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## Edibility and Medicinal Studies of *Crinum ornatum* in Comparison with *Allium sativum*

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**Abstract:** Historically, *Allium sativum* have been documented and valued for their spicy and medicinal qualities by many cultures around the globe for many years. Notwithstanding, medicinal activity of other bulb species such as *Crinum ornatum* have also been published. However, the bulb species of *Crinum ornatum* and *Allium sativum* were individually analyzed quantitatively for proximate compositions and flavonoids contents of the samples. Phytochemical and toxicological tests were carried out on the aqueous extracts of both species. These analyses were conducted in order to see spicy potentials of *Crinum ornatum* compared with *Allium sativum*. Proximate analysis results were presented as mean±standard deviation of three replicates, respectively; *Crinum ornatum* and *Allium sativum* contains 77.83±2.75 and 52.60±0.30% moisture, 4.67±0.58 and 4.50±0.27% ash, 0.67±0.29 and 2.98±0.03% crude lipid, 4.04±0.07 and 8.40±0.18% crude protein, 2.67±0.29 and 1.47±0.02% crude fibre, 87.96±0.46 and 82.65±0.04% available carbohydrate and 373.99 and 391.02 kcal/100 g energy value. Phytochemical screening for the two bulbs respectively revealed the presence of alkaloids, saponins, tannins, flavonoids, glycosides, cardiac-glycosides, volatile oils and steroids. The quantity of flavonoids in dried *Crinum ornatum* and *Allium sativum* are 52.4±0.02 and 29.20±0.29%, respectively. The LD<sub>50</sub> result of both samples were, respectively higher than 3000 mg/kg for the tested animals. These results justifiably shows that, *Crinum ornatum* bulbs could be considered as potential spice which would serve in medicinal and culinary purposes.

**Key words:** Spices, *Crinum-ornatum*, *Allium-sativum*, phytochemical-screening, toxicological-tests

### INTRODUCTION

Herbs and spices composes of numerous natural vitamins, phytochemicals, minerals and antioxidants, which are sometimes higher than the concentrations in the cereals, fruits and vegetables (Heber, 2014). However, many researchers in the field of nutritional food sciences believed that, encouraging the general public should be prioritized. This is because the antioxidants activity of herbs and spices aids in the reduction of oxidative stress, caused by free radicals that promotes protein, DNA and cell lipid oxidations, thereby activating inflammatory reactions, which damages tissues and cells, at long run causing cancer, diabetes, obesity, arthritis and diseases of neurodegenerations, like Alzheimer and Parkinson (Heber, 2014). Among these herbs includes, *Crinum ornatum* and *Allium sativum*.

*Crinums* are bulb-like plants having large number of flowers on their leafless stems and they are genus of perennial plants (about 180 species) that are usually found along the streams and lakes in tropical and subtropical areas. Their leaves are basal, typically long and strap-shaped, with colours ranging from light green to green (Akintola *et al.*, 2014; Lawal and Dangoggo,

2014; Oloyede *et al.*, 2010a). In addition, the bulb-like *Crinums* are plants closely related to amaryllis (*Hippeastrum*) known to be grown in many gardens for ages (Lawal and Dangoggo, 2014).

At the other hand, *Allium sativum* having characteristic pungent and spicy flavours is described as a bulb, composed of 4-60 cloves, 1.5-3 inches (4-7.5 cm) in diameter and grows to a height of 10-1.5 cm. The flowers are white with a rose or green cast. The bulbs themselves are creamy white and may have a purplish hue (Chauhan, 1999) and it has been used throughout recorded history for both culinary and medicinal purposes (Suleria *et al.*, 2015; Thomson and Ali, 2003). The health benefits of *Crinum ornatum* have been revealed, such as the isolated alkaloids of Crinamine (C<sub>17</sub>H<sub>19</sub>NO<sub>4</sub>) (Fig. 1) and Lycorine (C<sub>16</sub>H<sub>17</sub>NO<sub>4</sub>) (Fig. 2) from *Crinum ornatum* bulbs possess antioxidant and anticonvulsant properties (Oloyede and Farombi, 2010; Oloyede *et al.*, 2010b).

Similarly, *Allium* species especially *Allium sativum* for many years have been medicinally used to alleviate tumor, cardiovascular diseases and ageing (Colina-Coca *et al.*, 2014; Stajner *et al.*, 2006). The main chemical in *Allium sativum* is Allicin (C<sub>6</sub>H<sub>10</sub>OS<sub>2</sub>) (Fig. 3).

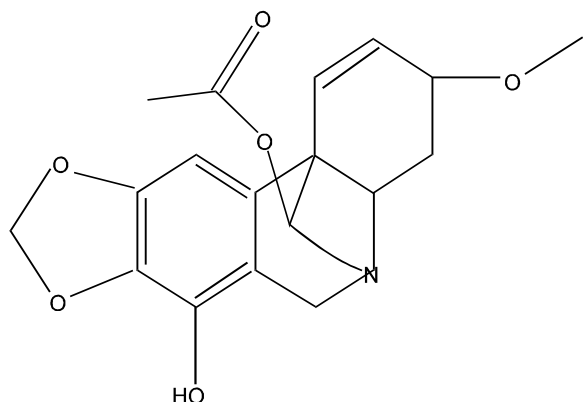


Fig. 1: Molecular structure of crinamine

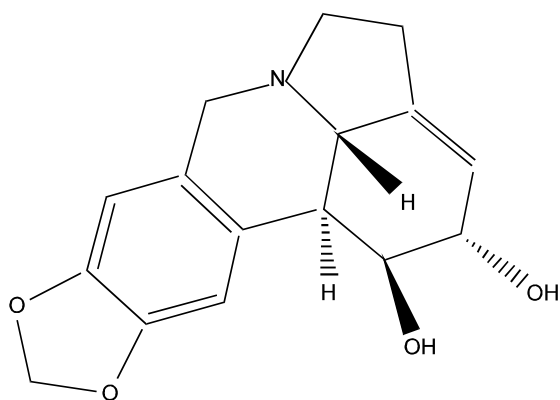


Fig. 2: Molecular structure of lycorine

It has a strong antibacterial effect. In addition, it prevents the development of illnesses caused by undigested foods, boost the immune system and neutralize free radical scavengers so as to strengthen the entire body. But, it destroys majority of beneficial bowel flora causing sterile inflammation in intestinal canal when it's consumed in large dosage, (Amagase *et al.*, 2001).

Notwithstanding, Sokoto, Nigeria (Fig. 4) is one of the state in the northern region popularly known for many years practicing irrigation farming for the production of many spices and herbs which includes *Allium sativum* (Ayoola, 2014). In addition, *Crinum ornatum* bulbs are used by the traditional medical practitioners in treatment of skin related diseases and it's grown for demarcating farm lands in the rural areas of Sokoto State, Nigeria (Lawal and Dangoggo, 2014).

However, *Crinum ornatum* and *Allium sativum* are named as "Albasar kwaadi" and "Tafarnuwa", respectively by the majority of the Hausa speaking people of the northern Nigeria (Blench and Dendo,

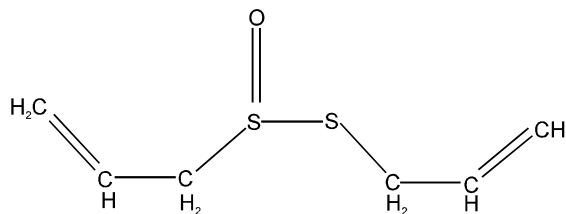


Fig. 3: Molecular structure of alliin

2007). Figure 5 and 6, respectively shows the photographs of *Crinum ornatum* and *Allium sativum*.

Based on the aforementioned, *Allium sativum* have been valued for their spicy and medicinal qualities by many cultures around the globe for many years. Notwithstanding, medicinal activity of other bulb species such as *Crinum ornatum* have also been published (Hutchings, 1996).

Thus, the objective of these studies is to provide the information on the pH, nutritional, phytochemicals, percentage flavonoids and toxicological activities of *Crinum ornatum* bulbs in comparison with *Allium sativum* in order to see the possibility of the spicy potentials of *Crinum ornatum* towards serving in flavouring, medicinal and nutritional benefits. With the hope that these will improve the cultivation of both species; considering the annual increase of human population making foods and spices limited in certifying their needs, as well as to serve as referencing platform to readers and researchers.

## MATERIALS AND METHODS

**Sampling and treatments:** The bulbs of *Crinum ornatum* and *Allium sativum* were purchased from Sokoto central market and transported in a polyethylene bag for identification at Botany unit, Usmanu Danfodiyo University, Sokoto. The epicarps of the bulbs were removed and separated from the stalks for easy assessment. The bulbs were completely dried in an oven at 60-80°C for 3 days after they were cut into smaller pieces. Electric blender was used to grind the sliced bulbs into powder.

**Extraction method:** Fifty gram of the ground samples underwent extraction by soaking with 300 cm<sup>3</sup> of distilled water for 24 h at room temperature, with occasional shaking. The mixtures were filtered and some of the filtrates were used for phytochemical screening, respectively. A portion of the filtrates were preserved by drying in an oven at 60-80°C for 2 days, respectively. The dried samples were used for toxicological analysis (Daniyan and Muhammad, 2008).

**Proximate analysis:** Proximate analysis of *Crinum ornatum* and *Allium sativum* were carried out,



Fig. 4: Map of study area. \*Abubakar lawal (Edibility and medicinal studies of *Crinum ornatum* in Comparison with *Allium sativum*)



Fig. 5: *Crinum ornatum* bulbs. \*Abubakar lawal (Edibility and medicinal studies of *Crinum ornatum* in Comparison with *Allium sativum*)

respectively using the method demonstrated by Lawal and Matazu (2012) as well as Lawal and Dangoggo (2014), which involves the determination of ash content, moisture content, crude protein, crude fibre, crude lipid, available carbohydrate and energy value, as follows:

- (a) **Determination of % moisture:** Initially, an empty crucible was weighed. 5 g of raw (wet) analyte sample was transferred into the empty crucible and weighed. The content of the crucible was subjected to continuous drying in a hot air drying oven at 105-110°C within 24 h, cooling and weighing until a constant weight was obtained. The percentage moisture content was calculated using Eq. 1:

$$\text{Moisture content (\%)} = \frac{\text{Loss in weight} \times 100}{\text{Sample weight}} \quad (1)$$

- (b) **Determination of % ash content:** The 2 g of the dried sample was transferred into an initially weighed crucible and ashed in a muffle furnace at temperature of 500-600°C for 3 h. The resulted ash was cooled and weighed. Percentage ash content was calculated using Eq. 2:

$$\text{Ash (\%)} = \frac{\text{Weight of ash} \times 100}{\text{Sample weight}} \quad (2)$$

- (c) **Determination of % crude fat:** The 250 cm<sup>3</sup> soxhlet extraction flask was washed and oven dried at



Fig. 6: *Allium sativum* bulbs. \*Abubakar lawal (Edibility and medicinal studies of *Crinum ornatum* in Comparison with *Allium sativum*)

105-110°C, cooled and weighed. 20 g of the dried analyte sample was transferred into a porous thimble and it was covered with clean white cotton wool before placing it in the extraction flask. Extraction was carried out for 6 h after the introduction of 200 cm<sup>3</sup> of n-hexane into the set-up. The thimble was carefully removed at the end of the extraction. The flask containing the extracted crude lipid was disconnected and oven dried at 105-110°C for one hour and weighed. Finally, the percentage of crude lipid was calculated using Eq. 3:

$$\text{Crude fat (\%)} = \frac{\text{Weight of lipid} \times 100}{\text{Sample weight}} \quad (3)$$

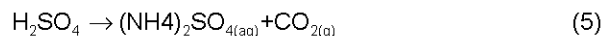
- (d) **Determination of % crude protein:** The 15 cm<sup>3</sup> of conc. H<sub>2</sub>SO<sub>4</sub> was mixed with 1 g of the dried (ground) analyte sample and addition of 0.1 g digestion tablets into a micro-Kjeldahl flask. The flask was heated in a digestion block (heater) for 24 h until the content became a clear solution. The cleared mixture was diluted to 50 cm<sup>3</sup> with distilled water. Then, 10 cm<sup>3</sup> of the sample aliquot, 40 cm<sup>3</sup> of distilled water and 20 cm<sup>3</sup> of 40% NaOH were transferred into a macro-Kjeldahl flask before introducing it to a macro-Kjeldahl distillation set-up. The distillation process took about 5 min and resulted distillate was collected into a flask containing 20 cm<sup>3</sup> of boric acid changing the colour from purple to green. The flask content was titrated with 0.01M H<sub>2</sub>SO<sub>4</sub> and the colour changed from green to purple at end point. The average titre value recorded was used to determine the percentage of nitrogen, using Eq. 4:

$$N (\%) = \frac{\text{Titre value} \times MA \times NF \times DF \times 100}{\text{Sample weight} \times \text{aliquot}} \quad (4)$$

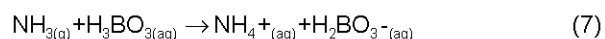
where, MA: Molarity of acid, NF: Nitrogen factor, DF: Dilution factor. Hence:

$$\% \text{ Crude protein} = \% N \times 6.25$$

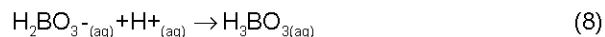
**Chemical equation for sample digestion to determine % N:** Analyte sample + concentration:



Distillation of the aliquot:



Titration:



- (e) **Determination % crude fibre:** The 2 g of dried (ground) analyte sample (W<sub>0</sub>) was mixed with 20 cm<sup>3</sup> of 1.25% H<sub>2</sub>SO<sub>4</sub> and gently boiled for 30 min after it was introduced into a 100 cm<sup>3</sup> conical flask. The mixture was filtered with muslin cloth and the residue was rinsed with hot distilled water into another 100 cm<sup>3</sup> conical. The 20 cm<sup>3</sup> of 1.25% NaOH was added into the flask and filtered with a muslin cloth after it was boiled for 30 min. The resulted residue was rinsed with hot

distilled water and later rinsed once with 10% HCl and twice with ethanol. It was finally rinsed 3 times with petroleum ether at boiling point of 40-60°C. The residue was scraped into a weighed crucible and oven dried for 12 h at 105°C. The dried residue was weighed ( $W_1$ ) and then ashed at 600°C in a muffle furnace. The resulted ash was allowed to cool and weighed ( $W_2$ ). The percentage of crude fibre was calculated using Eq. 9:

$$\text{Crude fiber (\%)} = \frac{W_1 - w_2 \times 100}{W_0} \quad (9)$$

- (f) **Available carbohydrate:** Available carbohydrate was calculated by subtracting the total of the percentages of ash, crude protein, crude lipid and crude fibre from the 100% moisture free samples
- (h) **Energy value:** The energy value was estimated using the method of Umar *et al.* (2006) in kilocalorie (kcal/100 g) using, the expression:

$$(\% \text{ crude protein} \times 4) + (\% \text{ crude lipid} \times 9) + (\% \text{ available carbohydrate} \times 4)$$

**pH analysis:** The pH of the samples was individually measured using the method documented by Black *et al.* (1965), by which a set of electrode was dipped in a suitable sample-water paste for each of the samples. The pH of the suspension was read on a pH-meter and recorded.

**Phytochemical analysis:** The qualitative tests were carried out on the aqueous extracts of the analyte samples, respectively using the methods used by Lawal and Dangoggo (2014), as well as Lawal *et al.* (2010), for the determination of alkaloids, tannins, saponins, flavonoids, glycosides, cardiac glycosides, saponin glycosides, volatile oils and steroids, as follows:

- (a) **Test for alkaloids:** The test tube occupied with 3 cm<sup>3</sup> of extracted sample and 1 cm<sup>3</sup> of 10% HCl was heated for 20 min on a steam bath at 80-95°C. The mixture was allowed to cool and filtered. 1 cm<sup>3</sup> each of the filtrate was, respectively treated with three drops of Mayer's and Wagner's reagents. Appearance of creamy and reddish-brown precipitate, respectively indicated the presence of alkaloids
- (b) **Test for flavonoids:** The 1 cm<sup>3</sup> of 10% NaOH was mixed with 3 cm<sup>3</sup> of extracted analyte sample into a test tube. Appearance of yellowish solution indicated the presence of flavonoids
- (c) **Test for glycosides:** A mixture of 5 cm<sup>3</sup> of extracted analyte sample and 2.5 cm<sup>3</sup> of 50% H<sub>2</sub>SO<sub>4</sub> were introduced into a test tube. The mixture was heated in boiling water for 15 min, cooled and neutralized with 10% NaOH. Then, 5 ml of Fehling's solutions (A and B) was added to the mixture and boiled. Occurrence of brick-red precipitate indicated the presence of glycosides

- (d) **Test for cardiac glycosides:** The 2 cm<sup>3</sup> of acetic acid containing traces of FeCl<sub>3</sub> and 2 cm<sup>3</sup> of conc. H<sub>2</sub>SO<sub>4</sub> were subsequently added to 2 cm<sup>3</sup> of extracted analyte in a test tube. A blue-layer appearance indicated the presence of cardiac glycosides
- (e) **Test for saponin glycosides:** Approximately 2.5 cm<sup>3</sup> of Fehling solutions (A and B) were added to 2.5 cm<sup>3</sup> of extracted analyte sample in a test tube. The bluish-green precipitate formed indicated the presence of saponin glycosides
- (f) **Test for steroids:** One cubic centimeter (1 cm<sup>3</sup>) of the extracted sample was added to 2 cm<sup>3</sup> of chloroform in a test tube. 2 cm<sup>3</sup> of conc. H<sub>2</sub>SO<sub>4</sub> was carefully added to form a lower layer. Appearance of a reddish brown colour at the interface indicated the presence of steroids
- (g) **Test for volatile oils:** The 20% HCl was mixed with 5 cm<sup>3</sup> of extracted analyte sample and shaken. Indication of white precipitate confirmed the presence of volatile oils
- (h) **Test for tannins:** Five drops of freshly prepared 10% KOH was added to 1 cm<sup>3</sup> of the extracted sample. Dirty-white precipitate appeared indicating the presence of tannins
- (i) **Test for saponins:** Five cubic centimeters (5 cm<sup>3</sup>) of the extracted sample was strongly shaken in a test tube. Formation of large amount of froths that lasted for 30 min confirmed the presence of saponins

**Quantitative analysis of flavonoids:** The method of Okwu and Josiah (2006) was adopted for the quantitative analyses of flavonoids as follows: Ten grams (10 g) each of the dried (ground) samples of *Crinum ornatum* and *Allium sativum*, respectively were extracted with 100 cm<sup>3</sup> of 80% aqueous methanol at room temperature. The solutions were filtered through no. 42 filter paper into weighed crucibles. Then, the crucibles' contents were evaporated to dryness over water baths and the final weights were determined. The determination of % flavonoids contents of both samples were calculated using Eq. 10:

$$\text{Flavonoids content (\%)} = \frac{\text{Loss in weight} \times 100}{\text{Sample weight}} \quad (10)$$

**Toxicological analysis:** Lethal dose concentration (LD<sub>50</sub>) determination on the aqueous extract of *Crinum ornatum* and *Allium sativum*, respectively were carried out using the method of Organization for Economic and Cultural Development (OECD, 2001); Rats were grouped into five so that each group had one rat. A rat from each group was administered a single oral dose of 3000 mg/kg of the aqueous extracts of *Crinum ornatum* and *Allium sativum*, respectively with a feeding tube and observed

for 48 h. This was repeated one after the other for all the groups. The controlled group of the rats was administered with distilled water. Symptoms of toxicity such as increase or decrease in movement, loss of appetite and time of regaining it, body scratching, nervous sensation, salivation, depression and time of death were recorded. The number of survivors in each of the groups after 48 h was recorded, respectively.

## RESULTS AND DISCUSSION

The pH results for the *Crinum ornatum* (5.61) showed to be more acidic than *Allium sativum* (6.92) as presented in Table 1. These results confirmed the bulbs to be generally low acidic vegetables and these agrees with the pH range of 5.37 to 5.85 for *Allium cepa* as documented by Food pH Level (2011).

Therefore, samples with higher pH (low acidity) may contribute positively because lower acidic food are advantageous in consumption in order to prevent negative effects of acidic medium; i.e., the stomach secretes gastric juice which includes pepsinogen, rennin, mucin and hydrochloric acid. The acid acts on pepsinogen to produce pepsin which functions best in an acid medium. The stomach acidity helps in killing dangerous bacteria and other parasites which enters the stomach together with food materials during feeding (Oxford University Press, 2002).

The results of the Proximate analysis for *Crinum ornatum* and *Allium sativum* are documented as mean±standard deviation of three replicates, respectively 77.83±2.75 and 52.60±0.30% moisture, 4.67±0.58 and 4.50±0.27% ash, 0.67±0.29 and 2.98±0.03% crude lipid, 4.04±0.07 and 8.40±0.18% crude protein, 2.67±0.29 and 1.47±0.02% crude fibre, 87.96±0.46 and 82.65±0.04% available carbohydrate and 373.99 and 391.02 kcal/100 g energy value as recorded in Table 2.

The moisture content of *Crinum ornatum* (77.83%) is statistically ( $p < 0.05$ ) higher than *Allium sativum* (52.60%). Meanwhile, The 52.6% moisture for *Allium sativum* is lower than those recorded for *Allium sativum*; 66.57, 67.66 and 73.86% (Odebunmi *et al.*, 2010; Hussain *et al.*, 2010; Hussain *et al.*, 2009), respectively. Therefore, High moisture content of a sample implies its poor storage quality because samples with moisture content more than 15% encourages microbial attacks during storage (Umar *et al.*, 2006).

The contents of ash for both *Crinum ornatum* (4.67%) and *Allium sativum* (4.50%) were statistically ( $p > 0.05$ ) similar. The ash content of *Allium sativum* (4.50%) is in the same range with 4.84% reported by Hussain *et al.* (2009) but appeared to be higher than 1.28% reported by Odebunmi *et al.* (2007). Definitely, high amount of ash content implies the availability of essential minerals present in a particular sample (Umar *et al.*, 2006).

Crude lipids content for the *Crinum ornatum* (0.67%) is statistically ( $p < 0.05$ ) lower than *Allium sativum* (2.98%).

Table 1: pH of the bulb species

Component	<i>Crinum ornatum</i>	<i>Allium sativum</i>
pH	5.61	6.92

Table 2: Proximate analysis of the bulb species

Component	<i>Crinum ornatum</i>	<i>Allium sativum</i>
Moisture (%WM)	77.83±2.75 <sup>a</sup>	52.60±0.30 <sup>b</sup>
Ash (%DM)	4.67±0.58 <sup>a</sup>	4.50±0.27 <sup>a</sup>
Crude lipid (%DM)	0.67±0.29 <sup>b</sup>	2.98±0.03 <sup>a</sup>
Crude protein (%DM)	4.04±0.07 <sup>b</sup>	8.40±0.18 <sup>a</sup>
Crude fibre (%DM)	2.67±0.29 <sup>a</sup>	1.47±0.02 <sup>b</sup>
Available carbohydrate (%DM)	87.96±0.46 <sup>a</sup>	82.65±0.04 <sup>b</sup>
Energy value (kcal/100 g)	373.99	391.02

Values are expressed as mean±standard deviation of three replicates.

Values in the same row with different superscript (a and b) are significantly different ( $p < 0.05$ ). WM: Wet matter, DM: Dry matter

Table 3: Phytochemical screening of aqueous extract of the bulb species

Test	----- Presence of phytochemicals -----	
	<i>Crinum ornatum</i>	<i>Allium sativum</i>
Alkaloids	+++	+++
Tannins	+++	++
Saponins	+++	+++
Flavonoids	++	++
Glycosides	+	++
Cardiac glycosides	+++	+
Saponin glycosides	+	-
Volatile oils	+++	+++
Steroids	+++	+++

(+++): Present in large amount, (++): Present in moderate amount, (+): Present in trace amount, (-): Absence

Table 4: The % flavonoids of the bulb species

Sample	<i>Crinum ornatum</i>	<i>Allium sativum</i>
Flavonoids (%)	52.40	29.20

However, crude lipids for *Allium sativum* (2.98%) is almost in the same range with 2.43% (Hussain *et al.*, 2010) but higher than 0.72% (Otunola *et al.*, 2010). Although, high amount of crude lipid in a sample enhances its energy giving value, as fat is broken down in the body by oxidation process with the release of energy; one gram of fat gives 37 kcal of energy (Lawal and Dangoggo, 2014).

Similarly, crude protein contents of *Crinum ornatum* (4.04%) is statistically ( $p < 0.05$ ) lower than *Allium sativum* (8.40%). The *Allium sativum* contents of crude protein (8.40%) is in the same range with 7.87% as reported by Odebunmi *et al.* (2010) but lower than 13.20% reported by Hussain *et al.* (2010). Thus, high amount of crude protein in a sample acts as an energy source and a tissue builder (Adeniyi *et al.*, 2012).

The crude fibre content of *Crinum ornatum* (2.67%) is statistically ( $p < 0.05$ ) higher than *Allium sativum* (1.47%), which is in the same range with 1.86% reported by Hussain *et al.* (2009). Hence, high amount of crude fibre in a sample improves protection against constipation and it also have an effect on heart disease because studies have shown that soluble fibre lowers levels of artery-clogging cholesterol in the blood stream (Krishnamurthy *et al.*, 2012).

Simultaneously, *Crinum ornatum* (87.96%) is statistically ( $p < 0.05$ ) higher than *Allium sativum*

Table 5: Acute toxicological study for the aqueous extract of the bulb species

Sample	Concentration of extract (mg/kg)	Exceptional symptoms observed after sometime	No. of death
<i>Allium sativum</i>	3000	Appetite regained after 1 h	0
<i>Crinum ornatum</i>	3000	Appetite regained after 15 min and they were more aggressive	0
Distilled water	3000	None	0

(82.65%) in available carbohydrates. Although, this contents (82.65%) is higher than 73.22% (Otunola *et al.*, 2010). Therefore, high amount of available carbohydrate in a sample serves as a major energy source in the diet of animals (Grieshaber, 2013).

The energy value for the bulb of *Crinum ornatum* (373.99 kcal/100 g) appeared to be higher than 391.02 kcal/100 g of *Allium sativum*. Both values obtained shows to be higher than 367.64 and 357.19 kcal/100 g of *Allium sativum* and *Allium cepa* documented by Nwinuka *et al.* (2005). Surely, the report of Sharma *et al.* (2002) revealed that samples with higher energy value contributes to energy giving in the body.

**Phytochemical screening of the bulb species:** Table 3 showed the result for the qualitative analysis of phytochemical constituents in the aqueous extracts of *Crinum ornatum* and *Allium sativum*. In this study, large amount of alkaloids content were observed in *Crinum ornatum* and *Allium sativum* which could be the reason for their medicinal activities. These results also supported the reports of Otunola *et al.* (2010) and Machocho *et al.* (2004), respectively.

Saponins content were observed largely in *Crinum ornatum* and *Allium sativum*. This agrees with the reports of Mikail (2010) and Otunola *et al.* (2010) on the qualitative test of saponins in aqueous extract of *Allium sativum*. Hence, the production of saponins by plants served as a defensive mechanism against microbial attacks (Okwu and Emenike, 2006). Similarly, *Crinamine* from *Crinum jagus* had been shown by Adesanya *et al.* (1992) to possess antibacterial activity.

Large amount of tannins observed in *Crinum ornatum* but moderately in *Allium sativum*. The presence of tannins in *Allium sativum* may be responsible for its sharp taste. However, the report of Okwu and Emenike (2006) shows that tannins possess the property of hastening the healing of wounds.

Simultaneously, moderate amount of flavonoids content were observed in *Crinum ornatum* but trace amount in *Allium sativum*. Thus, flavonoids have been known for their protection against allergies, inflammation, platelets aggregation and microbial infections (Okwu and Omodamiro, 2005). Similarly, Burkill (1985) reported that, *Crinum ornatum* possess the properties as anti-tumour, immune-stimulating, analgesic, antiviral, anti-bacterial and anti-fungal.

Meanwhile, glycosides content were largely observed in *Allium sativum* but trace amount in *Crinum ornatum*. However, glycosides in plants claims to be considered as an adaptive strategy to prevent environmental hazards (Al-Tardeh *et al.*, 2008).

Cardiac glycosides showed to be in larger quantity in *Crinum ornatum* compared to the trace amount observed in *Allium sativum*. Thus, cardiac glycosides are used in treatment of congestive heart failure and cardiac arrhythmias (Malik and Siddiqui, 1981). The presence of cardiac glycosides in *Allium sativum* agrees with the findings of Mikail (2010) on the qualitative analysis of the bio-active components of *Allium sativum*. Saponin glycosides content were tracery observed in *Crinum ornatum* but absent in *Allium sativum*. However, natural saponin glycosides could serve as free radical scavenger that has the ability of protecting against oxidative injury to bovine serum albumin (BSA) (Sharma and Prasad, 2010). In addition, saponin glycosides has been found useful in Japan for curing liver cirrhosis, chronic hepatitis and prevention of the viral growths associated with RNA and DNA (Friedli, 2010).

*Crinum ornatum* and *Allium sativum* possessed large amount of Volatile oils. This agrees with documentation of Johnston and Parsons (2010) on the presence of volatile oils in *Allium sativum* and could help in prevention of high blood pressure, bacterial and viral infections and inflammation.

Similarly, *Crinum ornatum* and *Allium sativum* possesses large amount of steroids and it's in accordance with the report of Otunola *et al.* (2010) and Mikail (2010) on the phytochemical analysis of *Allium sativum*. Thus, steroids are naturally produced as lipids in the body which also comprises of reproductive hormones (Shiau *et al.*, 2014).

**Percentages (%) flavonoids of the bulb species:** Table 4 summarized the quantitative % flavonoids in both analyte samples, respectively. *Crinum ornatum* (52.40%) contained larger amount of flavonoids than *Allium sativum* (29.20%). However, *Allium sativum* (29.20%) is also found to be in the same range with 33.40% for *Allium sativum* reported by Stajner *et al.* (2006). Recently, it was revealed that a sample with higher content of flavonoids may contribute in beneficial health effects as antioxidants; i.e., neutralizing free radical which damages the body tissue and lead to heart diseases, strokes and cancer (Carocho and Ferreira, 2013).

**Toxicological analysis for the aqueous extract of the bulb species:** Table 5 summarized the results of the toxicological analysis for the aqueous extract of *Allium sativum* and *Crinum ornatum*. The observable symptoms of discomfort in the animals in group "A"



administered with *Allium sativum* (3000 mg/kg) aqueous extract were; loss of appetite, which was regained after 1 h, slow movement, depression, less aggressive, lying at the corners of the cage but no death was recorded.

While, the group "B" administered with *Crinum ornatum* (3000 mg/kg) aqueous extract showed to have similar with the symptoms observed in groups A animals, except that they regain appetite after 15 min and they were more aggressive. Therefore, these results showed that the medium lethal dose (LD<sub>50</sub>) of *Allium sativum* and *Crinum ornatum* are both higher than 3000 mg/kg for the tested animals. Thus, a sample whose the acute oral LD<sub>50</sub> is above 1000 mg/kg is regarded relatively safe (Clarke and Clarke, 1979). Similarly, WHO (1991) considered extracts with LD<sub>50</sub> above 3000 mg/kg are essentially safe (Sani *et al.*, 2009).

**Conclusion and recommendation:** Considering the results of phytochemical screening, percentage of flavonoids and toxicological studies of *Allium sativum* in comparison with *Crinum ornatum*, these results justify that *Crinum ornatum* bulbs could be considered as a potential source of spices. These would provide both flavouring and medicinal benefits when consumed. Although, more research should be carried out on the sub-chronic (long-time toxicity) in order to have a safe and profitable consumption.

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