NUTRITIONAL AND ANTI-NUTRITIONAL COMPOSITION OF *Laurus nobilis* (Linn)

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ABSTRACT

This study was carried out to compare to the Nutritional and the Anti-nutritional composition of Laurus nobilis (Linn) to the standard of World Health Organization (WHO) Nutritional and anti-nutritional composition of vegetable spices. The bay leaves samples were analyzed for percentage (%) moisture content, ash content, Lipid, crude fibre, crude protein, carbohydrate contents and the energy value in Kcal/100g. of the samples were determined in triplicates to ascertain the nutritional quality of the leaves. The proximate analysis revealed that Bay leafs contain moisture (11.80 ± 0.54%), Ash (5.50 ± 0.10%), Crude fibre (26.12 ± 0.11%), Crude Protein (4.10 ± 0.10%), Lipid (8.14 ± 0.06%), Carbohydrate (70.46 ± 0.22%) and the energy value (371.5Kcal/100g). The Mineral composition (mg/100g) of Bay leafs showed Magnesium with (528 ± 0.02) to be the highest followed by Iron (457 ± 0.10), Sodium (378.5 ± 1.16), Phosphorous (327.318 ± 0.47), Calcium (307 ± 1.51), and lastly Potassium with (187.5 ± 2.65). The minerals analyzed were found to be below the permissible limit set by the standard organizations such as World Health Organization (WHO) and Food and Agriculture Organization (FAO). The Anti-nutrients compositions are Alkaloids (3.4 ± 0.02%), Flavonoids (0.177 ± 0.001%), Phytic Acid (0.836 ± 0.02%), Oxalate (7.13 ± 0.02%), Cyanide Glycoside (474.281 ± 10.002mg/kg). The results showed that Laurus nobilis contained essential and valuable nutrients which are beneficial to human health and that boiling of the leafs for about 5 minutes will effectively reduce the Anti-nutritional content which inhibits the absorption of the nutritional composition

Keywords: Laurus nobilis (bay leaf), mineral elements

Introduction

The knowledge and use of plants as spices is as old as the history of humankind and plants used as spices are usually aromatic and pungent. Spices are known as products of plants, which are mostly used for seasoning, flavoring and thus enhancing the taste of food, beverage and drugs. Vegetable spices often mean an edible part of a plant other than a sweet fruit or seed, which typically implies the leaf, stem or root of a plant (Moyo, 2013). Vegetables spices play an important role in human nutrition; they offer the most rapid and lowest cost source of fiber, minerals and vitamins to the majority of people in developing countries, where they are frequently consumed in relatively small amounts as side dish or relish with the staple foods (Nangula, 2010). The wide variation in color, taste and texture of various vegetables is an interesting additional touch to the meals. Hence, the cultivation and consumption of green leafy vegetables cuts across different races because of their nutritional and health benefits (Akinwunmi, 2016). Green leafy vegetables constitute an indispensable constituent of human diet in West Africa. Some are cultivated while some occur in the wild. They play good roles in the economy of local or rural dwellers. Their importance to people has been documented more than seven decades ago (Teddy, 2015). Their economic values to man especially to rural dwellers cannot be ignored. In West Africa, the plants including the ones with ancient introduction have been described and properly documented being the pioneering works in West Africa floristics (Nangula, 2010).

Materials and methods

Apparatus and Reagents

Crucible, oven, furnace, desiccator, macro kjeldahl digestion and distillation units, kjeldahl flask, conical flasks, beakers, measuring cylinder, round bottom flask condenser unit, Buchner flask/funnels, mixed catalyst (K_2SO_4 + Anhydrous $CuSO_4$), Extraction Thimbles, soxhlet apparatus, wooden pestle and mortar, sieve, analytical weighing balance, what-man filter paper, hot plate, spatula, stirring rod, wash bottle.

Sulphuric acid, HCl, Sodium hydroxide, Nitric acid, potassium sulphate (reagent grade), distilled water, deionized water, boric acid, indicator solution, petroleum ether.

Source of Plant Material

Fresh leaves of *Laurus nobilis* were collected from a farm plot located in Idemili North Local Government Area of Anambra State in May 2019 and authenticated in the Herbarium of Federal University Lokoja, Lokoja, Kogi state.

Collection and Preparation of Bay Leaves

The fresh leaf samples were obtained from a local farm Idemili North Local government area of Anambra State. The fresh leaves were air dried for about a month to a constant weight at Room Temperature (25^{o}C). The dried leaves were pulverized to fine powder using wooden mortar and pestle. The powered form sample was kept in airtight container until use.

Proximate Analysis

The Proximate Analysis was carried out at the Chemistry Laboratory in Federal University Lokoja, Lokoja, Kogi State.

Proximate analysis of the sample was separately determined using the method described by (*Lawal, 2014)*. All experiment was carried out in triplicate.

Anti-nutritional factors

The determination of Anti-nutritional factors was carried out at Central Services Laboratory, National Cereals Research Institute, Bida Niger State.

Mineral Analysis

The Mineral Analysis was carried out at Central Services Laboratory, National Cereals Research Institute, Bida Niger State.

Two grams of pulverized sample was placed in a crucible and ignited in a muffle furnace at 550°C for 6 hours. The resulting ash was dissolved in a 20 mL of 10% HNO3 and heated slowly for 20 minutes. After heating, it was filtered and the filtrate was diluted up to 100 mL using de-ionized water and this was used for the determination of mineral content. Atomic Absorption Spectrophotometer (AAS, iCE 3000 C113300129 v1.30) was used to determine Na, Fe, Ca, Mg, P and K in the filtrate and the result was expressed in mg/100g.

Statistical Analysis

The data obtained (in triplicates) were calculated as mean ± standard deviation (mean ± SD) and significant differences were calculated using student t-test (Nathaniel, 2012). For statistical comparison in all cases, values of $p \leq 0.05$ were taken as significant. The statistical package used was Graph Pad Prism (Version 5.0, San Diego, CA).

Results & Discussions

Table 1: Proximate Composition of Bay Leaf

The result obtained for the proximate composition of dried bay leaf are mean of Triplicate determination. This is shown in Table 1 below. The precision and accuracy of the results presented in this chapter were tested with the replicate results and the coefficient of variation were all less than 5% i.e. P < 5% difference.

Analyte	Moisture content (%)	Ash Content (%)	Crude Fibre (%)	Crude Protein (%)	Lipid (%)	Carbohydrate (%)	Gross Energy value (Kcal/100g
Mean ± SD	11.80 ± 0.54	5.50 ± 0.10	26.12 ± 0.11	4.10 ± 0.10	8.14 ± 0.06	70.46 ± 0.22	371.5

The dry matter was found to be 88.20% and the organic matter was found to be 94.50%. There is no standard deviation for carbohydrate, energy, dry and organic matter value because they were not determined experimentally; rather they were obtained by calculation and estimation from the values obtained for other parameters. Hence, these parameters accumulate the standard deviation and errors for all other parameters. Proximate assay is an important criterion to assess the overall composition and nutritional status of any ingredient intended for food use. In this context, Bay leaves was analyzed for different qualities attributes such as moisture, crude protein, Lipid, Crude fiber, ash and carbohydrate. Result of proximate composition on dry weight bases (Table 1) showed significant variations among legume samples for moisture, crude protein, Lipid, Crude fiber, ash and carbohydrate.

The result in Table 1 showed that the moisture content of 11.80 ± 0.54% is lower compared to some common Nigeria leafy vegetables such as *Xanthosema sagittifolum* 14.7%, *Vernonia amygdaline* 27.4% (Tunde, 2018). High moisture content above 15% in leaves was reported to favor microbial activities during storage. However, the fibrous and compact head nature of *Laurus nobilis* makes it a bit difficult for microorganism to access, giving it a longer shelf life. The ash content which is a measure of the inorganic matter of the sample was found to be 5.50 ± 0.10%. This value is higher compared to that of cauliflower 0.7%, broccoli 0.6%, carrot 0.6%, and lettuce (0.4%), but lower compared to 2.0% in spinach *(*Mark, 2013). The sample contained 8.14 ± 0.06% Lipid, which is higher when compared to 0.5% in Brussels sprout and 0.6% in kale (Anon, 2011).

Fats and oils in diets are the major sources of energy; however, diet high in fat are implicated in obesity and certain cardiovascular disorders such as atherosclerosis, cancer and ageing (Levin, 2019). The crude fiber content of 26.12 ± 0.11% is higher compared to 2.3% in cauliflower, 2.0% in Kale, 2.5% in Brussels sprout (Anon, 2011). Dietary fiber is an important constituent in *Laurus nobilis* and other vegetables spices of the Lauraecae family, helping to reduce serum cholesterol level, risk of coronary heart disease, and contributing to prevent colon and breast cancers and hypertension (Rodriguez, 2016).

The crude protein content of 4.10 ± 0.10% in the sample is higher compared to 1.6 ± 0.20% reported for the same vegetable spices in Brussels sprout and 1.8% in cauliflower. (Rumeza, 2016), 1.40% The protein content is also lower when compared to some edible vegetables spices consumed in Lokoja.*(Vernonia amygdalina*-6.5 ± 1.55%, *Telferia occidentalis*-20.0 4 ± 0.24%, and 18.15±0.61% in *Amaranthus tricolor*) (Levin, 2019).

The carbohydrate content of 70.46 ± 0.22% is higher compared to 4.8±0.01% reported by (Rumeza, 2016) for the same vegetable, but falls within the range of 50.0 – 68.6% reported by (Anon, 2011) in Brassica vegetables. The key role of carbohydrate in the body is the provision of energy and low level of carbohydrate in fruits and vegetable has been reported to be beneficial for diabetic patients and individuals watching weight (Agoreyo, 2012).

The metabolizable energy content of 371.5kcal/100g which was calculated using the Atwater factor (Asibey-Berko, 2019) falls within the range of 24 – 40kcal/100g in different bay leafs (Anon, 2011), but is significantly lower compared to 248.8 – 307.1 kcal/100g reported in some Nigeria leafy vegetables (Isong, 2019).

This attests to the fact that *Laurus nobilis* is a high-energy food source and as such may not be very helpful in weight management program.

Mineral Composition of Bay Leafs

The result obtained for the mineral composition of Bay leafs is shown in Table 2

Table 2: Mineral Composition of Dried Bay Leafs

Element	Na (mg/100g	K (mg/100g)	Ca (mg/100g)	Mg (mg/100g)	P (mg/100g)	Fe (mg/100g)
Mean ± SD	378.5±1.16	187.5±2.65	307 ± 1.51	528 ± 0.02	327.318±0.47	457 ± 0.10

Table 2 shows the mean concentration values of the mineral elements in Dried Bay leafs. Using Microsoft excel windows 2010, the precision and accuracy of the results were tested with the duplicate results and the coefficient of variation were all less than five percent ($p < 5\%$) difference. Six mineral elements were analyzed in the dried bay leaf sample for the purpose of this study, all of which are essential (non-toxic) mineral elements. They are Sodium (Na), Potassium (K), Calcium (Ca), Phosphorous (P) and Iron (Fe). The highly soluble mineral elements: calcium (Ca), Magnesium (Mg), phosphorus (P), Iron (Fe), and potassium (K) help in the maintenance of acid-base balance of hydrogen ion concentration of the body.
Na (378.5±1.16 mg/100g), K (187.5 ± 2.65 mg/100g), Ca (307 ± 1.51 mg/100g), Mg (528 ± 0.02 mg/100g), P (327.318 ± 0.47 mg/100g), Fe (457 ± 0.10 mg/100g). The differences in the composition may be due to the differences in the locality of its growth and the stage at maturity prior to harvesting.
Sodium is required by the body to regulate blood pressure and blood volume. In the adult human body, Ca content comprises approximately 1000 g in women and 1200g in men. Most of it (>99%) is located in the skeleton and the teeth as hydroxyapatite, Ca is found in blood, extracellular fluid, muscle and other tissues and cells (Favus, 2016). Calcium helps in regulation of muscle contraction required by children, pregnant and lactating women for bones and teeth development.
Phosphorus is an essential nutrient for the skeleton and deficiency causes rickets in children and osteomalacia in adults. (Genant, 2013).After oxygen, hydrogen, carbon, nitrogen and Ca, P is the 6th most abundant element in the human body, A 70kg man has approximately 700 g of P in his body, Around 80-85%of the P is located in the skeleton as hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$). The remaining P is located in extracellular fluids and soft tissues, mainly as a component of proteins, phospholipids, nucleotides and nucleic acids (Berner, 2018).
High amount of potassium in the body was reported to increase iron utilization, and beneficial to people taking diuretics to control hypertension and suffer from excessive excretion of potassium through the body fluid (Arinanthan, 2013).
Iron is said to be an important element in the diet of pregnant women, nursing mothers, infants convulsing patients and elderly to prevent anemia and other related diseases (Oluyemi, 2016).

Magnesium play fundamental roles in most reactions involving phosphate transfer; it is believed to be essential in the structural stability of nucleic acid and intestinal absorption while its deficiency in man is severe diarrhea and migraines and plays a role in energy production and in supporting the immune system.

Anti-Nutritional Composition of Bay Leafs

The result obtained for the anti-nutritional composition of dried bay leaf are mean of duplicate determinations. This is shown in Table 3 below. The precision and accuracy of the results presented in this chapter were tested with the replicate results and the coefficient of variation were all less than 5% i.e. P < 5% difference.

Table 3: Anti-Nutritional Composition of Dried Bay Leafs

Analyte	Alkaloids %	Flavonoids %	Phytic Acid %	Oxalate %	Cyanide Glycoside (mg/kg)
Cyanide Glycoside (mg/kg)	3.4 ± 0.02	0.177 ± 0.001	0.836 ± 0.02	7.13 ± 0.02	474.281 ± 10.002

Anti-nutritional factors in the leaves of *Laurus nobilis* were below toxic levels and so does note pose much adverse effects to consumers. The Anti-nutritional factors were phytic acid, oxalate, alkaloids, flavonoids, cyanogenic glycoside (Table 3). These anti-nutritional factors are natural plant components and are found in virtually all plants used for human foods or animal feeds. The detailed biochemical effects of the chemical components, including the pharmacological and other effects of the anti-nutritional factors in plants have been reported (Soetan, 2018).The result of anti-nutrient analyses of *Laurus nobilis* in shown on Table 3 above.

Alkaloids are a class of naturally containing organic nitrogen containing bases. Some common alkaloids include morphine and nicotine. Alkaloids are responsible for the bitterness in many traditional leafy vegetables. There are two groups of alkaloids, namely pyrrolizidine and quinolizidine. Pyrrolizidine are usually found in plants, which render these plants as toxic.

Quinolizidines are more often found in *Amaranthus* species. Pyrrolizidines are not harmful on their own but become highly toxic when they are transformed by cytochrome P-450 monooxygenases in the human liver. Most Nigerian traditional leafy vegetables contain alkaloids ranging from 4 to 11%. *Laurus nobilis* contains alkaloid of 3.4 ± 0.02%. Most Nigerian traditional leafy vegetables have a significant decrease in alkaloid content after 5 minutes boiling ($p<0.0001$). The remaining traditional leafy vegetables all required a total of 15 minute boiling to reduce the alkaloid content significantly to between 2% and 5, 6% with the exception of *Oxygonum sinuatum* which had no significant difference in alkaloid decrease between all three boiling parameters. which could have been due to varietal and agro-climatic conditions of the traditional leafy vegetables.

Laurus nobilis contains Flavonoid content of 0.177 ± 0.001% which connotes that the sample attributed anti-oxidative, anti-inflammatory, and anti-carcinogenic properties coupled with its capacity to modulate key cellular enzyme cellular function is below minimum rate.

The oxalate content of 7.13 ±0.02% is lower compared to 22±0.60% in green cabbage, 25.06±0.13.70% in red cabbage, and 25±0.70% in Chinese cabbage (Mohammed, 2013).The content of phytic acid 0.836 ± 0.02% is lower when compared to 14.83 ± 0.40% in green cabbage, 15.36 ± 0.90% in red cabbage, 13.83 ± 0.40% in Chinese cabbage (Soetan, 2018), and in some common cereals such as maize-48%, millet- 10%, and Soya beans-8%. (Mitchikpe, 2018)

Phytic acid and Oxalate are anti-nutritional factors which are present in various fruits and vegetables, with high concentrations discovered to cause great effects on mineral bioavailability in foods. (Weaver, 2012).

The Cyanide Glycoside concentration of 474.281 ± 0.02 mg/kg is lower when compared to 482.50 ± 2.60mg/kg in green cabbage, 482.50 ± 2.80mg/kg in red cabbage and 475.63 ± 1.60mg/kg in Chinese cabbage. (Mohammed, 2013) Excessive ingestion of cyanide glycosides can be very poisonous as it interferes with electron flow in the mitochondria electron transport chain, thereby inhibiting energy generation. The concentrations of anti-nutrients (Alkaloids, Flavonoids, oxalate, phytic acid and cyanide glycoside) obtained in this study are lower than the lethal dose, hence, may not elicit toxic effect when consumed.

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