usually dark in color and valued for their ability to promote appetite and digestion hence they are used as a patent medicine and as flavoring in cocktails (Mark C, Kneubühl M and Bodmer S. 2000). Bitters have a common characteristic of a bitter taste and act to increase the vital energy centres in the body. Bitters are also made up of numerous groups of chemical compounds extracted from herbs and roots (medicine plant).

Historically, the botanical ingredients used in preparing bitters consist of bark, aromatic herbs, roots and fruit for their flavor and medicinal properties (Katalinic et al, 2006). Some of the common ingredients are; orange peel, bitter kola, ginger, garlic, gentian, cassia, cascarilla, cinchona bark etc. Most bitters also contain water and alcohol, the latter functions as both solvent for botanical extracts and as preservative while the alcoholic percentage and strength vary across different products and brands. Indeed, plant extracts, now popularized and publicized as herbal drinks in the form of bitters have been shown to treat, manage and cure several diseases (Katalinic et al, 2006). Unorthodox traditional medicine practices which employs the use of herbs (medicinal plant) have in recent times been gaining much patronage and popularity for their solution to ailments seemingly elusive to the system of orthodox medical practice. Modern medicine may have widened for sometimes but there are little differences in terms of medication between orthodox and unorthodox/traditional medicine, this gap seems to be closing fast as the current trend is that most modern pharmacology had its origin in these medicinal plants making both adopting practices from each other.

Nigeria like most countries in Africa has a low life expectancy of 60 years and below (Mark, 2000). Low life expectancy in many African countries is the direct consequence of civil war, hunger, poverty and HIV/AIDS; amongst others (Mark, 2000). Some of the factors that affect life expectancy are very obvious whilst others are hidden or silent. For a microbiologist and biochemist, one factor that affects average life expectancy stands out and this is the exact chemical composition and component of what people eat, drink and apply to their bodies. The exact chemical components of most products used in Nigeria are not known. Most of these products do not come in proper packaging and if they do the labels give little information about the chemical composition. There is a need for people in Nigeria and other West Africans to conduct scientific research that will provide detailed chemical knowledge of everything they eat, drink, apply to their bodies or use as medicines. In cases where items are packaged well, and important for the public to be aware that the beauty of product packaging is good but, better is the information provided on the labels. As far as alcoholic bitter herbal products are concerned, the use of "Chemical Constituent Labels" for the major active ingredients in the products must be encouraged in Nigeria. The importance of alcoholic bitter herbal products and their increasing use in Nigeria and in other parts of the world cannot be over-emphasized. However, the rate at which herb-based products are flooding the Nigerian market without regulation is highly worrisome to health experts and other medical stakeholders. Generally, alcoholic bitter herbal medicines are believed to be curative and harmless with no severe toxicity or side effects.

The widespread use of herbal medicinal items in Nigeria is largely attributed to this idea, which is supported by the fact

that they are less expensive than conventional drugs. However, using alcohol-based bitter herbal remedies can result in serious poisoning, problems, and even death (Mark, 2000). If there is no safeguard in place to avoid their inclusion, starting from material collection, preparation, production, packing and storage, these consequences are caused by some potentially harmful elements and pollutants they include. The use of inherently toxic herbs, primarily because of incorrect herb identification, variability in active or toxic ingredients due to growing conditions, processing or preparation, and the inevitable mechanisms of adulteration and contamination are some potential causes of toxicity of alcoholic bitter herbal products (Mark,2000). Furthermore, due to their training, which focuses more on conventional medicine than on herbs and herbal toxicities, Nigerian physicians have insufficient knowledge of the toxicities associated with herbal medicines. Since few clinicians are familiar with the potential side effects of herbal medicine, it is difficult to quickly recognize and treat these conditions when they arise as medical emergencies. Alcoholic herbal bitters are a fascinating topic for investigation in Nigeria. These beverages are aqueous extracts of plants or herb combinations that have alcohol (18–45% Volume) added in small amounts. The Nigerian market is being flooded with alcoholic herbal bitters, many of which have sophisticated packaging and numerous media advertisements.

Presuming a conviction of utmost safety, making the products appealing to a huge section of the population including both genders, young or old. From the perspective of the Nigeria consumer, there are many reasons for the wide patronage of these alcoholic drinks and these include health, recreation and vitality or even fertility. While the safety and quality of the medicinal plant, materials and finished, herbal medicinal products have become a major concern globally (Moraes and Bolini, 2010; Ziarati, 2012;Adefolaju, 2014). Nigeria herbal alcoholic bitters on the contrary have no information available to the public on the various plants used for the formulation of these drinks. Prescriptional directions of dose, quantities to be consumed (daily), the rate or frequency of consumption etc are all left to the discretion of the consumer who has no idea of the plant used or the parts used for the formulation of the alcoholic bitter herbal drinks. Hence, there have been several reports in the Nigerian media of incidents of priapism, dysuria, strangury and even death attributed to the consumption of herbal alcoholic bitters by the victims.

Dghaim etal., (2015): Investigated heavy metals in 81 samples of seven herbs determined using Atomic Absorption Spectrometry (AAS) and Metals found in varied concentrations. The concentration ranges found are 0.1–1.11mg·kg−1 for cadmium, less than 1.0–23.52 mg·kg−1 for lead, 1.44–156.24 mg·kg−1 for copper, 12.65–146.67 mg·kg−1 for zinc and 81.25–1101.22 mg·kg−1 for iron. The findings of the study suggest that most of the analyzed herbs contained unsafe levels of heavy metals that exceeded the World Health Organization (WHO) permissible limits (PL).

In general, several cases of health issues, such as a reduction in immune defenses, cardiac dysfunction, fetal deformity, poor psychosocial and neurological behavior and gastrointestinal impairment, among others, were connected to high dietary heavy metal intake (Mahan, et al.,2012; Singh etal., 2011). Several Asian, South American and African herbal items have been found to contain heavy metals in various ratios, according to previous reports (Rahimi, et al. 2012; Alwakeel, 2008). On the safety of alcoholic bitter herbs and the products made from them that are sold in the market, the information available is limited.

Liquor-based bitter are viewed and considered to be useful and efficient by its consumer, they are taken not only as a means of intoxication but also for therapeutic purposes (sex enhancer, digestive facilitation, sugar reduction, etc.). The sensible use of the drug, however, necessitates that "medications must be suited to clinical demands, in doses that satisfy their unique requirements, for an adequate time, at the lowest cost to the consumers and their community." Therefore, the misuse, underuse or excess of bitter leads to resource waste and widespread health risks.

Alcoholic bitter Herbal drink is medicinal and intoxicating but the dose per day, product composition, herbal formulation and diseases it can cure, resident time/expiration date, side effect on the recommended dose and excess dose among other relevant information are unavailable which may be addressed by the finding from the research work.

The adulteration and proliferation of plant-based products is a global problem and cannot be addressed without combined efforts from industry, academia and regulators. This research topic focused on the problems associated with product authentication, production, adulteration and contamination, value chains, agricultural practices, resident time, sustainability and safety. Hence, there are paucity of information available on the safety of alcoholic bitter herbal drinks sold in Nigeria and that is the rationale behind this study.

This study aims at determining the level of heavy metal contamination in ACTION BITTER alcoholic bitter herbal drinks consumed in Nigeria to assess their heavy metal concentration in comparison with the World Health Organization (WHO) standard limits.

MATERIALS AND METHODS

Sample Preparation and Treatment

Twenty- one ACTION BITTER alcoholic bitter samples containing 0.25L each per container samples previously pretreated and homogenized for sample digestion and analysis. Glassware and digestion vessels used was soaked in 20% nitric acid and rinsed with distilled water. Multi-element standard solutions of lead (Pb), Chromium (Cr), Cadmium (Cd), iron (Fe), Magnesium (Mg), Nickel (Ni) and copper (Cu) was prepared by dilution of 1000 mg/L stock solutions (Fluka TraceCert Ultra, Sigma-Aldrich) with 5% nitric acid (HNO_3) solution. The calibration curve for each element was linear with a correlation coefficient of 0.995. Microwave digestion, 0.5 g of the herbal sample was accurately weighed into a digestion vessel, followed by addition of 0.5mL of 37% hydrochloric acid (HCl) (trace metal concentrated, Suprapur, Merk), 9.0 mL of 69% nitric acid (HNO_3) (trace metal concentrated, Suprapur,Merk), and 1mL of 30% hydrogen peroxide (Sigma-Aldrich). The mixture was subjected to US-EPA 3052 microwave-assisted digestion as adopted in MARS Microwave digestion system (CEM Corporation, Matthews, USA) (Fabricant and Farnsworth, 2001). At the end of the digestion program, the samples were filtered for atomic absorption spectroscopy analysis.

RESULT AND DISCUSSION

Table 1: AAS analysis result of action bitters (Mg/L)

Analyte	Molar mass	WHO limit	Conc (Sample)	Std.D	%RSD
Cadmium (Cd)	228.80	0.2	0.017	0.0006	3.83
Chromium (Cr)	357.87	140	0.061	0.0190	31.35
Copper (Cu)	324.75	73.3	0.056	0.0095	16.93
Iron (Fe)	248.33	425.5	0.223	0.0033	1.47
Magnesium (Mg)	202.58	10	1.118	0.0230	2.06
Nickel (Ni)	232.00	67.9	0.112	0.0173	15.48
Lead (Pb)	283.31	0.3	0.073	0.0119	16

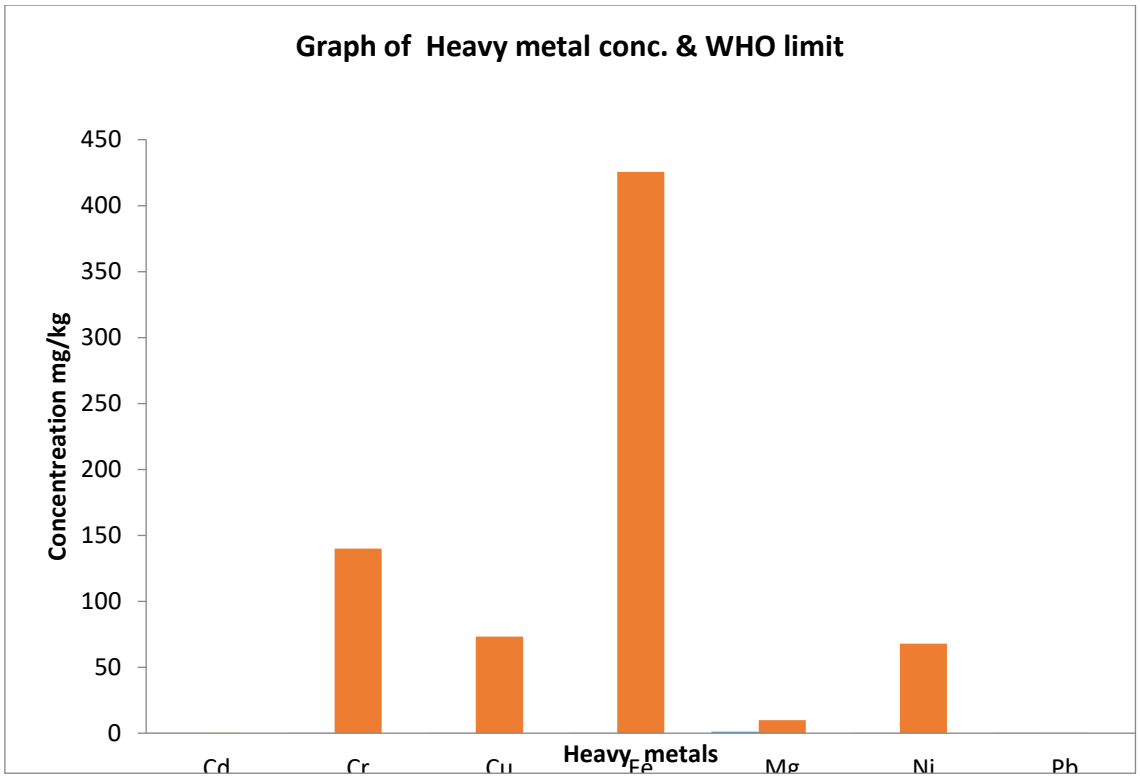

Figure 1: Heavy metal concentration and WHO limit

Table 1 and figure 1 show the concentration of Cadmium (Cd), Lead (Pd), Nickel (Ni), Iron (Fe), Copper (Cu), Zinc (Zn) and Chromium (Cr) present in action bitter alcoholic herbal drink. The concentration ranges from -0.073 to 1.118 mg/l and relative standard deviation of 1.47 to 31.35%. The values of the heavy metals and WHO limit are depicted as Cadmium 0.017 mg/l, WHO limit 0.2 mg/l; Chromium 0.061mg/l, WHO limit 140 mg/l; Copper 0.056 mg/l, WHO limit 73.3mg/l; Iron 0.223 mg/l, WHO limit 425.5 mg/l; Magnesium 1.118mg/l, WHO limit 10mg/l; Nickel 0.112 mg/l. WHO limit 67.9mg/l and lead -0.073 mg/l, WHO limit 0.3 mg/l. The concentration of cadmium is 0.017mg/l which is below the WHO standard limit of 0.2 mg/l; Chromium is 0.061mg/l which is also below the WHO standard limit of 140 mg/l; Copper is 0.056 mg/l which is also below the WHO standard limit of 73.3 mg/l; Iron is 0.223 mg/l is also below WHO standard limit of 425.5 mg/l; Magnesium is 1.118 mg/l which is below WHO standard limit of 10 mg/l; Nickel is 0.112 mg/l which is also below the WHO standard limit of 67.9 mg/l and lead is -0.073 which is below the WHO standard limit of 0.3 mg/l. Based on the atomic absorption spectrometry conducted, the result obtained revealed values consumed are below threshold level. This inference does not authenticate safety for action bitter alcoholic herbal drink consumers, because the analysis is based on a milligram per litre while consumption is based on individual control which may be below or above a milligram per litre rate.

CONCLUSION

In conclusion, the results of this study does not indicate potential health risk of heavy metals to consumers in Nigeria over long-term consumption of contaminated Alcoholic herbal bitter. The findings of this study also highlight the significance of safety and hygiene practices to consumers. The analysis of toxic metals can be useful in evaluating standard dosage in comparison with product specification of the alcoholic herbal bitter to ascertain accuracy and safety data. Therefore, it is of great advantage to establish universal standards and quality requirements for hazardous elements in herbal drinks so that this natural resource can continue and expand further, to benefit health globally. Further studies are required to determine the presence of toxic metals and to assess their long-term cumulative risk on consumer health.

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