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The anti-nutritional factors in the stems of a local cultivar of *moringa oleifera (lam)*

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ABSTRACT

The methods of Association of Analytical Chemists were used to determine the levels of tannins, saponins and cyanogenic glycosides in *Moringa oleifera* stem, and the levels of oxalates (Munro and Bassir) and phytates (Griffith and Thomas) were also estimated. The Technicon sequential Multi-sample amino acid analyzer (TSM) was used to determine the amino acid content. Tannins (100mg/100g), cyanogenic glycosides (31.40mg/100g) and oxalates (51.24mg/100g) were present in the stems at higher levels while saponins (12.10mg/100g) and phytates (0.048mg/100g) occurred at much lower levels. The stems contained %crude fat (1.77±0.98), % crude proteins (3.59±0.96), %carbohydrates (87.44), %ash (1.63±0.22), %moisture (5.57±0.35) and %dry matter (5.57±0.35). The total energy value of the stem was 380.05 kcal/100g. The stems contained ascorbic acid and niacin as 71.44mg/100g and 1.32mg/100g respectively, but lacked pyridoxine, riboflavin and thiamine. Calcium (1.38mg/100g), Potassium, (32.4mg/100g) and sodium, (378.38mg/100g), three essential electrolytes also abound in the stems. These anti-nutritional values indicate that *Moringa oleifera* stem, apart from its nutrient composition, is also medically and pharmacologically important. It is not a surprise that the plant is used in traditional medicine in Africa, Asia, and Americas.

KEYWORDS

Moringa oleifera;
Nutrient composition;
Amino acid;
Anti-nutritional factors.

INTRODUCTION

The plant belongs to the *Moringaceae* family, with about fourteen species, *Moringa oleifera* being the best known. It is native to Sub-Himalayan parts of northern India, but is now widely distributed in the tropics and sub-tropics[1-5], because it tolerates a wide range of soil and rainfall conditions. *Moringa oleifera* is a drought-resistant, very fast growing plant and is available all year round[2, 4-6].

Some of the uses of the plant include in alley cropping, animal forage, as domestic cleaning agent, as fertilizer, for live fencing, as medicine, and as an ornamental[7]. Given these multiple uses, it is not a surprise that there is a renewed interest in research, development, and utilization of the plant in many parts of the tropics

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such as East and Southern Africa, West Africa and South East Asia[7].

Apart from its dietary importance, local folklore credits *Moringa* with a lot of herbal potency[1, 3, 8]. The stems are aphrodisiac and anthelminthic, and are used to treat sores, skin infections and effective in treating boils. The stem bark is also used to cure eye diseases[7].

Despite the wide claim on the medicinal use of the *Moringa oleifera* stem, studies on the bioactive and nutritional potentials of this plant remain scanty. This work is therefore, aimed at documenting the levels of anti-nutritional factors in *Moringa oleifera* stems found in Awka, Anambra state, Nigeria, in a bid to determining its usefulness and suitability as an herbal remedy or otherwise.

EXPERIMENTAL

Sample collection and treatment

The mature *Moringa oleifera* stems were collected from family gardens in Ifite, Awka, Anambra state, Nigeria. The stems were cut into pieces first using knives and dried, before grinding into fine powder. The milled sample was kept in screw-capped containers and stored in a deep freezer and analyzed within seven days.

Determination of the anti-nutrients

The levels of oxalates[9], phytates[10], tannins[11], saponins[11], and cyanogenic glycosides[11] in *Moringa oleifera* stems were determined using the prescribed methods.

Proximate analysis and mineral composition

The methods of the Association of Official Analytical Chemists[12] were used for the determination of moisture, crude protein, crude lipids, ash and dry matter in the stems of the plant. The mineral content was estimated using atomic absorption spectro-photometer (AAS). The calorific value was estimated in kilocalories by multiplying the percentage crude proteins, lipid and carbohydrates by the recommended factors 4, 9, and 4 respectively[13].

Vitamin analysis

The determination of the water-soluble vitamins namely niacin, pyridoxine, riboflavin, thiamine and ascorbic acid were by high performance liquid chromatography (HPLC), as described by AOAC[12].

Determination of Amino Acid Profile

The amino acid profile in *Moringa oleifera* stem was determined using methods described by Speckman *et al*,[14]. The dried and milled stems were defatted, hydrolyzed, evaporated in a rotary evaporator and then loaded into the Technicon sequential Multi-Sample Amino Acid Analyzer (TSM). The amino acid values of the sample were calculated from the chromatogram peaks.

RESULTS AND DISCUSSION

The levels of the anti-nutritional factors in *Moringa oleifera* stems are shown in Figure 1. Tannins (100mg/100g), oxalates (51.24mg/100g) and cyanogenic glycosides (31.40 mg/100g) were higher in the stems while saponins (12.10mg/100g) and phytates (0.05mg/100g) have lower values. Tannins have antagonistic competition with proteins, consequently, lowering their bioavailability, and can therefore elicit protein deficiency syndrome, kwarshiorkor and marasmus. Tannins have also been reported to prevent protein digestion by inhibiting the activation of pepsinogen and chymotrypsinogen to pepsin and chymotrypsin respectively[15]. Phytic acid and oxalates have complicated effects in the human system, particularly indigestion of food and flatulence[16, 17]. They also react tightly with divalent ions such as calcium and zinc ions, thereby making them unavailable to the body[17]. However, these anti-nutrients could be removed through soaking, boiling or even frying[18-20, 5].

The proximate composition of *Moringa oleifera* stems are shown in Figure 2. It contained %crude fat (1.77±0.98), % crude proteins (3.59±0.96), %carbohydrates (87.44), %ash (1.63±0.22), and %moisture (5.57±0.35). The energy value was 380.05 Kcal/100g.

Moringa oleifera stem is not a good source of protein since according to Pearson[21], any plant food that provides more than 12% of its calorific value from protein is a good source of protein. However, it contained a high amount of carbohydrates (87.44).

The mineral and vitamin compositions of the *Moringa oleifera* stems are shown in Figures 3 and 4

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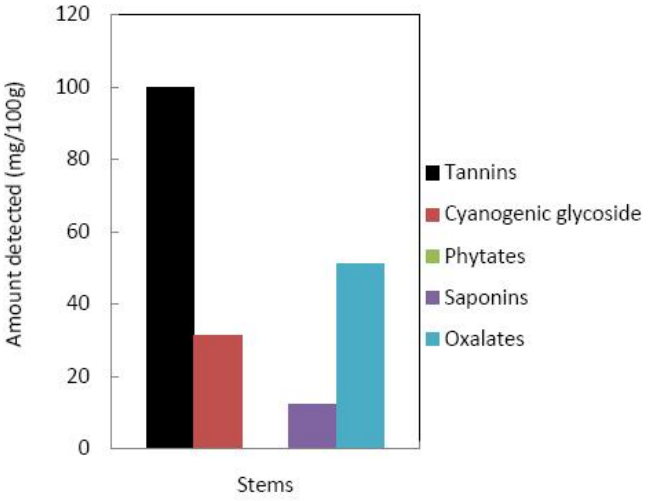

Figure 1 : The levels of anti-nutrients in *Moringa oleifera* stem

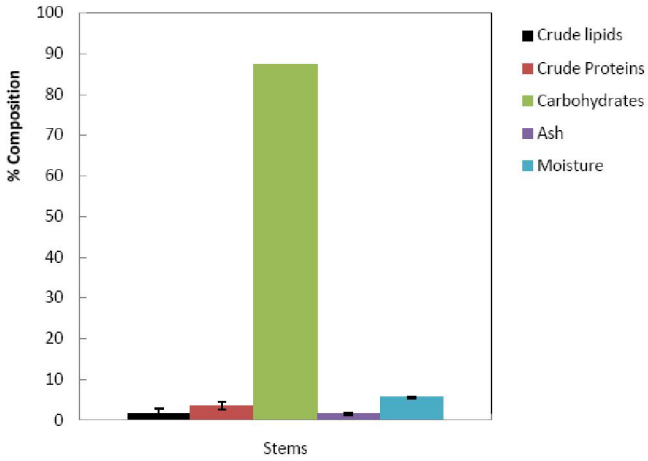

Figure 2 : The proximate composition of *M. oleifera* stem (Mean ± S.E.M)

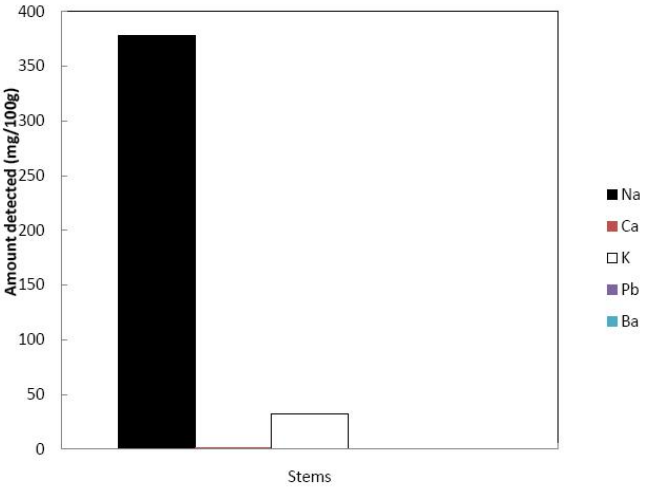

Figure 3 : The mineral composition of *Moringa oleifera* stem

respectively. The stem contained higher ascorbic acid (71.44mg/100g) and lower amount of niacin (1.32mg/100g), and thiamine, riboflavin and pyridoxine were not detected. It contained sodium, (378.38mg/100g), calcium (1.38mg/100g) and potassium (32.4mg/100g). Lead and Barium were not detected in this study.

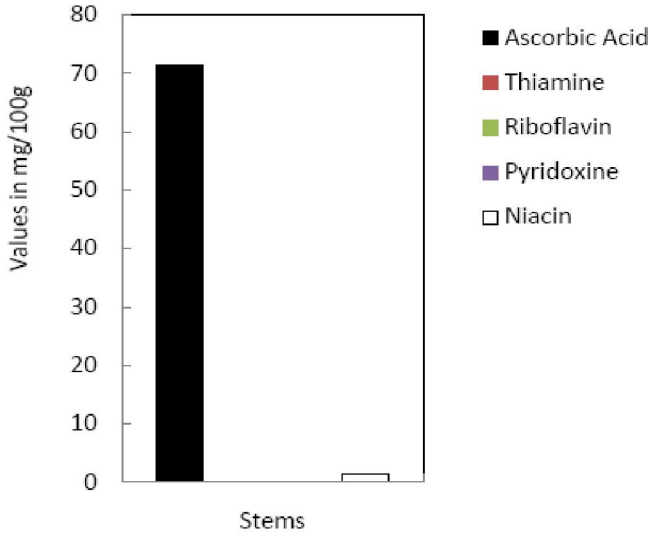

Figure 4 : The vitamin composition of *Molinga oleifera* stem

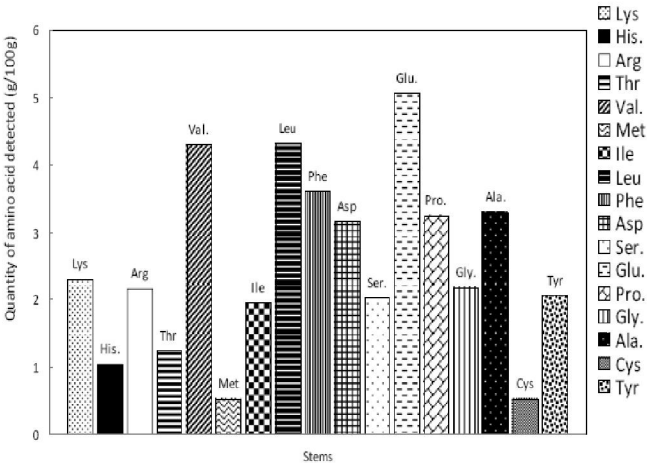

Figure 5 : The amino acid profile of *Moringa oleifera* stems

The amino acid profile of the *M*oringa *oleifera* stem is shown in Figure 5. It contained all the essential amino acids with the highest being leucine (4.31g/100g protein) and valine (4.30g/100g protein) while the lowest was methionine (0.52g/100g protein). The highest non-essential amino acid was glutamate (5.07g/100g protein) while the least was cystine (0.53g/100g protein). The stem contains all the essential amino acids (EAA), just as in the leaves, as reported by Fuglie[1], needed for normal body functioning. In many plants, %NEAA (non-essential amino acid) is always higher than %EAA[17].

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CONCLUSION

The anti-nutritional values indicate that the local cultivar of *Moringa oleifera* stem, apart from its nutrient composition, is also medically and pharmacologically important. It is not a surprise that the plant is used in traditional medicine in Africa, Asia, and Americas[1, 22].

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