COMPARATIVE EVALUATION OF NUTRITIONAL AND ANTINUTRITIONAL FACTORS IN NODDLES SOLD WITHIN AWKA METROPOLIS

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Abstract
The objective of the study was to compare the nutritional and anti-nutrient of selected instant noodles sold and consumed in Awka metropolis, Nigeria. The proximate analysis, mineral composition (Ca, Mg, K, P, & Fe) and heavy metal (As, Pb, Cr, Hg & Ni) content were determined using standard methods. The result showed that moisture content of sample B (7.80%) was higher than Sample A (5.60%), while higher ash value was reported for sample B (3.18%) with Sample A (2.76%), fiber content were relatively same foe both samples B (7.63%) and A (7.50%), fats and oil was 18.65% in sample B and 15.53% in Sample A, protein was 1.41% in sample B and 1.36% in Sample A while carbohydrate was 67.12% in Sample A and 57.46% in sample B. Calcium ranges from 33.56 to 77.00Mg/100g with Sample A having the highest value and sample B with the least value. Sample A also have the highest value for magnesium (43.50 Mg/100g) while sample B have the least value (22.80 Mg/100g). Phosphorus analysis showed that Sample A had highest occurrence (191.60 Mg/100g). Arsenic was lower in Sample A (0.117mg/kg) than Sample B (0.153mg/kg), lead was also lower in Sample A (0.031mg/kg) than Sample B (0.068mg/kg), Nickel was also lower in Sample A (0.015mg/kg) than Sample B (0.053mg/kg) while chromium was lower in Sample B (0.005mg/kg) than Sample A. The results indicated that Sample A contained the highest concentration of all the mineral analyzed in the study while Sample B have better values in terms of proximate compositions.
Keywords: *Noodles, mercury, heavy metal, proximate, phosphorus, arsenic and fibre.*

Introduction

Noodles are nutritious wheat foods made from common wheat flour, water and other additives depending on the type of noodles (Sui *et al*., 2016). According to Owen (2021), annual consumption of pasta products has increased drastically because of consumers changing perception of pasta. According to a 2018 survey, by World Instant Noodles Association Atlanta USA, it was reported that the annual consumption of instant noodles in the world averaged about 94 billion cups (World Instant Noodles Association, Atlanta USA 2018). The consumptions of instant noodles per capital varies among countries, ranging from 0.57 - 5.54 kg (approximately 10-100 packages), even though these figures tend to increase every year. Instant noodles are normally consumed by people of all socioeconomic status (Duranti, 2016). However, instant noodles mainly consist of wheat flour whose protein quality is inadequate to provide adequate essential amino acids (Awuchi, 2019). Lysine is known to be a limiting amino acid in wheat flour. The absence of lysine makes the body difficult to synthesize protein, hormones, enzymes and antibodies, which are needed for growth and other functions (Flodin, 2017).

The nutritional and chemical compositions of various noodles produced and sold at various locations in Nigeria have not been exhaustively reported. This gap necessitated this research as a means of contributing information on the implication of noodles consumption. Therefore, the main objective of the present study was to evaluate the nutritional and anti-nutritional composition of noodles and their health implications

Minerals are naturally occurring substances that are solid and inorganic which are represented by a chemical formula, usually abiogenic, and has an ordered atomic structure (Oda *et al*., 2008; Djrolo*et al*., 1998). Anti-nutritional factors are defined as naturally occurring substances that interfere with nutrient intake and availability in the animal. Their biological effects can

range from a mild reduction in animal performance to death (Okwu, 2006). Noodles contain a number of anti-nutritional factors such as saponins and tannins which decrease nutritive value of Soybean seeds and cause health problems of both human and the animals when taken in large amounts. Tannins reduce the bioavailability protein value of food.

Noodles have received considerable attention in recent years because of the nutritional and health protective values. They are consumed directly as snack food in many cultures throughout the world. More analysis on noodles will only increase the available data on their nutritional and anti-nutritional composition.

According to World Health Organization and U.S. Food and Drug Administration (FDA), noodle products are known with having low in fat and sodium, and rich in complex carbohydrates. Due to boosting and modernization of food industry, the global food market is becoming more diversified. For this purpose, development and studying of new pasta and noodle products with good nutritional, functional and acceptability is inevitable work. Also, The growing awareness in recent years of the health promoting and protecting properties of non-nutrient bioactive compounds found in processed food has prompted an increased attention to its consumption as vital components of daily diets. This thus underscores the significance of noodles as vital dietary components in Sub-Saharan Africa. Knowledge of its nutritive value is thus necessary in order to encourage the increased production and consumption of those that are highly nutritive. Data on the nutrient and antinutrient composition of noodles produced and sold in Anambra State is scanty, fragmentary and inadequate. A comprehensive data is necessary. Therefore, the main objective of the present study was to evaluate the nutritional and anti-nutritional composition of noodles and their health implications as an avenue to generate data bank of the chemical constituents for noodles.

Materials & Methodology

The instant noodles (Sample A) which is a type of food consisting of noodles sold in precooked dried block with flavoring powder, and sample B (Tummy-Tummy) were purchased from Eke Awka Market, Anambra State. The samples were milled into powder and solvent extraction of the samples was done by cold extraction; 50 g of powdered sample of were soaked in 200ml of ethanol. The mixture were kept undisturbed at room temperature for 72 hrs in a sterile flask covered with aluminum foil to avoid evaporation and subjected to filtration through sterilized Whatman no.1 filter paper. The extracts were used for anti nutritional analysis. AOAC standard procedures were adopted for the proximate analysis. The mineral contents of the test samples were determined by the dry ash extraction method following each specific mineral element as described by AOAC (2005). 20 grams of the samples was burnt to ash (as in ash determination and the resulting ash was dissolved in acid mixture of 1M HCl and 1M HNO3 and made up to 100ml volumetric flask. The solution was used for the various analysis of mineral. Calcium contents of the test sample was determined by the EDTA complex isometric titration. Twenty (20) ml of each extract was dispersed into a conical flask and panels of the masking agents, hydroxytannin, hydrochlorate, and potassium cyanide was added followed by 20ml of ammonia buffer (pH 10.0). A pinch of the indicator-Ferrochrome black was added and the mixture was shaken very well. It was titrated against 0.02N EDTA solution. A permanent blue colour was observed and the reading taken. The calcium contents was calculated using the formulae below.

Calcium (mg/100g) = {TV x 0.4008 x 1000} / Vol of sample used.

Results and Discussion:

The result for the proximate analysis of the sample is presented on Table 1 showing the moisture, ash, protein, fat and oil, crude fibre and carbohydrate contents of the samples

Table 1: Proximate composition of the samples

PROXIMATE (%)	Sample A	Sample B
MOISTURE	5.60± 2.00	7.80 ± 1.10
ASH CONTENT	2.76± 0.07	3.18± 0.05
PROTEIN	1.36± 0.05	1.41± 0.15
FAT AND OIL	15.53± 0.00	18.65± 0.00
CRUDE FIBER	7.63± 1.11	7.50± 0.05
CARBOHYDRATE	67.12± 0.01	57.46± 0.25

The result of the proximate composition of two samples is presented in table 1.The result showed that moisture content was high in sample B(7.80%) than sample A(5.60%), the ash content was high in sample B (3.18%) than sample A (2.76%). The result showed that sample B had a higher concentrations of the proximate values except in the crude fiber where sample A recorded elevated value.

Table 2: Mineral Contents of the Samples Sold and Consumed in Awka Metropolis (Mg/100g)

Sample	Calcium	Magnesium	Potassium	Phosphorus	Iron
A	77.00	43.50	226.00	191.60	5.77
B	33.56	22.80	129.60	181.00	2.60

The results of the mineral contents which are metals or elements essential for metabolism of the body, for the samples sold and consumed in Awka metropolis are shown in Table 2. It was observed that elevated levels of the mineral contents were implicated in sample A with average lower amounts in sample B. Table 3 revealed the heavy metals determined occurred at concentrations below their respective threshold limit by World Health Organization (WHO).

Table 3: Heavy Metal Contents of the Samples Sold in Awka Metropolis (Mg/kg)

Sample	Arsenic	Lead	Chromium	Mercury	Nickel
A	0.117	0.031	0.073	0.000	0.015
B	0.153	0.068	0.005	0.000	0.053
WHO Standard	0.050	0.025	0.050	0.00	0.10

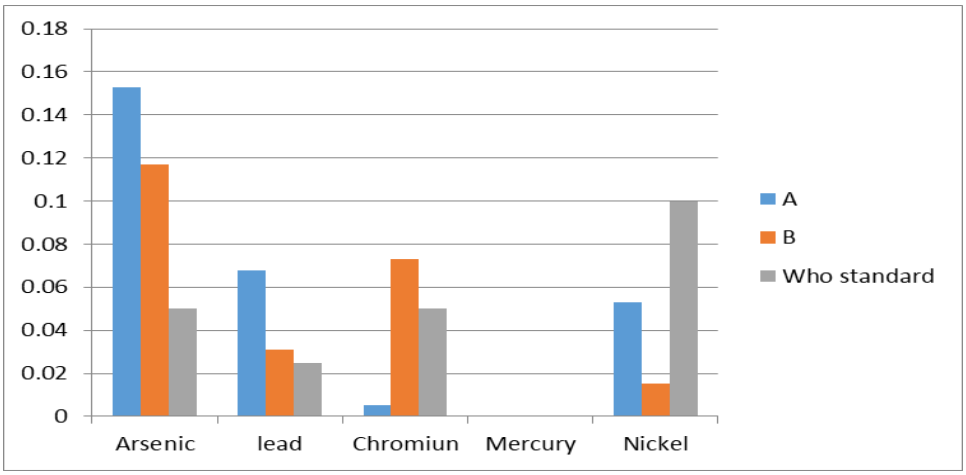


Fig. 1: Comparism of amount of metals (Mg/kg) in the Samples with WHO Standards.

Arsenic concentrations in Samples A (0.15mg/kg) and B (0.11mg/kg) occurred above WHO Standard of 0.05mg/kg threshold limit. Similarly, Lead was also discovered to occur above threshold limit in both samples as observed in Figure 1. Hence, these samples which are expected to have at least a year between date of manufacture and expiration are left with as little moisture as possible to limit rate of bacterial attack.
The fat ranged between 18.65% in sample B and 15.53% in Sample A. The protein (1.36% - 1.41%) of these noodle samples showed their deficiency in supplying adequate amount of dietary protein. Therefore, caution should be taken in the over dependence on noodles or other protein sources such as egg, meat, fish etc could be incorporated while serving these noodles in other to augment this noted deficiency.

Crude fibre content of these noodles which range between 1.00% - 9.25% on its own is perceived to be of acceptable level. The level of crude fibre in all these samples could be seen as permissible.

The high carbohydrate content with the range of between 57.68% to 67.71% was recorded. Table 2 indicates the high level of minerals in the noddles sold within Awka metropolies. Potassium is the most abundant element in the samples with a value of 129.60 Mg/100g and 226.0 Mg/100g in sample A and B respectively. The values are relatively high which make them good food material for hypertensive people. High amount of potassium in the body increases iron utilization and beneficial to people taking diuretics to control hypertension and suffer from excessive excretion of potassium through the body fluid (Gary, 2010). Sample A could be recommended as a source of K which have numerous functions in the biochemical and physiochemical functions of the body.

Phosphorus content of noodles were also found to be high with Sample A was highest (191.60 Mg/100g), followed by Tummy-Tummy (181.00 Mg/100g). The result made the noodles recommendable, especially for hypertensive patients as higher phosphorus content might decrease blood pressure. The concentration of phosphorus in noodles was found to be in conformity with that stated by Ojure & Quadri (2012). Sodium plays an important role in signal transduction, acid base balances etc.

Looking at Calcium, it ranges from 33.56 to 77.00Mg/100g with Sample A having the higher value and sample B with the least value. The Calcium forms component of bones and teeth, necessary for blood clotting and muscle contraction. The availability of Calcium in the body depends on calcium to sodium ratio and presence of anti-nutritional factors. Calcium, if available in the body helps in development of strong teeth and bones. In addition, it helps in the formation of blood, intra-cellular and extra-cellular fluids within and outside the cell of the tissues (Akanbi *et al*., 2011). Magnesium is closely associated with calcium to the body, as magnesium helps regulate intracellular flow of calcium ions. Magnesium deficiency may lead to fatigue, confusion, weakness and problem with muscle contraction.

The overall observation on the heavy metal level of these selected noodles as in Table 3 showed that all the noodles fell below the WHO recommended level for heavy metal hence they are not associated health effects. Several cases of human disease, disorders, malfunction and malformation of organs due to metal toxicity have been reported such liver cirrhosis, Tubular nephritis Dysfunction, Reduction in neuropsychological function, etc. On the other hand, the levels of heavy metals in these noodles did not follow a uniform pattern as some conformed to the WHO permissible levels for heavy metals in food samples while few others were a little beat above the permissible limits.

Conclusion

This study revealed that noodles sold within Awka metropolies vary significantly in their nutritional composition. The results indicated that sample A contained the higher concentration minerals analyzed while sample B were implicated in elevated proximate compositions.

The Mineral composition showed that all the noodles sold within Awka Metropolies were rich in essential minerals and could be good sources of nutrients in diets for consumption. Occurrence of Arsenic and lead at above WHO Standard was also recorded. Appreciable amount of Potassium was observed in both samples. The evaluation of the mineral composition of Noodles showed that it is highly rich in nutrients and therefore good for human consumption for the maintenance of health and vitality.

References

Adelek, M.L., Tripp, R. and Dankyi. A. A. (2010). Adoption and Impacts of Improved Maize Production Technology: A Case Study of the Ghana Grains Development Project. Economics Program, No 99-01, Mexico, D.F.

Akah, T. T. and Offiah E. E., (2012). Phytochemical screening of Nigerian medicinal plants Lioydia. *J. Integrative Med*., 41, 234-246.

Akanbi, T.O., Nazamid, S., Adebowale, A.A., Farooq, A. & Olaoye, A.O. (2011). Breadfruit starch-wheat flour noodles: preparation, proximate compositions and culinary properties. *International Food Research Journal*, 18, 1283-1287.

Akanbi, T.O., Nazamid, S., Adebowale, A.A., Farooq, A. & Olaoye, A.O. (2011). Breadfruit starch-wheat flour noodles: preparation, proximate compositions and culinary properties. *International Food Research Journal*, 18, 1283-1287.

AOAC (2005) 18th Edition, Officiating Analytical Chemists, Washington DC, Method 935.14 and 992.24

Awuchi, C.G (2019). Proximate Composition and Functional Properties of Different Grain Floor Composites for Industrial Application. International Journal of Food sciences, 2 (4): 43 – 63.

Baik, A., and Lee, M. (2003). Asian Noodles: *Science, Technology, and Processing Journal* 5: 27 – 36

Batran, SAES, El-Gengaihi SE, & El-Shabrawya OA.(2006) Some toxicological studies of Momordica charantia L. on albino rats in normal and alloxan diabetic rats. *J Ethnopharmacol.;* 108: 236-242.

Beach EF, Turner JJ (1958). An enzymatic method for glucose determination uptake in body fluids. Clin. Chem. 4: 462-468.

Carlo,A, Abdullatif, B.M.; Asiri, N.A. (1994). Effect of Deficit Irrigation on Photosynthesis Pigments, Proline Accumulation and Oil Quality of Sweet Basil (Ocimumbasilicum L.) at Flowering and Seed Setting Stages, *IJBPAS*,1(3), 271-284.

Cesarone H, afolayan C and meyer E 1992, Studies of Nigerian medicinal plants I. Preliminary survey of plant alkaloids. *Journal of West African Science Association* 13 (1): 13-33.

Chayarop C., E.P. Okafor and A.S. Uka, (2011). Evaluation of the tubers and oil of Cyperusesculentus. Bioresource Technology, 61: 171- 173.

Chen, C., Diao, X., Thurlow, J. and Alhassan, R. (1994). Assessing Development Impact – Learning from Experience. PEGNet Conference, Accra (Ghana), September 11, p. 2.

Chirikova H, Oladele, A.K., and. Aina, J.O. (2010). Chemical composition and Functional properties of Flour produced from two varieties of tiger nut. African Journal of Biotechnology, 6: 2473- 2476.

Corke T S and Bhattacharya, A. S. (1996). Noodles / Asian wheat flour noodles. In C. W. Wrigley, H. Corke, & C. E. Walker (Eds.), *Encyclopedia of Grain Science* (Vol. 2,

Dahanukar SA, Kulkarni RA, Rege NN (2000). Pharmacology of medicinal plants and natural products. In. J. Pharm. 32:81-118.

Djrolo F, Houngbe H, Avode G, Addra B, Kodjoh N, Avinadje M, Monterio B (1998) Malnutrition related diabetes (tropical diabetes). Med. Afrique Noire, 45: 538-542.

Duraipandiyan B., Raja A, Gajalakshmi P and Raja MMM (2006) "Cardiac and vascular structure and function are related to lipid peroxidation and metabolism," 37(3): 231–236,

Duranti, M. (2006). Grain legume proteins and nutraceutical properties. *Fitoterapia* Vol. 77, pp. 67–82.

Essiett, U. A., Akpabio, K. E., 2009. The comperative anatomy of Talinum triangulare and Talinum portulacifolium in Nigeria. Academic and Scientific Research Institute Publication. Int. J. Biotechnol and Allied Sci., 4(1), 424-432.

FAO, (2012). Maize in human nutrition. Food and Agricultural Organization, No 25, Rome, Italy. Flodin, B. X. (2008). Asian noodles: History, classification, raw materials, and processing. *Food Research International*, 41(9), 888-902

Gary, G.H. (2010). Asian noodles science, technology, and processing, Hoboken, New Jersey: John Wiley & Sons, Inc., pp. 99-154.

Oda, N.H., Seib, P.A., Ward, A.B., and Deyoe, C.W. (2008). Noodles. Ⅳ. Influence of flour protein, extraction rate, particle size, and starch damage on the quality characteristics of dry noodles. *Cereal Chemistry Journal*, Vol. 62 pp. 441-446.

Okwu, J. (2006) Antimicrobial activity of aqueous extracts of Vernonia amygdalina, Garcinia kola and Gongronemalatifolium and their blends on some beer spoilage organisms. Technical Quarterly of the Master Brewers' Association of the Americas. 41(4):398–402.

Ojure, M.A. and Quadri, J.A. (2012). Quality evaluation of noodles produced from unripe plantain flour using xanthan gum. *International Journal of Recent Research and Applied Studies* (IJRRAS), 13(3), 740-752.

Owen, G. (2021). Cereal Processing Technology. Cambridge: Woodhead Publishing, pp 5-7

Sui, Y., Kong, H., Shang, Y., Huang, X., Wu, F., Hu, M., Lin, D., Lu, W., Wang, Y (2016). Effects of short-term Hypoxia and Seawater Acidification on Hemocyte Responses of the Mussel Mytilus Coruscus. *Marine Pollution Bulletin*, !08(1-2): 46 – 52.

World Instant Noodles Association Atlanta USA (2008). Instant Ramen Facts-Worldwide. USA., PP 13.