ANALYSIS OF MICRO-NUTRIENTS COMPOSITION OF COCOYAM (COLOCASIAE ESCULENTA) AND SWEET POTATO (IPOMOEA BATATAS L) LEAVES IN MELON SOUP

1 MBEREKPE, Priscilla. B., & 2 IGBO, Chinyere., A.
1Department of Home Economics Education, School of Vocational Education, Federal College of Education (Tech) Potiskum, Yobe State, Nigeria
2Department of Home Economics and Hospitality Management Education, Faculty of Vocational and Technical Education, University of Nigeria, Nsukka Enugu State
E-mail: priscillamberekpe@gmail.com

Abstract

The study ascertained the micro-nutrient composition of cocoyam and sweet potato leaves in melon soups. The study was conducted to identify vitamins and mineral composition in three types of melon soups. The instrument adopted for the study was laboratory analysis of food nutrients using official methods of Association of Official Analytical Chemists. The data for micro nutrients were collected in triplicates from the melon soups in the food analysis laboratory, raw triplicate values of each micro nutrient in the soups were collected and analyzed using $\bar{X} \pm SD$ and ANOVA statistics to test the hypotheses 1 – 4. The findings revealed that cocoyam and sweet potato leaves melon soups are as rich as fluted pumpkin leaf melon soup in micro nutrients, such as vitamin A (Iµ) 16.03: 16.80 while fluted pumpkin 19.88; vitamin C (mg) 26.30: 36.89 while fluted pumpkin 28.46; folic acid (mg) 33.44: 40.64 while fluted pumpkin 46.73 among others. For minerals- Na (mg) 29.80: 26.16 while fluted pumpkin 34.19; Fe (mg) 1.41: 1.60 while fluted pumpkin 1.24 K (mg) 36.08: 46.46 while fluted pumpkin 34.57; Ca (mg) 11.19: 8.10 while fluted pumpkin 5.88; Mg (mg) 4.62: 3.53 while fluted pumpkin 2.63 among others. The study also showed that there was a significant difference between the mean values of the micro-nutrients analysis. The study recommended that, the consumption of cocoyam and sweet potato leaves should be encouraged by families in the country, as well be made available in the open market same way the popular vegetables are sold such as fluted pumpkin (Ugu) leaf.

Keywords: Micro-Nutrients, Cocoyam, Sweet potato, Soup, Leaves

Introduction

Vegetable is any part of a plant that is eaten by man as food. Vegetable is a plant part, which does not contain seeds, although some vegetables may be used in plant reproduction (Fadupin, Ogunkunle, Atikekere and Faburoso, 2017). Leafy vegetables as described by Ogukwe, Amaechi and Enenebeaku, (2017) are succulent plants grown mainly in gardens and around homes; they are consumed raw or cooked to compliment major staple diets like cassava, cocoyam, maize, rice, yam and others. According to International Agency for Research on cancer (2013), vegetable refers to edible plants, commonly collected and or cultivated for their nutritional value for humans. Meeks (2021) viewed vegetables as low energy-dense foods relatively rich in vitamins, minerals and other bioactive compounds as well as being good sources of fibre. Fleshy and edible leaves
from vegetable plants can be eaten raw and cooked with other condiments as soup, as supporting food or main dishes and they may be aromatic, bitter or tasteless but are cheap and accessible (Okon and James, 2015). Leafy vegetables can be semi-wild and wild depending on where they are found and cultivated; which made vegetables to be indigenous or non-indigenous in nature. Olugbenga, Undigwewndeye, Uyabeme, (2015) opined that, indigenous leafy vegetables are highly recommended because their consumption gives diversity to daily food intake, by adding flavor and zest to the diet. Indigenous green leafy vegetables and the young shoots could be cooked, boiled and consumed in different forms thereby adding to the important component of diversified diets rich in protein, vitamins and mineral elements improving dietary quality (Thompson and Agbugba, 2013). Indigenous green leafy vegetables are vital component in human diet as they provide essential micro nutrients that protect against chronic disease development in the human body and enhance good health (Sultanbawawa and Sivakumar, 2022). Indigenous leafy vegetables are valuable sources of food, income and traditional medicine in Nigeria. Some indigenous vegetables are lesser-known (unpopular or not well known), and some are known; though, there are various types of indigenous green leafy vegetables. Cocoyam and sweet potato leaves are known to be addressed as lesser-known because the tubers are known and used while the leaves are not used as such by people most especially in Nigeria.

Cocoyam is another tuber crop used mainly for human food. Cocoyam is an herbaceous perennial plant which belongs to the family of Araceae and may belong to either the genus colocasia or the genus xanthosoma. According to Obidiegwu, Kendabie, Obidiegwe and Amadi, (2016) cocoyam is an important food crop for more than four hundred million people worldwide, especially in the tropics and sub-tropics. Similarly, Ogukwe, Amaechi and Enenebeaku, (2017) opined that cocoyam constitutes one of the basic food crops of major economic importance in Nigeria. Obidiegwu, et al, (2016) further stated that cocoyam leaves contain significant levels of protein and are excellent sources of carotene, potassium, calcium, phosphorus, iron, riboflavin, thiamin, niacin, vitamin A and C, and dietary fiber; and in addition contain greater amount of vitamin B-complex than whole milk. Cocoyam in addition to sustaining food security in domestic market also brings important earnings and the leaves can be deployed into the daily recipe routine by families (Awak, Udofia, Akan, Uffia and Udoekpong, 2017). However, the authors further opined that, cocoyam has a nutritional value compared to sweet potato.

Sweet potato whose botanical name is Ipomoea batatas L. from the family of convolvulaceae is a herbaceous perennial vine that has purplish medium-sized flowers, large nutritious tuberous roots and alternate heart-shaped loped leaves. According to Ismail (2014) sweet potato leaves are edible, highly digestible, and the leaves serve as a vegetable in some parts of the world. Similarly, Butler (2017) opined that, Sweet potato roots and tops possess a variety of chemical compounds relevant to human health. Areghere (2012) also stated that sweet potato leaves are highly digestible, a dietary source of vitamins, minerals, antioxidants, dietary fiber and essential fatty acids and free from toxins. Sweet Potato (Ipomoea batatas) is listed as one of the vegetables consumed by all ethnic groups in Ghana and some other African countries, though, only the tubers are consumed in large quantities especially in Nigeria (Areghere 2012). However, Jang and Koh (2019) observed that, the young leaves are nutritious containing several micro elements such as zinc, potassium, sodium, manganese, calcium, magnesium, iron, vitamin C and dietary fiber than some other popular green leafy vegetables or tubers. Howe (2018) also explained that, the young leaves serve as a nutritious vegetables source to man, which contain high concentrations of several nutrients such as appreciable amount of magnesium, phosphorus, vitamin C, fatty acids with levels of potassium, sodium, manganese, calcium, iron and zinc respectively. These micro elements and fiber protect the body from degenerative diseases, cardiovascular diseases, cancer, constipation and micronutrient deficiencies; because the nutrients present to the body are anti-cancer and antioxidant substances which in-turn fight against the free radicals the body produce. Thereby preventing or healing of these deficiency diseases when consumed in sauces or soups.
Soup is primarily a liquid food, generally served warm or hot (but may be served cool or cold), which is made by combining ingredients such as meat or fish and vegetables with stock, water or other liquid and other ingredients such as thickeners which are also condiments (melon, ogbono, achi, ogiri etc), herbs (false cubeb leaf (uizza), thyme, ginger, garlic), and spices (locust beans, scent leaf, crayfish, African nutmeg etc). Oderinde (2015) observed that, soups form part of the daily menu of the average person in Nigeria, because some people claim that, they do not feel comfortable without eating “swallow” each day and almost all carbohydrate diet is accompanied with one form of soup or another e.g. pounded yam, boiled yam, processed cassava (garri and fufu), rice, maize or sorghum flour, potato, water-yam, cocoyam and these are accompanied with soup on daily basis.

In Nigeria most soups are made with thickeners which differ in type such as ogbono, okro, kuka, cocoyam, yam, melon among others. The use of melon in soup thickening is popular in almost every tribe or culture in Nigeria and Africa. Melon is popularly known as “egusi”; which is mostly grown for consumption by Africans to complement starchy foods such as fufu, eba, akpu, pounded yam among others (Okpala, 2016). Okpala (2016) further stated that, the melon (egusi) seed is known as colocynthis citrullus (cucurbita citrullus L. or citrullus lanatus thumb) and belong to the family of cucurbitaceae. It is known by various names such as bitter cucumber, pumpkin seeds, egusi melon, vine of Sodom plant, wildgourd, bitter apple, and colocynth or desert gourd. According to Endl, Achigan-Dako, Pandey, Monforte, Pico and Schaefer (2018) the melon plant originated from Africa, Mediterranean region and Asia; and the spherical fruit is greenish in colour when young but changes to slightly yellow or faint once mature. Okpala (2016) and Ezekiel, Sulyok, Somorin and Krksa, (2018) stated that, melon is a major soup ingredient and a common component of daily meals. The coarsely ground up melon seeds are used in thicken stews and contribute to widely enjoy steamed dumplings. Similarly, Audu, Ehanwo, Aremu and Usman (2018) explained that, the melon kernels or seeds contain good sources of essential amino acids such as arginine, tryptophan and methionine, vitamins A, B1, B2, and niacin; and also good in minerals such as sulphur, calcium, magnesium, manganese, potassium, phosphorus, Iron and zinc. These nutrients perform several roles in the body which include encouraging good blood flow, strengthening the immune system among others. Therefore, assessing the bioavailability of micro nutrients of cocoyam and potato leaves is crucial to creating awareness of its nutritional values in melon soups.

Statement of the Problem

Research has it that cocoyam and sweet potato leaves are rich in certain vitamins or vitamin precursors, notably vitamin C, beta-carotene, and micro-nutrients. Due to lack of awareness of their micro-nutrient potentials, and economic advantage cocoyam and sweet potato leaves may bring to households, most people of the Southeast do not consume the leaves rather they plant and wait for the storage tubers to mature, harvest the tubers and give out the leaves to animals for feed with very few farmers consuming the harvested leaves. The leaves of cocoyam and sweet potato are being wasted or given to animals when they can be useful source of vegetables to humans. Secondly, during the dry season, the very popular vegetables such as fluted pumpkin may not be easily available and expensive; these alternatives (cocoyam and sweet potato leaves) may help ameliorate the scarcity of vegetables. Hence, the study was designed to ascertain the micro-nutrient composition of these vegetables in melon soups. The Findings of this study would be of immense benefit to humanity, most especially; parents, home makers, Home Economics teachers, nutritionists, dietitians, community health workers and the entire populace of the nation as this will provide them with information on the micro-nutrients of the vegetables.

Purpose of the Study

The main purpose of the study was to ascertain the micro-nutrient composition of cocoyam and sweet potato leaves in melon soups in South East geopolitical zone. Specifically, the study sought
1. To determine vitamins composition of cocoyam leaf soup.
2. To determine minerals composition of cocoyam leaf soup.
3. To determine vitamins composition of sweet potato leaf soup.
4. To determine minerals composition of sweet potato leaf soup.

**Research Questions**

The study sought answers to the following research questions:
1. What are the vitamin compositions of cocoyam leaf soup?
2. What are the mineral compositions of cocoyam leaf soup?
3. What are the vitamin compositions of sweet potato leaf soup?
4. What are the mineral compositions of sweet potato leaf soup?

**Hypotheses (HOs)**

The following null hypotheses were tested at $P \leq 0.05$ level of significance:
1. There was no significant difference between the vitamins composition of Cocoyam leaf soup and Fluted Pumpkin (Ugu) leaf soup.
2. There was no significant difference between the minerals composition of Cocoyam leaf soup and Fluted Pumpkin (Ugu) leaf soup.
3. There was no significant difference between vitamins composition of Sweet Potato leaf soup and Fluted Pumpkin (Ugu) leaf soup.
4. There was no significant difference between the minerals composition of Sweet Potato leaf soup and Fluted Pumpkin (Ugu) leaf soup.

**Methodology**

**Design of the study:** The study was conducted using Experimental research design which involves laboratory-based studies. This Laboratory-Based In-vitro Studies enabled the researcher to examine the presence of specific variables (such as the micro nutrients in the selected vegetables) using reagents under controlled environment.

**Area of the study:** The study was conducted in the Southeast, geopolitical zone of Nigeria. However, the vegetables for the study were collected from the farms of some indigenes of Nsukka and were identified in the department of crop science, faculty of Agriculture, University of Nigeria, Nsukka. The study was conducted in the Department of Home Economics and Hospitality Management Education Faculty of Vocational and Technical Education, University of Nigeria. The micro-nutrients analysis was conducted in the Department of Home Science and Nutrition Food Analysis Laboratory University of Nigeria Nsukka.

**Population for the study:** There was no population for the study other than four foods Laboratory Technologist (research assistants) in the Department of Nutrition and Dietetics of the University of Nigeria, Nsukka who assisted the researcher in the determination of micro-nutrients composition of the lesser-known vegetables soups (cocoyam and sweet potato).

**Instruments for Data Collection:** The standard instrument for micro-nutrients analyses developed by Analysis of Association of Official Analytical Chemists (AOAC) of 2010 was used.

**Method of Data Collection:** The researcher with the help of four food Laboratory Technologists determined the micro-nutrients composition of the lesser-known vegetables (cocoyam (colocasia esculenta’s) and sweet potato (ipomoea batatas L.’s) leaves) in melon soup in southeast zone using the method of Analysis of Association of Official Analytical Chemists (AOAC, 2010) which is a standard instrument for chemical analysis for research questions 1- 4.

**Experimental Procedure for food micro nutrients determination (materials and methods)**

**For the micro nutrients analysis**

This involved the laboratory analytical process of determining the micro-nutrients composition (laboratory based in-vitro studies) which involves vitamins A, B$_1$, B$_9$, C and E, and minerals such as sodium, calcium, magnesium, phosphorus, zinc, iron, potassium and copper determination. The samples of the vegetables (colocasia esculenta and ipomoea batatas L leaves) in addition to the fluted pumpkin leaf (control) were bought from farmers within the University of Nigeria Nsukka. The fresh vegetables were washed, plucked, and shredded, made into melon soups.

**Materials and Method of Soup Samples**

3 milk cups of ground melon seeds (egusi)
2 cooking spoons of ground crayfish
300 ml or 2 milk cups of palm oil
1 big onion chopped
Pepper to taste
1 litre of water
150g of Ugu leaf (fluted pumpkin)
150g of Cocoyam leaf
150g of Sweet potato leaf
Salt to taste

Method of cooking
1. Place palm oil into a sauce pot and place over moderate heat for 2 minutes
2. Add the chopped onion to the hot oil and allow heating for 3 minutes without burning
3. Add the grind melon to the hot onion oil and continue frying until melon forms lumps.
4. Add water to the fried melon and add pepper and stir the mixture in the saucepot and allow to boil for 10 minutes
5. Add the crayfish and salt, continue boiling for 5 minutes.
6. Bring down the saucepot and share soup into three equal portions.
7. To the first portion add shredded sweet potato leaf and bring to boil for 2 minutes over high heat. (a short time was used to cook the vegetables because the soups will still be autoclaved at 60°C for about 6 hours).
8. To the second portion add the shredded cocoyam leaf and bring to boil for 2 minutes over high heat.
9. To the third portion, add the shredded fluted pumpkin leaf and bring to boil for 2 minutes.
10. The three melon soup samples were taken to the laboratory for micro-nutrients analysis.

The soup samples were dried at 60°C for six hours, ground to powder and were used for the analysis of the micro-nutrients (vitamins A, B₁, B₉, C and E, and minerals such as sodium, calcium, magnesium, phosphorus, zinc, iron, potassium and copper determination).

Method of Data Analysis: Research questions 1-4 were analyzed and expressed as percentage and mean ± SD. The Hypotheses 1 – 4 was analyzed using analysis of variance (ANOVA) at P≤ 0.05 level of significance. The decision rule for the hypotheses stood at, any item less than 0.05 indicates no significant, and greater than 0.05 implied significant difference.

Results

Research Question 1: What are the Vitamins composition of cocoyam and fluted pumpkin leaves melon soup?

Table 1: Mean and Standard deviation of the Vitamins composition of Cocoyam and fluted pumpkin leaves melon soups (mg/100g).

<table>
<thead>
<tr>
<th>Nutrient parameters</th>
<th>Cocoyam leaf Mean in %</th>
<th>Cocoyam leaf X ± SD</th>
<th>Fluted pumpkin leaf Mean in %</th>
<th>Fluted pumpkin leaf X ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (Iu)</td>
<td>16.03</td>
<td>665.97 ± 23.65</td>
<td>19.88</td>
<td>857.17 ± 8.61</td>
</tr>
<tr>
<td>Vitamin B₁ (mg)</td>
<td>0.48</td>
<td>0.60 ± 0.02</td>
<td>0.94</td>
<td>1.21 ± 0.02</td>
</tr>
<tr>
<td>Vitamin B₉ (mg)</td>
<td>33.44</td>
<td>41.67 ± 0.13</td>
<td>46.73</td>
<td>60.47 ± 2.41</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>26.30</td>
<td>32.78 ± 0.54</td>
<td>28.46</td>
<td>36.82 ± 0.74</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>23.74</td>
<td>29.59 ± 0.56</td>
<td>3.99</td>
<td>5.17 ± 0.24</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data represents mean of triplicate determination Iu means international units Mg means miligram

Table 1 showed X ± SD of the vitamins content of cocoyam leaf soup and fluted pumpkin leaf soup. It showed that only vitamin E (29.59 ± 0.56) was higher than fluted pumpkin leaf (5.17 ± 0.247). However, vitamins such as vitamin A (665.97±23.65), Vitamin B₁ (0.60±0.02), Vitamin B₉ (41.67±0.13) and Vitamin C (32.78±0.54) in cocoyam leaf soup are much lower than fluted pumpkin leaf (ugu). Though, the table showed that cocoyam leaf melon soup was very rich in vitamins as fluted pumpkin: Vitamin A (857.17±8.61), Vitamin B₁ (1.21±0.02), Vitamin B₉ (60.47±2.41), and Vitamin C (36.82±0.74) respectively.

The null hypothesis tested also proved that there were significant differences at P≤0.05 level between the mean standard deviation of vitamins contents in soups prepared with cocoyam leaf and fluted pumpkin. Therefore, the hypothesis was rejected and nullified.
Research Question 2: What are the Mineral composition of cocoyam and fluted pumpkin leaves melon soup?

Table 2: Mean and Standard deviation of the Minerals composition of Cocoyam and fluted pumpkin leaves melon soups (mg/100g).

<table>
<thead>
<tr>
<th>Nutrient parameters</th>
<th>Cocoyam leaf Mean in %</th>
<th>Cocoyam leaf Fluted pumpkin leaf Mean in %</th>
<th>Fluted pumpkin leaf Mean in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na) (mg)</td>
<td>29.80</td>
<td>143.80 ± 3.18</td>
<td>34.19</td>
</tr>
<tr>
<td>Iron (Fe) (mg)</td>
<td>1.41</td>
<td>6.79 ± 0.33</td>
<td>1.24</td>
</tr>
<tr>
<td>Magnesium (Mg) (mg)</td>
<td>4.62</td>
<td>22.27 ± 0.25</td>
<td>2.63</td>
</tr>
<tr>
<td>Zinc (Zn) (mg)</td>
<td>0.10</td>
<td>0.46 ± 0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>Phosphorus (P) (mg)</td>
<td>12.06</td>
<td>58.21 ± 0.96</td>
<td>8.53</td>
</tr>
<tr>
<td>Calcium (Ca) (mg)</td>
<td>11.19</td>
<td>54.00 ± 2.00</td>
<td>5.88</td>
</tr>
<tr>
<td>Copper (Cu) (mg)</td>
<td>4.73</td>
<td>22.86 ± 0.92</td>
<td>12.90</td>
</tr>
<tr>
<td>Potassium (K) (mg)</td>
<td>36.08</td>
<td>174.09 ± 0.49</td>
<td>34.57</td>
</tr>
<tr>
<td>Total %</td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Data represent means of triplicate determinations % = percentage Mg stands for milligram SD = standard deviation

Table 2 showed $\bar{X} \pm SD$ of the Minerals mean values in cocoyam and fluted pumpkin leaves. The mineral mean content of cocoyam leaf for Na (143.80±3.18), Fe (6.79±0.33), Cu (22.27±0.25) and K (174.09 ± 0.49) are lower than the fluted pumpkin leaf Na (216.88 ± 1.16), Fe (7.88 ± 0.08), Cu (81.87 ± 1.12) and K (219.32 ± 1.14). The table also showed that, cocoyam leaf soup had higher mean ( $\bar{X}$ ) value in mineral content of Mg (22.27 ± 0.25), Zn (0.46 ± 0.03), P (58.21 ± 0.96) and Ca (54.00 ± 2.00) than fluted pumpkin leaf soup in Mg (16.68 ± 0.52), Zn (0.31±0.36), P (54.12 ± 0.08) and Ca (37.33 ± 1.15) respectively.

The null hypothesis tested also proved that there were significant differences at $P\leq 0.05$ level between the mean standard deviation values of minerals contents between soups prepared with cocoyam leaf and fluted pumpkin leaf. Therefore, the hypothesis was rejected and nullified.

Research Question 3: What are the vitamins compositions of sweet potato and fluted pumpkin leaves melon soups?

Table 3: Mean and Standard deviation of vitamins composition of Sweet potato and fluted pumpkin leaves melon soups (mg/100g).

<table>
<thead>
<tr>
<th>Nutrient parameters</th>
<th>Sweet Potato leaf Mean in %</th>
<th>Sweet Potato leaf Mean in %</th>
<th>Fluted pumpkin leaf Mean in %</th>
<th>Fluted pumpkin leaf Mean in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (Iμ)</td>
<td>16.80</td>
<td>593.36 ± 7.49</td>
<td>19.88</td>
<td>857.17 ± 8.61</td>
</tr>
<tr>
<td>Vitamin B1 (mg)</td>
<td>0.47</td>
<td>0.50 ± 0.02</td>
<td>0.94</td>
<td>1.21 ± 0.02</td>
</tr>
<tr>
<td>Vitamin B2 (Folic acid) (mg)</td>
<td>40.64</td>
<td>43.04 ± 0.38</td>
<td>46.73</td>
<td>60.47 ± 2.41</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>36.89</td>
<td>39.07 ± 0.21</td>
<td>28.46</td>
<td>36.82 ± 0.74</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>5.19</td>
<td>5.59 ± 0.03</td>
<td>3.99</td>
<td>5.17 ± 0.24</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data represented means of triplicate determinations

Mg stands for Miligram $\bar{X}$ = mean
Iμ means International Unit SD = standard deviation
Table 3 of Vitamins compositions showed that, fluted pumpkin leaf melon soup was higher in vitamin A,(857.17±8.61), B1 (1.21±0.02) and B9 (60.47±2.41). While vitamin C (39.07 ± 0.21) and E (5.50 ± 0.03) are higher in sweet potato leaf soup than fluted pumpkin leaf soup when compared. However, Table 5 showed that sweet potato leaf was equally as nutritive in vitamins as fluted pumpkin leaf melon soup.

The null hypothesis tested also showed that, there were significant differences at P≤0.05 level between the mean standard deviation values of vitamins of sweet potato leaf and fluted pumpkin leaf melon soup. On this premise, the hypothesis was rejected and nullified.

**Research Question 4**: What are the minerals compositions of sweet potato and fluted pumpkin leaves melon soups?

**Table 4: Mean and Standard deviation of minerals content composition of Sweet potato and fluted pumpkin leaves melon soups (mg/100g).**

<table>
<thead>
<tr>
<th>Nutrient parameters</th>
<th>Sweet Potato leaf Mean in %</th>
<th>Fluted pumpkin leaf Mean in %</th>
<th>X ± SD</th>
<th>X ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na) (mg)</td>
<td>26.16</td>
<td>34.19</td>
<td>118.40 ± 1.09</td>
<td>216.88 ± 1.16</td>
</tr>
<tr>
<td>Iron (Fe) (mg)</td>
<td>1.60</td>
<td>1.24</td>
<td>7.26 ± 0.08</td>
<td>7.88 ± 0.08</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>3.53</td>
<td>2.63</td>
<td>15.98 ± 0.15</td>
<td>16.68 ± 0.52</td>
</tr>
<tr>
<td>Zinc (Zn) (mg)</td>
<td>0.10</td>
<td>0.05</td>
<td>0.43 ± 0.03</td>
<td>0.31 ± 0.00</td>
</tr>
<tr>
<td>Phosphorus (P) (mg)</td>
<td>10.80</td>
<td>8.53</td>
<td>48.86 ± 0.59</td>
<td>54.12 ± 0.80</td>
</tr>
<tr>
<td>Calcium (Ca) (mg)</td>
<td>8.10</td>
<td>5.88</td>
<td>36.67 ± 1.04</td>
<td>37.33 ± 1.16</td>
</tr>
<tr>
<td>Copper (Cu) (mg)</td>
<td>3.25</td>
<td>12.90</td>
<td>14.73 ± 1.50</td>
<td>81.87 ± 1.12</td>
</tr>
<tr>
<td>Potassium (K) (mg)</td>
<td>46.46</td>
<td>34.57</td>
<td>210.25 ± 2.17</td>
<td>219.32 ± 1.14</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Data represent means of triplicate determinations % = percentage SD = standard deviation

\[ \bar{X} = \text{mean} \] Mg stands for Milligram

Table 4 showed that the \( \bar{X} \pm SD \) of Minerals content of sweet potato leaf and fluted pumpkin leaf. Sodium mean value in fluted pumpkin was higher (216.88 ± 1.16) than sweet potato (118.40 ± 1.09). Fluted pumpkin also had higher value of \( \bar{X} \pm SD \) in Iron (7.88 ± 0.08), magnesium (16.68 ± 0.52), phosphorus (54.12 ± 0.80), calcium (37.33 ± 1.16), copper (81.87 ± 1.12) and potassium (219.32 ± 1.14) while sweet potato leaf melon soup was higher in Zinc (0.43 ± 0.03). However, Table 7 showed that sweet potato leaf was equally as nutritive in minerals as fluted pumpkin leaf melon soup.

The null hypothesis tested also showed that there were significant differences at P≤0.05 level between the mean standard deviation values of minerals contents of sweet potato and fluted pumpkin leaves melon soup. On this premise, the hypothesis was rejected and nullified.

**Discussion**

The findings from the study revealed that, cocoyam leaf melon soup was very rich in vitamins. Cocoyam leaf melon soup had higher mean values of vitamin E than fluted pumpkin leaf soup. While the fluted pumpkin leaf melon soup also had higher mean values of vitamins A, thiamin, folic acid and ascorbic acid. The hypothesis tested stated that, there are significant differences at p-value on vitamins, which indicated that the hypothesis was rejected. This result was in consonance with Ramawat and
Merillon, (2014), who observed that, cocoyam leaves are inexpensive, easily accessible and provide health promoting compounds such as vitamin and antioxidants. Likewise, the result was in consonance with the submission of Obidiegwu, et al (2016) study, which stated that cocoyam leaves contain excellent sources of carotene, riboflavin, thiamin, niacin, vitamin A and C and dietary fibre. The significant of these vitamins include: antioxidative activity, reduction of liver injury, anti-hypertension and ultraviolet protection effect to the body.

The findings from the study on minerals also revealed that, cocoyam leaf melon soup was very rich in minerals. Cocoyam leaf melon soup has higher mean standard deviation values of calcium, phosphorus, magnesium than fluted pumpkin leaf soup. While the fluted pumpkin leaf melon soup also had higher means values in sodium, Iron, zinc, copper and potassium. The null hypothesis tested in table 2 stated that, there are significant differences at p-value between the minerals contents, which indicated that the hypothesis was nullified. This result was in consonance with Ukpong, Abasiekong and Etuk (2014) which observed that cocoyam leaves are good sources of potassium, Iron, zinc and moderate quantities of calcium, phosphorus and magnesium but poor in manganese and copper. Likewise it was in alliance with the submission of Obidiegwu, et al (2016) study, which stated that cocoyam leaves contain significant levels of protein and are excellent sources of potassium, calcium, phosphorus, Iron, and dietary fibre. The significant high potassium, phosphorus and calcium contents in cocoyam leaf melon soup are good for excellent nerve functions, osmotic equilibrium and bone development. Magnesium is known as anti-stress and relaxation mineral.

The findings from the study on vitamins revealed that, sweet potato leaf melon soup and fluted pumpkin leaf melon soup are rich in vitamin: vitamins A, thiamine, folic acid or folate, ascorbic acid and alpha tocopherol. The results in the table showed that, sweet potato leaf melon soup had slightly lower mean values of vitamin A, thiamin and folic acid than the fluted pumpkin leaf melon soup. Sweet potato leaf melon soup had higher mean value of vitamin C (ascorbic acid) and vitamin E (Alpha tocopherol) than fluted pumpkin leaf. While fluted pumpkin leaf had higher mean values of vitamin A, thiamin and folic acid. The null hypothesis tested showed that, there were significant differences at p-value which led to the rejection of the hypothesis. This finding was in alliance with the submission of Jang and Koh (2019) who opined that, the young sweet potato leaves contain high concentration of several nutrients such as appreciable amount of vitamin C, thiamin. The findings of the study was also in agreement with the submission of Areheore (2012) study, that sweet potato leaves are highly digestible, fairly rich in protein and a source of vitamins, antioxidants, dietary fibre and essential fatty acids. And likewise, with the submission of Cook (2017) and Ware (2017), the authors observed that, sweet potato leaves are rich in vitamin A, C, E, thiamin, riboflavin and folic acid. The presence of folic acid or folate could also prevent neural tube defect in child bearing mothers. The significant of these vitamins include: anti-oxidative activity, reduction of liver injury, anti-hypertension and ultraviolet protection effect to the body.

The findings from the study on minerals also revealed that, sweet potato leaf melon soup and fluted pumpkin leaf melon soup are rich in mineral: sodium, Iron, magnesium, zinc, phosphorus, calcium, copper and potassium. The results in the table showed that, sweet potato leaf melon soup had slightly lower mean values of the minerals such as sodium, Iron, magnesium, Zinc, phosphorus, calcium, copper and potassium than the fluted pumpkin leaf melon soup (i.e. fluted pumpkin leaf had higher mean values of minerals). The null hypothesis tested showed that, there were significant differences at p-value which led to the rejection of the hypothesis. This finding was in alliance with the submission of Jang and Koh (2019), the authors opined that, the young sweet potato leaves contain high concentration of several minerals such as appreciable amount of magnesium, phosphorus, fatty acids, fibre with levels of potassium, sodium, calcium, manganese, Iron respectively with a remarkably little of Zinc. The findings of the study were also in agreement with the submission of Areheore (2012) study, who opined that, sweet potato leaves are highly digestible, fairly rich in protein and a source of vitamins, minerals, antioxidants dietary fibre and essential fatty acids. Similarly, the results were
also in consonance with Cook (2017) and Ware (2017), the authors stated that, sweet potato leaves are rich in appreciable amount of iron, magnesium, potassium, phosphorus, zinc, calcium and copper. The significant high potassium, phosphorus and calcium contents in sweet potato leaf melon soup are good for excellent nerve functions, osmotic equilibrium and bone development.

**Conclusion**

Based on the study, it is obvious that cocoyam and sweet potato leaves are rich in micro-nutrients. Therefore, the presence of these micro-nutrients in the vegetables such as vitamin A, thiamin, folic acid, ascorbic acid, vitamin C, iron, calcium, phosphorus, potassium, magnesium, zinc, and copper made them good sources addressing deficiency diseases, colon diseases, building the immune system, bone formation and prevention of degenerative and cardiovascular diseases. Thus, cocoyam and sweet potato leaves could actually serve as an alternative to the popularly utilized vegetables because these under-utilized vegetables can be used in preparing soups as demonstrated in the study.

**Recommendations**

1. The consumption of cocoyam and sweet potato leaves should be encouraged by all families because these vegetables could help in the prevention of constipation and protein energy malnutrition as well as micro nutrient deficiencies in both children and adults.
2. Home Economics Education should be encouraged financially by the federal and state government to conduct extension service in nutrition education. This is to enable populace in the rural areas to have access to good nutrition especially from lesser-known crops or vegetables of these kinds.
3. The production of cocoyam and sweet potato leaves should be encouraged by both the federal and state government. Cocoyam especially that had issues of production in the past in some localities should be encouraged to be grown at all cultural zone of the country through irrigation farming in order for people to assess these micro nutrients present in the leaves.
4. Home Economists, Nutritionists and Dieticians should be sponsored by the federal and state government to create awareness in the consumption and utilization of cocoyam and sweet potato leaves in the nation by organizing seminars and workshops.
5. The local traders should also be encouraged to commercialize these vegetables in the markets just the same way the popular vegetables are sold in the open markets, because these lesser-known vegetables will be cheaper than the popular vegetables during the dry season and equally provide the same vitamins and minerals needed for body protection.

**References**


Ezekiel, C. N; Sulyok, M; Somorin, Y & Kraska, R (2018) Fate of Aflatoxin during traditional melon cake and sauce processing in


