



Comparative study, chemical composition of (*Allium cepa*) onion, (*Alliumsativum*) garlic and (*Z. officinale*) ginger

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Abstract

Onion (*Allium cepa*), ginger (*Zingiber officinale*) and garlic (*Allium sativum*) are house hold and popularly utilized plants that have been exploited severally for its nutritional qualities. The phytochemical constituents, mineral and proximate composition of onion ginger and garlic were investigated. They were grated separately using hand grater. Phytochemical screening was carried out on the resulting grated samples and it was discovered that the three samples contains carbohydrates, phytosterols and saponnins, and absence of glycosides. The status of some other secondary metabolites (alkaloids, tannins, steroids, phlobatannins, proteins, flavournoids and terpenoids) in the three samples was identified. A proximate analysis was carried out in the laboratory in order to evaluatesome parameters which include the moisture content, ash value, protein, fats, carbohydrate and fibre content of the studied samples. The results of the proximate analysis showed that onion bulb, ginger and garlic contain mostly moisture (81.881, 75.917 and 71.210) and carbohydrates (10.865, 10.868 and 9.110) with crude fat, fibre and ash at the least concentrations for the three samples. The elements investigated are: Sodium, Potassium, Calcium, Phosphorous, Zinc, Manganese, Cooper, Iron. Calcium and potassium followed by phosphorous were confirmed to be the most abundant elements in the studied samples while copper, manganese and zinc took the least concentrations.

Keywords:

Introduction

In many countries, majority of people have adopted the use of natural food ingredient such as garlic, onion and ginger as spices. *Allium capa* (onion), *Zingiber officinale* (ginger) and *Allium sativum* (garlic) are among the commonly use spices; primarily, this is because they are readily available, easily assessable and health benefits. They are reported to be nutritional¹. *Allium cepa* and *Allium sativum* are rich in nutrients such as protein, carbohydrate, minerals, dietary fibre and vitamins².

Many studies indicated that regular intake of these plants reduce the possibility of having cancer. These vegetables/plants are essential parts of diet which build resistance against various illnesses³. The phytochemical constituents available in these samples are answerable for some of the stated health benefits that are likely to be derived from them⁴.

Garlic: Garlic (*Allium sativum*.) is a plant that can also be referred to as a bulb associated with the *Amaryllidaceae* family, genus *Allium* and kindom *plantae*. It is grown and distributed all over the globe. It has been estimated that china is the highest producer globally⁵. It can be used as a preventive herb, a spice and as epidemics solutions e.g. dysentery⁶. Garlic has unfavorable odour especially after cut or milled. Several studies have pointed to the fact that *allicin* is one of the most prominent

component found in garlic which caused its odour, flavour as well as other nutritional benefits⁷.

Onion: Onion (*Allium cepa*) is an old plant that has been recognized for its medicinal use. And it is a plant recognized by several people and consumed globally⁸. Onion belongs to the family *Amaryllidaceae*, genus *Allium* and kindom *plantae*. It originated from central Asia about 5000m years ago as a short-lived plant which makes it one of the sources of food in the ancient days. Brewster⁹ that usually germinate at a very close angular distance north from equator. *Allium cepa* is foundly called onion throughout Nigeria, Alubosa in Yoruba, albasa in hausa and yabasi in igbo, consumed all over Nigeria regardless of their tribe, religion and ethnic. Onion is otherwise called Queen of the kitchen, because of uniqueness, taste and smell while been used¹⁰. Onion is a plant that is not restricted to season, meaning that it is available both in dry season as well as the rainy season. Onion (*Allium cepa*) is a plant, cultivated across Europe which its productivity has increased tremendously¹¹.

Ginger: Ginger is generally recognizes to be a plant, whose root is used as a spice (fresh and dry). It is associated with the *zingiber aceae* family and genus *zingiber*, although used in traditional medicine and also as dietary supplements.

Ginger (*Z. officinale*) has been used since ancient times as an important spice throughout the globe. The common one is from *Rhizoma zingiberis* obtained from *Z. officinale* rhizomes and it is commercially available in Nigeria and other parts of the world. In some years back, it was use in Asiatoaid digestion, remove or cure nausea, relieve toothache, control bleeding, remedy, anti-snakebite to mention but few. It is very important in today traditional Chinese medicine too as it is been produced in mass and use in India. It has been used to control bleeding, prevent cholesterol, and to treat arthritis in traditional Indian medicine. Ginger (*Zingiber officinale*) has been used as a spice in Nigeria and a medicine for over 200 years in traditional all over the world.

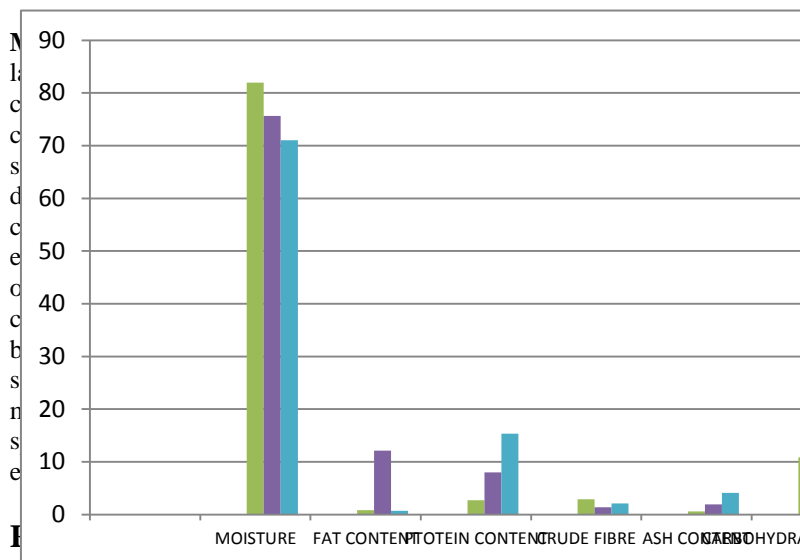
This study was aimed at comparing the phytochemical, proximate composition and minerals present in (*Allium Cepa*) Onion, (*Allium Sativum*) Garlic And (*Z. Officinale*) Ginger sold at Owo, Ondo State, Nigeria.

Materials and methods

Sample Collection and Authentication: The three samples (onion, ginger and garlic) were purchased fresh from ikoko market Owo, Ondo State, Nigeria, from the traders on 15th of April, 2022. The samples were identified and authenticated at the Department of science laboratory technology, environmental biology unit Rufus Giwa polytechnic Owo, Ondo state.

Sample Preparation: The samples were washed and drained for few minutes and were grated separately using hand greater and then the analysis was carried out on fresh samples.

Materials: The materials used are: beaker, crucible, conical flask, laboratory oven, furnace, furnel, Buchner funnel, soxlet apparatus, kjedal flask, fume hood, distillation set up, droper, pipette, HCl, H₂SO₄ chloroform, NaOH, Boric acids, Ethanol, methanol, KOH etc.



The results are mention in Tables and Figures.

Table-1: Results of proximate composition.

Proximate Parameters	Onion	Ginger	Garlic
Moisture	81.881±0.21	75.917±0.23	71.210±0.21
Fat Content	0.791±0.01	8.114±0.02	0.712±0.00
Protein Content	2.721±0.01	5.899±0.05	7.420±0.03
Crude Fibre	2.899±0.10	1.371±0.02	2.125±0.01
Ash Content	0.123±0.01	0.641±0.00	0.901±0.02
Carbohydrates	14.306±0.3	8.058±0.05	17.632±0.02

Figure-1: A chart of the results of proximate parameters of onion, garlic and ginger.

Table-2: Results of Mineral Composition of Ginger (Mg/100g).

Minerals	Onion	Ginger	Garlic
Sodium	4.71±0.01	7.52±0.00	6.14±0.01
Zinc	1.01±0.00	4.63±0.00	1.00±0.01
Iron	1.04±0.00	9.649±0.01	4.090±0.1
Calcium	45.63 ± 0.03	181.43±0.03	30.103±0.00
Phosphorous	40.23±0.01	20.61±0.02	12.71±0.2
Potassium	140.05±0.1	90.75±0.03	10.18±0.2
Copper	0.13±0.00	0.27±0.00	0.910±0.0
Manganese	0.15±0.01	0.12± 0.01	0.01±0.01

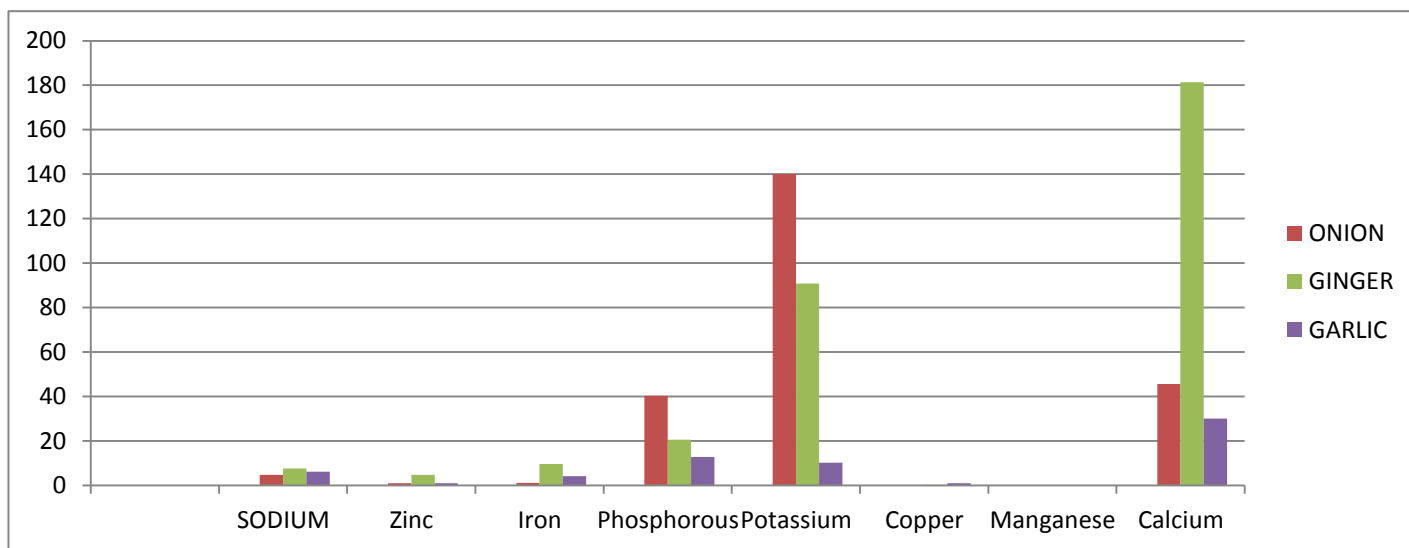


Figure-2: A chart of the results of mineral parameters of onion, garlic and ginger.

Table-3: Results of Photochemical Screening of ginger.

Parameters	Onion	Ginger	Garlic
Tannins	+++	-	++
Alkaloids	-	+	++
Phlobatannins	+++	-	+
Saponins	+	++	+
Steroids	-	+	-
Terpenoids	-	+	+
Flavonoids	-	+	++
Proteins	+++	-	+
Glycosides	-	-	-
Carbohydrates	++	++	++
Phytosteroids	+	+	+

+ Present, ++ moderately present, +++ highly present and – represents absent.

The nutrients: Proximate composition of ginger, garlic, and onion: The proximate compositions of onion, ginger and garlic fresh samples are in Table-1. The proximate analysis is important for evaluation of nutritional composition of food samples in processing industries.

Moisture: The proximate analysis of the studied samples showed high moisture content (Onion 81.88, Ginger 75.917 and Garlic 71.210), with onion having the highest value, followed by ginger and finally the garlic. These values showed that the burning of samples in a furnace could become more easier. It also indicates that the shelf life of fresh samples would be very short and become damaged due to microbial growth. These values are closer if not exactly to the following values 81.97% and 78.86% by Odebunmi *et al.*¹⁶ and the differences noticed could be as a result of the physical state and processing of the samples. It was reported that fresh unripe plantain has lower moisture content (58.783) compared to the studied samples (Onion 81.88, Ginger 75.917 and Garlic 71.210)¹⁵. This means fresh unripe plantain can stay longer than the studied samples before deterioration. The high water content aids digestion, as the body does not need to use some of its own water to digest food. Less pressure is therefore put on the digestive system.

Moisture analysis enables right predictions of shelf life. Low moisture content allows the food to be stored for longer period. Food with higher moisture level cannot be stored for a longer period, because fungal growth is bound to be noticed on such sample which can cause food poisoning¹⁵.

Crude protein: The crude protein value of (2.721, 5.899, and 7.420) for onion, ginger and garlic respectively is in agreement with the report of Odebunmi *et al.*¹⁶, stating that spices have low protein content. Protein value for ginger (5.899) is higher than that of onion (2.721) and lower than garlic (7.420). Low protein value of ginger and onion makes it useful as additive in monogastric feeding. While protein value for garlic (7.420), indicate that it could be useful in the treatment or prevention of coronary heart disease since the plant protein decreases the risk of high blood pressure and high cholesterol. The higher protein contents indicate that its intake can contribute to the formation of hormones and maintenance of body. This confirms that ginger and garlic give energy.

Crude fibre: The crude fibre value (2.899, 1.371 and 2.125) for onion, ginger and garlic respectively can be compared to the report of Bhat *et al.*¹⁷ stating 1.6% crude fiber for ginger. In this study, onion (2.899) has the highest value of crude fibre, followed by garlic (2.125), which makes both onion and garlic more effective and useful in the management of various illnesses. The presence of crude fibre in the diet is necessary for digestion and evacuation of waste in the bowels Ponnusamy, and Vellaichamy¹⁸. In addition, it decreases the absorption of cholesterol from the gut. Thus the result of the proximate analysis showed that ginger has the lowest crude fibre content in comparison with the onion and garlic.

Ash: The ash content which is an indication of mineral elements was (0.123, 0.641, 0.901%), which was different from those reported for (1.23 and 2.54%) for garlic and ginger by Odebunmi *et al.*¹⁶. Garlic (0.901) in this study was reported to have the highest value of ash in these samples could be promising sources of essential mineral elements because they hold high level of ash. It appears that onion, garlic and ginger fresh samples could supply enough quantity of minerals required for growth. The analysis of ash is very essential which provides an insight into the nutritionally essential mineral elements. It was reported that the ash value of a sample gives an idea of the mineral elements present in the sample Edeogu *et al.*¹⁹.

Fat: The results of proximate composition of the three samples indicated that ginger (8.114) has the highest fat content. The effect of the too much intake of fat has some health implications associated to overweight Wardlaw, and Kessel 2002²⁰. In this study, onion (0.791) and garlic (0.712) could be seen to be preferred, because of its tendency in reducing the risk of having coronary heart disease.

Carbohydrate: This study also reveals that carbohydrates content of the fresh onion bulb (14.306), ginger (8.058) and garlic (17.632) are high having that of garlic the lowest. Carbohydrates are needed in numerous biochemical reactions not directly concerned with energy metabolism. Thus the carbohydrate levels of the studied samples suggest its usefulness as alternative source of glucose.

Minerals: The following elements were investigated in fresh onion, ginger and garlic. Na (4.71, 7.52 and 6.14), Zinc (1.01, 4.63 and 1.00), Iron (1.04, 9.64 and 4.090), Ca (45.63, 181.43 and 30.103), P (40.23, 20.61 and 12.71), K (140.05, 90.75 and 10.18), Cu (0.13, 0.27 and 0.910) and Mn (0.15, 0.12 and 0.01). The predominant mineral elements detected in fresh ginger sample in this study follows the order of Ca>K>P>Fe>Na>Zn >Cu,>mn the garlic follows the order of Ca>P>K>Na>P>Fe >Zn > Cu >mn while the results of onion are in order of K> Ca > P > Na > Fe > Zn > Mn > Cu. It was observed that the Sodium detected in onion (4.71), ginger (7.52) and garlic (6.14) were low and relatively closer in value, and this means that the three samples can be prescribed interchangeably to suit the purpose of moderating the sodium level in the body.

The sodium and potassium 7.52 and 90.75 contents confirmed the earlier reports that potassium is one of the most abundantly available elements in Nigerian agricultural produce. Phosphorus and Calcium contents were also available in onion and garlic (Ca 45.63, 0.103) and (P 40.23, 12.71) respectively, but the calcium level in the fresh ginger sample is considerably high (181.43). Calcium is the largest constituent of bone and blood and is also important for proper functioning of cardiac muscles, blood coagulation etc. In the result of the mineral analysis conducted in onion, ginger, and garlic, the lower level of copper (0.13, 0.27 and 0.910), manganese (0.15, 0.12 and 0.01), zinc

(1.01 and 1.00) in onion and garlic, and iron (1.04) only in onion were observed. Manganese may be necessary for normal brain and nerve functions and its deficiency could cause poor bone growth or skeletal defect, slow or impaired growth, to mention but few. Zinc in the other hand is an element found all over the body, it aids proper functioning of immune system. With a variety of diet, body usually gets enough zinc needed. While copper is a mineral element that body needs to stay healthy.

Photochemical screening: The results of the phytochemical screening of fresh onion ginger and garlic sample indicated that alkaloids terpenoids, flavonoids were present both in ginger and garlic but absent in the onion sample. Carbohydrates were highly present in the three study samples, phytosterol moderately present while glycoside is completely absent in the three samples. Onion sample has enough phlobatannins, tannins, and proteins which are absent in the ginger but moderately present in garlic

Conclusion

It can be observed that onion, ginger and garlic are good sources of nutrition and could possibly be used in pharmacology, industries and homes. Having concluded that fresh onion bulb, ginger and garlic could be therapeutically useful for the body, it can be recommended that people should consume them, and that further research should be done in order to compare the fresh samples to the dry ones.

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