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# Nutritional Evaluation of *Brillantaisia patula* Leaves

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aim:** To determine the nutritional and anti-nutritional compositions of *Brillantaisia patula* leaves using standard analytical methods.
**Place and Duration of Study:** The proximate, mineral and anti-nutritional compositions were determined in the chemistry laboratory of Ekiti State University, Ado – Ekiti while the amino acid was determined at the Analytical Laboratory of Multi-Environmental Management Consultant, Lagos, Nigeria.
**Methodology:** The proximate composition was carried out using the methods of Association of Official Chemists (AOAC) while mineral and anti-nutritional compositions were determined using standard analytical methods. Amino acid analysis was carried out through ion exchange chromatography (IEC) using the Technicon Sequential Multisample (TSM) Amino Acid Analyser.
**Results:** The proximate composition ranged from 3.18% (crude fat) to 38.6% (carbohydrate). The major mineral constituents of the sample were: P (1061 mg/100g), K (874 mg/100g), Ca (799 mg/100g), Na (82.6 mg/100g) and Mg (24.3 mg/100g) while the minor mineral constituents were: Fe

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(26.9 mg/100g), Zn (7.7 mg/100g) and Mn (6.05 mg/100g). The evaluated anti-nutritional contents were: 6.71 mg/g oxalate, 5.37 % saponin, 1.0 mg/100g tannin and 4.72 mg/kg cyanide. Additional results showed that the leaves contained eighteen amino acids with values ranging from 0.504 g/100g cp (tryptophan) to 14.0 g/100g cp (glutamic acid). The value of the total essential amino acids (TEAA) with histidine was 45.6g/100g cp while the total non-essential amino acid (TNEAA) was evaluated to be 46.5 g/100g cp.

**Conclusion:** *Brillantaisia patula* leaves could be utilized as a good source of essential amino acids and important mineral elements.

*Keywords: Brillantaisia patula; mineral element; anti-nutrient; amino acid; nutrition.*

## 1. INTRODUCTION

*Brillantaisia patula* T. Anderson (*B. patula*) belongs to the family of Acanthaceae. It is a shrubby plant of about 6-10 ft high with sometimes several inches in circumference at the base of stem. It usually produces comparatively large violet-purple flowers with upper lip yellowish and purple spotted. *B. patula* can be found in Nigeria, Togo, Gabon, West Cameroon and across Uganda and Angola [1]. The Yoruba name of *B. patula* is 'Owo', while it is known as 'Delembetogo' in Gabon and it is called 'Delelembe' in Congo. It is sometimes grown in local gardens. It is only cultivated by few people despite its nutritional and medicinal benefits which can help ease the problem of malnutrition in developing countries. It is a familiar medicine in Southern Nigeria taken by a bride or a barren wife to ensure conception. In Congo, the leaves are given to women with stomach-trouble, and they are also taken for chest-conditions and infantile spleen affections [2]. In Gabon, the leaves are used for yaws and rheumatism, and a decoction is taken to ease childbirth and for menstrual pains and stomachache [2,3].

It has been reported that green leafy vegetables are the cheapest and most readily available source of micronutrients in tropical Africa where carbohydrate forms the commonest staple food [4]. Hence the need to research into the nutritional values of underutilized leafy vegetables like *B. patula*. Some authors have given reports on the medicinal values and the essential oils present in the leaves of *B. patula* leaves [1,5-7] but there is paucity of information on the nutritional and anti-nutritional compositions of the leaves. This study was conceived to contribute to the achievement of one of the United Nations' sustainable development Goals (SDG) of reducing/minimizing the problem of malnutrition and food security (with our focus on Tropical Africa) and with a view to getting further information on the nutritional and anti-nutritional compositions of *B. patula*. Therefore, this study was undertaken to determine the proximate, mineral, anti-nutrients and amino acid compositions of *B. patula* leaves.

## 2. METHODOLOGY

### 2.1 Preparation of Samples

Fresh *B. patula* leaves were obtained from Ikere Ekiti, Ikere Local Government Area, Ekiti State, Nigeria. Fresh leaves were handpicked from the stem of the mature plant and were identified and authenticated by a taxonomist at the Department of Plant Science, Ekiti State University, Ado Ekiti, Nigeria. The leaves were washed with distilled water and air dried in the laboratory at room temperature for about two weeks. The dried leaves were milled into uniform powder with the aid of a Marlex blender and the sample was finally stored in airtight bottles before analysis.

### 2.2 Proximate Analysis

The moisture, ash, fat, protein and crude fibre contents were determined using the methods of Association of Official Chemists [8]. Carbohydrate was determined by difference. Energy value was obtained by multiplying carbohydrate, crude protein and crude fat values by the Atwater factors of 17, 17 and 37 respectively.

### 2.3 Determination of Anti-nutrients

Tannin content was determined using the method of Van-burden and Robinson [9]. Saponin, oxalate and cyanide were determined using the procedures described by Obadoni and Ochuko [10], AOAC [8] and Eleazu and Eleazu [11] respectively.

### 2.4 Determination of Mineral Content

Potassium and sodium were determined using a flame photometer (Corning, UK Model 405). KCl

and NaCl were used to prepare the standards. Phosphorus was determined by vanadomolybdate colorimetric. All other metals were determined by atomic absorption spectrophotometer (Bulk Scientific East Norwalk, CT, USA) [8].

## 2.5 Amino Acid Analysis

Two grammes (2.0 g) of sample was weighed into the extraction thimble and the fat extracted with chloroform/methanol (2:1 v/v) mixture using a Soxhlet apparatus [8]. The extraction lasted for 5-6 h. Thirty milligramme (30 mg) of the defatted sample was weighed into glass ampoules. Seven millilitres of 6 M HCl was added and oxygen expelled by passing nitrogen gas into the sample. The glass ampoules were sealed with a Bunsen flame and put into an oven at 105 ±5°C for 22 h. The ampoules were allowed to cool; the content was filtered to remove the humins. The filtrate was then evaporated to dryness at 40°C under vacuum in a rotary evaporator. The residue was dissolved with 5 ml acetate buffer (pH 2.0) and stored in a plastic specimen bottle and kept in the deep freezer.

Amino acid analysis was carried out by ion exchange chromatography (IEC) as desribed by FAO/WHO [12] using the Technicon Sequential Multisample (TSM) Amino Acid Analyser (Technicon Instruments Corporation, New York). The period of analysis was 76 min for each sample. The gas flow rate was 0.50 ml/min at 60°C with reproducibility consistent within ±3%. The net height of each peak produced by the chart recorder of the TSM (each representing an amino acid) was measured and calculated. The amino acid values reported were the averages of two determinations. Norleucine was the internal standard.

### 2.5.1 Determination of amino acids quality parameters

Determination of the amino acid scores was first based on the formula given by FAO/WHO and secondly, amino acid score was determined based on the whole hen's egg score. In this method, both essential and nonessential amino acids were scored. Amino acid score was also calculated based on the composition of the amino acids obtained in the sample compared with the suggested pattern of requirements for pre-school children (2-5 years). The essential amino acid index (EAAI) was determined as described by Nielsen [13] while the predicted protein efficiency ratio (P-PER) and isoelectric point (pI) were determined using Eq. (1) and Eq. (2) respectively.

$$\mathrm{P-PER} = -0.468 + 0.454\,(\mathrm{Leu}) - 0.105\,(\mathrm{Tyr}) \quad (1)$$

$$\mathrm{IPm} = \sum_{i=1}^{n} \mathrm{IP_i X_i} \quad (2)$$

Where $IP_m$ is the isoelectric point of the mixture of amino acids, $IP_i$ is the isoelectric point of the $i^{th}$ amino acid in the mixture and $X_i$ is the mass or mole fraction of the $i^{th}$ amino acid in the mixture.

## 3. RESULTS AND DISCUSSION

## 3.1 Proximate Composition

The proximate composition of a food material is important in evaluating its nutritional and health value and in determining the safety, toxicology and stability of the food to chemical, physical and microbiological changes [14]. The proximate composition of the *B. patula* leaves is shown in Table 1. The moisture content of the leaves was 13.7 ± 0.1%, a value lower than 15.58 – 30.90 % reported for some Nigerian leafy vegetables [15]. The low moisture content of *B. patula* leaves is advantageous because it will enhance the sample's shelf life. High moisture content has overall negative effect on the stability of a food product as it acts as medium for numerous reactions[16].

**Table 1. Proximate composition of leaves (%) and calculated energy (kJ/100g)**

| Proximate | Mean composition * |
|---|---|
| Moisture Content | 13.7 ± 0.1 |
| Crude Ash | 20.2 ± 0.1 |
| Crude Fibre | 8.27 ± 0.05 |
| Crude Protein | 16.1 ± 0.1 |
| Crude Fat | 3.18 ± 0.04 |
| Carbohydrate | 38.6 ± 0.3 |
| Energy | 1048 |

**Values are mean ± standard deviation of duplicate determination*

The ash content of a food material is a good indicator of the mineral composition of the plant. The ash contentt of the leaves (20.2 ± 0.1%) showed that it could serve as a good dietary mineral source when compared with the recorded ash contents of the leaves of T. *occidentalis* (8.54%;)[17] and *Rumex crispus L.* (15.35%)[18]. The mean percentage crude fibre composition of *B. patula* leaves (8.27±0.05) was similar to that of *Ficus exasperate* leaves (8.26)

[19] but higher than crude fibre contents of *I. aqatica*, *O. corymbosa* and *A. viridis* with values of 7.44, 7.26 and 6.54 respectively [20]. Fibre helps in the maintenance of human health and has been known to reduce cholesterol level in the body [21].

The crude protein content of *B. patula* leaves (16.1±0.1%), was comparable to that of *Ocimum gratissimum* and *Ocimum santum*, two commonly consumed leafy vegetables in Nigeria with 16.27% and 16.37% protein contents respectively [22]. The level of protein in the leaves indicates that it could be used as a source of protein. The crude fat composition was the lowest of the proximate compositions, showing that the sample was low in fat. Low-fat diet is often prescribed for the management of arteriosclerosis [23]. The carbohydrate content of the leaves (38.6 ± 0.3%) was higher when compared to that of gourd seeds and pumpkin leaves with 9.38 and 6.93% carbohydrate composition [24]. The high carbohydrate content shows that it could serve as a good energy giving food and aid the assimilation of food nutrients. The metabolizable energy was estimated to be 1048kJ/100g, a value higher than 688.72KJ/100g reported for *Rumex crispus* leaf [18].

## 3.2 Mineral Composition

Table 2 shows the mineral composition of the *B. patula* leaves. The decreasing order of magnitude of the major mineral constituents of the sample in mg/100g were P (1061±0), K (874), Ca (799±1), Na (82.6±0.6) and Mg (24.3±0.4). Phosphorous is needed for bone growth, kidney function and cell growth. It also plays a role in maintaining the body acid-alkaline balance [25]. The concentration of calcium in this study was better than the range of values (5.296 – 11.63 mg/100g) reported for some edible wild plants [26]. Calcium is an important component of human extracellular fluid, bone and blood and it is also essential in milk coagulation, blood clothing, cell permeability regulation and in the proper functioning of cardiac muscles [27]. The retention of calcium in the human body is greatly influenced by the phosphorus level, as high phosphorus has been reported to increase calcium loss via the urine. This brought about the concept of Ca/P ratio in food quality analysis. A Ca/P value above unity is considered good while values below 0.5 is considered poor [28]. The Ca/P ratio for the sample was 0.75, which means its consumption will not result in calcium loss in the body. Deficiency of P and Ca may result in adult ricket (osteoporosis) and bone thinning (osteomalacia), which commonly affects women [29]. Potassium and sodium are also present in significant amount in the *B. patula* leaves. Na and K are important in tissue excitability maintenance and ionic balance in the body. The ratio Na/K is important in the body for hypertension and arteriosclerosis prevention because while K depresses the blood pressure, Na enhances the blood pressure [30]. *B. patula* leaves had a very good Na/K ratio of 0.09 which is less than the maximum recommended Na/K value of 0.6 [24].

**Table 2. Mineral composition of *B. patula* leaves**

| Mineral | Concentration (mg/100g) |
|---|---|
| Na | 82.6 ± 0.6 |
| K | 874 ± 4 |
| Mg | 24.3± 0.4 |
| P | 1061± 0 |
| Fe | 26.9± 0.1 |
| Ca | 799± 1 |
| Zn | 7.7± 0.2 |
| Mn | 6.05± 0.03 |
| Cu | 0.52± 0.02 |
| Cr | 0.05 ± 0.01 |
| Cd | ND |
| Pb | ND |
| Na/K | 0.09 |
| Ca/P | 0.75 |

*Values are mean ± standard deviation of duplicate determinations*

The minor mineral constituents (in mg/100g) present in *B. patula* leaves were: Fe (26.9±0.1), Zn (7.7±0.2), Mn (6.05±0.03), Cu (0.52± 0.02) and Cr (0.05 ± 0.01). The concentration of iron in the sample was higher when compared with those of some cultivated vegetables such as lettuce (0.7 mg/100g), cabbage (0.3 mg/100g) and *T. terristis* (2.8 mg/100g) [31]. This implies that *B. patula* leaves as a good source of iron could replenish this nutrient in anemic conditions. Iron is involved in DNA synthesis and may also play roles in normal brain development and immune function [32]. Zinc functions as a constituent of metalloproteins where it serves a structural, catalytic, regulatory or antioxidant role [33].

## 3.3 Anti-nutritional Factors in *B. patula* Leaves

Table 3 shows the level of some of the anti-nutrients present in *B. patula* leaves. The

concentration of tannin found in the leaves was 1.0 ± 0.0 mg/100g. This was lower than the value 1.86 mg/100g reported for *Trianthema portulacastrum* [34]. The safe limit of tannins in foods depends on the availability of protein in the food. The evaluated oxalate content of *B. patula* leaves (6.71 ± 0.12 mg/g) was lower than the reported oxalate content of monkey orange seeds (26.25 mg/g) [35]. Oxalate is known to interfere with calcium absorption by forming insoluble salt of calcium and this insoluble salt of calcium can pass through the excretory system and interrupts with the efficient working of the kidney, and otherwise causes a disease called kidney stone [36]. Boiling has been found to be an effective measure in reducing the oxalate levels in leafy vegetables [37].

The saponin value of 5.37 ± 0.16 % in *B. patula* leaves was similar to 5.25 ± 0.28 % reported for the leaf of *Chenopodium album* [38]. With a level of < 10% of saponin level in the sample, it is considered safe as higher values have been found to lead to gastroenteritis [36,39]. The cyanide content of the leaves 4.72 ± 0.00 mg/kg was lower than the lethal dose of 40-60 mg/kg reported for cassava [40]. Thus, the cyanide level of our sample in the present study is within acceptable limit for human consumption.

### 3.4 Amino Acids Composition of *B. patula* Leaves

In the present study, *B. patula* leaves contained eighteen amino acids (Table 4). Ten out of the eighteen amino acids were classified as essential amino acids while the remaining eight were classified as non- essential amino acids. Glutamic acid was found to have the highest concentration (14.0 g/100g cp). This value was higher than those reported for *Moringa oleifera* leaves (8.22 g/100g) [41] and *Celosia spicata* leaves (12.8 g/100g cp) [42]. Tryptophan was found to have the lowest concentration (0.504 g/100g cp. The methionine content of the leaves was higher when compared with the reported value for *Ocimum gratissium* leaves (1.88 g/100g) [43], however these authors reported a higher tryptophan value (1.14 g/100g).

The total amino acid (TAA) of *B. patula* leaves (92.0 g/100g cp) was higher than the reported TAA value of *Moringa oleifera* leaves (76.4 g/100g cp), stem (65.4 g/100g cp) and root (70.9 g/100g cp) [41]. This implies that *B. patula* leaves could be a better source of amino acid when compared with moringa leaves, stem and root.

The parameters on the quality of the protein in *B. patula* leaves are presented in Table 5. The value of the total essential amino acid (TEAA) with histidine in *B. patula* leaves (45.6 g/100g cp) was better than 24.42 g/100g cp reported for *B. eurycoma* seeds [44]; 21.5 g/100g cp for sorghum grains [45], but lower than 56.6 g/100g cp of the egg reference protein [46]. The percentage ratio of TEAA with histidine to the TAA in our sample (49.6%) was better than in *Moringa oleifera* leaves (46.4%) [41] and *Ocimum gratissium* leaves (48.7%) [41].

The value of the total neutral amino acid (TNAA) for the sample was 50.6 g/100g cp with percentage ratio of 55.0 which implies that it made up the bulk of the amino acids in the sample. The total acidic amino acid (TAAA) of *B. patula* leaves was second in concentration after TNAA while the total basic amino acid TBAA was found to be the least concentrated which revealed that the protein is slightly acidic in nature. The aromatic amino acid (ArAA) range suggested for infant protein (6.8–11.8 g/100 g cp) [12] compares favourably with the current report of 10.5 g/100 g cp. The total sulphur amino acid (TSAA) (2.99g/100g cp) was about one half of the 5.8 g/100 g cp recommended for infants [12].

It has been observed that vegetable proteins contain substantially more cystine than methionine, for example the %Cys in TSAA in *Moringa oleifera* leaves was 51.6% [41]. However, in the present study, cystine level was lower than methionine and the % Cys in TSAA was 23.0, which implied that the sample behaved like animal protein. Leu/Ile ratio (1.49) was low in the sample; hence no concentration antagonism might be experienced in the sample when used as the protein source in food. It has been shown that excess leucine in foods interfered with the utilization of isoleucine and lysine [47].

**Table 3. The level of some anti-nutrients in *B. patula* leaves**

| Anti-nutrient | Tannin (mg/100g) | Oxalate (mg/g) | Saponin (%) | Cyanide (mg/kg) |
|---|---|---|---|---|
| Composition | 1.0±0.0 | 6.71 ± 0.12 | 5.37 ± 0.16 | 4.72± 0.0 |

*Values are mean ± standard deviation of duplicate determinations*

**Table 4. Amino acids composition of *B. patula* leaves (g/100g crude protein)**

| *Amino acid* | *Concentration* |
|---|---|
| Glycine (Gly) | 5.59 ± 0.36 |
| Alanine (Ala) | 4.74 ± 0.39 |
| Serine (Ser) | 4.04 ± 0.35 |
| Proline (Pro) | 3.08 ± 0.21 |
| Valine (Val) | 5.62 ± 0.13 |
| Threonine (Thr) | 3.99 ± 0.14 |
| Isoleucine (Ile) | 4.02 ± 0.26 |
| Leucine (Leu) | 5.99 ± 0.35 |
| Aspartic acid (Asp) | 9.94 ± 0.12 |
| Lysine (Lys) | 5.89 ± 0.40 |
| Methionine (Met) | 2.30 ± 0.04 |
| Glutamic acid (Glu) | 14.0 ± 0.7 |
| Phenylalanine (Phe) | 5.64 ± 0.25 |
| Histidine (His) | 5.57 ± 0.17 |
| Arginine (Arg) | 6.05 ± 0.81 |
| Tyrosine (Tyr) | 4.39 ± 0.70 |
| Tryptophan (Trp) | 0.504 ± 0.070 |
| Cystine (Cys) | 0.687 ± 0.013 |
| Total (TAA) | 92.0 |

*Values are mean ± standard deviation of duplicate determination*

The P-PER value of *B. patula* leaves (1.76) was comparable to that of moringa leaves (1.72) [39] but better than 1.62 and 0.27 documented for millet ogi and sorghum ogi respectively [48]. However, the P-PER value of our sample was lower than 4.06 (corn ogi) and reference casein with P-PER of 2.50 [48].The essential amino acid index (EAAI) obtained in the present study (1.23) was slightly higher than the value for Ocimum *gratissium* leaves (1.18) [43]. EAAI is useful as rapid tool to evaluate food formulations for protein quality, although it does not account for difference in protein quality due to various processing methods or certain chemical reactions [49, 50]. Calculation of isoelectric point (pI) from the amino acids would give a rough estimate of the pH to prepare the protein isolate of an organic substance without necessarily going through protein solubility determination [51]. The pI of our sample was 5.35.

Amino acid scores of *B. patula* leaves based on FAO/WHO [52] (Table 6) standards revealed that all the essential amino acids had scores greater than 0.5 or 50%, showing the high quality of the leave protein. Trp had the least score with 0.504. Therefore, to correct for the amino acid score, it is 100/50.4 or 1.98 as much B*. patula* leaves if it were to serve as the sole protein source in diets.

**Table 5. Parameters on the quality of protein in *B. patula* leaves**

| **Parameter** | **Level** |
|---|---|
| Total Amino Acid (TAA) | 92.0 |
| Percent total amino acid (%TAA) | 100 |
| Total non-essential amino acid (TNEAA) | 46.5 |
| Percent total non-essential amino acid (%TNEAA) | 50.5 |
| Total essential amino acid (TEAA) with Histidine | 45.6 |
| Percent total essential amino acid (%TEAA) with Histidine | 49.6 |
| Total essential amino acid (TEAA) without Histidine | 40.0 |
| Percent total essential amino acid (% TEAA) without Histidine | 43.5 |
| Total neutral amino acid (TNAA) | 50.6 |
| Percent total neutral amino acid (%TNAA) | 55.0 |
| Total acidic amino acid (TAAA) | 23.9 |
| Percent total acidic amino acid (% TAAA) | 26.0 |
| Total basic amino acid (TBAA) | 17.5 |
| Percent total basic amino acid (%TBAA) | 19.0 |
| Total sulphur amino acid (TSAA) | 2.99 |
| Percent total sulphur amino acid ( %TSAA) | 3.25 |
| Percent cystine in TSAA | 23.0 |
| Total aromatic amino acid (TArAA) | 10.5 |
| Percent total aromatic amino acid (%TArAA) | 11.4 |
| Leu/Ile | 1.49 |
| Calculated isoelectric point (pI) | 5.35 |
| Predicted protein efficiency ratio (P-PER) | 1.76 |
| Essential amino acid index (EAAI) | 1.23 |

**Table 6. Essential amino acid scores of B. patula leaves based on FAO/WHO (1973) standards**

| Amino acid | [a]Suggested level of standard scoring pattern (mg/g cp) | Amino acid content of sample (mg/g cp) | Sample Score |
|---|---|---|---|
| Ile | 40 | 40.2 | 1.01 |
| Leu | 70 | 59.9 | 0.856 |
| Lys | 55 | 58.9 | 1.07 |
| Met+ Cys | 35 | 29.9 | 0.854 |
| Phe + Tyr | 60 | 100 | 1.67 |
| Thr | 40 | 39.9 | 0.998 |
| Trp | 10 | 5.04 | 0.504 |
| Val | 50 | 56.2 | 1.12 |
| Total | 360 | 390 | 1.08 |

[a] [52]

**Table 7. Amino acid score of *B. patula* leaves with respect to whole hen's egg scoring pattern***

| Amino acid | Whole hen's egg (g/100g) | Sample (g/100g) | Sample Score |
|---|---|---|---|
| Val | 7.50 | 5.62 | 0.749 |
| Thr | 5.10 | 3.99 | 0.782 |
| Ile | 5.60 | 4.02 | 0.718 |
| Leu | 8.30 | 5.99 | 0.722 |
| Lys | 6.20 | 5.89 | 0.950 |
| Met | 3.20 | 2.30 | 0.719 |
| Cys | 1.80 | 0.687 | 0.382 |
| Phe | 5.10 | 5.64 | 1.11 |
| Tyr | 4.00 | 4.39 | 1.10 |
| Trp | 1.80 | 0.504 | 0.280 |
| Gly | 3.00 | 5.59 | 1.86 |
| Ala | 5.40 | 4.74 | 0.878 |
| Ser | 7.90 | 4.04 | 0.511 |
| Pro | 3.80 | 3.08 | 0.811 |
| Asp | 10.7 | 9.94 | 0.929 |
| Glu | 12.0 | 14.0 | 1.17 |
| His | 2.40 | 5.57 | 2.32 |
| Arg | 6.10 | 6.05 | 0.992 |

*[46]

**Table 8. Essential amino acid scores of *B. patula* leaves based on requirements of pre-school child (2-5 years) scoring pattern**

| Amino acid | Preschool (g/100g) | Sample (g/100g) | Sample Score |
|---|---|---|---|
| Val | 3.50 | 5.62 | 1.61 |
| Thr | 3.40 | 3.99 | 1.17 |
| Ile | 2.80 | 4.02 | 1.44 |
| Leu | 6.60 | 5.99 | 0.908 |
| Lys | 5.80 | 5.89 | 1.02 |
| Met + Cys | 2.50 | 2.99 | 1.20 |
| Phe +Tyr | 6.30 | 10.0 | 1.59 |
| Trp | 1.10 | 0.504 | 0.458 |
| His | 1.90 | 5.57 | 2.93 |

The results of the EAA of *B. patula* leaves based on the amino acid requirement recommended for preschool child (Table 8) revealed that His had the highest score with 2.93. Histidine is a semi-essential amino acid particularly useful for children growth. It is the precursor of histamine present in small quantities in cells. Trp had the

least score with 0.458 and would need a correction of 100/45.8 or 2.18.

Comparing the amino acid score of *B. patula* leaves with the whole hen's egg score (Table 7), His, Gly, Glu, Phe and Tyr had higher values than hen's egg score; which makes the leaves a good source of these amino acids. Moreover, the amino acid with the least score was Trp (0.280 or 28.0%) making it the limiting amino acid. Here, Trp would need a correction of 100/28.0 or 3.57.

## 4. CONCLUSION

This study has revealed that *Brillantaisia patula* leaves contained relatively high crude protein, crude fibre and crude fat. The leaves are observed to contain reasonable quantities of beneficial dietary mineral elements such as P, K, Na. Ca, Mg and Fe. The leaves showed very fair levels of anti-nutritional factors and also contained appreciable levels of essential amino acids such as valine, threonine, isoleucine, leucine, lysine, methionine, phenylalanine, histidine, arginine and tryptophan.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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