Original Research Article

Comparative nutrient, mineral and antinutrient composition of two indigenous South African spices

Abstract

Two South Africa spices which were *Lippia javanica* (Izinziniba) and *Foeniculum vulgare* (Imbambosi) were analysed for their proximate principles, minerals, vitamins and anti-nutrients. *Lippia javanica* had higher lipid, fibre and carbohydrate contents (90%, 50% and 70%) respectively than *Foeniculum vulgare* (67%, 37% and 47%). Protein, ash and moisture content (21%, 12% and 12%) were higher in *Foeniculum vulgare* than in *Lippia javanica* (12%, 7% and 11%). *Foeniculum vulgare* showed higher N, Mg, K and Na content while *Lippia javanica* was higher in Ca, Zn, Cu and Fe. Vitamins A and E were also higher in *Lippia javanica* while *Foeniculum vulgare* had higher vitamin C content. No significant differences were observed in the phytate, oxalate and tannin contents of the two spices, but saponin and cyanide were significantly lower in *Lippia javanica* than in *Foeniculum vulgare.* These spices have the potential of contributing to the average requirement for different nutrients.

Key words: *Lippia javanica; Foeniculum vulgare;* Nutritional composition; Spices.

INTRODUCTION

Spices are known to add flavor to foods and beverages, but they also help to stimulate appetite.[1] Some spices have medicinal uses such as aids in digestion (cardamom), speed up of metabolism (cayenne pepper), anti-hypertensive (celery) and antimicrobial (basil). Two of the commercially important South African spices with medicinal uses are *Lippia javanica* (Burn. F.) Spreng and *Foeniculum vulgare* Mill. used by the isiXhosa.[2] The major inhabitant of the Eastern Cape Province of South Africa, which is well known for its diversity in plant species.[3] Plants used in traditional medicine by the people of the Eastern Cape have been extensively documented.[3,4]

Lippia javanica is one of the four indigenous *Lippia* species; it occurs as an erect woody shrub approximately 2 m in height, the plant is used extensively in traditional medicine.[5]The Xhosa people are known to drink the tea infusion of *L. javanica* for the treatment of coughs, colds and bronchial problems in general. They use the leaves and stem and drink it with milk or water. In addition, the people also use *Lippia javanica* for the disinfection of meat that has been infected with anthrax.[2]

Foeniculum vulgare is also well-known indigenous spice. The specie is usually used as flavourings in baked goods, meat and fish dishes, ice cream, and alcoholic beverages, due to its characteristic anise odour.[6] These two South African spices have long been known and reported to have health, protecting properties, as well as important resources in promoting good nutrition in Africa with a long history of human use as both food and medicine.[7]Apart from their nutritive values, reports have also shown that spices possess natural compounds known as antinutrients that interfere with the absorption of nutrients there by causing damage to health.[8] For example, phytic acid, flavonoids and tannins are anti-nutrients that interfere with the absorption of minerals from the diet.[9] These compounds chelate metals such as iron and zinc reducing their absorption. On the other hand, polyphenols such as tannins have anticancer properties, so beverages such as green tea that contain large amount of these compounds might also be good for the health despite the anti-nutrient properties.[10] The aim of this study was to evaluate and compare the nutrient composition (proximate, mineral, vitamins) and anti-nutritional factors of these two indigenous spices (*Lippia javanica* and *Foeniculum vulgare*) in order to highlight their phytotherapeutic and neutraceutical potentials.

Materials and Methods

Collection of plant material

The aerial parts (leaves, flowers, stems) of *Lippia javanica* and *Foeniculum vulgare* were collected from their natural habitat, in Alice, Eastern Cape Province of South Africa. The plants were identified at the Albany herbarium in Rhodes University and voucher specimens (ASO 2014/1 and ASO 2014/2) were respectively prepared and deposited in the Giffen Herbarium of the University of Fort Hare.

Preparation of Plant Materials.

The plant materials were oven-dried at 45°C, pulverized, and stored in airtight containers at 4°C prior to analysis.

Proximate Analysis

Moisture content: This was determined by weighing out approx. 5 g of ground sample into preweighed petri dishes and placed in an oven set at 105°C for 12 h. The sample was allowed to cool in a desiccator, weighed again, until constant weight was obtained. Moisture content was calculated as described previously[11]:

$$\text{Moisture content \%} = 100 \times \frac{(B-A) - (C-A)}{(B-A)}$$

Where: A= Weight of clean, dry scale pans (g), B= weight of scale pan+ wet sample (g)

C= weight of the scale pan + dry sample (g)

Ash content

2 g of powdered sample was placed in pre-weighed crucibles and incinerated in an E-range muffle furnace with the TOHO program at 550°C for 12 h, as described previously.[11]Ash content of the sample was calculated as:

$$\text{Ash content \%} = \frac{\text{Weight after ashing-weight of empty crucibles}}{\text{Weight of crucible and sample-weight of empty crucible}} \times 100$$

Crude lipid

5 g of the powdered sample was weighed into 250 ml conical flask, 100 ml of diethyl ether was added, covered with aluminium foil and shaken in an orbital shaker for 24 h, filtered and the supernatant decanted. Another 100 ml of diethyl ether was added to the residue and shaken for another 24 h, residue obtained after filtration was the lipid free sample and it was calculated as described previously.[11]

$$\text{Crude lipid} = \frac{\text{Weight of sample after diethyl ether extraction}}{\text{Initial weight of the sample}} \times 100$$

Crude fibre

5 g of the powdered sample was weighed and digested in 100 ml of 1.25% sulphuric acid for 30 minutes, acid digested sample was allowed to cool and then filtered. The residue was collected for further digestion with 100 ml of 1.25% sodium hydroxide and was filtered. The residue was dried in an oven at 100°C to a constant weight and the dried residue was incinerated in a muffle furnace for 24 h at 550°C. The crude fibre was calculated from the loss in weight on ignition of dried residue after digestion of fat free samples as described previously.[11]

$$\% \text{ fibre} = \frac{\text{loss of weight on ignition}}{\text{Weight of sample used}} \times 100$$

Crude protein (%): The value of nitrogen in sample was multiplied by 6.25 to give the % crude protein as described previously.[11] Calculation:

$$\% \text{ crude protein} = \text{Nitrogen in sample} \times 6.25$$

Digestible carbohydrate by (difference)

The total carbohydrate content was determined by adding together the sum of the percentage moisture, ash, crude lipid, crude protein and crude fibre, then subtracting this value from 100. [12] Calculations:

% Total carbohydrate = 100 - (% moisture + % Ash + % fat + % Protein + % Fibre)

The percentage contribution to energy

The percentage contribution to energy due to protein (PEP), due to total fat (PEF) and due to carbohydrate (PEC) as PEP %, PEF % and PEC % respectively were calculated. The percentage utilizable energy due to protein (UEDP %) was also calculated.[13]

Mineral Analysis

Sodium, potassium, calcium, nitrogen, magnesium, phosphorus, copper, manganese, Aluminium, zinc and iron were determined using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP/OES) as described by [14] Ca/P, Na/K, Ca/Mg and the millequivalent ratio of [K/(Ca +Mg)]; the mineral safety index (MSI) of Na, Mg, P, Ca, Fe and Zn were also calculated .[13]

Determination of Vitamin C

Two and half gram (2.5 g) of the sample was weighed into conical volumetric flasks and 12 ml glacial acetic acid was added, the mixture was stirred for about 20 minutes and filtered. The filtered solution was made up to 100 ml using distilled water. 50 ml of the sample solution was mixed with 10 ml of methylene blue solution (0.4 mmol/L) and diluted to 10 ml with distilled water. Absorption was measured at 665 nm using a spectrophotometer. Ascorbic acid was used as standard. The vitamin C content was calculated from the standard curve as $y = 0.7535x$.[15]

Vitamin A determination

One gram (1 g) of the sample was weighed and mixed with 20 ml of petroleum ether. It was evaporated to dryness in a water bath. 0.2 ml of chloroform acetic anhydride was added with 2 ml of trichloroacetic acid chloroform. The absorbance was measured at 620 nm. The vitamin A content was calculated from the standard curve as $y = 0.7365x$.[15]

Vitamin E determination

One gram (1 g) of the sample was weighed and dissolved in 20 ml of ethanol. One millilitre (1 ml) of 0.2% ferric chloride in ethanol was added and then 1 ml of 0.5% α, α-dipyridyl was added. It was diluted to 5 ml with distilled water and absorbance was measured at 520 nm. Concentration of vitamin E was calculated from the standard curve as $y = 0.5544x$.[14]

Antinutrients

Total Tannin

Total tannin was determined as described by. [16] 0.2 g of sample was measured into a 50 ml beaker; 20 ml of 50% methanol was added, covered with foil paper and placed in a water bath for 1 h. It was shaken thoroughly to ensure uniform mixing. The extract was filtered using a double layered Whatman No 41 filter paper into a 100 ml volumetric flask. To this, 20 ml of distilled water, 2.5 ml Folin –Denis reagent and 10 ml of 17% Na_2CO_3 were added and mixed properly. The mixture was made up to mark with distilled water and allowed to stand for 20 minutes to develop the bluish green colour. Absorbance of tannic acid, the standard solution and samples were read on a Spectronic 21D at a wavelength of 760 nm. The average gradient factor content was extrapolated from the standard curve. Percentage tannin was calculated as:

$$\% \text{ Tannin} = \frac{\text{absorb.of sample x average gradient factor x Dilution factor}}{\text{Weight of sample x 10000}}$$

Total Saponin

Saponin content was determined as described by.[17] 20 g of the plant sample was added to 100 ml of 20% ethanol and kept on a shaker for 30 minutes. The aliquot was then heated over a water bath at 55°C for 4 h. The resulting mixture was filtered and the residue re-extracted with 200 ml of 20 % aqueous ethanol. The mixture was reduced to 40 ml over a water bath at 90°C. The concentrate was transferred into 250 ml separatory funnel and extracted twice with 20 ml diethyl ether. The ether layer was discarded while the aqueous layer was retained, followed by the addition of 60 ml of n-butanol. The butanol extract was washed twice with 10 ml of 5 % aqueous sodium chloride. The remaining solution was heated over a water bath and evaporated to dryness to constant weight at 40 °C. The saponin content was calculated using the equation:

$$\% \text{ Saponin content} = \frac{\text{Weight of residue}}{\text{Weight of sample}} \times 100\%$$

Determination of phytic acid

Phytic acid was determined as described previously by.[18] Two grammes (2.0 g) of the sample were weighed into a 250 ml conical flask. 100 ml of 2% concentrated HCl was used to soak sample for 3 h and then filtered with a Whatman No 1 filter paper. 50 cm^3 of the filtrate and 10 cm^3 of distilled water were added in each case. Ten millilitres (10 ml) of 0.3% ammonium

thiocyanate solution was added to the solution and titrated with standard $FeCl_2$ solution containing 0.00195g. Each gram of iron is equivalent to 0.00195g. A yellow colour which persisted for 5 minutes was taken as the end point. The percentage phytic acid was calculated as: % Phytic acid = y x 1.19 x 100. where, y = titre value x 0.00195 g.

Determination of cyanogenic glycosides content

The alkaline picrate method [19] was employed for the determination of cyanogenic glycosides. A 5 g portion of each sample was dissolved in 50 ml distilled water in a corked conical flask and extracted for 12 h. It was then filtered and the filtrate was used for the cyanide content determination. To 1 ml of the filtrate in a corked test tube, 4 ml of alkaline picrate was added and incubated in a water bath for 5 minutes. The absorbance was read at 490 nm. The absorbance of the blank, which contained only 1 ml distilled water and 4 ml alkaline picrate solution was read and used to stabilize the spectrophotometer before taking the absorbance of the samples. The cyanide content was extrapolated from a cyanide standard curve and calculated using the formula:

$$\text{Cyanide (ug/g)} = \frac{\text{Absorbance x Gradient factor x Dilution factor}}{\text{Weight of sample}}$$

Determination of Oxalate

The method of [20] was used for this determination. 0.2 g of sample was put in a 20 ml conical flask, 15 ml of 3M H_2SO_4 was added and stirred for 1 h with a magnetic stirrer then filtered using a Whatman No 1 filter paper. 5 ml of the filtrate was titrated against hot 0.05M $KMnO_4$ solution till a faint pink colour persists for 30 seconds. Oxalate content was then calculated by taking 1 ml of 0.05 M $KMnO_4$ as equivalent to 2.2 mg oxalate.

Statistical analysis

Results are reported as the means ± standard deviations of triplicate experiments. Differences between means were separated using the t- test and results were considered significant at $P < 0.05$.

Results and discussion

Proximate composition of *Lippia javanica* and *Foeniculum vulgare*

The proximate composition of *Lippia javanica* and *Foeniculum vulgare* showed that there was no significant difference in the moisture content of both spices (Table 1). Moisture content of a food sample is an index of water activity and is used as a measure of stability and susceptibility to microbial attack. Therefore, the low moisture content of the spices is an indication that they can be preserved for a reasonable period without the risk of microbial deterioration and spoilage.[21] Ash content in *Lippia javanica* (7%) was less than in *Foeniculum vulgare* (12%). Ash content is an indication of the levels of minerals or inorganic component of the samples.

Lippia javanica had a higher level of crude fibre (50%) compared to *Foeniculum vulgare* (37%) which means *Lippia javanica* could play a better role in helping the body to maintain an internal distention for proper peristaltic movement of the intestinal tract than *Foeniculum vulgare*. A diet with high fibre content have been used for weight control and fat reduction as they give a sense of satiety even when small food is eaten.[22] The daily energy requirement for an adult is between 2500-3000 kCal (10455-12548 KJ) depending on the physiological state while that of infants is 740 kCal (3094.68 KJ).[20] This implies that an adult would require between 1854 g-2228 g (taking the calculated energy of 4717KJ/100g) of *Lippia javanica*, while he will also require 1422 g-1709 g (taking the calculated energy of 3618 KJ/100g) of *Foeniculum vulgare*. Infants would require 550 g of *Lippia javanica* and 422 g of *Foeniculum vulgare* (taking the calculated energy of 4717.37 and 3618.2 for *Lippia javanica* and *Foeniculum vulgare* respectively). This means samples with higher energy will require lower quantity of sample to satisfy the percentage utilizable energy due to protein (UEDP %) for sample (assuming 60% utilization) 2.6% and 5.8% for *Lippia javanica* and *Foeniculum vulgare* respectively. The UEDP % compared favourably with the recommended safe level of 8% for an adult who requires about 55g protein per day with 60% utilization. The Proportion of total energy due to fat (PEF%) values were higher in *Lippia javanica* (71%) and *Foeniculum vulgare* (68%) which are far above the recommended level of 30% [22] and 35% [23]for total fat intake; this can be helpful for people trying to add weight through a healthy diet. The current practice of evaluating nutritive value of diets should include not only energy and protein adequacy but also the micronutrient density of the diet.

Mineral composition of *Lippia javanica* and *Foeniculum vulgare*

Minerals act as inorganic co-factors in metabolic processes which means that the absence of these inorganic co-factors could lead to impaired metabolism.[20] Table 2 gives the list of the nutritionally important minerals as well as the computed mineral ratios of the two spices. Potassium is very important in maintaining the blood fluid volume and osmotic equilibrium, the high level of potassium in both *Lippia javanica* (1907 mg/100g) and *Foeniculum vulgare* (3187 mg/100g) signifies their importance as discussed above. Phosphorus level in the two plants were the same (400 mg/100g), their phosphorus level were more compared to other plants reported in the literatures.[20, 23] The N, Ca, Mg, K, P, Na and Fe were comparably more in the two plants investigated, but *Foeniculum vulgare* had higher in N, Mg and K content, while *Lippia javanica* was higher in calcium.

Calcium is essential for healthy bones, teeth, blood and regulation of skeletal, heart and tissue muscles, while magnesium has been reported to be helpful in fighting heart disease, stroke and in cell repair. Iron may increase packed cell volume, boost the immune system and prevent anaemia in humans.[24,25] The Ca/P in *Lippia javanica* (4.58 mg/100g) and *Foeniculum vulgare* (4.17 mg/100g) is higher than 0.5 which is the minimum ratio required for favourable calcium absorption in the intestine for bone formation.[20,26] Also for normal retention of protein during growth and for balancing fluid a K/Na ratio of 1.0 is recommended, the high value of K/Na ratio in *Lippia javanica* (5.32 mg/100g) and *Foeniculum vulgare* (2.30 mg/100g) obtained in the present report suggests that they can help in modulating or adjusting diets rich in Na. The high value of Ca/Mg ratio obtained for *Lippia javanica* (7.132 mg/100g) and *Foeniculum vulgare* (4.309 mg/100g) is higher than the minimum recommended daily allowance of 1.00mg. This means both spices are good dietary sources for normal health. The milliequivalent ratio of [K/Ca+Mg] in *Lippia javanica* (0.91) and *Foeniculum vulgare* (1.55) is the normal adult value for magnesium of 1.5-2.5 mEq/L recommended in the blood, [20,26] therefore *F.vulgare* can be suggested to be a good source of magnesium in human body. Copper stimulates the immune system to fight infections, repair injured tissues as well as to promote healing. Severe deficiency of Cu in pregnant women increases the risk of health problems in both foetus and infants. [21] The copper content reported in the two spices (*Lippia javanica* and *Foeniculum vulgare*) suggest that they may be used to enrich the diet of pregnant women. Nitrogen is a macro nutrient that plays an important role in the digestion of food and growth. Catabolism of amino acids leads to a net loss of nitrogen from the body corresponding to approximately 30 to 55 g of protein each day in healthy adults. [27]

Zinc is very important because it is found in every tissue in the body and is directly involved in cell division, a good antioxidant and helps to prevent cancer. [27] Also it is involved in proper endocrine function and the maintenance of ideal hormone level. Both spices have a high content of zinc (4.7 mg/100g & 3.6 mg/100g) for *Lippia javanica* & *Foeniculum vulgare* respectively. This supports that their inclusion in the diet as sources of zinc.

The iron content was very high (78.4 mg/100g) in *Lippia javanica* compared to *Foeniculum vulgare* (17.7 mg/100g). This is an indication that *L.javanica* can help to increase packed cell volume, boost the immune system & prevent anaemia in humans.[24, 25]The high mineral content and the ratio in which they occur relative to one another could mean that addition of these spices to food will adjust the content of diets rich in Na, K and Mg. This could account for their medicinal uses in the treatment of hypertension .[24, 25]

Vitamins composition of *Lippia javanica* and *Foeniculum vulgare*

Vitamin contents of *Lippia javanica* and *Foeniculum vulgare* showed that vitamins A and E were significantly higher in *L.javanica* compared to *F.vulgare* while the vitamin C content was higher in *F. vulgare* (Table 3). Vitamin C promotes absorption of soluble non-haemolytic iron possibly by chelation or simply by maintaining the iron in the reducing Fe^{2+} form.[28]The effect can be achieved with the amounts of vitamin C obtained in foods. However, the amount of dietary vitamin C required to increase iron absorption ranges from 25 mg upwards and depends largely on the amount of inhibitors such as phytates and polyphenols present in the meal.[28] Vitamin A is an essential nutrient needed in small amounts by humans for normal functioning of the visual system, growth and development and care of epithelial cellular integrity, immune function and reproduction. The presence of these vitamins in *Lippia javanica* and *Foeniculum vulgare* makes them good sources of these vitamins in food.

Antinutrient and phytochemical composition of *Lippia javanica* and *Foeniculum vulgare*

The low amount of oxalate in *Lippia javanica* and *Foeniculum vulgare* is an indication that the availability of minerals like calcium to the body will not be affected. High amount of saponin in *L. javanica* and *F. vulgare* may lead to coagulation of red blood cells.[27]

High amount of saponin in *Lippia javanica* and *Foeniculum vulgare* may also been associated with haemolytic activity, cholesterol binding properties and bitterness.[8, 29] It has been reported that saponin contain properties that participate in precipitating and coagulating

blood cells. Tannins are dietary anti-nutrients that are responsible for the astringent taste of foods and drinks.[30]Tannins bind both proteins and carbohydrates which have several implications for commodities containing tannins. Their presence can cause browning or other pigmentation problems in both fresh processed food products. The presence of tannin in these spices implies they may have astringent properties and in addition could quicken the healing of wounds and burns .[27, 31] High level of cyanide in food has been implicated with cerebral damage and lethargy in human and animal, cyanide has also been linked to an increased incidence of goitre, the mean daily ingestion of cyanide ion was calculated to be 0.61 mg/kg of body weight.[32] Since spices are adjuncts to food which are required in little quantity, the consumption of *Lippia javanica* and *Foeniculum vulg*are may not be detrimental to brain function. It is evident that antinutrients and phytochemicals have both adverse and beneficial effects in humans. For example, it has been reported that phytates limit the availability of some notable minerals like zinc, magnesium, iron and calcium by forming complexes that are indigestible thereby decreasing their bioavailability.[21] On the other hand when phytates, tannins, saponins and other antinutrients were used at low levels they exhibited hypoglycaemic, hypocholesterolomic, antioxidant, anti-inflammatory, antihypentensive and anticancer properties. However, since most of these antinutrients are heat labile and so may not be limiting factors to the use of these spices. In addition, saponins and tannins are useful for their antioxidant properties and in the treatment of several diseases including cancer. Therefore, the presence of these compounds in the spices could account for their culinary and therapeutic uses.

Conclusion

This study compared the nutritient, mineral and antinutrient composition of two indigenous South African spices, *Lippia javanica* (Izinziniba) and *Foeniculum vulgare* (Imbambosi). The proximate principles, minerals, vitamins and anti-nutrients were analysed. The result of this study showed that *Lippia javanica* and *Foeniculum vulgare* are good sources of nutrients, minerals, vitamins and phytochemicals and they may be used to enrich the diet. On the other hand the presence of phytates, tannins, saponins and other antinutrients observed at low levels may imply that they have therapeutic uses as hypoglycaemic, hypocholesterolomic, antioxidant, anti-inflammatory, antihypentensive and anticancer agents. However, most of these antinutrients are heat labile and so may not be limiting factors to the use of these spices, therefore, the presence of these compounds in the spices could account for their therapeutic uses.Comparatively, *Lippia javanica* has a better nutrient content than *Foeniculum vulgare*.

References

1. Bassey ME, Johnny II, Okoro BI. Lesser known spices of Akwa Ibom state: their nutritional, antinutrition, mineral and phytochemical analysis. *Arch of App Sci. Res.* 2001; 3 (3):553-559.
2. Van wyk BE. A broad review of commercially important Southern Africa medicinal plants. *J Ethnopharmaco.* 2008; 119:342-355.
3. Afolayan AJ, Grierson DS, Mbeng WI. Ethnobotanical survey of medicinal plants used in the management of skin disorders among the Xhosa communities of the Amathole District, Eastern Cape, South Africa. J Ethnopharmaco. 2014; 153: 220-232.
4. Bhat RB. Plants of Xhosa people in the Transkei region of Eastern Cape (South Africa) with major pharmacological and therapeutic properties. J. Med. Plts. Res. 2013;7: 1474-1480.
5. Weiping He & Baokang Huang. Review of chemistry and bioactivities of a medicinal spice: *Foeniculum vulgare*. J. Med. Plts. Res. 2011; 5(16): 595-3600.
6. Pascual ME. Slowing K. Carretero E. Sanchez MD. & Villar A. *Lippia*., traditional uses, chemistry and pharmacology; a review. *J Ethnopharmaco* 76, 2001, 201-214.
7. Odav B. Beekrum U. Baijnath H. Preliminary assessment of nutritional value of traditional leafy vegetables in Kwazulu-natal, *J. Food Comp. Anal.*2007; 20:430-435.
8. Aliyu M. Olagunju A. Ndidi US. Audu ZO. Nutrients and anti-nutrients analyses of *Aframomum longiscapum* seeds. *Int. J.Food Nutr. & saf.* 2012; 3:120-126.
9. Beecher GR An overview of dietary flavonoids nomenclature, occurrence and intake. *J. Nutr.* 2003:133(10):324-325.
10. Chung KT. Wong TY. Huang YW. and Lin Y. Tannins and human health a review crit. *Rev. Food Sci. Nutr*. 1998; 38:421-464.
11. Antia BS. Akpan EJ. Okon PA. and Umoren. Nutritive and Anti-nutritive evaluation of sweet potatoes (*Ipomea batatas*) leaves Pakistan Journal of Nutrition. 2006;5(2): 166-168.
12. Muller HG. and Tobin G. Nutrition and Food Processing. Croom Helm, London, 1980.
13. Hathcock J.N. Quantitative evaluation of vitamin safety. Pharmacy Times. 1985; 104-113.

14. Bvenura C. and Afolayan AJ. Heavy metal contamination of vegetables cultivated in home gardens in the Eastern Cape. S Afr J Sci. 2012; 108: 9-10.
15. Simeon E. Anaduaka EG. Ogugua VN. Durunna AH. In-vitro evaluation of some nutritive and antioxidant constituents of oryctes Rhinoceros Larva, IOSR *J Environ. Sci. Tox & Food Tech.(IOSR-JESTFT);*2014: 2319-2399.
16. Awe IS and Sodipo OA. Purification of saponins of root of *Blighia sapida*. Nigerian *J.Biochem. Mol. Bio*. 2001; 16(3):201-204.
17. Obadoni BO, Ochuko O. Phytochemical studies and comparative efficacy of the crude extracts of some homeostatic plants in Eddo and Delta states of Nigeria. *Global J Pure and Applied Sciences;* 2002: 8(2): 203-208.
18. Aina VO. Sambo B. Zakari A. Haruna H. Umar H. Akinboboye and Adam M Determination of nutritional and antinutrient content of *Vitis vinifera* (Grapes) grown in bomo (Area C) Zaria, Nigeria. *Adv. J. Food Sci. and Tech.;* 2012: 4(6): 445-448.
19. Jonathan AA. and Funmilola AS: Nutritional and anti-nutritional composition of *Bridelia ferruginea* Benth (Euphorbiaceae) stem bark sample. *Int. J. Scientific Research in Knowledge* 2014; *2(2):92-104.*
20. Dauda BEN. Matthew JT. Paiko YB. Ndamitso MM. Nutritive and anti-nutritive composition of Locust Bean tree emperor mooth larvae Burnaea alcinoe (Lepidoptera –saturnii) from Gurara local government Area, Niger state, Nigeria. *J. Sci. Res. and Rep.* 2014; 3(13) 1:771-1779.
21. McNeely JA. Conserving the World's Biological diversity. Transaction Books. New Brunsick. 208. National Advisory Committee on Nutrition Education (NACNE) (1983). Proposal for nutritional guidelines for healthy education in Britain. Health Education Council. London, 1990.
22. Committee on medical aspects (COMA). Food policy Diet and Cardiovascular Disease. HMSO. London, 1984.
23. Nkafamiya II. Osemeahon SA. Modibbo UU. Aminu A. Nutritional status of non-conventional leafy vegetables, *Ficus asperifolia* and *Ficus sycomorus*. Afr. J. Food Sci. 2010; 4(3): 104-108.
24. Agunbiade OS. Ojezele OM. Ojezele JO. and Ajayi AY. Hypoglycaemic activity of *Commmelina africana* and *Ageratum conyzoides* in relation to their mineral composition. *Afr. Health Sci.* 2012; 12 (2): 198-203.

25. Afolayan AJ. and Otunola GA. Ultrastructure and elemental analysis of *Hypoxis hemerocallidea*: A multipurpose medicinal plant, *Afr J.Trad.Complement Alternat Med.* 2014;11(4): 39-43.
26. Adeyeye EI. Adesina AJ. Nutritional composition of African breadfruit (*Treculia africana)* seed testa. *J. Agric. Res. & Devpt*. 2012;11(1): 159-178.
27. Eleazu CO. Ikpeama AI. Amajor JU. Eleazu KC. Proximate composition, Essential Oils and Energy Value of 10 New Varieties of Ginger (*Zingiber Officinale* Roscoe). *Int. J. Bio. Pharmacy and Allied Sciences*. 2012; 1(9):1293-1303.
28. Hallberg D. Brune M.& Rossander-Hulthen LIs there a physiological role of vitamin c in iron absorption. Ann NY Academic Sciences. 1987; 498: 324-332.
29. Okwu DE. Evaluation of chemical composition spices and flavouring agents. Global *J. Pure Applied Science* 2001; 7: 455-459.
30. Chikezie PC. Agomuo EN. Amadi BA. Biochemistry, Practical/Research Method, A Fundamental Approach. 2008; 2:51-53.
31. Farquar JN. Plant Sterols, their biological effects in human. Handbook of Lipids in Nutrition BOCA Rotan HL CRC Press.1996;101-105.
32. Akyildiz BN. Kurtoglu S. Kondolot M. Tunc A. Cyanide poisoning caused by Ingestion of Apricot seeds. Annal of Trop. Paed. 2010; 30(1): 2042-4868.

Table 1: Proximate composition of *Lippia javanica* and *Foeniculum vulgare* (%)

Nutrient	*Lippia javanica*	*Foeniculum vulgare*
Ash	6.75 ± 2.81	11.60 ± 2.33
Moisture	10.73 ± 1.10	11.69 ± 2.94
Lipid	90.00 ± 17.31	66.67 ± 64.29

Crude Fibre	50.00 ± 0.00[a]	36.67 ± 5.77[b]
Crude protein	12.06 ±1.19[a]	20.54 ± 0.51[b]
Digestible carbohydrate	69.55 ± 12.8	47.18 ± 60.30
PEF	70.59	68.18
PEP	4.35	9.65
PEC	25.06	22.16
UEDP	2.61	5.79
Energy KJ/100g	4717.37	3618.24

Note: Moisture content, Ash, lipid and carbohydrate shows no significant different in *Lippia javanica* and *Foeniculum vulgare* ($p>0.05$) while the crude fibre and crude protein were significantly different ($p<0.05$), values are Means ± SD of triplicate samples; means with superscript are significantly different (PEP=Proportion of total energy due to protein, PEF= Proportion of total energy due to fat, PEC=Proportion of total energy due to protein, UEDP = Utilizable energy due to protein).

Table 2: Elemental components of *Lippia javanica* and *Foeniculum vulgare* (mg/100g)

Elemental analysis	*Lippia javanica*	*Foeniculum vulgare*
N	1930±189.6[a]	3286±80.9[b]
Ca	1833±75.8[a]	1666±38.85[b]
Mg	257±40.45[a]	386.67± 5.78[b]
K	1907±457[a]	3187±32.18 [b]

P	400±40.4	400±26.45
Na	358±371.5[a]	1383±46.45[b]
Zn	4.7±0.39[a]	3.6±0.17[b]
Cu	1.4±0.15[a]	0.9±0.73[b]
Mn	7.5±0.68	7.3±0.15
Fe	78.4±36.95[a]	17.7±2.37[b]
Na/K	0.188	0.434
K/Na	5.327	2.304
Ca/P	4.582	4.165
Ca/Mg	7.132	4.309
[K/(Ca + Mg)]	0.91	1.55

Note: All elemental composition N, Ca, Mg, K, Na, Zn, Cu and Fe except P and Mn were significantly different ($p<0.05$) in *Lippia javanica* and *Foeniculum vulgare*, values are Means ± SD of triplicate samples; means with superscript are significantly different.

Table 3: Vitamin A, E, and C contents of *Lippia javanica* and *Foeniculum vulgare* (mg/100g)

Vitamins	*Lippia javanica*	*Foeniculum vulgare*
Vitamin A	1.31±0.38[a]	0.67±0.10[b]
Vitamin C	0.27± 0.09[a]	0.44 ± 0.01[b]
Vitamin E	2.52±0.001[a]	2.50 ±0.002[b]

Note: Vitamin A, C and E were significantly different ($p<0.05$) in *Lippia javanica* and *Foeniculum vulgare*, values are Means ± SD of triplicate samples; means with superscript are significantly different.

Table 4: Antinutrient content of *Lippia javanica* and *Foeniculum vulgare* (mg/100g)

Anti-nutrient	*Lippia javanica*	*Foeniculum vulgare*
Oxalate	0.73±0.54	1.114±0.034
Saponin	268.5 ±360.8[a]	1855±658.7[b]

Phytate	0.012±0	0.012±0
Tannin	0.003±0.001	0.002±0.000
HCN	8.45 ± 0.600	10.5± 3.421

Note: Oxalate, phytate,tannin and hydrogen cyanide shows no significant in *Lippia javanica* and *Foeniculum vulgare* ($p>0.05$) while saponin were significantly different ($p<0.05$), values are Means ± SD of triplicate samples; means with superscript are significantly different