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# RESEARCH ARTICLE

## ANALYSES OF SOME FOOD SEASONING PRODUCTS IN NIGERIA

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## ABSTRACT

**Background**: The safety of artificialfood seasoning should be a major concern to health authorities and the general public. Hence the influence of these food seasoning on the taste, Aroma, acceptability and health of the consumer are certain. Some brands of artificial food seasoning sold in Nigerian markets were analyzed for Calcium (Ca), Cadmium (Cd), Iron (Fe), Manganese (Mn), Zinc (Zn) and Lead (Pb) using AES-MPS after sample digestion with the mixture of nitric acid and hydrogen peroxide. **Objectives**: To evaluate heavy metal content of some brands of artificial food seasoning sold in Nigerian Markets in order to ascertain their safety. **Methods:** Total of nineteen samples was identified, purchased, digested and analyzed using Atomic Emission Spectroscopy method. **Results:** The results obtained indicated the presence of Ca (29.50 – 1075 µg/g), Pb (7.00 - 22.00 µg/g), Fe (36.00-3942.00 µg/g), Mn (0.50 -13.00 µg/g) and Zn (4.50 - 46.50 µg/g);while cadmium (Cd) was not detected in all the samples. **Discussion:** This study indicated presence of heavy metals Fe, Pb and Zn in 100% of the artificial food seasoning, Mn in 21% and electrolyte (Ca) in 94%, while Cd was below the detection limit of the equipment used for the analysis. **Conclusion:** The artificial food seasoning analyzed were contaminated with Pb above permissible limit (2.5 µg/g) therefore it is a matter of concern due to its detrimental health effect. More attention on surveillance of food seasoning sold in Nigerian market is required in order to guarantee safety of the consumers' health.

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## INTRODUCTION

The trace elements are classified as either essential or toxic in nature and their presence in food substances is a major concern (Onianwa *et al*., 1999). The circulation and use of different brands of food seasoning in Nigeria is well known. The word "food seasoning" is a broad concept but it is used to describe any additive that changes or enhances the flavor of a dish without changing its basic composition, they are added in a sprinkle or a dash. Their ingredients include salt; sugar, acids and spices such as mint, thyme, garlic, chili powder, mustard and vinegar which some apart from adding flavor to foods also contain medicinal values (Umedum *et al*., 2013; Herndon, 2010). Makanjuola and Osinfade (2016) have reported safety of some natural food seasoning (Onion, nutmeg, garlic, ginger and pepper) from heavy metal contamination.

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In Nigeria, different brands of seasonings are manufactured asbouillon cubes or packaged in powdered forms. The main contents are salt, monosodium glutamate (MSG), hydrogenated oil (trans fat) and other variable spices such as Cray fish, beef, chicken, chillipepperas indicated by the manufacturers and are widely used in preparation of food in homes and restaurants (Otunola*et al* ; 2010; Akpanyung, 2005; Nwinuka *et al.,* 2005). Among the manufacturers of food seasoning in Nigeria are Nestlè Foods, Unilever and Promasidor which produces Maggi, Knorr and Roycoand Onga powder and cube respectively. Others seasoning areDoyinseasoning cubes, AJI-NO-MOTO seasoning, Tetra seasoning cubes, Tasty cubes, Mamador seasoning cubes, Prime seasoning cubes, Suppy cubes and Devon King's seasoning cubes amongst many others. The cubes/powder has different pack sizes, price and taste.AJI-NO-MOTO is a popular seasoning widely used to intensify and enhance umami flavors in sauces, broths, soups and many more foods, an MSG (monosodium glutamate) product, is the purest form of umami which gives the seasoning its long-lasting and meaty

taste, altogether different from sweet, salty, sour and bitter taste. MSG is the sodium salt of glutamic acid made from fermentation of cane sugar, one of the most common naturally occurring amino acidsthat make up about 20% of our body weight. For example, when glutamic acid fermented, it becomes glutamate. Glutamate activates our taste receptors, eliciting the delicious savory taste known as umami. Glutamic acid is a precursor for the neurotransmitter gamma-aminobutyric acid (GABA). GABA is abundant in the nervous system and plays a vital role in inhibition, or signal calming. Over the years, FDA has received reports of symptoms such as headache and nausea after eating foods containing MSG. These adverse event reports helped trigger FDA to ask the independent scientific group Federation of American Societies for Experimental Biology (FASEB) to examine the safety of MSG in the 1990s. The FASEB report identified some short-term, transient, and generally mild symptoms, such as headache, numbness, flushing, tingling, palpitations, and drowsiness that may occur in some sensitive individuals who consume 3 grams or more of MSG without food. However, a typical serving of a food with added MSG contains less than 0.5 grams of MSG. Consuming more than 3 grams of MSG without food at one time is unlikely (FDA, 2012). There is an urgent need for this study due to few existing data on mineral content of artificial food seasoning used in Nigeria. This study therefore aimed to evaluate heavy metal content of some brands of artificial food seasoning sold in Nigerian market in order to add to the few existing database towards expanding the database on mineral content of artificial food seasoning consumed in Nigeria.

## MATERIALS AND METHODS

**Samples and Sampling:** Samples of different brands were obtained from retail store in Ibrahim Babangida Market Suleja, Niger State, Nigeria. Total of nineteen samples were purchased for the study, documented and coded in air-tight polyethene bag as; Adja Chicken Flavor Poulet (ACFP), Ami chicken flavor (ADCF), Mr. Chef (MC), Onga Chicken Season (OCS), Ami Tomatoes Flavor (ATF), Dangote Classic Cube (DCC), Ami Tomatoes Flavor (ATF), Gino Chicken Flavor (GCF), Maggi Cube Star (MCS), Mr. Chef Beef (MCB), Gino Max Beef (GMB), Good PeppeMamah (GPM), Maggi Naija Pot (MNP), Maggi Chicken Flavor big (MCFB), Ami Shrimp Flavor (ASF), Knorr Chicken 2 (KC2), Terra Chi (TC), Onga Cube (OC), Royco (RC) and Knorr Iron-Iodine (KFI).

**Materials and Reagents Used:** All the chemicals and reagents used were of Analar grade. Appropriate types and sizes of glassware used were. Concentrated solutions of $HNO_3$ (Purity of 70 %, ACS reagent grade), Hydrogen peroxide ($H_2O_2$), Deionized water, Mcrowave assisted digester, Micropipette (Model: perfect choice, sizes 0-200µl and 0-1000µl), Plastic sample bottles (100$cm^3$) and Atomic Emission Spectrometer (AES-MPS) were used for the analysis.

**Microwave Assisted Digestion:** The sample (0.5 gram) was weighed into sample racks and digested with a mixture of nitric acid/ hydrogen peroxide (8:2), diluted with deionized water, made-up to mark in 50mL volumetric flask and transferred into capped plastic bottle.

**Analytical Procedure for Heavy Metals Analysis:** The digested sample solutions were analyzed for Ca, Cd, Fe, Mn, Pb and Zn using Atomic Emission Spectrometer (AES-MP) after optimization and calibration with standard solutions of the elements of the interest. The data obtained were processed by calculating the actual concentrations in the samples analyzed using the relation:

$$\text{Metal (µg/g)} = \frac{C \times V_2 \times D.f}{W(g)}$$

Where; C is the concentration of the sample solution in µg g/; $V_2$ is the volume of the diluted digested sample solutions in mL; W is the weight of the sample used and d.f is the dilution factor, if used. The analysis was carried out based on the equipment operating condition as stated in Table 1.

**Table 1. Instrument Operating Condition for the Analysis**

| Element | Wavelength (nm) | Nebulizer Flow (L/min.) |
|---|---|---|
| Ca | 714.815 | 0.6 |
| Cd | 288.802 | 0.5 |
| Fe | 371.993 | 0.65 |
| Mn | 403.076 | 0.90 |
| Zn | 213.857 | 0.45 |
| Pb | 405.781 | 0.75 |

## RESULTS

Results of concentration of calcium (Ca), Cadmium (Cd), iron (Fe), manganese (Mn), zinc (Zn) and Lead (Pb) for nineteen samples of artificial food seasoning sold in Nigerian Markets were reported in Table 2. The results indicated the presence of Ca, Fe, Pb and Zn in all the samples, Mn in four of the samples at variable concentrations, while Cd in all the samples was below the detection limit (<0.001) of the equipment used. Variation in the levels of the mineral elements could be attributed to the various constituents that made-up each of the food seasoning. The results of the study indicated higher level of Ca in the samples analyzed followed by Fe, Zn, Pb and Mn. Calcium (Ca) is a mineral element which is often associated with healthy bones andteeth; it also plays an important role in blood clotting, muscles contraction, and regulation of normal heart rhythms and nerve functions. About 99% of the body's calcium is stored in bones, and the remaining 1% is found in blood, muscle, and other tissues. The body gets calcium by eating foods or supplements that contain calcium, and the other is by drawing it from bones to the other parts of the body. Calcium is usually regulated in the body by a parathyroid hormone (generate calcium from the bones to the blood stream) and calcitonin hormones (stop the release of excess calcium from bones and signals the kidneys to rid more of it in the urine) in order to maintain normal body functions[Institute of Medicine, 2011].The Recommended Dietary Allowance (RDA) of calcium for men and women of age 19-50 years is 1,000 mg daily (DRI, 2000). The RDA need to be adhered to in order to avoid calcium overload which could result to health risk condition such as kidney stones, prostate cancer, heart problems and constipation especially for people over the age of 50 years. Calcium is also a large mineral that can block the absorption of other minerals like iron and zinc. Results obtained from this study (Table 2) shows the decreasing order of calcium content of the food seasoning as follows; KC2 (1075.50 µg/g) >TC (475.00 µg/g)>RC (353.00 µg/g) >OCS (198.00 µg/g) > GCF

**Table 2. Mineral Content**

| S/N | Samples Codes | Mean Concentrations (µg/g) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Ca | Cd | Fe | Mn | Pb | Zn |
| 1 | ACFP | 122.00 | <0.001 | 54.50 | 0.00 | 20.50 | 43.50 |
| 2 | ADCF | 186.00 | <0.001 | 62.50 | 0.00 | 22.00 | 40.50 |
| 3 | MC | 168.00 | <0.001 | 55.50 | 0.00 | 19.50 | 41.50 |
| 4 | OCS | 198.00 | <0.001 | 54.00 | 0.00 | 17.50 | 47.00 |
| 5 | ATF | 117.00 | <0.001 | 37.50 | 0.00 | 15.00 | 44.50 |
| 6 | DCC | 108.00 | <0.001 | 41.50 | 0.00 | 19.00 | 45.00 |
| 7 | GCF | 196.00 | <0.001 | 57.70 | 0.00 | 21.00 | 39.50 |
| 8 | MCS | 159.50 | <0.001 | 39.00 | 0.00 | 10.50 | 44.50 |
| 9 | MCB | 140.00 | <0.001 | 38.00 | 0.00 | 12.50 | 46.50 |
| 10 | GMB | 120.50 | <0.001 | 41.00 | 0.00 | 19.50 | 40.50 |
| 11 | GPM | 156.50 | <0.001 | 44.50 | 0.00 | 16.00 | 40.00 |
| 12 | MNP | 192.00 | <0.001 | 50.00 | 0.00 | 15.00 | 41.00 |
| 13 | MCFB | 170.00 | <0.001 | 38.50 | 0.00 | 7.00 | 43.50 |
| 14 | ASF | 174.50 | <0.001 | 36.00 | 0.00 | 8.50 | 45.00 |
| 15 | KC2 | 1075.50 | <0.001 | 3942.00 | 13.00 | 30.00 | 4.50 |
| 16 | TC | 475.00 | <0.001 | 128.00 | 4.00 | 30.50 | 14.00 |
| 17 | OC | 0.00 | 0.00 | 1.50 | 0.00 | 10.00 | 10.00 |
| 18 | RC | 353.00 | <0.001 | 2085.50 | 3.50 | 29.50 | 19.50 |
| 19 | KFI | 29.50 | <0.001 | 30.50 | 0.50 | 10.50 | 8.00 |

(196.00 µg/g)> MNP (192.00 µg/g ) >ADCF (186.00 µg/g)>ASF (174.50 µg/g )> MCFB (170.00 µg/g) >MC (168.00) >MCS (159.50 µg/g) >GPM (156.50 µg/g ) >MCB (140.00 µg/g)>ACFP (122.00 µg/g) >GMB (120.50 µg/g) >ATF (117.00 µg/g) >DCCl (108.00 µg/g)>KFI (29.50 µg/g) >OC (0.00 µg/g). The highest concentration of calcium was detected in Knorr Chicken 2(KC2) and the lowest in Knorr Iron-Iodine-KFI, while calcium concentration in Onga cube (OC) was below detection limit (<0.001) of the equipment used. The concentration range of calcium in the analyzed samples is below the RDA value for adult of age 19-50 year of both sexes therefore, they cannot be depended upon to meet such need but consumption has to be with caution in order to avoid overloads.

**Iron (Fe)** is an essential mineral which serves as component of hemoglobin, myoglobin, active site of various reproductive hydrogenase, most frequently associated with sulphur containing glands and plays a major role in metabolism. It also enhances oxidation of protein, carbohydrate and fat to control body weight which is an important factor in some diseases such as diabetes (Makanjuola and Osinfade, 2016). It is the most common nutritional deficiency which affects all age groups worldwide, causing extreme fatigue and lightheadedness.

Liver enlargement and joint diseases were also linked to its health effect (Darko *et al.*, 2014). The two forms of iron that comes from food are heme (found only in animal flesh like meat, poultry, and seafood) and non-heme iron (found in plant foods like whole grains, nuts, seeds, legumes, and leafy greens). Non-heme iron is also found in animal flesh (as animals consume plant foods with non-heme iron) and fortified foods. Results obtained from this study (Table 2) shows the decreasing order of iron content of the food seasoning as KC2 (3942.00 µg/g) > RC (2085.50 µg/g)>TC (128.00 µg/g) > ADCF (62.50 µg/g) > GCF (57.70 µg/g)> MC (55.50 µg/g ) >ACFP ( 54.50 µg/g)> OCS (54.00 µg/g )> MNP (50.00 µg/g) > GPM (44.50) > DCC (41.50 µg/g) > GMB (41.00 µg/g ) >MCS (39.00 µg/g)> MCFB ( 38.50 µg/g) >MCB (38.00 µg/g) >KFI (30.50 µg/g) >OC (1.50 µg/g). The highest concentration of iron was detected in Knorr Chicken-2(KC2), while the lowest concentration was in Onga Cube (OC).

The iron contents of maggi brand of the food seasoning analyzed in this study ranges as 38.50 – 50.00 µg/g which is higher compared to result obtained from maggi brand of food seasoning reported by Adeeko *et al.,* (2019). Zinc (Zn) is a mineral that is essential for cell growth and division, immune function, DNA synthesis, protein production and also required for over 300 enzyme reactions (Prasad, 2013). The recommended daily intake (RDI) of zinc for both sexes and all age groups are well documented, for example, RDI for adult men and women are 11 and 8 mg respectively (DRI, 2000). The major contributor to zinc deficiency in developing world has been linked to high phytate-containing cereal protein intake. Conditioned deficiency of zinc has been observed in patients with mal-absorption syndrome, liver disease, chronic renal disease, sickle cell disease, and other chronic illnesses. Major clinical problems resulting from zinc deficiency in humans include growth retardation; cell-mediated immune dysfunction, and cognitive impairment (Prasad, 2014).

Results obtained from this study shows the decreasing order of zinc content of the food seasoning as OCS (47.00 µg/g) > MCB (46.50 µg/g)>DCC (45.00 µg/g) > ATF (44.50 µg/g) > MCFB (43.50 µg/g)> MC (41.50 µg/g ) >MNP ( 41.00 µg/g)> GMB (40.50 µg/g )> GPM & ACFP (40.00 µg/g) > GCF (39.50 ) > GC (19.50 µg/g) > TC (14.00 µg/g ) >OC (10.00 µg/g)> KFI ( 8.00 µg/g) >KC2 ( 4.50 µg/g). The highest level of zinc was observed in Onga Chicken Season (OCS), while the lowest concentration was observed in Knorr Chicken 2 (KC2). Previous study reported concentration range of zinc content of commercially sold maggi food seasoning as 0.02 - 0.03 µg/g which was lower as compared to concentration range of zinc obtained (41.00 – 44.50 µg/g) from maggi food seasoning (MNP, MCFB & MCS) analyzed in this study. The outcome of this study indicated that none of the food seasoning analyzed could be depended upon as a source of meeting the RDA of zinc for adult male and female ( DRI, 2000).Lead (Pb) is a toxic metal with no known health benefit to human, its ingestion over time result to bioaccumulation in human body system which in-turn leads to several health challenges such as abdominal pain, adrenal insufficiency, anemia, arthritis, arteriosclerosis, blindness, cancer, deafness, depression, diabetes, dyslexia, epilepsy, fatigue, impaired glycogen storage, hallucinations, hyperactivity, impotency, inflammation, kidney dysfunction, learning disabilities,

diminished libido, migraine headaches, multiple sclerosis, psychosis, thyroid imbalances, tooth decay and cardiovascular diseases (Bergeson, 2008; Kumar *et al.,* 2020).The result obtained from this study (Table 2) indicated the decreasing order of lead content of the food seasoning as TC (30.50 µg/g) > KC2 (30.00 µg/g)>RC (29.50 µg/g) > ADCF (22.00 µg/g) > GCF (21.00 µg/g)> ACFP (20.50 µg/g ) >GMB & MC (19.50 µg/g)> DCC (19.00 µg/g )> OCS (17.50 µg/g) > GPM (16.00) > AFT & MNP (15.00 µg/g) > MCB (12.50 µg/g ) >MCS & KFI (10.50 µg/g)> OC (10.00 µg/g) > ASF (8.50 µg/g) >MCFB (7.00 µg/g). The level of lead in all the samples analyzed was above the permissible limit of lead in instant noodles(WHO/FAO (1984). The presence of lead in these foods seasoning could be through manufacturing process. For example, plumbing that contains lead can contaminate water used in the food seasoning production or other food contact surfaces containing lead that passes or leaches lead into food or storage packs; presence of lead in the recipes could also contribute to lead content of the food seasoning.

Manganese (Mn) is an essential metal requires for intracellular activities and functions as a cofactor for a variety of enzymes such as arginase, glutamine synthetase (GS), pyruvate carboxylase and Mn superoxide dismutase (Mn-SOD). It plays critically important roles in development, digestion, reproduction, antioxidant defense, energy production, immune response and others. Its deficiency is rare, but poisoning may be possible if exposure to it over a long period of time. These could result to accumulation in the liver, pancreas, bone, kidney and brain.

Hepatic cirrhosis, polycythemia, hypermanganesemia, dystonia and Parkinsonism-like symptoms have been reported in patients with Mn poisoning. In recent years, Mn has come to the forefront of environmental concerns due to its neurotoxicity. Molecular mechanisms of Mn toxicity include oxidative stress, mitochondrial dysfunction, protein misfolding, endoplasmic reticulum (ER) stress, autophagy dysregulation, apoptosis, and disruption of other metal homeostasis (Chen *et al*., 2015). Result obtained from this study (Table 2) indicated the presence of magnesium in samples KC2 (13.00), TC (4.00), RC (3.50) and KFI (0.50) only and were below the daily recommended dietary allowance for both sexes of all age groups [DRIs, 2000]. Cadmium (Cd) is a toxic metal with no known health benefits. Food is the major source of cadmium exposure in the general population(Järup *et al.,* 1998).The result of this study indicated there was no cadmium detected in all the food seasoning analyzed, therefore no harm for intake of cadmium from the food seasoning under study.

## CONCLUSION

The outcome of this study indicated presence of heavy metals Fe, Pb and Zn in 100% of the artificial food seasoning, Mn in 21% and Ca in 94%, while Cd was below the detection limit of the equipment used for the analysis. The presence of Pbis above the permissible limit making it an issue of concern due to its detrimental health effect. Therefore, more attention should be given to surveillance of artificial food seasoning in order to ensure that they are free from heavy metal contamination in order to safeguard the health of the consumers.

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