

Selenium Content in some Brands of Bottled Beer Marketed in Makurdi Town Benue State, Nigeria

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Abstract: This study report levels of Selenium in different brands of bottled beer marketed in Makurdi town - Benue State of Nigeria. The samples were collected from sales restaurant of the area. 10mL Concentrated nitric acid (69%) was added to 25mL of the sample. The mixture was evaporated on a hot plate in a fume cupboard until the brown fumes disappears leaving white fumes. 50mL of distilled water was added and this was concentrated by evaporating on hot plate to 25mL. Subsequently, 25mL of distilled water was added to make up to 50mL. This was filtered and the value selenium determined using a SHIMADZU UV 2550 UV-Visible Spectrophotometer at 520 nm. From the results, the selenium concentrations (mg/L) in these beer samples were: 0.32, 0.98, 1.56, 1.10, 0.68, 0.89, 1.90, and 1.07 for A, B, C, D, E, F, G and H respectively. These were all above the USEPA maximum contaminant level (0.05 mg/L) for selenium. Therefore, there is a clear need to improve on the quality of these bottle beer products in order to keep Se levels in the appropriate quantity to avoid negative health and environmental consequences of its higher concentration.

Keywords: Bottled beer, Selenium, Trace Element, Makurdi

1. Introduction

Selenium is an essential microelement, which is incorporated by specific mechanisms in the structure of some proteins and enzymes with multiple physiological roles [1] – [4]. Selenium is used in photocopy applications, glass manufacture, pigments, chemicals, pharmaceuticals, fungicides, electrical apparatus, and in the rubber industry. Among its numerous implications in the human body, selenium has an antioxidant role [5], modulates the immune response [6] and regulates certain endocrine pathways, including the biosynthesis and metabolism of the thyroid hormones [7]. Selenium also acts as an insulin-mimetic [2]. Selenium deficiency (concentration less than 0.1 mg/L) can lead to cardiovascular diseases, cancer [1], [2]; a weakened immune system and hypothyroidism [8]. Long time exposure to selenium in high doses (concentration of 1 mg / kg) results in increased mortality due to malignant neoplasms [8] - [12]. There are areas in the world where selenium content in soils is very high (with concentration exceeding 5 mg/L). In these areas chronic selenosis occurs, which manifests itself by hair loss; nail brittleness, gastrointestinal and neurological dysfunctions, skin rash and “garlic-breath” odor [1], [2], [8]. It has been reported that, depending on the dose, acute intoxication leads to acute tubular necrosis and/or severe gastritis or gastric ulcer [13]. According to John *et al.*, [3], [8], [14], the dietary intake of selenium for humans depends mainly on its concentration in food, the amount of food consumed and also on its bioavailability. As a result, it is important to know its content in foodstuffs. Selenium content in foodstuffs and its nutritional requirement for humans was determined by Bogdan *et al.*, [2]. Overall selenium content varies significantly between different categories of foodstuffs. Fruits and vegetables generally contain low levels of selenium, with some exceptions [2]. Selenium content in meat, poultry, eggs and seafood is generally high. Legumes, cereals and derivatives are the main contributors to the dietary selenium intake for most countries. In the report of

John *et al.*, [3], Selenium (Se) concentrations in food are highly variable, and may reflect Se concentration and availability from the soil in which they were grown. Their results showed that selenium concentrations in foodstuffs are unreliable and if an accurate determination of Se intake is needed, Se concentration should be determined for food consumed. The levels of copper, selenium and zinc in beverages purchased in Nigeria were studied by Orisakwe *et al.*, [15]. The selenium levels ranged from 0.24 - 1.67 mg/L for the canned and 0.07 - 1.23 mg/L for non-canned beverages. 95% canned beverages had selenium levels that exceeded the maximum contaminant limit (MCL) whereas 90% of the non-canned products had selenium levels above the MCL. The mean and median values of selenium exceeded the MCL (0.05 mg / L) in the beverages. Methdilazine hydrochloride was proposed as a selective and sensitive reagent for the spectrophotometric determination of selenium (IV) [1]. Currently, low concentration of aqueous Se concentration or speciation is analyzed either by ICP-MS, Hydride generation graphite furnace AAS or Ion chromatography hydride generation AES [2], [16], [17].

Sharma *et al.*, [16] also stated that several methods for determination of selenium through complexation, oxidative coupling and diazotized coupling. There are few literatures on selenium contents in bottled beer in Africa. Therefore this paper reports level of Selenium in different brands of bottled beer marketed in Makurdi town - Benue State of Nigeria, as these beverages are consumed on daily basis in some cases in large quantity among the people of this area.

2. Materials and Methods

Eight brands of bottled beer were purchased from Beer Parlour within Makurdi town Benue State, Nigeria. The brands include: Grand, Heineken, 33 export, Star, Gulder, More, Harp and Guinness Stout. These samples were coded as A, B, C, D, E, F, G and H.

3. Selenium Determination

10mL Concentrated nitric acid (69%) was added to 25mL of the sample. The mixture was evaporated on a hot plate in a fume cupboard until the brown fumes disappears leaving white fumes. 50mL of distilled water was added and this was concentrated by evaporating on hot plate to 25mL. Subsequently 25mL of distilled water was added to make up 50mL. This was filtered and selenium measured using a SHIMADZU UV 2550 UV-Visible Spectrophotometer [18] at wavelength of 520nm.

4. Results and Discussions

3.1 Results

Results of levels of Selenium in different brands of bottled beer marketed in Makurdi town - Benue State of Nigeria are presented in Table 1.0 and Figure 1.0 as follows:

Table 1.0: Selenium concentration (mg/L) in the samples

Samples	Conc. Se mg/L
A	0.32
B	0.98
C	1.56
D	1.10
E	0.68
F	0.89
G	1.90
H	1.07

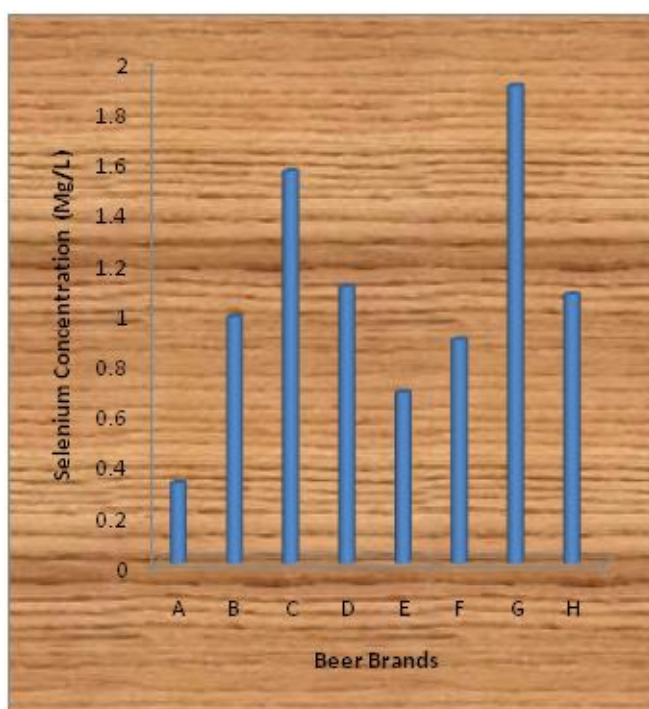


Figure 1.0: Concentration of selenium in different Beer Brands in Makurdi Town

3.2 Discussion

From the results the selenium concentrations (mg/L) in these beer samples were: 0.32, 0.98, 1.56, 1.10, 0.68, 0.89, 1.90, and 1.07 for A, B, C, D, E, F, G and H respectively. But The USEPA maximum contaminant level is 0.05 mg/L for selenium. The scenario here is that the entire bottled beer

samples had concentration that is above the MCL [19]. Orisakwe *et al.*, [15] also shared similar experience. In their report of the levels of copper, selenium and zinc in beverages purchased in Nigeria, they observed that the selenium levels ranged from 0.24 - 1.67 mg/L for the canned and 0.07 - 1.23 mg/L for non-canned beverages [15]. 95% canned beverages had selenium levels that exceeded the maximum contaminant limit (MCL) whereas 90% of the non-canned products had selenium levels above the MCL. The mean and median values of selenium exceeded the MCL (0.05 mg / L) in the beverages [15]. Selenium is an essential element to the human diet with a safe daily intake for adults estimated at 0.2-0.5 mg per day; whereas, Signs of selenium toxicity occur at selenium ingestion levels of 0.7 –7.0 mg/day [19], [20]. If concentrations of selenium in the foods are above 0.05 mg/L, chronic effects such as hair or fingernail loss, numbness in fingers or toes, and circulatory problems are possible for short period's exposure. Long exposure period can cause: hair and fingernail loss; damage to kidney and liver tissue, and problems with the nervous and circulatory systems [19], [20].

It is high time we started improving on the processing of these products and controlling our intake of foods with high amounts of Se in order to be free from selenium's toxicity as highlighted above.

5. Conclusion

The results indicate that Se in beer brands analyzed were all above the USEPA MCL of 0.05mg /L. This may pose a real danger to consumers, since beer is consumed heavily on daily basis in this part of the country and bioaccumulation of these trace elements can have serious consequence to human health. There is a clear need to improve quality control in the processing of bottle beer and other beverage products in order to reduce selenium levels.

6. Recommendation

The present concentration of selenium in beer samples indicate that the strict quality control measures be adopted from sourcing of raw materials to packaging of this drinks.

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