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Phytochemicals Screening, Minerals Composition and Proximate Analysis of Garlic (*Allium sativum*)

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Abstract

Garlic (*Allium sativum*) is a widely used medicinal plant with potential health benefits. The use of medicinal plants as remedies or medicine in prevention and treatment of several diseases was in place for many years. Garlic (*Allium sativum*) is among those plants because it possesses those characteristics. In this study, we investigated the phytochemical constituents, mineral composition, and proximate analysis of garlic. The qualitative phytochemicals screening of garlic ethanolic extract reveals the presence of Tannins, Alkaloid, Saponin, steroid, Glycosides, phenols and flavonoid while the quantitative shows that the extract composed of Alkaloid 10%, Saponin 5.30%, Tannin 4.10 µg/ml, Glycosides 4.40%, flavonoid 2.20%, phenols 3.14 µg/ml. The proximate analysis reveals that the garlic extract contains carbohydrate 65.84%, fiber 7.14%, fat 2.15%,ash 9.90%,moisture 7.58%, protein 7.30% The determination of some minerals composition in (mg/kg) reveals that the extract is composed of sodium(22mg/kg), potassium(531.5 mg/kg), zinc(7.1 mg/kg), copper(0.36 mg/kg), Iron(2.7 mg/kg), calcium(233 mg/kg) and

magnesium(35.4 mg/kg) respectively were also detected, highlighting garlic's potential as a nutraceutical food supplement.. This research contributes valuable insights into the bioactive components of garlic, supporting its traditional use and potential health benefits. Further studies could explore its antioxidant, antimicrobial, and therapeutic properties.

Keywords: Garlic, Phytochemicals, Proximate composition, Mineral analysis

INTRODUCTION

Natural products have played a significant role in traditional medicine systems, including Chinese, Ayurvedic, and Egyptian medicine (Sarker *et al.,* 2007). As a natural source of chemotherapy, they have also gained popularity among scientists looking for alternative drug sources. The World Health Organization (WHO, 2004) defines a medicinal plant as any plant that has compounds in one or more of its organs that have therapeutic value or that serve as building blocks for the semi-synthesis of chemotherapy drugs. Such a plant will have its parts comprising leaves, roots, rhizomes, stems, barks, flowers, fruits, grains or seeds, employed in the control or treatment of a disease condition and consequently has chemical components that are medically active (Doughari, 2012). Bioactive substances derived from plants are called phytochemicals. Since the plant that produces them might not need them, they are referred to as secondary metabolites. Any portion of the plant body may include active components because they are naturally formed in all of its sections, including the bark, leaves, stem, roots, flowers, fruits, and seeds (Tiwari *et al.,* 2010).

Allium sativum L., a plant belonging to the Liliaceae family, is commonly known for its medicinal properties and as a helpful spice for treating a range of illnesses and physiological conditions. One of the major bulb crops cultivated and utilized as a spice or condiment all over India is garlic. Garlic is a stomach stimulant and carminative, which aids in food absorption and digestion, according to the Unani and Ayurvedic systems used in India. The allicin included in garlic's aqueous extract lowers blood cholesterol levels. Antimicrobial activity of garlic extract is demonstrated against numerous genera of bacteria, fungi, and viruses. Garlic's therapeutic properties are attributed to its elevated sulfur component content.

Numerous authors have highly complimented the chemical components of garlic that have been studied for the treatment of blood pressure, atherosclerosis, cancer, cardiovascular disease, diabetes, and hyperlipidemia. (Tiwari *et al.,* 2010). Doctors typically advise inhaling garlic oil or juice for treating rheumatism, pulmonary TB, sterility, impotence, coughing, and red eyes. Garlic has an insecticidal effect. For eight hours, about 1% of garlic extract provides mosquito protection. Garlic extract, when combined with ginger and chilli, provides a protective effect against soil nematodes (Tsao *et al.,* 2001). Garlic extract has been demonstrated to be beneficial against a variety of fungus. One of the oldest known medicinal plants is likely garlic, which has been used for centuries to treat a variety of human ailments. The main therapeutic benefits of garlic include lowering blood pressure and cholesterol, preventing infections, and preventing cancer. Researchers are primarily interested in garlic's medical properties because of its wide range of therapeutic applications and low toxicity. Antimicrobial activity of garlic extract is demonstrated against numerous genera of bacteria, fungi, and viruses.

One of the plants that has been used for decades to treat infectious disorders is garlic (*Allium sativum* L.), which has been the subject of extensive research over many years. It is a highly recognized farmed food that is a member of the Amaryllidaceae family worldwide. One of the first plants to be cultivated, garlic originated in Central Asia (Kao *et al.,* 2014). For thousands of years, various bacteria have acknowledged the potential medical usefulness of garlic as a therapeutic agent (Tiwari *et al.,* 2010).

Garlic, for instance, has well-established antifungal, antiviral, antibacterial, antihelmantic, antiseptic, and anti-inflammatory qualities. Additionally, garlic extracts demonstrated efficacy against gram positive (S. aureus, S. pneumonia, streptococcus, and Bacillus anthrax) and gram negative (E. coli, Salmonella sp., Citrobacter Enterobacter, Pseudomonas Klebsiella) pathogens, all of which are global causes of morbidity (Tsao *et al.,* 2001). It is used to treat respiratory tract infections, diarrhea, otitis media, and stomach pain in Africa, especially in Nigeria (Jaber *et al.,* 2007). It was used to treat asthma, hay fever, and common colds in Europe and India (Timbo *et al.,* 2006). Garlic is known to be a nutritious meal, but it also possesses antioxidant, antiviral, antibacterial, and antifungal properties. It has also been shown to have anti-cancer and anti-atherosclerotic qualities. Its efficacy and broad spectrum antibacterial action against several types of bacteria, viruses, parasites, protozoa, and fungi have been shown in numerous studies.

Plant extracts and medications generated from plants have greatly improved human health and wellness over time (Anyanwu and Nwosu, 2014). Herbal medicines function similarly to conventional drugs because the chemical compounds in plants mediate their effects in the human body through mechanisms that are similar to those that are already well understood for the chemical compounds in conventional drugs. Because of this, herbal remedies have the same potential for negative side effects as conventional medications while also being just as effective (Tapsell *et al.,* 2006). It is widely acknowledged that researching historical applications of plants can help find new therapeutic uses. These plants are used in medicine because their seeds, leaves, stem, or roots contain bioactive components such phenols, flavonoids, tannins, and alkaloids (Tapsell *et al.,* 2006).

Once their efficacy has been demonstrated clinically, many developing nations view local medicinal plants as potential additions to the WHO's list of "essential drugs." Throughout human history, medicinal plants have been identified and utilized. According to Manta *et al.* (2013), plants possess the capacity to produce an extensive range of chemical compounds, which are employed for vital biological processes and defense against bacteria and other predators.

The aim of this research is to determine the phytochemicals, minerals contents and proximate analysis of Garlic (*Allium sativum*).

MATERIALS AND METHODS

Apparatus Used**:**

Motar and pestle, sieve, 1000ml conical flask, 250ml beaker, 500ml measuring cylinder, filter papers (watman filter paper), funnel, test tubes, 2ml – 10ml syringes and crucible dish.

Equipment Used:

Electric weighing balance (Adam laboratory, model No: AE438181850).

Stuart orbital shaker SSL1 (Bibby scientific LTD UK).

Rotary Evaporator(Model RE52A, China).

Oven (Genlab thermal engineers, model No: 11E200).

Centrifuge machine (Model No;K24, serial No;13036, made in Germany).

Kjeldhl's apparatus (Pyrex glass).

Vecstar furnace (chesterfield U.K. series No; 347011, model no.ECF2).

Chemicals and Reagents:

Ethanol (Sigma Aldrich, U.K), Gallic acid (Kremel, China), Acetic acid(Hydrite chemical co..USA), Diethyl ether (Loba chemie pv,.LTD India), N-butanol (Guaghua sci-tec.LTD. China), Sodium hydroxide (Hopkin and hyclians LTD, England), Borate acid (Kremel China), Sulfuric acid (Sigma Aldrich, UK), Petroleum ether (Loba chemie pv.LTD, India), Hydrochloric acid (Kremel China), Lactic acid (Changzhou biochemical co.LTD China), Wagners reagent , Magnesium acetate (JHD, China), Magnesium (East anglia chemicals England), Ferric chloride (Qualikems fine chemicals PVT.LTD, India), lead acetate (Lab tech chemicals Nigeria), Anthrone (Loba chemie pv.LTD, India), Sodium carbonate anhydrous (Park scientific LTD. UK), Folindenis folin ciocalteau (Loba chemie pv.LTD. LTD), Ammonium hydroxide (Griffin and George, England), Copper sulphate (Qualikems fine chemicals PV.LTD. India), Sodium sulphate (Park scientific LTD. UK), Methyl red (BDH chemicals pool, England).

Reagents Preparation

Tetraoxosulphate (vi) acid (H_2SO_4)(1.5%) and 1.5gm of sodium hydroxide (NaOH) were dissolved with distilled water in two different 100ml volumetric flasks and filled to the mark.

2% Boric Acid (H_3BO_3) Boric acid (2g) powder was weighed, transferred into a 100ml volumetric flasks and dissolved using a small quantity of distilled water and then filled to the mark.

Collection and Identification of Plant Materials

The fresh garlic bulbs samples were bought from gombe market gombe state North Eastern Nigeria. The sample was identified by botanist, department of biological science of Gombe State University, they were then dried under shade for 3 weeks days and grounded to fine powder with porcelain mortar and pestle; these grounded samples were kept in a sealed container for elemental analysis, proximate composition and phytochemical screening of the garlic(powder).

Preparation of Garlic Bulbs (*Allium sativum)* Extract

Twenty five grams (25g) of garlic powder was extracted using 125ml of ethanol and 125ml of distilled water. Were shake thoroughly on an orbital shaker at 200rpm for two hours and it was filtered. The excess solvent from the filtrate was evaporated using rotary evaporator. The crude extract was transferred and stored in a refrigerator for further used.

Percentage Yield

The percentage yield of fine powder garlic of 25g was calculated using formula below.

Percentage yield = $\frac{x}{y}$ x 100

Where; *x* is the weight of the extract and

y is the weight of powder sample from garlic bulbs extract (*Allium sativum*)

The percentage yield of garlic bulbs (*Allium sativum*) extract.

The weight of the empty beaker= 52.55g

The weight of beaker + extract = 54.58g

The weight of extract = 54.58g-52.55g = 2.03g

Using the formula

% Yield = $\frac{x}{y}$ x 100

Where *x* = 2.03g and y = 25g

Therefore % Yield = $\frac{2.03}{25}$ x 100

% Yield = 0.0812x100

% Yield = 8.12%

Phytochemical Screening

The ethanolic leave extract of gatrlic bulbs was subjected to qualitative and quantitative test to determine the presence and amount of alkaloid, flavonoid, phenol, saponin, tannin, steroids and glycoside.

Qualitative phytochemical screening of garlic bulbs powder

Test for Alkaloid (Wagners Test): A few drops of Wagner's reagent were added to few ml of plant extract along the sides of test tube. A reddish- Brown precipitate indicated the presence of alkaloid (Banu et al, 2015).

Test for Flavonoid (Shindo'sTest): 1.3ml of the extract was mixed with 0.5g of magnesium turnings; the mixture was boiled for 5 minutes; the appearance of orange to red color indicated the presence of flavonoid (Ajuru et al, 2017).

Test for Phenol:A few drops of ferric chloride solution were added to 2ml of the extract in a watch glass; the appearance of bluish green color indicated the presence of phenol (Ajuru et al, 2017).

Test for Saponin (Frothing Test):2.5ml of the extract was mixed with a few drops of distilled water and the mixture was shaken vigorously, a cupious lather formation was noticed which indicated the presence of saponin (Ajuru et al, 2017).

Test for Tannin (Wohler's Test): A few drops of basic lead acetate solution were added to 1.6ml of the extract; the appearance e of a white precipitate indicated the presence of tannin in some of the plant extract (Ajuru et al, 2017).

Test for Glycoside: 2.5ml of the extract was mixed with a little quantity of anthrone on watch glass, one drop of concentrated sulphuric acid was added and made into a paste, and heated gently over a water bath; a dark green coloration indicated the presence of glycoside (Ajuru et al, 2017).

Test for steroids: 1ml of the extract was mixed with two ml of chloroform in a test tube and equal volume of concentrated sulphuric acid was added to the side of the test tube the turning of red in the upper layer and yellow with green flourecence in the sulphuric acid layer indicates the presence of steroid.

Quantitative determination of garlic bulbs extract (*Allium sativum)*

Extracts were analyzed for the presence of alkaloids, saponins, tannins, glycoside, phenols and flavonoids according to Sofawara (1993), Trease and Evans (1989), Yadav and Agarwala, (2011).

Determination of Tannin

0.5g of sample was weighed using electric weighing balance and poured into a 250ml conical flask. 75ml of distilled water was added. The mixture was boiled for 30 minutes and centrifuged at 2000rpm. The supernatant was collected in a 100ml volumetric flask and the volume was made up to 100ml. 1m of the sample extract was transferred into 100ml volumetric flask containing 75ml of distilled water. 0.5ml of Folin-Denis reagent and 1ml of sodium carbonate was added. The absorbance was read at 700nm after 30 minutes. Standard tannic acid was prepared using 0.1g/100ml of stock solution and the standard tannic acid graph was plotted.

$X = \frac{y-c}{m}$

Where; X = concentration of the tannic aci (µg/ml)

- Y = absorbance of the sample
- C = intercept from the standard tannic acid graph
- M = slope from the standard tannic acid graph

Determination of Flavonoid

$50cm^3$ 80% aqueous ethanol and 20% distilled water was added to 2.5g of sample in a 250ml beaker. The mixture was covered and allowed to stand for 24hours at room temperature. The supernatant was discarded and the residue was re-extracted (three times) with the same volume of ethanol. Filter paper was used to filter mixture and left to evaporate to dryness.

%Flavonoid = $\frac{Weight\ of\ flavonoid}{Weight\ of\ sample}$ x 100

Determination of Phenol

0.5g of the sample was homogenized in 10X volume of 80% ethanol. The homogenate was centrifuged at 6000rpm for 20 minutes. The extraction was repeated with 80% ethanol. The supernatants were pooled and evaporated to dryness. The residue was the dissolved in a known volume of distilled water (20ml). Different aliquots were pipette out and the volume in each test tube was made up to 3.oml with distilled water. Follin – Ciocalteau reagent (0.5ml) was added equal volume of NaCO_3 and the tubes were placed in a boiling water

bath for exactly one minute. The tubes were cooled and the absorbance was read at 600nm in a spectrophotometer against a reagent blank.

A standard gallic acid solutions (0.2 – 1ml) corresponding to 2.0 - 10µg concentration were also treated as above and the standard gallic acid graph was plotted.

$$X = \frac{y-c}{m}$$

Where; X = concentration of phenol (µg/ml)

- Y = absorbance of the sample
- C = intercept from the standard gallic acid graph
- M = slope from the standard gallic acid graphs

Determination of Alkaloid

5g of the sample was weighed poured into a 250ml beaker; 200ml of 20% acetic acid in ethanol was added and covered to stand for 4 hours. This was filtered and the extract was concentrated using a water bath to one quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the preparation was complete. The whole solution was allowed to settle and the precipitate was collected by filtration and weighed (Ajuru et al, 2017).

$$\%\text{Alkaloid} = \frac{Weight\ of\ alkaloid}{Weight\ of\ sample} \times 100$$

Determination of Saponin

5g of the powder sample was taken and heated at 55℃ in 100ml of 20% ethanol for 4 hours and filtered. The residue was treated with 100ml of 20% ethanol and combined the filtrate which was concentrated to 40ml by heating in a water bath at 90℃ . The filtrate is treated with 20ml diethyl ether shaken vigorously in a separating funnel, the ether layer was then discarded the and the aqueous layer was mixed with 60ml n-butanol and the solution was evaporated to dryness in an oven.

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

Determination of glycoside

0.5g of the extract was taken and dilute with distilled water. To 1ml of dilute extract 1ml of 5% NaoH was added it was boiled for 2minutes and violet brick red ppt was observed it was filterd using a known weight filter paper and dried in an oven at 50℃ and the weight of the filter paper was taken.

$$\% \text{ Glycoside} = \frac{w_2 - w_1}{w} \times 100$$

where

W_1 = weight of empty filter paper

W_2=weight of filter paper +residue

W = weight of sample

Proximate Composition of garlic bulbs

Proximate analysis is an analysis that is performed based on the six (6) classes of food, this include; protein, moisture content, ash content, lipid (fat), fiber and carbohydrate. In carrying the analysis, the methods used vary according to the food material being studied and also in details of evaluation procedure of Association of Official Analytical Chemist (Horwitz, 2000).

Determination of protein

I. Digestion

2g of the powder sample was weighed and transferred into a digestion flask, 0.5g of $CuSO_4$ and 5.0g of sodium sulfate was added, as well as 25ml of concentrated H_2SO_4 solution. A significant amount of antibump was added and the digestion flask was placed on a hot plate and it was heated gently until clear green colour was observed.

II. Distillation

After complete digestion, 100ml of distilled water was added, as well as 10ml of 20% NaOH solution, to the digest. The measuring cylinder used to measure the NaOH solution, was rinsed with 50ml distilled water and the content transferred to the digestion flask. Antibump was added and the distillation set-up was connected to the upper chamber of the apparatus (Kjeldahl apparatus). 20ml of 2% H_3BO_3 was measured and transferred into a receiving flask. 3 drops of screened methyl red indicator were added. The receiving

flask was placed at the middle chamber of the apparatus (Kjeldahl apparatus), and the delivery tube was immersed into the pinkish solution in the receiving flask. The heat knob of the upper chamber was turned on for distillation to begin, and about 20ml of the resulting pale yellow solution was collected for titration.

III. Titration

After complete distillation, the pale yellow receiving solution was then titrated with 0.05M H_2SO_4 solution until a permanent pink colour was observed, which indicated the end point.

$$\% \text{ Nitrogen} = \frac{\text{Titer Value} \times 0.0014}{Weight\ of\ sample} \text{ x } 100$$

Percentage protein (%P), is calculated by multiplying the %N by the Jones factor, F, corresponding to the protein source, as shown below:

% Protein = %N × F

Determination of moisture content

A dried cooled platinum dish was weighed (w_1) and 3g of the fresh leaves sample was introduce into the dish and weighed accurately (w_2). The dish was transferred and its content into an oven at 105°C to dry for about 3 hours and the dish was removed and weighed (w_3).

$$\%\text{Moisture} = \frac{w_2 - w_3}{w_2 - w_1} \text{ x } 100$$

Where; Weight of dish (w_1)

Weight of dish and sample (w_2)

Weight of dish and sample after drying in oven (w_3)

Determination of ash content

A dry cool platinum dish was accurately weighed as (w_1) and about 3g of the leaves sample was added in the dish and weighed as (w_2). A it was place into a muffle furnace at 500°C until fully ashed (colour changes to gray) and weigh as (w_3).

$$\%\text{Ash} = \frac{w_3 - w_1}{w_2 - w_1} \text{ x } 100$$

Where; Weight of dish (w_1)

Weight of dish and sample (w_2)

Weight of dish and sample after heating in muffle furnace (w_3)

Determination of lipid content (fat)

2g of the powder sample was weighted (w_1) and poured into a conical flask of a known weight (w_2) 150ml of petroleum ether was added and the mixture was shaken for one hour on mechanical shaker at 200rpm. The content was filtered and the filtrate was kept in an oven for evaporation and weighted as (w_3).

$$\%\text{Fat} = \frac{w_3 - w_2}{w_1} \times 100$$

Where; Weight of the sample (w_1)

Weight of empty conical flask (w_2)

Weight of conical flask plus fat (w_3)

Determination of fiber content

After complete filtration of fat, the residue was then digested with 1.25%H_2SO_4 and 1.25% NaOH solution. The residue was allowed to dry and transferred into beaker containing 200ml of 1.25%H_2SO_4 and boiled for 30 minutes, it was cooled and filtered through filter paper and the residue was then washed with boiled water until the acid was completely washed. The residue was drained and poured back to the beaker containing 200ml 1.25% NaOH and it was boiled again for 30 minutes, it was cooled and filtered through filter paper and the residue was then washed as above and dried in an oven at 130℃ to constant weight and it was allowed to cool. The residue was then scrapped into a known weight platinum dish and it was placed in muffle furnace at 500℃ until the residue was turn to ash and it was weighted again.

$$\%\text{Fiber} = \frac{w_3 - w_1}{w_2 - w_1} \times 100$$

Where; Weight of dish (w_1)

Weight of dish and sample (w_2)

Weight of dish and sample after heating in muffle furnace (w_3)

Determination of carbohydrate

$$= 100 - (\%protein + \%moisture + \%ash + \%fat + \%fibre)$$

Detection of Mineral Composition

2g of the powder sample was weighted and poured into digestion flask containing hydrochloric acid (HCl) and nitric acid (HNO_3) 360:120 and the flask was heated until complete digestion was observed. The flask was then removed cooled and filtered through filter paper and the filtrate was made to 100ml with distilled water and it was taken to atomic absorption spectrophotometer (AAS) for the detection of heavy element and their concentration.

RESULTS

Phytochemical Screening

As presented in table 1 below, the tests were carried out with an ethanolic extracts of the sample (garlic bulbs). The phytochemical screening reveals the presence of alkaloid, flavanoid, phenol, saponin, steroid, tannin and glycoside in the ethanolic extract of garlic bulbs powder.

Table 1 Results of qualitative Phytochemical screening of ethanolic extract of garlic bulbs powder.

S/N	PHTTOCHEMICALS	INFERENCE
1	Alkaloid	+++
2	Flavanoid	+
3	Glycosides	+
4	Steroid	+
5	Tannin	++
6	Phenolic	+
7	Saponin	++

Key: + =Present, ++ =moderately present, +++ = Adequately present,

The result in the table 1 above shows that alkaloid was found to be adequately present, tannin and saponin were found to be moderately present while,flavonoid, glycosides, steroid, and phenolic were found to be in low amount.

Table 2 Result of quantitative phytochemical screening of ethanolic extract of garlic bulbs powder.

S/N	PHYTOCHEMICALS	AMOUNT
1	Alkaloid %	10
2	Phenol (gallic acid standard µg/ml)	3.14
3	Flavonoid %	2.20
4	Saponin %	5.30
5	Glycoside %	4.40
6	Tannin (tannic acid standard µg/ml)	4.10

From the result in the table 2 above the quantitative phytochemical estimation of garlic sample reveals that the extract is composed alkaloid 10%, saponin 5.30%, glycoside 4.40, flavonoid 2.20% while the concentration of phenol was found to be 3.14 (µg/ml) and tannin 4.10 (µg/ml) respectively.

Table 3 Result of proximate analysis of garlic bulbs sample

S/N	**Proximate Composition**	**Results (%)**
1.	Protein	7.39
2.	Moisture content	7.58
3.	Ash Content	9.90
4.	Fat Content	2.15
5.	Crude Fiber	7.14
6.	Carbohydrate	65.84

The table 3 above shows the result of proximate analysis of garlic bulbs sample the result reveals that the carbohydrate was found to be the most abundant composing of (65.84%) followed by ash (9.90), moisture (7.58%), protein (7.39%), fiber (7.14%) and fat (2.15%).

Table 4: Some mineral composition of garlic bulbs powder (*Allium sativum*)

S/N	Minerals	Inference (mg/kg))
1.	Sodium Na^+	22
2.	Potassium K^+	531.5
3.	Zinc Zn^{2+}	7.1
4.	Cupper Cu^{2+}	0.36
5.	Iron Fe^{2+}	2.7
6.	Calcium Ca^{2+}	233
7.	Magnesium Mg^{2+}	35.4

The table 4 above shows the result of determination of some mineral composition of garlic bulbs sample the result is presented in mg/kg, the result are as follows, potassium (531.5kg) followed by calcium (233 mg/kg), magnesium (35.4 mg/kg), sodium (22 mg/kg), zinc (7.1 mg/kg), iron (2.7 mg/kg) and copper was found to be (0.36 mg/kg). 28

DISCUSSION

The current study's findings indicate that garlic extracts from *Allium sativum* bulbs include a number of phytochemicals. A plant's inherent defense against grass-eating insects, vertebrates, fungus, infections, and parasites is bolstered by phytochemicals, which also give plants their color, flavor, and smell (Ibrahim et seq., 2010). The study's *Allium sativum* extracts contained the phytochemicals glycoside, flavonoid, tannin, alkaloid, phenolics, and saponins. According to the phytochemical composition of the *A. sativum* extract, alkaloids (10%) were found to be the most abundant phytochemical, followed by flavonoids (2.20%), saponin (5.30%), glycosides (4.40%), and tannin (4.10%). The extracts also

contain flavonoids, which function as strong soluble inhibitors and radical scavengers to prevent cell damage and even exhibit strong metastatic tumor activity. These properties also aid in the management of aerophilic stress caused by polygenic disorder. The extract included glycoside and tannin as well. Saponins possess antimicrobial properties. Furthermore, saponins have been shown to possess antitumor inhibitory and anti-mutagenic properties, which may reduce the risk of cancer in humans by preventing the growth of cancer cells (Roa *et al.,* 1995). Tannins inhibited the growth of several fungi, yeasts, microorganisms, and viruses (Prohp & Onoagbe, 2012).

The results of this investigation were consistent with those of Abaoba *et al.* (2011) and Muhammad & Idris (2019), who discovered that clove extract had a wide range of antibacterial activity against all types of microorganisms and fungi. This may have been caused by the glycoside, tannin, and flavonoid content of the extract. Based on the study's findings, the *A. sativum* bulb's proximate composition is composed of carbohydrate, protein, lipids, fiber, moisture, and ash. Specifically, the results show that the carbohydrate content is 65.84%, protein is 7.39%, fats are 2.15%, crude fiber is 7.14%, moisture is 7.58%, and ash is 9.90%. This demonstrated the increased carbohydrate content in comparison to other proximate compositions. Because of its greater carbohydrate content, garlic bulbs are a powerful source of energy for the body. The existence of protein indicates

According to the study's findings, low fat content in diet can be utilized as a technique to lower cholesterol levels (Fahey, 2005). This outcome was consistent with the findings of Muhammad *et al.* (2019) and Harsh *et al.* (2013).

The mineral analysis of garlic bulb extract revealed several significant critical minerals, as indicated by the study's results. These minerals are represented in (mg/kg) and include sodium (22%), potassium (531.5%), zinc (7.1%), copper (0.36%), iron (2.7%), calcium (233%), and magnesium (35.4). These minerals may be found in *A. sativum* bulbs, which make them a nutritious and wholesome food ingredient. The percentage that this elemental analysis produced coincides with values for the necessary daily allowance (RDA). This spice's mineral composition serves as an essential component of human diet. According to Valko *et al.* (2007), sodium, potassium, and magnesium are essential for maintaining a normal blood pressure level and may even help avoid deficient illnesses like kwashiokor. Certain mineral components are necessary for growth; for example, calcium is crucial for

the development of the skeleton and muscular function (Oluemi *et al.,* 2006). Magnesium aids in the absorption of specific nutrients, potassium and salt maintain equilibrium, and iron deals with cellular functions, including the prevention of anemia.

CONCLUSION

Garlic (*Allium sativum*) is a remarkable plant with diverse bioactive compounds and nutritional value. Through phytochemical screening, we identified alkaloids, saponins, flavonoids, phenols, glycoside, and tannins in garlic extracts. Additionally, the proximate analysis revealed its composition: carbohydrates (65.84%), protein (7.39%), fats (2.12%), crude fiber (7.14%), and moisture (7.58%). Notably, garlic contains essential minerals such as zinc, potassium, iron, calcium, sodium, and magnesium etc. These findings underscore garlic's potential as a functional food with health-promoting properties.

Further investigations should explore garlic's antioxidant, antimicrobial, and therapeutic effects, contributing to our understanding of its role in human health and disease prevention.

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