A Comparative Analysis of the Nutritional and Chemical composition of six West African Medicinal Fruits

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ABSTRACT:
Background: Many nations can no longer afford the ever rising cost of healthcare, governments across the world are in search of alternative and affordable ways of disease control. Clinical studies are revealing hope from herbs. 
Objectives: A comparative analysis of the nutritional and chemical composition of six fruits used for treating many diseases in West Africa; to examine the composition, concentration and education for easy choice of suitable fruits based on peculiar situations as well as to provide easy access of consensus evidence to busy healthcare practitioners. Also, clinical evidence of plant medicine is not as much as modern medicine and education is necessary.
Methods: A systematic review investigation. Theory is a Community approach to intervention services. Search engines were Google scholar, Firefox and Google.
Results: Macro and micronutrients were present in the plants. Moisture was high in all but, Tetrapleura tetraptera. Anacardium occidentale, 86.00g/100 g/dry weight showed highest carbohydrates concentration, Annona muricata was lowest, 14.63%. Crude protein was generally low in all the plants, Chrysophyllum albidum scored highest, 7.00%, Annona muricata scored lowest, 1.00%. Fat was generally low in all, highest fat, 4.00% occurred in Tetrapleura tetraptera and least, 0.88% in Annona muricata. Fibre concentration ranges from low to high. The highest fibre occurred in Tetrapleura tetraptera, 45.00% and the least in Mangifera indica, 1.80%. Ash was excessively high, 60.00% in Annona muricata, Mangifera indica came last with a score of 1.95%. Outcome will be beneficial to users.
Conclusion: The fruits were rich in nutrients with nutraceutical and pharmacological properties, justifying its use as native medicine.

KEYWORDS: Anacardium occidentale, Ananocia muricata, Chrysophyllum albidum, Comparative analysis, chemical composition, herbal plants, Mangifera indica, Carica papaya, native medicine, nutrient composition, Tetrapleura tetraptera.

1. INTRODUCTION
There is a rising cost of providing healthcare to communities across the world including the rich countries, Average health care spending per person in the United States, $15,275 CAD, next was Germany, $8,938 CAD, Netherlands, $7,973 CAD, Canada, $7,507 CAD, Sweden, $7,416 CAD and Australia, $7,248 Cad (56). Many countries are now seeking alternative ways to restore health to cut down costs. Plants used in Africa for controlling diseases are promising, and the rising demand for alternative medicines worldwide necessitated a need for this research essentially, as 80% of poor populations in developing countries carry a heavy burden of healthcare costs, which often comes from individuals’ purses. Also, side and adverse effects of some drugs are standing in the way too. Clinical evidence showed that natural remedies when properly administered not only show small and no side effects, they are nutritionally rich, with pharmacological properties, which possess the capacity to restore health. In this systematic review, the authors sought to determine the nutritional and chemical composition of six popular plants used as traditional medicine for treating disease in West Africa namely, Anacardium occidentale, Ananocia muricata, Mangifera indica, Carica papaya, Chrysophyllum albidum and Tetrapleura tetraptera. The fruits were ranked based upon the nutritional and chemical concentration to promote right choices for various body conditions. For a reason that evidence has suggested that the fruits possess nutritional and chemical compositions, which have strong potency against diseases and not all health conditions need very strong potent remedies to treat, some may need something mild or moderate. Thus, the levels of nutrient and chemical concentration of each was determined. The
purpose was to inform users, which include the public, health practitioners, researchers, farmers, manufacturers and policy decision makers.

2. METHODOLOGY
This is a systematic review. This research determined the nutritional and chemical composition of six fruits used as native medicines for treating various diseases in West Africa and made a comparative analysis of the nutritional and chemical composition of the fruits studied such as, *Anacardium occidentale*, *Annona muricata*, *Mangifera indica*, *Carica papaya*, *Chrysophyllum albium* and *Tetrapleura tetraptera*. Search engines used for the search were google scholar, Bing, Firefox, Google. The articles examined were peer reviewed articles that investigated the compositions of the fruits. The search words were, “*Mangifera indica*, *Carica papaya*, *Anacardium occidentale*, *Chrysophyllum albium*, *Tetrapleura tetraptera*, and *Annona muricata*, fruits chemical composition, and specific nutrient such as, “Iodine composition of specific plant”. Vitamin B1 composition of *Annona muricata” Only peer reviewed articles were selected and included in the data used for this investigational analyses. Conditions for exclusion, non peer reviewed and article not available online. The nutritional and chemical composition of the fruits were analyzed and synthesized comparatively.

2.1 Results
A rich concentrations of some macro and micronutrients were found in the fruits, which clinical evidence suggested to have nutraceutical and pharmaceutical capacities that supports its use as native medicines for various diseases management. Authors deemed the need for proper education as essential to fill gaps and prompt attention of users for right use. A comparative synthesis of the findings were presented in four subheadings such as, macronutrient, micronutrient minerals, trace elements, and micronutrient vitamins. Tables 1-3 contains details of the nutrient and chemical compositions of the fruits, which were comparatively synthesized.

2.1.1. Macronutrients
Six fruits examined in this research constituted small to large and acceptable macronutrients in different compositional levels. Moisture was high in all but *Tetrapleura tetraptera*, with only 3% moisture. *Carica papaya*, *Magnifier indica*, *Anacardium occidentale*, *Annona muricata* and *Chrysophyllum albium* scored 88.75%, 86.51%, 85.15%, 82.80% and 75.90% respectively. Least carbohydrates occurred in *Annona muricata*, 3.00% and the highest score, 86.00% occurred in *Anacardium occidentale* next was *Tetrapleura tetraptera*, 39.79%. *Carica papaya* scored 29.20% and *Chrysophyllum albium* and *Magnifier indica* scoring 18.39% and 17.00% respectively. Crude protein occurred generally low in all fruits, with *Annona muricata* scoring lowest, 1.00% and *Chrysophyllum albium*, scored highest, 7.00%, then *Carica papaya*, *Anacardium occidentale*, *Tetrapleura tetraptera* and *Magnifier indica* that scored 6.50%, 5.96%, 5.60%, and 5.00% respectively. Just like protein the crude fat concentrations among the fruits were generally low, *Tetrapleura tetraptera* scored highest, 4.00%, next was *Anacardium occidentale*, 2.64%, followed closely by *Carica papaya*, 2.01% then *Magnifier indica*, 1.60% and the least scores occurred in *Annona muricata* and *Chrysophyllum albium*, that came almost bracket 0.97% and 0.86% respectively. *Tetrapleura tetraptera* showed the highest fibre concentration, 45.00%, next was *Anacardium occidentale*, 11.52% then, *Annona muricata* 5.77%, followed by *Carica papaya* and *Chrysophyllum albium* with equal score of, 2.31% each and *Magnifier indica*, 1.80%. A disproportionate amount of Ash 60.00% was located in *Annona muricata*, next was *Tetrapleura tetraptera*, 9.00%, then *Anacardium occidentale*, 3.17%, followed by *Chrysophyllum albium*, 3.00%, *Carica papaya*, 2.18%, and *Magnifier indica*, 1.95%.

Table 1. Chemical Composition of *Anacardium occidentale*, *Annona muricata*, *Magnifier indica*, *Carica papaya*, *Chrysophyllum albium* and *Tetrapleura tetraptera* Fruit.

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Mangifera indica</th>
<th>Anacardium occidentale</th>
<th>Annona muricata</th>
<th>Carica papaya</th>
<th>Chrysophyllum Albium</th>
<th>Tetrapleura Tetraptera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macronutrients</td>
<td>g/100 g</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>g/100 g</td>
<td>%</td>
</tr>
<tr>
<td>Moisture</td>
<td>86.51</td>
<td>85.15</td>
<td>82.80</td>
<td>88.75</td>
<td>75.90</td>
<td>3.00</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>17.00</td>
<td>86.00</td>
<td>14.63</td>
<td>29.20</td>
<td>18.39</td>
<td>39.79</td>
</tr>
</tbody>
</table>

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Table 2. Micronutrient Mineral Composition of Anacardium occidentale, Annona muricata, Mangifera indica, Carica papaya, Chrysophyllum albidum and Tetrapleura tetraptera Fruit

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Mangifera indica</th>
<th>Anacardium occidentale</th>
<th>Annona muricata</th>
<th>Carica papaya</th>
<th>Chrysophyllum albidum</th>
<th>Tetrapleura tetraptera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Nutrients</td>
<td>mg/100 g</td>
<td>mg/100 g</td>
<td>mg/100 g</td>
<td>Mg/100 g</td>
<td>mg/100 g</td>
<td>mg/100g average</td>
</tr>
<tr>
<td>Minerals mg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>10.00</td>
<td>39.60</td>
<td>14.00</td>
<td>21.38</td>
<td>37.00</td>
<td>199.66</td>
</tr>
<tr>
<td>Potassium mg/100 g</td>
<td>204.30</td>
<td>2132.60</td>
<td>278.00</td>
<td>182.00</td>
<td>38.00</td>
<td>278.11</td>
</tr>
<tr>
<td>Sodium mc/cup</td>
<td>41.20</td>
<td>38.50</td>
<td>32.00</td>
<td>8.00</td>
<td>21.00</td>
<td>25.16</td>
</tr>
<tr>
<td>Magnesium</td>
<td>11.20</td>
<td>184.00</td>
<td>58.00</td>
<td>21.00</td>
<td>5.00</td>
<td>97.22</td>
</tr>
<tr>
<td>Phosphorus (%)/100 g</td>
<td>15.60</td>
<td>225.50</td>
<td>27.70</td>
<td>19.45</td>
<td>8.00</td>
<td>41.45</td>
</tr>
<tr>
<td>Iron</td>
<td>5.63</td>
<td>6.97</td>
<td>119.00</td>
<td>2.15</td>
<td>11.03</td>
<td>17.47</td>
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<tr>
<td>Manganese</td>
<td>0.16</td>
<td>6.40</td>
<td>2010.00</td>
<td>0.04</td>
<td>31.90</td>
<td>333.75</td>
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<tr>
<td>Zinc</td>
<td>0.13</td>
<td>11.20</td>
<td>35.00</td>
<td>0.08</td>
<td>0.57</td>
<td>15.88</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>0.85</td>
<td>0.85</td>
<td>17.00 ug/g</td>
<td>0.05</td>
<td>0.99</td>
<td>9.85</td>
</tr>
<tr>
<td>Copper (mg/kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobalt (mg/kg)</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
<td>1.20</td>
<td>44.00</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>0.02</td>
<td>0.03</td>
<td>0.79</td>
<td>0.71</td>
<td>1.90</td>
<td>NF</td>
</tr>
</tbody>
</table>

(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47).
2.1.2 Macrominerals
All fruits are rich in micronutrient minerals. Calcium (Ca) concentration was highest in Tetrapleura tetraptera, 199.66 mg/100 g, next was Anacardium occidentale 39.60 mg/100 g, Chrysophyllum albidum, 37.00 mg/100 g, Carica papaya, 21.38 mg/100 g, then Annona muricata, 14.00 g/100 mg, and Mangifera indica with a lowest score of 10.00.00mg/100 g.

Potassium (K) was disproportionately high in Anacardium occidentale, 2132.60 mg/100 g, next was Tetrapleura tetraptera, 278.11mg/100 g, followed by Annona muricata, 278.00 mg/100 g, Mangifera indica, 204.30 mg/100 g, then Carica papaya, 182.00 mg/100 g and Chrysophyllum albidum, with a least score of 38.00 mg/100 g.

The highest level of Sodium (Na), 41.20mg/100 g occurred in Mangifera indica, then Anacardium occidentale, 38.50 mg/100 g, followed by Annona muricata, 32.00 mg/100 g, Tetrapleura tetraptera, 25.16 mg/100 g, then, Chrysophyllum albidum, 21.00 mg/100 g, Carica papaya scored lowest, 8.00 mg/100 g.

Magnesium (Mg) occurred highest in 184.00 mg/100 g Anacardium occidentale, next was, Tetrapleura tetraptera, 97.22 mg/100 g, then Annona muricata, 58.00 mg/100 g, Carica papaya, 21.00 mg/100 g, Mangifera indica, 11.20 mg/100 g, and the least score, 5.00 mg/100 g occurred in Chrysophyllum albidum.

The highest concentration of phosphorus (P), 225.50 mg/100 g occurred in Anacardium occidentale, next was Tetrapleura tetraptera, 41.45 mg/100 g, then, Annona muricata, 27.70 mg/100 g, Carica papaya, 19.45 mg/100 g, Mangifera indica, 15.60 mg/100 g, and Chrysophyllum albidum with the least score of 8.00 mg/100 g.

2.1.3 Microminerals (Trace elements)
Annona muricata showed the highest concentration of Iron (Fe), 119.00 mg/100 g, next was Tetrapleura tetraptera, 17.47 mg/100 g, then, Chrysophyllum albidum 11.03 mg/100 g, Anacardium occidentale, 6.97 mg/100 g, Mangifera indica, 5.63 mg/100 g, and Carica papaya with lowest score of 2.15 mg/100 g.

A disproportionate amount of Manganese (Mn) occurred in Annona muricata, 2010.00 mg/100 g, another high concentration was found in Tetrapleura tetraptera, 333.75 mg/100 g, next was Chrysophyllum albidum 31.90 mg/100 g, Anacardium occidentale, 6.40 mg/100 g, and low concentrations in Mangifera indica and Carica papaya, which scored 0.16 and 0.04 mg/100 g, respectively.

Highest concentration of Zinc (Zn), 35.00 mg/100 g occurred in Annona muricata, next, was Tetrapleura tetraptera, 15.88 mg/100 g, then Anacardium occidentale, 11.20 mg/100 g and low levels in Chrysophyllum albidum Mangifera indica, and Carica papaya that scored 0.57, 0.13, and 0.08 mg/100 g, respectively.

Annona muricata got the highest score of Copper (Cu), 17.00 ug/lg, next was Tetrapleura tetraptera, 9.85 mg/kg, then Chrysophyllum albidum, 0.99 mg/kg, Anacardium occidentale, and Mangifera indica, with bracket score of 0.85 mg/kg and Carica papaya with lowest score of 0.05 mg/kg.
Cobalt (Co) was not found in all fruits but two namely, *Chrysophyllum albidum*, 1.20 mg/kg with the lowest score and *Tetrapleura tetraptera*, with the highest score of 44.00 mg/100 g. Chromium (Cr) was not found in *Tetrapleura tetraptera*, but occurred in the rest, though at low concentrations, with a highest score in *Chrysophyllum albidum*, 1.90 mg/kg, then, *Annona muricata*, 0.79 mg/kg, next was *Carica papaya*, 0.71 mg/kg, and *Anacardium occidentale*, and *Mangifera indica* with almost bracket scores of 0.03 and 0.02 mg/kg, respectively.

Boron (B) was not found in all the fruits but two, namely, *Tetrapleura tetraptera*, with highest level, 3.69 mg/kg and *Carica papaya* with the lowest score of 0.10 mg/kg.

Selenium (Se) was not found in *Anacardium occidentale*, and *Annona muricata*, it was found in *Mangifera indica*, least score occurred in *Carica papaya*, 0.60 mg/kg, the concentration in *Tetrapleura tetraptera*, 2.97 mg/kg was higher than the level in *Carica papaya*, the largest amount, 2.97 mg/kg was found in *Chrysophyllum albidum*.

Nickel (N) was not found in all the fruits but in *Chrysophyllum albidum*, 5.00 mg/kg.

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Mangifera indica</th>
<th>Anacardium occidentale</th>
<th>Annonamuricata</th>
<th>Carica papaya</th>
<th>Chrysophyllum Albidum</th>
<th>Tetrapleura tetraptera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin C</td>
<td>27.70 mg/100 g</td>
<td>378.45 mg/100 g</td>
<td>20.00 mg/100 g</td>
<td>60.90 mg/100 g</td>
<td>91.92 mg/100 g</td>
<td>0.41 mg/g</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>765.00 ug/100 g</td>
<td>NF</td>
<td>NF</td>
<td>47.00 ug</td>
<td>89.00 ug</td>
<td>0.007 ug</td>
</tr>
<tr>
<td>Beta-carotene</td>
<td>+</td>
<td>580.00 mg/g</td>
<td>NF</td>
<td>274 ug</td>
<td>240.19 ug</td>
<td>0.014 ug</td>
</tr>
<tr>
<td>Vitamin B1 (Thiamin)</td>
<td>+</td>
<td>15.50 mg/100 g</td>
<td>0.11 mg/100 g</td>
<td>0.24 mg/100 g</td>
<td>18.68 mg/100 g</td>
<td>0.05 mg/100 g</td>
</tr>
<tr>
<td>Vitamin B2 (riboflavin)</td>
<td>+</td>
<td>2.90 mg/100 g</td>
<td>0.05 mg/100 g</td>
<td>0.05 mg/100 g</td>
<td>0.87 mg/100 g</td>
<td>0.03 mg/100 g</td>
</tr>
<tr>
<td>Vitamin B3 (Niacin)</td>
<td>0.60 mg/100 g</td>
<td>0.23 mg/100 g</td>
<td>1.28 mg/100 g</td>
<td>0.36 mg/100 g</td>
<td>1.50 mg/100 g</td>
<td>0.10 mg/100 g</td>
</tr>
<tr>
<td>B5</td>
<td>+ve</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
</tr>
<tr>
<td>B6</td>
<td>+ve</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
<td>3.26</td>
<td>NF</td>
</tr>
<tr>
<td>B9 (Folate)</td>
<td>14.00 mg/100 g</td>
<td>NF</td>
<td>NF</td>
<td>NF</td>
<td>2.02</td>
<td>NF</td>
</tr>
</tbody>
</table>

**Table 3. Micronutrient Vitamins Composition of Anacardium occidentale, Annona muricata, Mangifera indica, Carica papaya, Chrysophyllum albidum and Tetrapleura tetraptera Fruit.**
Vitamin E (4 1.12) 5.80 NF 0.42 20.52 0.013
Vitamin k (phyloquinone)) 4.20 NF NF 2.60 ug 35.36 NF
Choline +ve NF NF +ve NF NF
Lycopene NF 294.50 NF 1928 ug NF NF
Lutein Zeaxanthin + NF NF NF 89.00 ug NF NF

(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50).
+ve: Present
NR: Not found

Micronutrient Vitamins
Results revealed that all the fruits are rich in vitamin C except Tetrapleura tetraptera, which showed a very low content of 0.41 mg/100 g. The rest were high. A disproportionate amount 378.45 mg/100 g occurred in Anacardium occidentale, high concentration was found in Chrysophyllum albidum, 91.92 mg/100 g, next was Carica papaya, 60.90 mg/100 g, then Mangifera indica, 27.70 mg/100 g and Annona muricata, 20.00 mg/100 g.

Vitamin A occurred in all the fruits but two. A very high concentration of vitamin A occurred in Mangifera indica, 765 ug/100 g. Chrysophyllum albidum was next with a score of 89.00 ug/100 g, then Carica papaya, 47.00 ug/100 g, and very low amount in Tetrapleura tetraptera, 0.007 ug/100 g. Beta carotene occurred in all but one, Annona muricata. The highest amount was reported in Anacardium occidentale, 580.00 ug/100 g, then Carica papaya, 274.00 ug/100 g, next was Chrysophyllum albidum, 240.19 ug/100 g and Tetrapleura tetraptera, 0.014 ug/100 g with the lowest score.

Vitamin B occurred in all the plants. Vitamin B1 occurred highest in Chrysophyllum albidum, 18.68 mg/100 g, next was Anacardium occidentale, 15.00 mg/100 g, then Carica papaya, 0.24 mg/100 g, Annona muricata, 0.11 mg/100 g, and Tetrapleura tetraptera, 0.014 mg/100 g. B2 was present in all, Annona muricata, scored highest score, 2.90 mg/100 g, next was Chrysophyllum albidum, 0.87 mg/100 g, Annona muricata and Carica papaya made a bracket low score of 0.50 mg/100 g each, and Tetrapleura tetraptera, 0.03 mg/100 g. No specific amount was reported in Mangifera indica. B3 was present in all fruits at low concentrations. Chrysophyllum albidum came first, 1.50 mg/100 g, followed by Annona muricata, 1.28 mg/100 g, then Mangifera indica, 0.60 mg/100 g, next Carica papaya, 0.36 mg/100 g, Anacardium occidentale, 0.23 mg/100 g, and Tetrapleura tetraptera, 0.10 mg/100 g. B5 was found only in Mangifera indica but level was not specified. It was not reported in the rest of the fruits. B6 occurred only in two fruits; only Mangifera indica concentration was not specified. The concentration in Chrysophyllum albidum was 3.26 mg/100 g. B9 occurred only in two fruits namely, Mangifera indica scoring highest, 14.00 ug/100 g and Chrysophyllum albidum was 2.02 ug/100 g. B 7 and B12 were not reported in all the fruit.

Vitamin E was reported in all but one, Annona muricata. The least score was found in Tetrapleura tetraptera, 0.013 ug/100 g, next low score was Carica papaya, 0.42 ug/100 g, followed by Mangifera indica, 1.12 ug/100 g, then Anacardium occidentale, 5.80 ug/100 g and Chrysophyllum albidum with the highest score of 20.52 ug/100 g.
Vitamin K was reported in three fruits only and none was reported in three namely, Anacardium occidentale, Annona muricata, and Tetrapleura tetraptera. It occurred only in three with the highest score, 35.36 mg/100 g occurring in Chrysophyllum albidum, next was Mangifera indica, 4.20 ug/100 g and Carica papaya, 2.60 ug/100 g with lowest score. Choline was indicated in two fruits only but the quantities were not mentioned. The fruits were Mangifera indica and Carica papaya. Lycopene was found in two fruits only, Anacardium occidentale, with lowest score of 294.50.80 mg/100 g and Carica papaya with highest score of 1928.00 mg/100 g. Lutein and zeaxanthin was reported only in one fruit, Carica papaya, 89.00 ug/100 g.

3. DISCUSSION
The fruits were rich in vitamins essentially, vitamins A, C and E which are powerful antioxidants. While vitamins generally provide nutritional and biochemical functions in the body to keep the body safe and healthy, antioxidants scavenge free radicals, neutralize its harmful effects to the body and protect the body from cell oxidation. Free radicals do significant harm to the genetic composition of human beings called deoxyribonucleic acid (DNA) and cell oxidation for a long period of time lays the foundation for the body to develop metabolic syndrome diseases namely cancer, diabetes, coronary heart diseases. Antioxidants prevent inflammation, spasm and growth of microorganisms (51, 52, 53, 55). Vitamin E is essential for female and male reproductive health and vitamin A is essential for growth, eye and reproductive health. Thus, the use of the fruits will provide nutrients for the body and keep the body healthy (51, 52, 53, 55). Additionally, new clinical studies have suggested that vitamin E lowered conditions susceptible to aging. One hundred, 100 g of cashew nuts contains 46 mg of vitamin E (46 mg/100 g). Vitamin E of Cashew nut offers extraordinary strength to the body, it is useful in the treatment of premature aging, skin remineralization, lines and wrinkle prevention in the face (54, 55).

There were large concentrations of macronutrients in all the fruits namely, moisture, carbohydrates, protein, lipids, fibre and ash, which are essential for body nourishment and disease prevention. And health restoration in situations of nutrients’ deficiencies (51, 52, 53).

The fruits were composed of moderately high amounts of minerals and some of the minerals have both nutritional and pharmacological properties and values. For example the fruits are high in iron and iron is an essential component of haemoglobin, which plays a vital role in the oxygenation of red blood cells. Low levels of iron in the blood result in anemia (51, 52, 53). The fruit contains zinc, which is involved in many metabolic activities in the body. It is needed for female and male reproduction, as well as fertility and sex organ health. Sodium (Na) and potassium (K), which regulates the body fluid and acid-base balance in the body were found in all the fruits. Calcium concentration of each fruit varied. Calcium works jointly with vitamin D as well as phosphorus and protein to perform various metabolic functions in the body. Calcium is good for healthy bones and teeth. Deficiency of calcium causes osteoporosis in humans and animals, rickets in children and diabetes across ages (51, 52, 53).

Moderate to high fibre composition of the fruits make the fruits very suitable food for the body. High fibre diet lowers the risks of metabolic syndrome diseases namely, type II diabetes, obesity and cardiovascular diseases. High fibre diet reduces blood sugar and lipids levels and significant reduction in weight. Fibre has both nutritional and pharmacological properties and values (51, 52, 53, 54).

4. CONCLUSION
All the fruits constituted macronutrients in significant amount, which are capable of satisfying the nutritional needs of human being and animals alike. Moderate to high concentration of micronutrients minerals in most of the fruits indicated that fruits possess nutraceutical and pharmacological properties. Clinical evidence suggested that the minerals have a capacity for health restoration. The micronutrient vitamins were reported in some of the plants and the vitamins reported in some of the plants were suggested by evidence to possess a capacity to restore health to the body. The presence of nutrients in varying concentrations provides a clue for easy choices based on suitability of needs. General public, researchers, public health, health practitioners, farmers, manufacturers, investors and policy decision makers are to benefit from the findings.
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COMPETING INTERESTS

Authors declared zero conflict of interests.

AUTHORS’ CONTRIBUTIONS

Author1* designed the study, performed the analysis, wrote the protocol, and wrote the first draft of the manuscript. Author 1* managed the analyses of the study and managed the literature searches. Author 2 participated in the reviewing of the draft and the manuscript. Author 2 participated in the analyses of the study, in managing the analyses of the study and in literature searches and management of literature searches. Authors read and approved the final manuscript.

CONSENT

This is a systematic review, written consent was not applicable.

ETHICAL APPROVAL

This is a systematic review, ethical approval is not applicable. This study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

REFERENCES


