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## Research Article

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## Nutritional and antinutritional analysis of *Chrysanthellum indicum* leaves

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### Abstract

Nutrients are required to drive the basic physiological activities that sustain life, and an imbalance in such nutrients which may be caused by either deficiencies or excess of one or more nutrient may lead to the initiation and/or exacerbation of virtually all diseases. Many common health problems can be prevented or alleviated with healthy diet. *Chrysanthellum indicum* leaves is widely consumed as food in the North central part of Nigeria including Kaduna, Nassarawa and Plateau States and other neighbouring states. The proximate constituent of the air dried vegetable leaves were determined by various methods; the various anti-nutritional Factors such as phytic acid, oxalic acid, and tannin were also determined using different methods. The study on proximate composition showed that the vegetable *Chrysanthellum indicum* has high crude protein (24.63%) compared to those of other Conventional Nigerian vegetables: *Curcubita pepo* (20.80%) and *Gnetum africana* (19.67%). The vegetable has 23.16% crude fibres, and 2.76% crude fat. It also contains about 29.38% potassium, 29.96% calcium. It also contains oxalate, tannins and phytic acid as anti nutrients. The study showed that the leaves of *Chrysanthellum indicum* contain substantial levels of nutrient which could be useful in human diet, with considerably low levels of anti nutritional content which is below established toxic level.

**Keywords:** *Chrysanthellum indicum*, Nutritional, Antinutritional, Leaves, Macronutrient, Micronutrient.

### Introduction

Nutrition is the provision to cells and organisms of the materials necessary to support life.<sup>1</sup> There are six major classes of nutrients; carbohydrates, protein, fats, minerals, vitamins and water. Based on the quantity available in a food or required by the body, Recommended Daily Intake Allowance (RDA) is categorized as either macronutrient or micronutrient.<sup>2</sup>

Nutrients are required to drive the basic physiological activities that sustain life. Nutrients function in diverse roles as energy sources; coenzymes and co-factors in enzyme systems; structural components of cell membranes; hormones effectors<sup>3, 4</sup>; precursors of biologically active molecules that include eicosanoids, neurotransmitters and nucleic acids, initiations and modulators of metabolic activity, determinant of membrane electrochemical potential, regulators of differentiation of epithelial cells and osteocytes and a broad spectrum of other activities.<sup>5</sup> Nutrient may also be involved in less well defined roles such as in membrane receptor synthesis and activity and inflammatory responses, and as promoters and inhibitors of gene expression,

cell replication and for normal life activities.<sup>6-8</sup>

Nutrient imbalance may be linked to initiation and/or exacerbation of virtually all diseases.<sup>9, 10</sup> These imbalances can be caused by either deficiencies or excess of one or more nutrient.<sup>3</sup> Many common health problems can be prevented or alleviated with healthy diet.<sup>11</sup> Nutritional medicine is a form of complementary and alternative medicine that seeks to maintain health and prevent or treat diseases by optimizing nutritional intake.<sup>12</sup> Following advances in nutritional medicine, it has evolved to orthomolecular medicine which involves the use of large doses of vitamins and minerals to treat disease.<sup>13</sup>

*Chrysanthellum indicum* is a low procumbent, faintly aromatic annual herb about 25-45cm high, that reproduces from seeds<sup>14</sup> and is widely consumed in the North-central part of Nigeria including Kaduna, Nassarawa and Plateau States and other neighbouring states. The Fulani also use it in preparing herbal tea that helps in indigestion and gastrointestinal tract disturbances. There are evidences that *Chrysanthellum indicum* leaves contain psycho-active substances which can affect behavior in rats<sup>15</sup> and it also possesses anti-convulsant effects. The effect of the methanolic extract on blood glucose levels of alloxan-induced diabetes winstar rats have been investigated showing its hypoglycaemic effect.<sup>16</sup> The phytochemical screening of *Chrysanthellum indicum* revealed the presence of alkaloids, flavonoids, saponins, steroids and tannins.<sup>17</sup>

Though *Chrysanthellum indicum* leaves are widely consumed in the North - central part of Nigeria, to date, little research has been done to document information on its nutritional and antinutritional properties; hence the need for this study to determine the nutritional and anti-nutritional content of *Chrysanthellum indicum* leaves.

## Materials and Methods

### Plant Collection and Identification

Fresh sample of *Chrysanthellum indicum* plant was purchased in Tomato market, Faringada in Jos North, plateau state. It was then identified by Mr. Hassan of the Federal College of Forestry, Jos, and further authenticated by Mr Azila of the Herbarium unit of the same school.

### Plant Preparation

The leaves were detached from the stalk and properly rinsed with clean water, and air dried under shed on a wooden board with a constant turning over to avert fungal growth. The sample was ground into fine powder using a mechanical grinder (Corolla), and then sieved through a mesh of about 0.5mm and stored in an air tight jar prior to analysis.

### Assay

Proximate analysis is a system of analysis of nutrient in which the gross component or proximate (water, carbohydrate, dietary fibres, fatty acids ash, proteins) are determined.<sup>18, 19</sup>

Anti-nutrients are natural or synthetic compounds that interfere with the absorption of nutrient.<sup>20, 21</sup> An example is phytic acid found in many grains which forms insoluble complexes with calcium, zinc, iron and copper.<sup>22</sup> Proteins can also be antinutrients, such as the trypsin inhibitors and lectins found in legumes.<sup>23</sup>

The proximate constituent of the air dried vegetable leaves were determined by various methods.<sup>11, 19</sup> For the elemental analysis, the sample was ground to ensure smooth and homogenous surface and finally analysed automatically the results were read directly from the monitor.<sup>24</sup>

Various anti-nutritional Factors such as phytic acid, oxalic acid, and tannin were determined using different methods.<sup>19</sup>

## Results

The *Chrysanthellum indicum* leaves was analysed using the method of Association of Analytical Chemist<sup>19</sup> and the result presented as follows:

**Table 1:** Mean Proximate Composition (%) of *Chrysanthellum indicum* leaves

| Proximates          | % Composition |
|---------------------|---------------|
| Carbohydrate        | 24.62         |
| Crude protein       | 24.63         |
| Crude fat           | 2.76          |
| Crude fibre         | 23.16         |
| Moisture            | 11.88         |
| Ash content         | 12.95         |
| Metabolizable Enegy | 939.37        |

**Table 2:** Mineral Composition (%) of *Chrysanthellum indicum* leaves

| Minerals | % Composition |
|----------|---------------|
| Si       | 2.398         |
| P        | 0.698         |
| S        | 325           |
| Cl       | 6.445         |
| K        | 29.380        |
| Ca       | 29.959        |
| Mg       | ND            |
| Ba       | ND            |
| Ti       | 0.301         |
| Mn       | 0.108         |
| Fe       | 1.992         |
| Zn       | 0.1084        |
| I        | ND            |
| C        | ND            |
| Ni       | 0.045         |
| Cu       | 0.1998        |
| Co       | ND            |

ND= Not detected

**Table 3:** Anti-nutritional Factors of *Chrysanthellum indicum* leaves

| Anti-nutrients | Concentration (mg/100g) |
|----------------|-------------------------|
| Oxalate        | 200.00                  |
| Tannins        | 0.83                    |
| Phytic acid    | 101.57                  |

## Discussion

The study on proximate composition showed that the vegetable *Chrysanthellum indicum* is a valuable source of nutrient and is comparable to many protein crops hence it could be used as a protein source for human consumption (Table 3), especially where protein source from animal product are very expensive.<sup>25</sup> reported that protein level of green leafy vegetable range from 20.48-41.66%, and the amount of crude protein in *Chrysanthellum indicum* (24.63%) compete favourably with those of other Conventional Nigerian Vegetables, it contained more protein than the reference vegetables *Curcubita pepo* (20.80%) and *Gnetum africana* (19.67%). It has been reported that protein-calories malnutrition deficiencies is a major factor responsible for nutritional pathology.<sup>25</sup>

Vegetable are poor sources of fat that make them good for obese people. The results revealed that the amount of lipid contents in the *Chrysanthellum indicum* were moderate.

Crude fat of *Amaranthus hybridus* (1.60%) were lower when compared to that of *Chrysanthellum indicum* (2.76%). A diet containing *Chrysanthellum indicum* leaves should be more palatable than that of *Amaranthus hybridus* because dietary fats function to increase food palatability by absorbing and retaining flavours.<sup>26</sup> A diet providing 1-2% of its caloric energy as fat is said to be sufficient to human beings as excess fats consumption leads to certain cardiovascular disorders such as atherosclerosis, cancer and aging.<sup>27</sup>

Non starchy vegetables are the richest sources of dietary fibre.<sup>28</sup> However in addition to its high carbohydrate content; it contains adequate fibre (23.16%). This implies that in the diet, it will perform the important roles of promoting softer stools with increased frequency and regularity of elimination, characteristic of fibre rich diet.<sup>11</sup> Adequate intake of dietary fibre can lower the serum-cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer.<sup>30, 31</sup>

The elemental analysis of *Chrysanthellum indicum* unravelled high amount of calcium (29.959%) and potassium (29.380%). It also contains more detectable element than the reference vegetable used, indicating its relevance and indispensable roles in solving many mineral related problems in consumers. Children, women of reproductive age and pregnant women are most vulnerable to micro nutrient deficiency and anaemia.<sup>32</sup>

The anti-nutrient content of *Chrysanthellum indicum* leaves are listed in table. These anti-nutrient factors tend to bind to mineral elements forming indigestible complex.<sup>33</sup> Calcium oxalates for instance tend to render calcium unavailable by binding to the calcium ion to form complexes (calcium oxalate crystals). These oxalate crystal formed prevent the absorption and utilization of calcium. The calcium crystal may precipitate around the renal tubules thereby causing renal stones.<sup>33, 34</sup> In general the level of anti-nutrient is low to significantly interfere with nutrient utilization. They are below the established toxic levels.<sup>33</sup>

## Conclusion

The study showed that the leaves of *Chrysanthellum indicum* contain substantial levels of nutrient which could be useful in human diet, with considerably low levels of anti nutritional content which is below established toxic level.

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