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# Research Article
# Essential Oil Composition, Nutrient and Anti-nutrient Analysis of *Vernonia mespilifolia* Less.

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## Abstract

**Objective:** This study aimed to evaluate the essential oil, nutrients and anti-nutrient content of *Vernonia mespilifolia* an indigenous medicinal plant used traditionally by the people of Eastern Cape, South Africa for the management of obesity. **Methodology:** Proximate parameters (moisture, ash, crude fats, proteins, crude fibers, carbohydrates and energy values) and mineral analysis (K, Na, Ca, Fe, P and Mg etc.) were evaluated using standard techniques. Essential oil was extracted using a rapid solvent-free microwave extraction method and analyzed using Gas Chromatography-Mass Spectrometer (GC-MS). **Results:** The results revealed that carbohydrate content was (46.66±0.44%), protein (10.75±0.08%), moisture (3.45±0.29%), fat (0.97±0.25%) and fibre (29.24±0.67%), while the gross total energy was 238.37±0.87 kcal/100 g. The minerals detected in appreciable quantity ranged from magnesium (1.55 mg/100 g) to potassium (2175.00 mg/100 g). The anti-nutrients (phytate, oxalate, saponins and alkaloids) content was relatively low compared with those of most edible plants and are not likely to cause any significant interference with nutrient absorption. The GC-MS analysis of the essential oils showed higher proportion of 2,5-dimethylhexa-2,4-diene, α-gurjunene, kaur-16-ene, acetamide, N-(3-nitrophenyl)-2,2-dichloro, α-elemene. **Conclusion:** The nutrients, mineral and essential oil contents of *V. mespilifolia* could be a good addition to the diet besides its medicinal values.

Key words: Proximate parameters, essential oil, anti-nutrients, GC-MS, mineral, *Vernonia mespilifolia.*

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

## INTRODUCTION

*Vernonia mespilifolia* Less. popularly known as Uhlunguhlungu (Xhosa) among the indigenous people of the Nkonkobe Municipality of the Eastern Cape of South Africa is one of the five Southern African species of the *Vernonia* family that is endemic or near-endemic to this subcontinent[1]. It is a climbing shrub that is 0.6-9.0 m tall, with pinnately-veined leaves, epaleate receptacle with obtuse involucral bracts and white to violet florets[1]. *Vernonia mespilifolia* is wide-spread in the Eastern Cape, Kwazulu-Natal, Limpopo, Mpumalanga and Western Cape provinces of South Africa[2]. It is used for ethno-medicinal management of weight loss and hypertension[3] and for the treatment of heart water disease in goats[4]. In some parts of Africa, the popular sister species, such as *V. amygdalina*, *V. calvaona* and *V. colorata* have been thoroughly investigated with respect to human nutrition and medicinal potentials for their hypoglycemic and hypolipidemic effects, as well as antimalarial, anthelminthic, anti-diabetic and antitumorigenic activities[5-8]. Despite the popular use of *V. mespilifolia* in folk and traditional medicine, the plant is not much studied scientifically for its nutritive and biological properties.

Essential oils are aromatic and largely volatile compounds which are commonly extracted by using solvent free extraction and hydrodistillation method. The solvent free microwave-assisted essential oil extraction method was used because of its efficiency to prevent disintegration of fragile volatile components of essential oils[9]. Despite its renowned medicinal potential, little or no report is known about its nutritional benefits hence this study aimed to analyze the proximate parameters, anti-nutritional content, mineral compositions and essential oil constituent of *V. mespilifolia* used in the management of obesity in Eastern Cape, South Africa.

## MATERIALS AND METHODS

The whole plant parts (leaves, flowers, stems and roots) of *V. mespilifolia* used for this study were collected in August 2015 from the wild at Dimbaza village near Alice in the Eastern Cape Province of South Africa. The plant was authenticated by Mr. Tony Dold of Selmar Schonland Herbarium, Rhodes University, South Africa and a voucher specimen (Unuofin Med, 2015/1) was prepared and deposited in the Giffen Herbarium, University of Fort Hare. The whole plant was rinsed with deionized water and gently blotted with paper towel to remove the water, oven-dried (LABOTEC, South Africa) at 40°C for 72 days until constant weight was achieved, then ground into powder (Polymix® PX-MFC 90D Switzerland).

**Proximate analysis:** The proximate parameters (moisture, dry matter, ash, crude fats, proteins and fibers, nitrogen, carbohydrates and energy values) were determined using Association of Official Analytical Chemists Methods[10,11]. Determination of moisture content was done by drying samples in oven (LABOTEC, South Africa) at 110°C until constant weight was attained[12]. Nitrogen estimation was carried out using the micro-Kjeldahl (BUCHI, KjelFlex K-360, Switzerland) method with slight modification[10]. The crude proteins were subsequently calculated by multiplying the nitrogen content by a factor of 6.25[10]. The energy value estimation was done by summing the multiplied values for crude protein, crude fat and carbohydrate at water factors (4, 9 and 4) respectively. Crude fats were determined by Soxhlet apparatus using n-hexane as a solvent. The ash values were obtained by heating samples at 550°C in a muffle furnace (E-Range, E300-P4, MET-U-ED South Africa) for 3 h. The carbohydrate content was determined by subtracting the total crude protein, crude fiber, ash content and crude fat from the total dry matter[12]. Crude fiber was estimated by acid-base digestion with 1.25% $H_2SO_4$ (v/v) and 1.25% NaOH (w/v) solutions[11].

### Anti-nutritive components

**Determination of oxalate content:** The modified method of Agbaire[13] was used to determine the oxalate content of the plant. Approximately 1 g of the pulverized sample was weighed into a conical flask, 75 mL of 3 M $H_2SO_4$ was added and stirred with a magnetic stirrer for an hour. This was filtered and 25 mL aliquot of the filtrate was collected and heated to 80-90°C. This filtrate was kept above 70°C at all times. The hot aliquot was titrated against 0.05 M of $KMnO_4$ until an extremely faint pale pink colour persisted for 15-30 sec. The oxalate content was calculated by taking 1 mL of 0.05 M of $KMnO_4$ as equivalent to 2.2 mg oxalate.

**Determination of phytic acid:** Phytic acid was determined as described by Damilola *et al.*[14]. Approximately 2 g of the sample was weighed into a 250 mL conical flask. Approximately 100 mL of 2% HCl was used to soak the sample for 3 h and then filtered through Whatman No. 1 filter paper. Approximately 25 mL aliquot of the filtrate was placed in a separate 250 mL conical flask and 5 mL of 0.3% ammonium thiocyanate solution was added indicator. Approximately 53.5 mL of distilled water was added and this was then titrated with standard iron III chloride solution which contains 0.00195 g of iron per milliliter until a brownish yellow colour persisted for 5 min. Phytic acid was calculated as Eq. 1:

$$\text{Phytic acid (\%)} = \text{Titre value} \times 0.00195 \times 1.19 \times 100 \quad (1)$$

**Determination of saponin:** Saponin content was determined as described by Obadoni and Ochuko[15]. Briefly, 5 g of the pulverized plant sample was added to 50 mL of 20% ethanol, kept on a shaker for 30 min and then heated in a water bath at 55°C for 4 h. The resulting mixture was filtered and the residue re-extracted with another 200 mL of 20% aqueous ethanol. The filtrates were combined and reduced to 40 mL in a water bath at 90°C. The concentrate was transferred into a separating funnel, 20 mL of diethyl ether was added and shaken vigorously. The ether layer which was the upper layer was discarded and the aqueous (bottom) layer retained in a beaker. The retained layer was re-introduced into a separating funnel and 60 mL of n-butanol was added and shaken vigorously. The butanol extract which is the upper layer was retained while the bottom layer was discarded. The butanol layer was washed twice with 10 mL of 5% aqueous sodium chloride. The remaining solution was collected and heated to evaporation in a water bath, then dried to constant weight at 40°C in an oven. The saponin content was calculated using the Eq. 2:

$$\text{Saponin content (\%)} = \frac{\text{Weight of residue}}{\text{Weight of original sample}} \times 100 \quad (2)$$

**Determination of alkaloids:** The alkaloid content was determined according to the method of Omoruyig *et al.*[16]. Briefly, 5 g of plant extract was mixed with 200 mL of 10% acetic acid in ethanol. The mixture was covered and allowed to stand for 4 h. This was filtered and the filtrate was concentrated on a water bath to one-fourth of its original volume. Concentrated ammonium hydroxide was added in drops to the extract until precipitation (cloudy fume) was completed. The solution was allowed to settle, washed with dilute ammonium hydroxide and then filtered. The residue collected was dried and weighed and the alkaloid content was calculated using the Eq. 3:

$$\text{Alkaloid (\%)} = \frac{\text{Weight of precipitate}}{\text{Weight of original sample}} \times 100 \quad (3)$$

**Macro and micro-nutrients analysis:** The elemental profile of *V. mespilifolia* was analyzed as described by Bvenura and Afolayan[17]. The dried homogenized sample (0.5 g) was taken in a Kjeldahl tube (250 mL) and digested with 20 mL of 98% sulphuric acid (Sigma Aldrich) at 370°C to a colorless liquid. The resultant liquid was diluted with distilled water up to 100 mL and filtered using Whatman-42 filter paper. This was then analyzed using Inductively Coupled Plasma Emission Spectrometer (ICP-OES DV 7300, Perkin Elmer, USA) equipped with Perkin Auto-Sampler with the following parameters: plasma flow rate (15 L $min^{-1}$), nebulizer flow rate (0.8 L $min^{-1}$), RF power (1500 W), auxiliary flow rate (0.2 L $min^{-1}$), sample flow rate (1.25-2.50 L $min^{-1}$), torch position (-3) for aqueous samples and 15 sec equilibration.

**Solvent Free Microwave Extraction (SFME) of essential oils:** The SFME was carried out with a microwave essential oil system (MILESTONE Microwave Laboratory Systems, Apollo Scientific, South Africa) with a maximum delivery power of 900 W variables in 10 W increments and 650 nm wavelength. During experiment, time, pressure and power were controlled with the "Easy-WAVE" software. Fresh samples of *V. mespilifolia* (100 g each) were heated using a fixed power of 400 W for 30 min at 100°C. The essential oils were collected, dried over anhydrous sodium sulphate and stored at 4°C until needed. Extractions were performed at least three times and the mean values are presented.

**Gas chromatography mass spectrometry (GC-MS):** The GC-MS analysis was performed using an Agilent 7890B GC system equipped with an Agilent 5977A mass selective detector (Chemetrix, Pty, Ltd, Agilent Technologies, DE, Germany) and a Zebron-5MS (cross-linked 5% phenyl methylpolysiloxane) column (ZB-5MS 30 m×0.25 mm ×0.25 μm). The following column and temperature conditions were used: GC grade helium was used as carrier gas at a flow rate of 2 mL $min^{-1}$ and splitless 1 mL injections was used. The injector and source temperatures were both set at 280°C. Initial oven temperature was 70°C. This was then ramped at 15°C $min^{-1}$ to 120°C, then ramped at 10°C $min^{-1}$ to 180°C and then ramped at 20°C $min^{-1}$ to 270°C and finally held at this temperature for 3 min. The data obtained was gathered with Chem Station. Identification of the components of essential oils was done by comparison of mass spectra obtained with those stored in NIST11.L library, PubChem Project (https://pubchem.ncbi.nlm.nih.gov/) and DrugBank (www.drugbank.ca/) to identify the known pharmacological properties associated with these compounds..

**Statistical analysis:** All experiments were performed in triplicates and the results expressed as Mean±SD using the Microsoft Excel 2010 spreadsheet.

## RESULTS AND DISCUSSION

**Proximate composition:** The result for the proximal content of *V. mespilifolia* is presented in Table 1. The moisture content was low (3.45±0.29%), this is a pointer that the plant will have

Table 1: Proximate composition of *Vernonia mespilifolia* Less.

| Parameters | Composition (%) |
|---|---|
| Moisture content | 3.45±0.29 |
| Total ash | 8.94±0.28 |
| Crude fat | 0.97±0.25 |
| Crude fibre | 29.24±0.67 |
| Crude protein | 10.75±0.08 |
| Carbohydrate | 46.66±0.44 |
| Energy value (kcal/100 g) | 238.37±0.87 |

Values are expressed as Mean±SD, n = 3

Table 2: Anti-nutrient composition of *Vernonia mespilifolia* Less.

| Parameters | Values (%) |
|---|---|
| Phytic acid | 3.23±0.35 |
| Oxalate | 0.29±0.05 |
| Saponins | 3.28±0.21 |
| Alkaloids | 0.62±0.03 |

Values are expressed as Mean±SD, n = 3

a protracted storage period and thus it would not be liable to microbial spoilage[18]. The moisture content is an essential aspect to consider in handling, safeguarding and sustenance of foodproducts[18]. The high ash content (8.94±0.28%) hints that *V. mespilifolia* has a high mineral. The study revealed that *V. mespilifolia* has high fibre content (29.24±0.67%) and as such its ingestion could aid in digestive processes and also reduce the absorption of cholesterol which has been implicated in the onset of cardiovascular diseases and cancer[19]. Furthermore, it could provide assistance to the gastrointestinal tract in the area of providing bulk to stool and lubrication of the colon[20]. The crude fat level of *V. mespilifolia* was 0.97±0.25%. This is quite low and could be advantageous if made a part of the diet for individuals suffering from overweight or obesity. This perhaps justifies the already locally established use of the plant in the management of obesity[3]. The crude protein content of *Vernonia mespilifolia* was found to be 10.75±0.08%. This value is relatively high and could complement protein from cereals and other plant foods that are known to be low in protein in the diet of consumers. The carbohydrate content of 46.66±0.44% suggests that the plant is a rich source of energy and could be used to enrich the energy content of diets[21]. The overall estimated energy of the whole plant of *V. mespilifolia* was 238.37±0.87 kcal/100 g (Table 1). This energy level is low due to the low crude fat and moisture level and attests to the fact that *V. mespilifolia* is a low energy food source and as such may be very helpful in weight management program as used by traditional healers.

**Anti-nutrient factor:** The result of anti-nutrient analysis of *Vernonia mespilifolia* is shown in Table 2. The saponin content (3.28±0.21%) was found to be within the safe limit, since saponins at levels <10% in a diet is said to be harmless to the body[22]. However, in humans and animals high saponin levels have been connected with gastroenteritis, manifested by diarrhoea, dysentery and haemolysis of red blood cells of rats[22,23]. According to Ridout *et al.*[24] and Umaru *et al.*[25] saponins protect plants from fungal and insect attacks but in humans and animals saponin reduces body cholesterol by preventing its reabsorption and suppresses rumen protozoan by reacting with cholesterol in the protozoan cell membrane thereby causing it to lyse.

The alkaloid content was 0.62±0.11%. Alkaloids are one of the most efficient therapeutic bioactive substances in plants. Some alkaloids stimulate the nervous system, others can cause paralysis, elevate blood pressure or lower it[26].

The phytate content of the plant was 3.23±0.35%. According to Oke[27], a phytate diet of 1-6% over a long period decreases the bioavailability of mineral elements in monogastric animals. It also forms insoluble complexes with a variety of minerals most especially the divalent ones such as calcium, copper, manganese etc., thereby lessening the accessibility of these nutrients[28]. This indicates that the consumption of large amounts of *Vernonia mespilifolia* may have adverse effects on human health. However, this anti-nutrient could easily be removed by blanching, boiling or frying[29].

The oxalate content was 0.29±0.05%. The presence of oxalate in foods causes irritation in the mouth and interferes with absorption of divalent minerals particularly calcium by forming insoluble salts[30,31]. This renders calcium unavailable for normal physiological and biochemical roles, such as the maintenance of strong bone, teeth, cofactor in enzymatic reaction, nerve impulse transmission and clotting factor in the blood. In addition, high oxalate intake can result in hyperoxaluria thereby increasing the risk of kidney stones[32,33]. The concentrations of anti-nutrients (saponin, oxalate, phytate and alkaloids) recorded in this study are within tolerable limit and may not elicit toxic effect when consumed especially when the specie is thermally treated before use.

Table 3: Mineral composition of *Vernonia mespilifolia* Less.

| Mineral elements | Composition (mg/100 g) |
|---|---|
| Calcium | 485.00±7.07 |
| Magnesium | 140.00±0.00 |
| Potassium | 2175.00±7.07 |
| Phosphorous | 400.00±0.00 |
| Sodium | 570.00±14.14 |
| Zinc | 4.40±0.07 |
| Copper | 1.55±0.07 |
| Manganese | 4.70±0.14 |
| Iron | 26.5±0.49 |

Values are expressed as Mean±SD, n = 3

**Elemental content:** The result for the mineral analysis of *Vernonia mespilifolia* presented in Table 3, showed that potassium content (2175.00 mg/100 g) was higher in the plant

compared to other minerals analyzed. The recommended daily allowance (RDA) of potassium for adults is 4700 mg[34]. Therefore, *V. mespilifolia* is able to contribute almost half of the RDA for potassium, this is an indication that the plant is a fairly good source of potassium. Potassium is the main intracellular cation in the human body required for vital cellular processes. It is involved in regulating acid-base balance, blood pressure, cell membrane function and basic cellular enzymatic reaction[35]. The sodium content (570.00 mg/100 g) of the plant is high, contributing 95% RDA proportion for adults in relation to the 600 mg RDA for an adult[34]. The Na is the most prominent cation in extracellular fluids, it is crucial in the maintenance of osmotic pressure of the body fluids and preserves normal function of the nervous and muscle[36]. A ratio of sodium ion to potassium ion less than one (Na+/K+<1) has been reported to be suitable for reducing high blood pressure. It, therefore, suggested that the plant could be a good source of food for hypertensive patients. The calcium content (485.00 mg/100 g) indicated that this plant can contribute meaningful amount of dietary calcium which is needed for growth and maintenance of bones, teeth and muscle and as such may be used as supplements in diets low in calcium ion. Calcium acts as a vital second messenger in blood coagulation, hormone secretion action, muscle contraction and nerve function[37].

Phosphorus content of 400 mg/100 g obtained in this study indicated that *V. mespilifolia* can contribute up to 40% of RDA of the 200-1,000 mg day$^{-1}$ needed in children and adults, respectively. Phosphorus is important in the synthesis of phospholipids and phospho-proteins[38]. It is also important for healthy bones and teeth. It is found in every cell and maintains normal cell growth and repairs. According to Shivraj and Khobragade[39], phosphorus maintains blood sugar level, acid-base balance and normal heart beat level. Though the magnesium content (140 mg/100 g) observed in this plant was low, it could still contribute about 31.1% out of the RDA of 450 mg day$^{-1}$ in human[40]. Magnesium acts as a cofactor to several enzymes (like kinases) which participate in energy and protein production processes. It is also vital in strengthening cell membrane structure and modulates glucose transport across cell membranes[41]. In addition, it is very important in the formation and function of bones, muscles and prevents high blood pressure and depression. It also plays a crucial role in muscle contraction, nerve transmission and boosting of the immune system[39]. The iron content 26.5 mg/100 g was higher than the Recommended Daily Allowance (RDA) of 9-15 mg day$^{-1}$ in children and adults, respectively[41], thus making the plant a good source of iron. Iron is an important element which aids in the transport of oxygen, electrons and blood formation. It is crucial in energy production, neurotransmitter synthesis and maintaining a stable immune system[42]. Iron down-regulates genes such as hepcidin, LXRá and FPN which are basic immunological factors thereby reducing cellular Reactive Oxygen Species (ROS), tissue damage, lipid retention and inflammation. This infers the role of iron as a therapeutic agent against inflammation and atherosclerotic conditions[43]. The manganese content 4.7 mg/100 g is high and can contribute up to 94% RDA proportion for children and adults in relation to the 2-5 mg day$^{-1}$ [44]. Manganese acts as a cofactor for several enzymes involved in metabolic processes necessary for the skeletal development, reproductive function and growth. This element is also involved in urea formation, metabolism of amino acids, cholesterol and carbohydrates[45]. The zinc content of 4.40 mg/100 g is also relatively high and may be used to supplement up to 31.4% of RDA of 4-14 mg day$^{-1}$ in children and adults, respectively[46]. The Zn is a vital micronutrient required for the structural and functional integrity of biological membranes, maintaining homeostasis, regulation of insulin production, regulation of glucose utilization by muscles and fat cells and detoxification of free radicals[47]. Copper content of 1.55 mg/100 g was slightly above the RDA of 0.7-1.1 mg day$^{-1}$ in children and adults, respectively[46]. The Cu is involved in the proper functioning of key enzymes like cytochrome C oxidase, amine oxidase, catalase, peroxidase, ascorbic acid oxidase, among others and plays a role in iron absorption. It is a necessary micronutrient for bone development, pigmentation, hair growth, reproductive system, haematologic and neurologic systems[48].

**Essential oil composition:** The detailed chemical profile of *V. mespilifolia* essential oil is given in Table 4. The SFME of 100 g of the plant yielded 0.46% of essential oil. Total number of chemical constituents identified from the essential oil was 15. The essential oil consisted mainly of 2,5-dimethylhexa-2,4-diene (84.14%), α-gurjunene (5.33%), kaur-16-ene (2.15%), acetamide, N-(3-nitrophenyl)-2,2-dichloro (1.75%) and α-elemene (1.20%). The remaining 10 compounds accounted for less than 1% (Table 3). The various compounds present were grouped into monoterpenes (γ-*terpinene,* 4-terpineol, 2, 3-epoxygeraniol), sesquiterpene (2, 3-epoxygeraniol, α-elemene), diterpene (kaur-16-ene) alkanes (9-octyleicosane, octadecane), apocarotenoids (hexahydrofarnesyl acetone) and alkenes (2, 5-dimethylhexa-2, 4-diene).

Essential oils are aromatic and volatile liquids, which are characterized by a strong odour, rarely coloured, andhave adensity lower than that of water. They could be synthesized

Table 4: GC-MS profile of essential oils of *Vernonia mespilifolia*

| Retention time | Name of compounds | Area (%) |
|---|---|---|
| 4.994 | γ-terpinene | 0.43 |
| 5.972 | 4-terpineol | 0.60 |
| 7.529 | 2,6-dibromopyridine | 0.82 |
| 8.253 | α-gurjunene | 5.33 |
| 9.048 | α-elemene | 1.20 |
| 9.448 | Cyclohexyl(2,3-dimethylphenyl)methanol | 0.66 |
| 9.661 | 2,5-dimethylhexa-2,4-diene | 84.14 |
| 9.781 | 2,3-epoxygeraniol | 0.80 |
| 9.895 | Acetamide, N-(3-nitrophenyl)-2,2-dichloro | 1.75 |
| 10.020 | Cyclohexyl-(3,5-dimethylphenoxy)-dimethylsaline | 0.41 |
| 10.084 | Hexahydrofarnesyl acetone | 0.52 |
| 10.469 | 2,10,10-trimethyltricyclo[7.1.1.0(2,7)]undec-7-en-6-one | 0.37 |
| 11.308 | Octadecane | 0.37 |
| 11.399 | Kaurene | 2.15 |
| 12.195 | 9-octyleicosane | 0.45 |

from all plant organs (flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and root) and they are stored in secretory cells, epidermal cells or glandular trichomes[49,50]. Essential oils are known to only represent a small fraction of a plant's composition, despite their important roles such as food production, cosmetic and pharmaceutical industries[51]. Essential oils consist largely of small molecule whose main constituents includes terpenes (oxygenated or not), with monoterpenes and sesquiterpenes. Nonetheless, allyl and propenyl phenols (phenylpropanoids) are also important components of some essential oils[52]. These substances are responsible for the fragrance and for different biological properties (anti-inflammatory, antimicrobial, anti-cancer, antiviral, anti-hyperglycemic and immunomodulatory activities[53-55]. The essential oils of *V. mespilifolia* had not been evaluated previously. However, the constituents as revealed in this study are very important. For instance, α-gurjunene has been implicated to show insecticidal potential[56-58]. According to Tao *et al.*[59] α-elemene is reported to have anti-cancer ability in both *in vitro* and *in vivo* models. Kaurene has been reported to possess to the ability to induce apoptosis in human leukemia cells and antibacterial activity[60-63]. Acetamide, N-(3-nitrophenyl)-2,2-dichloro possess anticancer activity[64].

## CONCLUSION

The study revealed that *Vernonia mespilifolia* can contribute a useful amount of nutrients to human and animal diets. The anti-nutrient content was of negligible and lower than most found in some already established vegetables and hence will not interfere with nutrients absorption. Also, levels of anti-nutrients can be reduced by preparation techniques such as soaking, blanching, steaming, boiling and cooking. *Vernonia mespilifolia* can serve as a supplement to many mineral deficiencies. It should, therefore, be considered as a plant with great potential in the food/nutritional and pharmaceutical industries.

## SIGNIFICANCE STATEMENTS

The present study gives insights into the essential oil and nutritional compositions of *Vernonia mespilifolia,* a medicinal plant commonly used in South Africa. This study revealed that this plant had high amount of certain important mineral components when compared with some conventional vegetables. It was also observed that the plant is rich in carbohydrate which serves as a major source of energy and large amount of fibre which will help aid food digestion, protein and low amount fat. Finally from our findings this plant species could be used to boast the immune system as a result of its rich essential oil compounds with therapeutic importance, mineral and nutrient compositions and this could be the reason of its therapeutic application in folkloric medicine.

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