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Comparative studies on the amino acid content of different parts of *Moringa oleifera* plant found in Awka, South-East, Nigeria

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ABSTRACT

The amino acid content of the different parts of *Moringa oleifera* plant was estimated using the Technicon sequential Multi-Sample Amino Acid Analyzer (TSM) as described by Speckman *et al*. The most abundant EAA are leucine, a branched-chain amino acid (24.54g/100g protein or 9.93%), arginine, a basic amino acid (19.84g/100g protein or 8.01%) and phenylalanine, an aromatic amino acid (16.19g/100g protein or 5.67%) while the most abundant NEAA are the acidic amino acids, glutamic acid (40.88g/100g protein or 16.69%) and aspartic acid (22.94g/100g protein or 11.97%). Statistical analysis indicates that there is no significant difference between the essential and non-essential amino acids present in all the parts of the plant studied, since the significance value of the results are well over 0.05.

KEYWORDS

Moringa oleifera;
Essential and non-essential amino acids.

INTRODUCTION

Moringa is a drought-resistant, very fast growing tree and is available all-year round[1-3]. It has a multitude of uses; the leaves, the pods, flowers and growing tips of the tree are edible and nutritious[4]. The plant belongs to the family Moringaceae. There are about fourteen species of the tree known, such as *M.stenopetala*, *M.peregrina*, *M.ovalifolia*, *M.oleifera* etc. *Moringa oleifera* is the best known specie. It is native to sub-Himalayan parts of northern India, but now widely distributed in the tropics and sub-tropics[3-5].

(a) **Kingdom**: Plantae
(b) **Division**: Magnoliophyta
(c) **Class**: Magnolipsida
(d) **Order**: Brassicales
(e) **Family**: Moringaceae
(f) **Genus**: *Moringa*
(g) **Species**: *Moringa oleifera*.

Vernacular names of *Moringa oleifera*

(i) **English**: Horse-radish tree, radish tree, mother's best friend.
(ii) **French**: Ben aile, benzolive.
(iii) **Senegal**: Neverdie, nebeday.
(iv) **Nigeria**: It has different vernacular names.
(v) **Igbo**: Okwe oyibo, okochi egbu, okughara ite, odudu oyibo.

(vi) **Yoruba**: Ewe ile, ewe igbale, idagba maloye.
(vii) **Hausa**: Zogalla, zogalla-gandi, bagaruwar maser.
(viii) **Fulani**: Gawara, rinimaka.

Sources[4,6,7]

Over decades, *Moringa oleifera* is one such essential vegetarian diet that has remained as a source of essential amino acid in the West African sub-region. It has a multitude of uses; the leaves, the pods, flowers and growing tips of the tree are edible and nutritious[4]. *Moringa* has been used to combat malnutrition especially among infants and nursing mothers[4]. The leaves can be eaten fresh, cooked or stored as dried powder for many months without loss of nutritional value[8]. In West Africa, some countries like Senegal, Ghana, Mali and Togo have made tremendous efforts in the utilization of *Moringa* in health, agriculture, and environment. Three non-governmental organizations-Trees for life, Educational concerns for hunger organization and Church world service (CWS) based in Senegal- have advocated the use of *Moringa* as "natural nutrition for the tropics" [8]. In fact, the nutritional properties of *Moringa* leaf are well known that there seems to be little doubt of the substantial health benefit to be realized by consumption of *Moringa* leaf powder in situations where starvation is imminent. Nonetheless, the outcomes of well controlled and well documented clinical studies are still clearly of great value.

Studies on the dietary constituents of the leaves credit it with essential amino acids, which is important in bridging the protein gap of poor countries like Nigeria. Thus, Nigerian empirical data is required to sufficiently support this. Also, there is need to compare the amino acid content in the other parts of the plant such as the flowers, seeds, roots and stems.

This work is therefore, aimed at comparing the amino acid content of the leaves, flowers, seeds, roots and stems of *Moringa oleifera* plant grown in Awka, South-east, Nigeria, in a bid to determine its suitability as a nutritious vegetable or otherwise.

EXPERIMENTAL

Sample collection and treatment

The mature dry *Moringa oleifera* pods, the fresh leaves, the stems, the roots and the flowers were collected from family gardens in Ifite, Awka, South-East, Nigeria. The pods were split open and the seeds removed, and then pooled together to form the bulk sample. The seeds, the leaves, and flowers were dried under room temperature for two days and separately ground into fine powder using manual grinder, while the roots and stems were cut into pieces first using knives and dried separately, before grinding into fine powder. The milled samples were kept in screw-capped containers and stored in a deep freezer and analyzed within seven days.

Amino acid analysis

The amino acid content of different parts of *Moringa oleifera* were determined using methods described by Speckman et al.[9] The dried and milled samples were defatted, hydrolysed, evaporated in a rotary evaporator and then loaded into the Technicon sequential Multi-Sample Amino Acid Analyzer (TSM). The amino acid values of the samples were calculated from the chromatogram peaks.

RESULTS

Appendix I is the chromatograph for amino acid standards while appendices II(a) to II(e) are the chromatograph of the amino acid profile of *Moringa oleifera* flower, leaf, seed, root and stem respectively. They are attached as the supplementary information.

Figure 1 shows the amino acid composition in g/100g protein of the different samples as calculated from the respective chromatographs. All the fractions consistently are composed of 17 out of the 20 naturally occurring amino acids lacking only in asparagine, glutamine and tryptophan. The plant contains all the essential amino acids except tryptophan in our findings, due to complete destruction of tryptophan during acid hydrolysis.[10, 11] The percentage essential amino acid (EAA) and non-essential amino acid (NEAA) are shown in Figure 2. The essential amino acids and non-essential amino acids are almost equal in concentration, for example, the percentage of EAA in the leaves is 50.66 while the %NEAA is 49.33. Figure 3 shows the proportion of branched chains, acidic, aromatic and basic amino acids in the different parts of the plant studied. The most abundant EAA are leucine, a branched-chain

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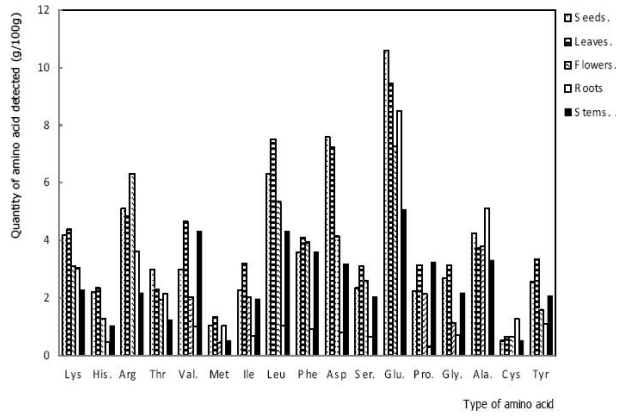

Figure 1 : The amino acid profile of the seeds, leaves, flowers, roots and the stems of *Moringa oleifera*

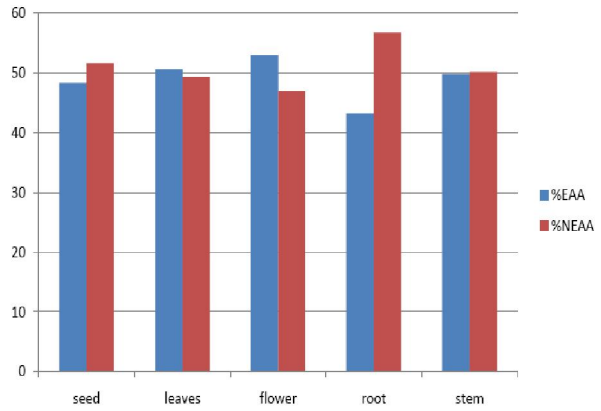

Figure 2 : %EAA and %NEAA in all the parts of the plant studied

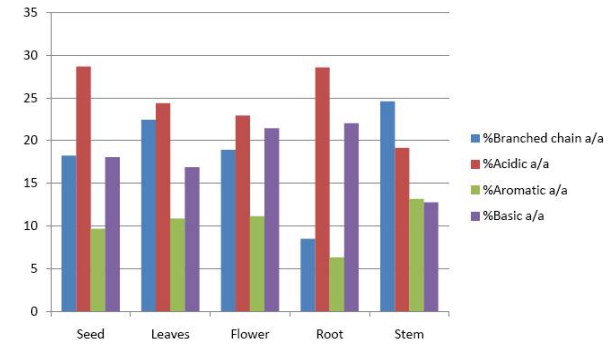

Figure 3 : The proportion of branched chain, acidic, aromatic and basic amino acids in different parts of *Moringa oleifera*

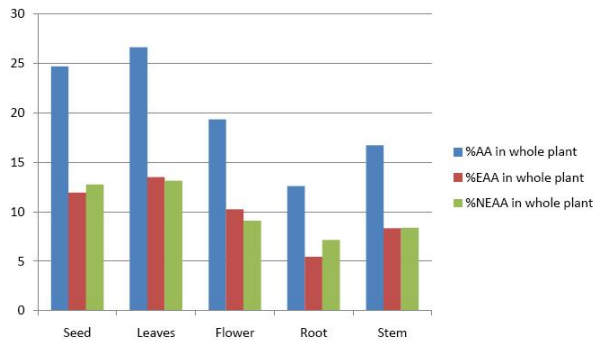

Figure 4 : The proportion of total amino acids, essential and non-essential amino acids in the whole plant

amino acid (24.54g/100g protein or 9.93%), arginine, a basic amino acid (19.84g/100g protein or 8.01%) and phenylalanine, an aromatic amino acid (16.19g/100g protein or 5.67%) while the most abundant NEAA are the acidic amino acids glutamic acid (40.88g/100g protein or 16.69%) and aspartic acid (22.94g/100g protein or 11.97%). The proportion of total amino acid, essential and non-essential amino acids in the whole plant are shown in figure 4. The proportion of both the total and essential amino acids in the whole plant follows the same pattern as thus:

leaf > seed > flower > stem > root.

DISCUSSION

The amino acid content (g/100g protein) of the seeds, leaves, flowers, roots and stems of *Moringa oleifera* and the percentage essential and non-essential amino acids in figure 1-4 are of great interest. The results indicate that the % of the essential amino acids (EAA) and non-essential amino acids (NEAA) are almost equal unlike in many plants where NEAA are always higher than EAA[11,12]. For example, the % of EAA in the leaves and flowers are 50.66% and 53.02% while the NEAA are 49.33% and 46.98% respectively. This was subjected to statistical analysis using analysis of variance. The results indicate that there is no significant difference between the essential and non-essential amino acids present in all the parts of the plant studied, since the significance value of the results are well over 0.05. We also observed that the most abundant EAA is leucine, a branched-chain amino acid (24.54g/100g protein or 9.93%) while the most abundant NEAA are the acidic amino acids glutamic acid (40.88g/100g protein or 16.69%) and aspartic acid (22.94g/100g protein or 11.97%). Similar observations were made in other plants by Adeyeye[13,11] The proportion of aromatic amino acids in all the parts of the plant studied indicate that it is lower than branched chain, acidic or basic amino acids (Figure 3). This is quite interesting since aromatic amino acids (eg. Tyr and Phe) take part in secondary metabolism. In this study, seventeen (17) amino acids were

determined instead of the twenty (20) naturally occurring amino acids commonly found in proteins[11,14]. This is due to the conversion of glutamine to glutamate, and asparagine to aspartate[15], and also the complete destruction of tryptophan during acid hydrolysis[10,11]. This might explain the higher levels of glutamic acid and aspartic acid in our results. The results of the amino acid profile of the leaves studied are higher than the values reported by Fuglie[8] for the dry leaf powder. However, both work confirm that *Moringa oleifera* contains all the essential amino acids needed for normal body functioning. There are significant positive correlation between the seeds with the stems, roots, flower and the leaves at 95% confidence level. This indicates that the distribution of amino acids in the seeds and other parts of the plant studied are highly similar, suggesting that the seeds may provide just exactly the same type of amino acid as the stems, roots, flower and the leaves of *Moringa oleifera*. The results from the seeds and leaves are also comparable to those bred in other parts of the world while those of flowers, roots and stems are novel.

CONCLUSION

The results from amino acid analysis suggest that the different parts of *Moringa oleifera* plant grown in Awka, South-East, Nigeria are rich in essential amino acids, and comparable to those bred in other parts of the world, thus may be used as amino acid supplement in both man and animal.

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