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Research Article

Phytochemical Screening and Proximate Analysis of Garlic (*Allium Sativum*)

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Abstract

Natural products have been an integral part of ancient traditional medicine systems. The objective of the study was to investigate the phytochemical constituents and proximate composition of Garlic (*A. sativum*) extracts. The phytochemical screening of the Garlic for various phytochemical constituents was conducted using laboratory method. The proximate and mineral composition was determined using standard method. The qualitative phytochemical screening of *Allium sativum* aqueous and ethanol extracts indicated the presence of Alkaloid, terpenoids, flavonoids, steroid, phenol, Anthraquinones, saponin, tannin and glycoside. Quantitatively, Alkaloid was found to be the abundant constituent making about 7.2%, followed by Tannin and saponin constituting 4.8% and 4.3% respectively. The qualitative proximate composition of the bulb extract of *Allium sativum* bulb in g/100g showed the extract contain carbohydrate, protein, fats, fibre, moisture and ash while the quantitative analysis result was presented as carbohydrate with 66.00%, protein 16.23%, fats 2.44%, crude fibre 03.96%, moisture content 5.52% and ash content 05.85%. The mineral composition analysis of the bulb indicates the presence of calcium (23.40%), potassium (10.95%), magnesium (3.90%), zinc (0.44%), phosphorous (9.85%), iron (5.20%) and copper (0.05%). The presence of nutrients proves why *A. sativum* bulb can be used as food supplement.

Keywords: Garlic; Phytochemical; Proximate analysis; Mineral composition

Introduction

Natural products have been an integral part of ancient traditional medicine systems, e.g. Chinese, Ayurvedic and Egyptian [1]. Over the years, they have assumed a very central stage in modern civilization as natural source of chemotherapy as well as amongst scientist in search for alternative sources of drugs. According to the World Health Organization [2], a medicinal plant is any plant which in one or more of its organs, contains substances that can be used for therapeutic purposes, or which are precursors for chemo-pharmaceutical semi synthesis. Such a plant will have its parts including leaves, roots, rhizomes, stems, barks, flowers, fruits, grains or seeds, employed in the control or treatment of a disease condition and therefore contains chemical components that are medically active [3]. Phytochemicals are bio-active chemicals of plant origin. They are regarded as secondary metabolites because the plant that manufactures them may have little need for them. They are naturally synthesized in all parts of the plant body; bark, leaves stem, root, flower, fruits, seeds, etc. i.e. any part of the plant body may contain active components [4].

Garlic (*Allium sativum* L.) is one of those plants that were seriously investigated over several years and used for centuries to fight infectious diseases [5]. It is belong to family Amaryllidaceae [6]. It is a cultivated food highly regarded throughout the world. Garlic is originally from Central Asia, and as one of the earliest of cultivated plants [7]. Therapeutic use of garlic has been recognized as a potential medicinal value for thousands of years to different microorganisms. For example; antifungal, antiviral, antibacterial antihelmantic, antiseptic and anti-inflammatory properties of garlic are well documented. Moreover, garlic extracts exhibited activity against both gram negative (*E. coli*, *Salmonella* sp. and *Citrobacter Enterobacter*, *Pseudomonas Klebsiella*) and gram positive (*S. aureus*, *S. pneumonia, streptococcus* and *Bacillus anthrax*) all of which are cause of morbidity worldwide [8].

In Africa, particularly in Nigeria, it is used to treat abdominal discomfort, diarrhea, otitis media and respiratory tract infections [9]. In Europe and India, it was used to treat common colds, hay fever and asthma [10]. In addition to its reputation as a healthy food, garlic has shown anti-viral, anti-bacterial, antifungal and antioxidant capacities. Additionally, anti-atherosclerotic and anti-cancer properties have also been demonstrated. Many researches had demonstrated its effectiveness and broad spectrum antimicrobial activity against many species of bacteria, viruses, parasites, protozoan and fungi [9]. Garlic extract inhibits the growth of Gram positive and Gram negative bacteria, such as *Staphylococcus, Streptococcus, Micrococcus*, *Enterobacter*, *Escherichia*, *Klebsiella*, *Lactobacillus*, *Pseudomonas*, *Shigella, Salmonella, Proteus*, and *Helicobacter pylori* [11]. The objective of the present study was to investigate the phytochemical constituents and proximate composition of Garlic (*A. sativum*) extracts.

Materials and Methods

Sample collection and identification of Garlic bulb

Fresh bulbs of Garlic *Allium sativa* (Family Amaryllidaceae) were purchased from Kano main Market in Kano city, Nigeria. Identification and authentication of the Garlic was done at Herbarium in the Department of Plant Science, Bayero University Kano with the following voucher number BUKHAN 297. Voucher specimens were deposited in the Herbarium for reference.

Preparation of extracts

The collected bulbs were washed with distilled water, air dried for two weeks and grounded into fine powder using sterile pestle and mortar under laboratory condition. Fifty (50) grams of the powder was mixed with 500ml of Distilled water and ethanol in a sterile conical flask separately and stand for 3 days with intermittent shaking. The mixtures were filtered using filter paper and concentrated in water bath at 70 °C for 3 hours. Each extract was kept in a sterile container and refrigerated at 4 °C for further experiment.

Phytochemical screening

The phytochemical screening of the Garlic for various phytochemical constituents such as terpenoids, flavonoids, alkaloids, reducing sugars, steroid, glycoside, phenol, Anthraquinones, saponin and tannin was conducted using standard methods as described by Sofowora [12] and Trease and Evans [13].

Quantitative phytochemical analysis

Different methods were used in evaluating the quantity of phytochemical constituents of the plant materials used. Spectrophotometric method was used to determine Terpenoids, tannins, steroids, anthraquinone, and glycosides. Folin-Ciocalteu procedure was used to determine phenol content. Flavonoids, alkaloids and saponins were determined by the methods described by Adeniyi *et al*. [14].

Proximate analysis

Proximate analysis of the *Moringa* leaves was conducted to determine the ash content; crude protein, crude fibre, crude lipid, carbohydrate and dry matter using methods described by Udo and Oguwele [15]; James [16] and Association of Official Analytical Chemist (AOAC) [17]. The proximate parameters were expressed in percentage (%).

Mineral analysis

The mineral composition of the leaves including potassium (K), calcium (Ca), magnesium (Mg), and zinc (Zn), phosphorous (P) and iron (Fe) were determined using the atomic absorption spectrophotometer, as described the methods of AOAC [17]. Phosphorus was determined colorimetry method.

Results

Phytochemical screening

The qualitative phytochemical screening of *Allium sativum* aqueous and ethanol extracts is presented in Table 1. The result indicated the presence of Alkaloid, terpenoids, flavonoids, steroid, phenol, Anthraquinones, saponin, tannin and glycoside.

Table 1: Qualitative phytochemical screening of *A. sativum* aqueous and ethanol extracts.

S/N	Phytochemical	Aqueous Extract	Ethanol Extract
1	Alkaloids	+	+
2	Flavonoid	+	+
3	Glycosides	+	+
4	Reducing sugar	-	-
5	Saponin	+	+
6	Steroids	+	+
7	Phenols	+	+
8	Terpenoid	+	+
9	Anthraquinones	+	+
10	Tannin	+	+

The qualitative phytochemical screening of *Allium sativum* extracts is presented in table below (Table 2). Quantitatively, Alkaloid was found to be the abundant constituent making about 7.2 %, followed by Tannin and saponin constituting 4.8 % and 4.3 % respectively.

Table 2: Quantitative phytochemical screening of *Allium sativum* extract.

S/N	Phytochemical	Quantitative Analysis (%)
1	Alkaloids	7.20±0.05
2	Flavonoid	2.18±0.03
3	Glycosides	0.05±0.00
4	Saponin	4.30±0.02
5	Steroids	0.50±0.00
6	Phenols	0.80±0.00
7	Terpenoid	0.40±0.01
8	Anthraquinones	1.40±0.03
9	Tannin	4.80±0.03

Proximate analysis

The qualitative and quantitative proximate analysis of *Allium sativum* bulb is presented in the table below (Table 3). The

qualitative proximate composition of the bulb extract of *Allium sativum* bulb in g/100g showed the extract contain carbohydrate, protein, fats, fibre, moisture and ash while the quantitative analysis result was presented as carbohydrate with 66.00%, protein 16.23%, fats 2.44%, crude fibre 03.96%, moisture content 5.52% and ash content 05.85%.

Table 3: Proximate Analysis of *Allium sativum* bulb.

S/N	Nutrient	Composition (%)
1	Carbohydrate	66
2	Protein	16.23
3	Fats	2.44
4	Crude fibre	3.96
5	Moisture content	5.52
6	Ash content	5.85

Mineral analysis

The mineral analysis of *Allium sativum* bulb is presented in Table 4. The mineral composition analysis of the bulb indicates the presence of calcium (23.40%), potassium (10.95%), magnesium (3.90%), zinc (0.44%), phosphorous (9.85%), iron (5.20%) and copper (0.05%).

Table 4: Mineral Analysis of *Allium sativum* bulb.

S/N	Mineral	Composition (mg/100g)
1	Potassium	10.95
2	Calcium	23.4
3	Magnesium	3.9
4	Zinc	0.44
5	Phosphorous	9.85
6	Iron	5.2
7	Copper	0.05

Discussion

The results of the present study suggested that several phytochemicals are present in *Allium sativum* bulb extracts. Phytochemicals give plants their colour, flavour, smell and are part of a plant`s natural defense system and protect them against herbivorous insects and vertebrates, fungi, pathogens, and parasites [18]. The phytochemicals saponin, flavonoid, tannin, reducing sugar, steroid, and terpenoid were present in *Allium sativa* extracts according to this study. The phytochemical content of the extract of *A. sativum* revealed that the Alkaloids was found to be the most abundant phytochemical (7.2 %) followed by tannin (4.8 %), saponin (4.3 %) and flavonoids (2.18 %).

Based on the finding of this study, terpenoid is present in the both the extracts. Terpenoids have been found to be useful in the prevention and therapy of several diseases, including cancer. Terpenoids are also known to possess antimicrobial, antifungal, antiparasitic, antiviral, anti-allergenic, antispasmodic, antihyperglycemic, anti-inflammatory and immunomodulatory properties [19]. Flavonoids are also present in the extracts as a potent water-soluble antioxidant and free radical scavenger, which prevent oxidative cell damage and also have strong anticancer activity [20]. It also helps in managing diabetes induced oxidative stress. Steroids are importance in pharmacy as they possess compounds like sex hormones and can be used for drug production [21]. Tannin and saponin were present in the extract. Saponins protect against hypercholesterolemia and antibiotics properties. In addition, it has been found that saponins have antitumor, antioxidant and anti-mutagenic activities and can lower the risk of human cancers by inhibiting the growth of cancer cells [22]. The growth of many fungi, yeast, bacteria and viruses was inhibited by tannins [23]. The finding of this study correlate with the finding of Abaoab et al. [24] which found that clove extract possessed a broad spectrum of antimicrobial activity exhibited for both bacteria and fungi due to presence saponin, tannin, flavonoid and terpenoid. The result of this study on Phytochemistry of Garlic supported the study conducted by Deresse [8] who found that garlic extracts exhibited activity against both gram negative (*E. coli*, *Salmonella* sp, and *Citrobacter Enterobacter*, *Pseudomonas Klebsiella*) and gram positive (*S. aureus*, *S. pneumonia, streptococcus* and *Bacillus anthrax*) due to presence of some phytochemicals such saponin and tannin.

The results of the present study indicate that the qualitative proximate composition of *A. sativum* bulb contain carbohydrate, protein, fats, fibre, moisture and ash while the quantitative analysis result was presented as carbohydrate with 66.00%, protein 16.23%, fats 2.44%, crude fibre 03.96%, moisture content 5.52% and ash content 05.85%. This indicated the higher content of carbohydrate when compared to the rest. The higher carbohydrate content may be useful in making *A. sativum* bulb a good source of energy for the body. The presence of moisture, ash, lipid and protein in *A. sativum* bulb suggests that it may be useful for body building, prevention of ageing while the high dietary crude fibre content will help in bowel movement. This important nutrients composition in *A. sativum* bulb provides a justification that the bulb could be used as food supplement. Finding of this study indicated low fat content in *A. sativum* bulb, and low fat foods are known to reduce cholesterol level [25]. This result was inconformity with that of Harsh et al. [26].

According to the result of this study, the mineral analysis of *Moringa* leaf extract contained some important essential minerals such as; calcium (23.40%), potassium (10.95%), magnesium (3.90%), zinc (0.44%), phosphorous (9.85%), iron (5.20%) and copper (0.05%). The presence of such minerals in *A. sativum* bulb could be utilized as a nutritionally valuable and healthy ingredient for food. The mineral elements contained in these spices are very important in human nutrition. Sodium, potassium, calcium and magnesium play a central role in the normal regulation of blood pressure [27]. They could also be valuable in improving immune system and preventing malnutrition related diseases. Mineral elements are required for normal growth, activities of muscles and skeletal development (such as calcium), cellular activity and transport of oxygen (copper and iron), chemical reaction in the body and intestinal absorption (magnesium), fluid balance and nerve transmission (sodium and potassium), as well as the regulation of acid-base balance (phosphorus). Iron is useful in prevention of anemia and other related diseases [28]. Manganese plays a role

in energy production and in supporting the immune system while zinc is useful for protein synthesis, normal body development and recovery from illness [29].

Conclusion

Based on the findings of the present study, phytochemical constituents, proximate and minerals components of *A. sativum* bulb were determined. The phytochemical components of *A. sativum* bulb contain alkaloid, saponins, flavonoids, glycoside, anthraquinones, tannin and terpenoids. The results of the proximate and mineral analyses of the whole leaf indicated the presence of considerable amount of nutrients. The presence of the phytochemicals has authenticated its usefulness by traditional herbalists in ethno medicine and potentials in drug formulation and development. In addition to that, the presence of nutrients proves why *A. sativum* bulb can be used as food supplement.

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