



MICRONUTRIENTS AND ANTINUTRIENTS SCREENING OF CLOVE SEEDS (*SYZYGIUM AROMATICUM*)

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ABSTRACT

Syzygium aromaticum L. is commonly known as clove and is an evergreen tropical plant, which has been used for cooking and therapeutic properties throughout the world. After the minerals value of the plant seeds had been pulverized and turned into paste, the antinutrient and micronutrient (minerals and vitamins) contents of clove seeds (*Syzygium aromaticum*) were tested using recognized techniques. In the seed plant sample, the micronutrients assay identified the presence of calcium (Ca²⁺), potassium (K⁺), copper (Cu²⁺), iron (Fe²⁺), magnesium (Mg²⁺), manganese (Mn²⁺), and phosphorous (P⁺). Potassium (K⁺) was the microelement with the highest concentration while zinc (Zn²⁺) had the lowest concentration in *Syzygium aromaticum* seeds at 0.807 mg/kg. Two water-soluble vitamins, B and C, as well as the fat-soluble vitamin D, were found, according to the results. Vitamin C is 21.18 g/100g, vitamin B1 is 4.11 mg/100g, and vitamin D is 57.86 g/100g. Phenol, glycosides, saponin, tannin, terpenes, and steroids were also quantified as antinutrients, and their ranges were as follows: 0.257% to 0.0028%. The findings indicated that clove seeds contain a significant amount of micronutrients, vitamins, and low levels of antinutrients, which could help the body meet its necessary dietary allowance.

Keywords: Antinutrients, micronutrients, minerals, *Syzygium aromaticum*, vitamins.

INTRODUCTION

Micronutrients include minerals and vitamins because the body only needs very small amounts (milligrams or micrograms) of them to produce the hormones, enzymes, and other compounds needed for healthy growth and development. Minerals are required for the growth of bones and teeth in addition to serving as vital parts of the body's tissues, hormones, and nervous system. Microminerals are required when the amount required by the human body per day is less than 100mg and macrominerals are required when the amount required by the human body per day is greater than 100mg (Ani and David, 2021) on the other hand, play a crucial role in the body's metabolic process, including cell division, tissue repair, and other essential procedures.

They could be either water-soluble or fat-soluble. Africans view seeds as a crucial component of their diet since they supply the vital minerals and vitamins required for optimum growth and health (edible leaves, stems, roots, fruits, or seeds).

However, plant substances called antinutrients prevent the body from absorbing essential nutrients. Most individuals don't worry much about them, but in famine situations or in those who consume primarily grains and legumes, they can become an issue. Compounds known as antinutrients work to block the absorption of nutrients. Phytate, tannins and other polyphenols, oxalate, saponins, and lectins are a few examples. (Ani and David, 2021).

Syzygium aromaticum L. is commonly known as clove and is an evergreen tropical plant, which has been used for cooking and therapeutic properties throughout the world (Ali *et al.*, 2019). Cloves are the dried flower buds of trees in the Myrtaceae family.

Antibacterial and anti-inflammatory properties have been discovered in *Syzygium* species. (Jirovetz *et al.*, 2006). The buds of *Syzygium aromaticum* were reportedly well-known in traditional medical systems for their odontalgic, diuretic, tonicardic, stomachic, and aromatic qualities as well as their carminative and stimulating action (Ali *et al.*, 2019). Additionally, it is used as a rubefacient, a carminative, and a preservative in herbal formulas, indicating potential antibacterial effects (Ayoola *et al.*, 2008).

Sesquiterpenes, tannins, triterpenoids, and a phenolic compound known as eugenol are only a few of the essential chemicals found in the many *Syzygium* species (4-allyl- 2-methoxyphenol) (Ali *et al.*, 2019). In addition to being an antioxidant, carminative, antispasmodic, antibacterial, and antiseptic substance, eugenol also has antimutagenic properties.

Phytochemical analysis revealed the presence of alkaloids, steroids, glycosides, terpenoids, tannins, flavonoids, and phenolic compounds in the crude extract (Baietto, 2014). In order to assess the seeds of clove, a wild plant native to Nigeria, for their micronutrient content, efforts are undertaken to extract clove (*Syzygium aromaticum*) dried flower buds or seeds (minerals and vitamins) and antinutrient (phytochemicals) qualities in order to investigate their potential functional dietary and medicinal uses on a scientific foundation. This report focuses on the assessment of the micronutrients and antinutrients screening of clove seeds (*syzygium aromaticum*).

MATERIALS AND METHODS

Collection of Samples:

The matured whole seeds of clove (*S. aromaticum L.*) were purchased from the local market of Oba Adesola, Lusada, Ogun State, Nigeria.

Preparation of clove seeds powder:

The mature, healthy clove seeds (*S. aromaticum L.*) were washed and patiently dried for 10 days under a shed. These seeds were ground in a blender to produce tiny, fine particles after drying. This was sieved with 1.0mm mesh size, and kept in an airtight container for analysis.

Phytochemical Analysis of Antinutrients

Qualitative analyses of antinutrients of *Syzygium aromaticum* seeds extract:

20grams of dried sample of the clove seeds were weighed for extraction using Soxhlet extractor. The extracted sample were stored for the analysis of alkaloid, saponnin, tanning, steroids, phenol, glycoside and flavonoids and terpenoids according to (Sofowara 1993; Trease and Evans, 1989; and Harborne, 1973).

Alkaloid Determination

To 1ml of the extract were measured into a test-tube, add 1ml Wagner's reagent and the presence of alkaloid were confirmed by the slight reddish precipitate.

Glycoside Determination

To 2ml of the extract in the test-tube, add 5ml of distilled water add 2ml of Conc. H_2SO_4 and boil for 15minutes using water bath. Allow cooling and then neutralizing with 2ml of 20% KOH, add 1ml of equal volume of Fehling solution A and B and boil for 15minutes. The formation of brick red colouration confirmed the presence of Glycoside (Siddiqui and Ali, 1997)

Terpenoid Determination

To 2ml of the extract in the test-tube, add 2ml of acetic anhydride and 2ml of Con. H_2SO_4 , the presence of terpenoids were confirmed by the colour change from blue to green rings (Siddiqui and Ali, 1997).

Tannin Determination

To 1ml of the extract in the test-tube, add 0.5ml of 20% freshly prepared KOH. The presence of Tannin was confirmed by the formation of dirty white Precipitate (Siddiqui and Ali, 1997).

Saponin Determination.

To 3ml of the extract in the test-tube, add 2ml of equal volume of feeling solution A and B, then boil for 5minutes. The presence of Saponnin was confirmed by the formation brick reddish precipitate (Siddiqui and Ali, 1997).

Flavonoids Determination

To 1ml of the extract in the test-tube, add 2 drops of Alcohol and 0.5ml of Conc. H_2SO_4 , the presence of Flavonoid were confirmed by the formation of yellowish colouration (Siddiqui and Ali, 1997).

Phenol Determination

To 1ml of the of extract in the test-tube, add 1ml of distilled water and 2-3drops of 5% NaOH, and the presence of Phenol were confirmed by the colour change from yellow to bright orange (Siddiqui and Ali, 1997).

Steroid Determination

To 1ml of the extract in the test-tube, add 1ml of acetic anhydride and 2ml of Conc. H₂SO₄; the presence of steroid were confirmed by the colour change from blue to green (Siddiqui and Ali, 1997).

Quantitative analyses of antinutrients of *Syzygium aromaticum* seeds extract

Phytochemicals of Saponins, tannins, and glycoside were quantitatively determined in the stock samples using established methods. The double solvent extraction of gravimetric method described by Ani and David (2021) was used for saponins content determination. Tannin and total phenol contents were evaluated spectrophotometrically as enunciated Santhi and Sengottuvel (2016) respectively.

Analysis of Mineral Determination of Clove seeds sample:

The concentration of minerals (Ca, K, Mg, Na, P, Pb, Cu, Fe, I, Mn, Cd, Ni, Cr, and Zn) in the stock samples were quantified using Association of Official Analytical Chemists (AOAC) Atomic absorption Spectrophotometric method (AOAC, 2006) as described by (Jirovetz *et al.*, 2000).

Fat-soluble and Water-soluble vitamin contents analyses of *Syzygium aromaticum* seeds extract:

Vitamin D, C, and B₁ contents of the stock sample were quantified by subjecting the extract to gas chromatographic analyses (AOAC, 2006) as described by (Ani and David, 2021).

RESULT

Qualitative Phytochemical screening of *Syzygium aromaticum* seeds extract

The results of the qualitative screening of phytochemical analysis of cloves seeds methanol extracts are shown in Table 1. Terpenes, glycosides, saponin, steroids, tannins, and phenols were found in the sample. There were no alkaloids or flavonoids found.

Table 1: Qualitative screening of phytochemical analysis of *Syzygium aromaticum* seeds extract

Parameters	Methanol
Alkaloid	-
Tannin	+
Saponin	+
Flavonoid	-
Phenol	+
Steroid	+
Glycoside	+
Terpenoids	+

Key:

- + Presence of phytochemical
- Absence of phytochemical



Quantitative composition of antinutrients of *Syzygium aromaticum* seeds extract.

The results of the quantitative phytochemical analysis of antinutrients are shown in Table 2. Terpenes, glycosides, saponin, steroids, tannins, and phenols were found in the sample. The highest constituent discovered was phenol, while the lowest was Terpenes. There were no alkaloids or flavonoids found.

Table 2: Phytochemical composition of *Syzygium aromaticum* seeds extract (%)

Components	Values (%)
Tannin	0.026
Saponnin	0.139
Phenol	0.257
Steroids	0.0059
Glycosides	0.118
Terpenes	0.0028

Minerals analysis of *Syzygium aromaticum* seeds extract (mg/kg)

Potassium, calcium, sodium, phosphorus, and iron (Fe) were the highest minerals in the clove seeds study, with 9244.62 mg/kg, 4562.62 mg/kg, 791.062 mg/kg, 173.53mg/kg, 117.059 mg/kg and 22.738 mg/kg respectively. Except for lead, Nickel and chromium, which were not present in the seeds sample, the remaining minerals were present in varying smaller amounts.

Table 3: Minerals composition of *Syzygium aromaticum* seeds extract (mg/kg)

Mineral element	Concentration (mg/kg)
Zinc	0.807
Cadmium	5.309
Nickel	0
Iron	117.059
Lead	0
Chromium	0
Copper	1.781
Calcium	1788.894
Magnesium	22.738
Manganese	791.062
Sodium	4562.28
Potassium	9244.62
Phosphorous	173.53

Vitamin Composition of *Syzygium aromaticum* seeds extract sample (mg/100g)

The vitamin analysis reveals that the sample is extremely high in vitamins D, C and B1.

Table 4 shows that vitamin B1, D and C is present in the sample.

Table 4: Vitamin composition of *Syzygium aromaticum* seeds extract mg/100g and in µg/100g

Vitamins	concentration in mg/100g	concentration in µg/100g
Vitamin C	21.18	

Vitamin D		57.86
Vitamin B ₁	4.11	

DISCUSSION

The Clove seeds (*Syzygium aromaticum*) revealed that there is presence of medicinal active constituents. Meanwhile, the medicinal beneficial effects of plants typically results from the secondary products present in the plant, it is usually not attributed to a single compound but a combination of the metabolites (Parekh *et al.*, 2006). The phytochemical active compounds of Clove seeds were qualitatively analyzed and the results are presented in the Table 1. In the screening process, Tannin, Saponin, Phenol, Steroid, Glycoside and Terpenoid showed various degrees of results in solvents medium (Methanol). Alkaloids and Flavonoids were not present this was also observed from (Jyothiprabha and Venkatachalam, 2016) research work. However, the medicinal value of plants lies in some chemical substances that have definite physiochemical action on the human body (Jirovetz *et al.*, 2006). Difference in phytochemicals has been found to possess a wide range of activities, which may help to protects against chronic diseases such as heart diseases and stroke, saponins protects against hyper chlolesterolemia and antibiotics properties (Rates, 2001). Steroids and tepernoids show the analgesic for central nervous system activity. The importance of Saponins and Tannins in various antibiotics used in treating common pathogenic strains has recently been reported by (Erdemoglu *et al.*, 2006). However, according to (Bandyopadhyay *et al.*, 1998) a glycoside appeared to be the major bioactive component that offers anti-secretory and antiulcer effects.

The Clove seeds (*Syzygium aromaticum*) in Table 2 has higher mineral content of potassium (K), sodium (Na), calcium (Ca), Manganese (Mn), phosphorous (P), iron (Fe), and magnesium (Mg) in the following decreasing order 9244.62mg/kg, 4562.28 mg/kg, 1788.894 mg/kg, 791.062 mg/kg, 173.53 mg/kg, 117.059 mg/kg and 22.738 mg/kg. According to the current report in the seeds of the plants, Cadium (Cd), copper (Cu) and (Zn), content are all lower in their mineral content values of 5.309mg/kg, 1.781 mg/kg and 0.807 mg/kg respectively. Essential minerals like Na, Ca, and K are found to be comparable to published findings (Ani *et al.*, 2021).

However, some of these minerals are pertinent to the body but in various degrees or amount, Calcium and Phosphorus are of great importance to the body compared with other minerals, and their functions include: strong teeth, strong bone and skeletal building but calcium are needed in the body at a higher percentage than Phosphorus Bilikis and Olarewaju (2015). In addition, the higher or lower level of Phosphorus in the body could cause some medical complication such as heart diseases and joint pain. Manganese plays a vital role in the body physiological process as a constituent of multiple of enzymes and activator of other enzymes. Zinc is essential trace element because very small amount of it are necessary for human health and as well as immune booster for treating: common cold, recurrent ear infection and preventing lower respiratory (Jirovetz *et al.*, 2006). Potassium and Sodium have similar characteristics, in terms of regulating the body system and balancing. In addition, Potassium is of importance to the body for both cellular and electrical function and as well regulates the water balance and acid-base balance in the blood tissue, While Sodium contributes to the proper muscle-contraction and nerve impulse conduction. Magnesium is a cofactor in over 300 enzymes system that regulates diverse biochemical reactions in the body including protein synthesis, blood glucose control, blood pressure regulation, glycolysis and as well the fourth most abundant mineral in the body (Jirovetz *et al.*, 2006). However, the presence of Copper is important for it aids normal body metabolism and it is as well a component of hemocyanin. Finally, Iron is a very vital mineral element because it helps in the growth and also carries oxygen around the body. In addition, one important sign of lack or low iron in the body is tiredness and fatigue.

Vitamins are micronutrients that have protective functions in the body and must be acquired via food. Vitamin D, also known as the sunshine vitamin, was present in high concentrations in the seed of *Syzygium aromaticum* (57.86 μg /100g) as shown in Table 4 above. Vitamin analysis revealed that the seeds of *Syzygium aromaticum* is high in vitamins D and C, and B₁, all of which play important roles. Increased intestinal uptake of phosphate, magnesium, and calcium, as well as a variety of other biological effects, are all attributed to vitamin D (Achikanu *et al.*, 2020). Vitamins act as co-enzymes in macronutrient metabolism. Anti-beriberi vitamin B₁ is also known as thiamine. Vitamins are micronutrients that have protective functions in the body and must be acquired via food (Koirala *et al.*, 2020). Increased intestinal uptake of phosphate, magnesium, and calcium, as well as a variety of other biological effects, are all attributed to vitamin D (Achikanu *et al.*, 2020). When eaten in sufficient amounts, the tested plant samples are good

sources of B and D complex and can be used to maintain good health in humans and animals (Okezie *et al.*, 2018). The importance of vitamins in maintaining good health cannot be over emphasized and these residues can represent another source for vital vitamins such as vitamin C, vitamin B1 and D. If children aged 4 to 9 years old eat 100 g of clove seeds per day, the vitamin C content may be sufficient, providing 88-100 percent of their recommended dietary intake (Wayah and Shehu, 2013). Vitamin C is needed for the production of collagen, hormones, and neurotransmitters. 100 g of clove seeds could also satisfy 77 percent of adolescent vitamin C needs, 69 percent of adult vitamin C needs, and 52 percent of pregnant mothers' vitamin C needs (Ezeh *et al.*, 2014).

Furthermore, Clove seeds' has high content of vitamin C which makes them soluble, allowing the iron content to produce more Vitamin C as antioxidants, which are essential in the prevention of coronary artery disease and cancer (Suleiman *et al.*, 2018). Thiamine (B1) vitamins play an important role in energy metabolism. Vitamin D is also important for bone and muscle health (Stroud, 2008).

CONCLUSION

This study shows great contents of phytochemicals, minerals and vitamins, which depict important dietary supplements that can be used to correct nutritional deficiencies, so as to balance our daily diets. The low contents of some of the antinutritional components suggest that cloves seeds are good source of food to human and also have medicinal value.

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