Phytochemical Constituents and Nutritional Evaluation of Three Selected Edible Flowers in Ado-Ekiti, Nigeria

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ABSTRACT

The study examined the bioactive phytochemical and nutritional compositions of *Hibiscus rosasinensis*, *Moringa oleifera* and *Musa paradisiaca* flowers collected from Ado Ekiti, Ekiti State, Nigeria. Various researches suggest that some flowers are eaten by man since ancient times and have therapeutic properties as well as nutritional value. Fresh flowers were collected, washed, dried and ground into powder for analysis. The results of the phytochemical screening revealed the presence of Flavonoids, Tannins, Saponins, Phenols, Terpenoids, Phlobatannins, Cardiac glycosides, Anthraquinones and Steroids in *M. oleifera* and *M. paradisiaca* flowers while Flavonoids, Alkaloids, Tannins, Phenols and Terpenoids were absent in *H. rosasinensis*. Quantitatively, *M. oleifera* and *M. paradisiaca* contained (mg/100g) Tannins 54.61 and 48.93, Saponins 46.51 and 25.42, and Phenols 44.37 and 36.09 respectively. *H. rosasinensis* contained 63.03mg/100g saponins while the estimated quantity of flavonoids in *M. paradisiaca* was 17.98mg/100g. The percentage estimation of the proximate composition of the three flowers revealed carbohydrate values ranging from 49.01 to 61.11, crude protein 1.90 - 3.07, crude fiber 17.27 - 29.00, ash 1.89 - 3.34, crude fat 3.36 - 5.60 and moisture content 12.37 - 13.66. All the flowers showed high level of mineral elements in order of Na<K>Ca>Cu>Fe>Mn>Mg and Zn while Pb and Ni found in *M. oleifera* and *M. paradisiaca* were below the permissible level and considered safe for human consumption. The presence of phytochemical in the flowers suggests possible preventive and curative property of the flowers. Also, the flowers are rich in carbohydrate, fiber and minerals hence can be fortified as supplementary food for man and livestock feeds.

Keywords: Ekiti State, Flower, Nutritional composition, Phytochemical, Supplementary food

INTRODUCTION

The beauty of many plants that offer great aesthetic value and ecological balance in the ecosystem is usually conferred on them by their flowers. Apart from this, edible flowers also play a significant role in the food culture of people in Nigeria and Africa as a whole. They are considered as foods from plant with valuable sources of nutrients especially in rural areas. Like vegetables, they have both medicinal and nutrition properties (Yashaswini et al., 2011). Edible flowers have been consumed for thousands of years in China and Japan (Mlcek and Rop, 2011). In other parts of the world, flower consumptions have been reported for centuries and are consumed as ingredients in different meals, salads and beverages (Navarro-gonzalez et al., 2015). In Nigeria, edible flowers are not considered as important items of diet in many homes. They are mostly consumed in the rural area or in the communities where they have traditional knowledge of their nutritional and therapeutic values. Flowers play many beneficial roles ranging from nutritional, social, cultural, religious, health and environmental to mention but a few.

Unfortunately, edible flowers are underutilized when compared to the green leafy vegetables. The reasons are not far fetch from the fact that little knowledge was known and documented about the nutritional and medicinal properties of these flowers which abound in Nigeria. Flowers are known to contain both beneficial and toxic substances that vary over a wide range of concentrations. Flowers to be incorporated in human diets must therefore be toxic free and have good nutritional properties (Alasalvar et al. 2013).

According to Amin et al. (2013), a large number of people in developing countries therefore live in abject poverty. Such people cannot afford food rich in essential nutrients needed for growth and development. Edible flowers can contribute substantially to protein, minerals, vitamins, fibers and other important nutrients which are inadequate in the daily diets of these people. Edible flowers are cheap, easily cultivated and readily available throughout the seasons in Nigeria. They can supplement fruits, fish, meat, egg and other food items that are out of reach of the poor populace (per. com). Edible flower also contain bioactive compound like tannins, flavonoids, phenols, essentials oils which produce definite physiological
action on human body (Edoga et al., 2005) that can bring about healing.

_Hibiscus rosinensis_ (L.) belongs to the family Malvaceae. It is an evergreen herbaceous plant extensively cultivated as an ornamental plant. The plant is distributed throughout the tropics and sub-tropical regions. Leaves are ovate or ovate-lanceolate, entire at the base and coarsely toothed at the apex. Flowers are pendiculate, actinomorphic, pentameric and complete. Its corolla consists of five petals, red in colours and about 8 cm in diameter. Its fruit is very rare but where found, is a capsule about 3 cm long. The flowers and the leaves of Hibiscus are highly nutritious and are used for culinary purposes (Duke and Ayensu, 1985). More so, various parts of this plant like leaves, flowers and roots have been reported to possess medicinal properties that allow for their use as aphrodisiac, laxative and emollient. Traditionally, the leaves of the plant are used in fatigue and skin disease (Kumar and Singh, 2012). The flowers are used to treat epilepsy, leprosy and diabetes (Kasture et al., 2000).

_Moringa oleifera_ (Lam.) is a fast growing, evergreen or deciduous tree that belongs to the family Moringaceae. The tree grows widely in the tropics and sub-tropics of Asia and Africa. It typically ranges in height from 5 to 10 meters (Morton, 1991). The leaves are bipinnate or more commonly tripinnate, up to 45 cm long and alternate, spirally arranged on the twigs. The leaflets are finely hairy, green, entire margins and are rounded or blunt-pointed at the apex and short-pointed at the base. Fruits are yellowish-white, borne on slender, hairy stalk in spreading or drooping axillary, clusters, 10–25 cm long and 2.0 to 2.5 cm broad, usually containing up to 26 seeds. The leaves, fruits, flowers and unripe pods on _Moringa_ tree are used as nutritive vegetables in many countries of the world (Ansvar and Bhanger, 2003; Answer et al., 2005). Its flowers have been reported to contain nine amino acids, sucrose, traces of alkaloids and ash which is rich in potassium and calcium (Ruckimani et al., 1998).

_Musa paradisiaca_ (L.) commonly called plantain is an herbaceous plant, belonging to the family Musaceae. It has a robust tree like pseudo-stem which consists of overlapping leaf bases forming a cylindrical structure almost 45 cm in diameter (Blomme and Ortiz, 2000). The leaves are large, elongated, oval and deep-green with a prominent midrib (Pradeep et al., 1986). The plant produces a single inflorescence and large bracts opening in succession, ovate, concave, dark red and somewhat fleshy. Its fruits are oblong and fleshy. The various uses of _M. paradisiaca_ flowers, bracts, ripe and unripe fruits, leaves, root and stems are documented in traditional and scientific literatures. Extracts from its edible flowers and their active constituents have been used for the treatment of various ailments in man (Kumar et al., 2012). For example, plantain flowers are used in the treatment of dysentery and hemorrhage. The bract of _Musa paradisiaca_ has medicinal applications in bronchitis, dysentery and ulcer. Bracts when cooked are used to treat diabetics (Peter, 2011).

Several researchers around the world have provided information on the nutritional profile, biological and pharmacological activities of different edible flowers. In Nigeria, despite the enormous health promoting benefits of edible flowers, there is paucity of information on these vast but underutilized edible materials (Shindu et al., 2008; Navarro-gonzalez et al., 2011 and Yashaswini et al., 2011). Hence, there is a need to explore the potential of these edible flowers through adequate scientific research activities. This work was carried out in order to evaluate the phytochemical and nutritional composition of three selected edible flowers obtained from Ado-Ekiti, Ekiti State, Nigeria.

**MATERIALS AND METHODS**

**Sample Collection**

Fresh flowers of _H. rosasinensis_, _M. oleifera_ and bracts of _M. paradisiaca_ were collected from Ekiti State University, Ekiti State, Nigeria. The botanical authentications of these materials were done at the Herbarium of the Department of Plant Science and Biotechnology, Ekiti State University. The specimens were washed with distilled water, sun dried for three days to reduce moisture content and later air dried. The dried samples were ground using blending machine (Akai BD 012) and packed in a separate plastic container. The samples were taken to the laboratory for chemical, proximate and mineral compositions analyses.

**Preparation of Plant materials**

The aqueous extract of each of the plant samples was prepared by soaking 50 g of each dried powdered sample in 500 cm$^3$ of distilled water, shaken intermittently and then allowed to stay for 48 h. It was later filtered using Whatman No. 42 filter paper.

**Phytochemical Analysis**

Phytochemical screenings of the aqueous extract and dried powder of the selected flowers were carried out using standard procedures as described by Trease and Evans (1989); Sofowora (1993).

**Quantitative Analysis of the Phytochemicals**

**Test for tannins:** A portion (2 g) of the dried powdered sample each was taken and boiled in 20 cm$^3$ of distilled water in a separate test tube and then filtered. A few drop of 0.1% Ferric Chloride was added and the solution was observed for brownish green colouration (Banso and Adeyemo, 2006).

**Test for Saponins:** Portions (2 g) of each of the powdered sample was boiled in 20 cm$^3$ of
distilled water in a water bath and then filtered. The filtrate (5 cm³) was mixed with 5 cm³ distilled water and shaken vigorously. The formation of stable foam was taken as an indication for presence of saponins.

**Test for alkaloids:** To 3 cm³ of aqueous extract, 3 cm³ of 1% HCl was added and stirred on a steam bath and filtered. Mayer’s reagent (Potassium mercuric iodide) was then added to the filtrate. Formation of yellow precipitate shows the presence of alkaloids.

**Test for flavonoids:** 5 cm³ of 10% dilute ammonia solution was added to 1 cm³ of aqueous extract of the plant. This was followed by the addition of few drops of concentrated H₂SO₄. A yellow colouration observed indicated the presence of flavonoids.

**Test for Phlobatannins:** A portion (2 cm³) of aqueous extract was added to 1% hydrochloric acid and then boiled. Formation of red precipitate confirmed the presence of phlobatannins.

**Test for Terpenoids:** A portion (5 cm³) of each aqueous extract of the sample was mixed with 2 cm³ of Chloroform and 3 cm³ of concentrated H₂SO₄ was carefully added to form a layer. A reddish brown colouration at the interface indicated the presence of terpenoids (Tease and Evans, 2005).

**Test for Anthraquinones:** A portion (5 g) of each powdered sample was taken and boiled in 10 cm³ of aqueous HCl and then filtered while hot. To the filtrate, 5 cm³ of Chloroform was added before the mixture was thoroughly shaken. The Chloroform layer was pipette into another test tube and 2 cm³ of 10% ammonia solution was added. A red colouration was observed in the lower phase which indicated the presence of anthraquinones.

**Test for steroids:** 2 cm³ of acetic anhydride was added to 0.5 g of the plant sample each with 2 cm³ of conc. H₂SO₄ acid. Presence of steroids is noted by the changing of colour from violet to blue (Harborne 1993; Trease and Evans 2005).

**Test for Cardiac glycosides:** (Killer-Killani Test). Portion (1 g) of the powdered sample was dissolved in 5 cm³ of distilled water and 2 cm³ of glacial acetic acid solution containing one drop of ferric chloride solution. This was underplayed with 1 cm³ of concentrated H₂SO₄. A brown ring at the interface indicated the presence of deoxysugar characteristics of cardenolides. A violet ring appeared below the brown ring while in the acetic acid layer a greenish ring was formed just above the brown ring and gradually spread throughout this layer.

**Quantitative Analysis of the Phytochemicals**

**Determination of Flavonoids:** 2 grams of each of the samples were extracted repeatedly with 10 cm³ of 80% aqueous methanol at room temperature. The mixture was filtered through Whatman No. 1 filter paper into a pre-weighed 250 cm³ beaker. The filtrate was later transferred into a crucible and evaporated into dryness over a water bath and weighed to a constant weight. (Krishnaiah et al., 2009).

**Determination of Alkaloids:** 5 grams of the sample were weighed into a 250 cm³ beaker and 20 cm³ of 10% acetic acid in ethanol was added and covered and allowed to stand for 4 h. This was filtered and the extract was concentrated on a water bath to one quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitate was collected and washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed (Harborne, 1973).

**Determination of Tannins:** The sample extract (1 cm³) was mixed with folin-ciocalteaus reagent (0.5 cm³), followed by the addition of saturated Na₂CO₃ solution (1 cm³) and distilled water (8 cm³). The reaction mixture was allowed to stand for 30 min at room temperature. The supernatant was recorded by centrifugation and absorbance of standard tannic acid was prepared and the absorbance was recorded at 725 nm using UV-visible spectrophotometer.

**Determination of Saponins:** Test extract was dissolved in 80% methanol and 2 cm³ of Vanillin in ethanol was added and mixed well. 2 cm³ of 72% sulphuric acid was added, mixed well and heated on a water bath at 60°C for 10 min. Absorbance was measured at 544 nm against reagent blank. Diosgenin was used as a standard material and compared the assay with Diosgenin equivalents.

**Determination of Total Phenol:** Total Phenol was estimated by the method of folin-ciocalteau. To 0.4 cm³ of the samples, 9 cm³ of distilled water was added followed by 1 cm³ of folin-ciocalteau reagent and shaken well. After incubating for 5 min, 10 cm³ of 7% sodium carbonate was added to all the flasks. The volume was then made up to 25 cm³ with distilled water and mixed well. Read the blue color developed at 750 nm after 90 min incubation at 23°C. The amount of total phenol was expressed in milligrams of Gallic acid equivalents (GAE) per serving.

**Proximate Composition**

The proximate composition comprising of the moisture, ash, crude fiber and crude fat content were determined using the standard methods of Association of Official Analytical Chemist (2006). The total nitrogen content was determined using micro-Kjeldahl and converted to crude protein (N × 6.25) (Association of Official Analytical Chemist, 2000). Carbohydrate content was obtained according to Onwuka (2005) which was calculated as follows:
%Carbohydrate = 100 (% Moisture + % Ash + % Protein + % Fiber).

### Mineral Content Determination

The mineral constituents in the dried powdered flower samples were determined. For each sample, 2 g was digested with concentrated nitric acid and concentrated perchloric acid in the ratio 5:3 and the mixtures were placed on a water bath for three hours at 80°C. The resulting solution was cooled and filtered in a 100 cm³ standard flask which was then made to the mark with distilled water (Asaolu, 1995). Na, K, Ca, Fe, Mg, Zn, Pb and Ni were determined using Atomic Absorption Spectrophotometer (Bulk Scientific Model 2000A/200), (Essien et al., 1992) and their absorption values were compared with absorption data of standards of each of the metals.

### RESULTS

Tables 1 and 2 present the results for the quantitative and qualitative phytochemical analysis of the three selected edible flowers obtained from Ekiti State, respectively. Nine out of ten phytochemicals investigated were detected in *M. oleifera* flower and *M. paradisiaca* bract. *H. rosasinensis* has only five phytochemicals.

#### Table 1. Qualitative phytochemical composition of flowers of *H. rosasinensis*, *M. oleifera* and *M. paradisiaca* bract.

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<tbody>
<tr>
<td><em>H. rosa sinensis</em></td>
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<td>+</td>
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<td><em>M. oleifera</em></td>
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<td><em>M. paradisiaca</em></td>
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</table>

Key: Fla. – Flavonoids, Alk. – Alkaloids, Tan. – Tannins, Sap. – Saponins, Phe. – Phenols, Phl. – Phlobatannins, Ter. – Terpenoids, Ant. – Anthraquinone, Car. Gly. – Cardiac Glycosides and Ste. – Steroids. “+” indicates presence, “-” indicates absence

#### Table 2. Quantitative phytochemical composition (mg/100g) of flowers of *H. rosasinensis*, *M. oleifera* and *M. paradisiaca* bract.

<table>
<thead>
<tr>
<th>Phytochemicals/ Samples</th>
<th>Flavonoids</th>
<th>Alkaloids</th>
<th>Tannins</th>
<th>Saponins</th>
<th>Phenols</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>H. rosasinensis</em></td>
<td>-</td>
<td>30.59±0.31</td>
<td>54.61±0.24</td>
<td>46.51±32.52</td>
<td>44.37±0.31</td>
</tr>
<tr>
<td><em>M. oleifera</em></td>
<td>-</td>
<td>17.98±0.28</td>
<td>48.93±0.14</td>
<td>25.42±0.26</td>
<td>36.09±0.28</td>
</tr>
</tbody>
</table>

Values are the mean of triplicates ± S.D

#### Table 3. Proximate estimation of flowers of *H. rosasinensis*, *M. oleifera* and *M. paradisiaca* bract.

<table>
<thead>
<tr>
<th>Carbohydrate</th>
<th>Protein</th>
<th>Fat</th>
<th>Ash</th>
<th>Fibre</th>
<th>Moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>H. rosasinensis</em></td>
<td>61.11±0.13</td>
<td>1.90±0.03</td>
<td>4.67±0.15</td>
<td>2.64±0.08</td>
<td>17.27±0.03</td>
</tr>
<tr>
<td><em>M. oleifera</em></td>
<td>49.01±0.22</td>
<td>3.07±0.18</td>
<td>3.36±0.15</td>
<td>1.89±0.22</td>
<td>29.00±0.54</td>
</tr>
<tr>
<td><em>M. paradisiaca</em></td>
<td>50.59±0.17</td>
<td>1.97±0.07</td>
<td>5.60±0.03</td>
<td>3.34±0.12</td>
<td>25.54±0.60</td>
</tr>
</tbody>
</table>

Values are the mean of triplicates ± S.D

Key: Car. – Carbohydrate, Cru. Pro. – Crude protein, Cru. Fat – Crude fat, Cru. Fib. – Crude fiber, Moi. Con. – Moisture content

Quantitative estimation (mg/100g) showed that the three flowers were rich in saponins which ranged between 25.42 and 63.03. *M. oleifera* flower contained 30.54mg/100g alkaloids, 54.61mg/100g tannins, 46.51mg/100g saponins and 44.37mg/100g phenols while *M. paradisiaca* bracts contained 48.93mg/100g tannins, 25.42mg/100g saponins and 36.09 mg/100g. The result of the proximate composition of the three flowers is presented in Table 3. The value obtained for carbohydrate ranged from 49.01 to 61.11%, crude protein 1.90 to 3.07%, crude fat 3.36 to 5.60%, ash content 1.89 to 3.34%, crude fiber 17.27 to 29.00% and moisture content 12.37 to 13.66%. The mineral element present in the three flowers followed the order Sodium > Potassium > Calcium > Iron > Magnesium > Manganese > Zinc and Copper. Trace amount of Nickel were found in *M. oleifera* flower and *M. paradisiaca* bract while Cadmium was not detected in the three flowers investigated (Table 4).
DISCUSSION

Edible flowers of *H. rosasinensis* *M. oleifera* and the bract of *M. paradisiaca* were found to contain phytochemicals which are of medicinal values (Morton, 1987; Kasture et al., 2000; Berhovich et al., 2013). Different phytochemicals have been reported by several authors to possess a wide range of biological activities which may help in ameliorating or curing certain diseases (Cowan, 1999; Okwu, 2004; Ighinosa et al., 2009; Adinortey et al., 2012; Amin et al., 2013). Comparatively, the result of our findings on phytochemical composition of *M. paradisiaca* bracts agreed with the reported work of Adeolu and Enesi (2013) but disagree with the presence of alkaloids in their findings. Also, the findings in this research work concord with the results obtained for phytochemical screening of water extract of *M. oleifera* leaves (Kasolo et al., 2010).

The presence of tannins in *M. oleifera* flower and *M. paradisiaca* bracts implies that they have potential antibacterial, anti-inflammatory and antiviral properties (Adzouana and Mombokou, 2012). The availability of flavonoids in *M. paradisiaca* bracts is an indication that the bracts may have a significant pharmacological property that can modify the reaction of the human body to allergies, ulcers as well as anti inflammatory and antimicrobial activities (Cushine and Lamb, 2005; Abigail et al., 2012). The hepatoprotective activity of the flower of *M. oleifera* has been documented by Gilani et al. (1997). This is due to the presence of quercetin, a well known flavonoid in the flower. The flowers of the three plants investigated contained saponins. Saponins have been reported to have cholesterol binding properties (Sodipo et al., 2000). They also have curative effects on cancer and are known to boost immune system (Adeolu and Enesi, 2012). Tannins and Phenols were found to be present in high concentrations in both *M. oleifera* flower and *M. paradisiaca* bracts. The presence of tannins in them infers that they can be used for the treatment of intestinal disorders like diarrhea and dysentery. Tannins have been reported for its astringent, wound healing and anti-inflammatory properties (Farquar, 1996). Phenol is considered to have antimicrobial properties which in turn could make the edible flowers effective in the treatment of typhoid fever and other bacterial infections (Otofokansi et al., 2005). Other important bioactive compounds like terpenoids, phlobatannins and cardiac glycosides have been documented to have different pharmacological effects on man. Terpenoids and steroids have been reported to be effective against bacterial such as *Staphylococcus aureus* (Cowan, 1999). Cardiac glycosides have been used to treat congestive heart failure.

The nutritional profile of the edible flowers showed that their moisture contents are lower compared to other edible flowers. Percentage moisture content of 89.32, 83.39 and 81.74 has been reported for *Tropaeolum majus*, *Tagetes erecta* and *Spilanthes oleracea* respectively (Navarro-Gonzalez et al., 2015). The low moisture content of the three investigated flowers suggests that they can be kept for some time without deterioration. They could also be useful in the dry season as an alternative soup ingredient when common leafy vegetables are not readily available. Their carbohydrate contents when compared to some vegetables like *Ceiba pentandra*, *Manihot esculentus* and *Abelmoschus esculentus* (Raimi et al., 2014) are higher and could be considered as a good source of energy. However, the values compared favourably with the 52.18% carbohydrate values reported for *Amaranthus asper* (Jimoh et al., 2010) and 54.3% *Cocchorus olitorius* (Arowosegbe et al., 2015). The values obtained for ash in the study are low when compared with the values reported for *H. sabdariffa* (7.50%) and *Telfaria occidentalis* (8.54%) (Asaolu et al. 2012).
but comparatively higher than 0.83% and 0.55% reported for leaves of Octium gratissimum and Talium fruticosum respectively (Adeniyi et al., 2012). The percentage crude fiber contents for the three flowers investigated are high when compared to the values reported for other foodstuff. The values are higher than that of O. gratissimum leaf (11.38%), Melanthera scadens leaf (12.66%) and Lea guineensis leaf (9.61%), (Faghohun et al., 2011). High fiber concentration in the studied flowers could make them to be regarded as good sources of crude fiber. Adequate intake of dietary fiber has been reported to lower the serum cholesterol level, hypertension, cardiac disease, diabetes and constipation in human (Ishida et al., 2000).

The crude protein contents of the flowers investigated are lower when compared to the reported value of 11.47% for M. paradisiaca bract (Adeolu and Enesi, 2013) and 20.80% for M. oleifera leaf (Arowosegbe et al., 2015). However, these values are similar to those contained in the reports of Navarro-Gonzalez et al. (2015) for some edible flowers. Crude fat contents of the flower samples in this study are moderate. The values are significantly more than what was reported for some edible flowers such as I. majus, T. erecta and S. oleracea. However, the values fall below the amount of crude fat reported for the leaves of Myrianthus arboresus (6.01%) and Spargonomphus spargonomphora (6.45%) (Oyeyemi et al., 2014). A diet providing 1.20% of its caloric energy as fat is considered to be sufficient for human being. Crude lipids are principal source of energy but should be consumed moderately so as to avoid obesity and other heart related diseases (Anita et al., 2016). Flowers like fruits are not very good sources of fats.

Minerals form the fundamental parts of enzyme systems and they help in prevention of many diseases and equally strengthen the human immune system (Campbell and Reece, 2006). The three edible flowers investigated in this study could be considered as excellent source of minerals when their mineral profiles are compared with some common leafy vegetables consumed in Nigeria. The mineral element composition is one of the most important factors that promote the use of edible flowers in human nutrition. The values of mineral element in our findings revealed high concentrations of potassium, calcium, magnesium and sodium. This result agreed with the work of Rop et al. (2012) but differs in low concentrations of Fe and Mn in their previous work. Sodium and potassium are important intracellular and extracellular cations, respectively. Food rich in K have been reported to help in prevention of cardiovascular and oncogenic diseases (Kader, 2008).

Calcium and phosphorus are very important in the formation of strong bones and teeth, blood clothing, heart function and cell metabolism (Rolte et al., 2009). The studied flowers contained iron needed in the hemoglobin formation, hence could be recommended for the treatment of iron deficiency (anemia). Manganese found in the flowers investigate was reported to activates many enzymes. Copper plays an important role in hemoglobin formation and also contribute to iron, and energy metabolism (Adinortey et al., 2012). Zinc has been reported to be involved in normal functioning of immune system (Ibrahim et al., 2001) and also associated with protein metabolism.

CONCLUSION

The three selected edible flowers constitute an important source of naturally occurring phytochemicals and this may provide a basis to incorporate them into various health/food formulations. The results further indicate that the flowers are potential sources of carbohydrate, dietary fiber and essential minerals which could be utilized in food science. Flowers which are regarded as waste could become wealth if their rich medicinal and nutritional values are properly harnessed.

Declaration of Conflicts of Interest

The authors declared that no competing interest exits.

REFERENCES


