

AMINO AND FATTY ACID PROFILES OF *MORINGA OLEIFERA* SEED FLOUR

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ABSTRACT

Amino acid and fatty acid profiles of *Moringa oleifera* seeds flour and oil were determined in this study. The seed was dried, milled and packaged in polyethylene bag. Analysis carried out on the flour includes proximate, amino acid and fatty acid profiles. Moringa seed flour contains higher protein (28.08%), fat (45.84%) and crude fibre, content (7.73 %). The anti-oxidant value was 38.08 mgAAEg⁻¹. The result revealed higher amino acid in Moringa seed flour with all the essential amino acid. Amino acid profile showed glutamate (14.83 g/100g) as the predominant amino acid in the seed flour. The major fatty acid in moringa seed oil was oleic acid (72%) which is unsaturated fatty acid. Moringa seed flour and oil are promising products from *Moringa Oleifera* which could be used to improve the diet of human being.

Keywords: Defatted, Moringa seed, Flour, Amino acid, Fatty acid

INTRODUCTION

Moringa oleifera (Syn. *M. ptrygosperma* Gaertn.) is of the family Moringaceae. It is a small graceful tree with sparse foliage, often planted in compounds or used as hedge in northern Nigeria (Kawo *et al.*, 2009). *Moringa oleifera* is a fast growing, aesthetically pleasing small tree. The specie is characterized by its long, drumstick shaped pods that contain its seeds within the first year of growth (Ajar *et al.*, 2013). It is well known for its nutritional and medicinal values by many communities in northern Nigeria (Kawo *et al.*, 2009). Most parts of this plant: root, bark, gum, leaf, fruit (pods) flowers, seed and seed oil have been used in folk medicine in Africa and South Asia (Fahey, 2005). It has been used for the treatment of inflammation, infectious diseases, cardiovascular, gastrointestinal, hematological and hepatorenal disorders (Morimitsu *et al.*, 2000; Siddhuraju and Becker, 2003; Ogbunugafor *et al.*, 2011). The seeds are sometimes removed from mature pods and eaten like peas or roasted like nuts (Ajar *et al.*, 2013). *Moringa oleifera* seeds are said to be

very good and safe for water treatment (Ogbe and Affiku, 2011/12). *Moringa oleifera* extract was reported to have antibacterial properties and conclusion was made to investigate it as a phytotherapeutic agent to combat infectious agents (Patel, 2011). Due to the importance and benefit of this crop, moringa seed flour and oil had to be studied extensively. Although, the protein and fatty acid composition had been studied in other part of the country (Anwar and Rashid, 2007; Kawo *et al.*, 2009) but generally, the protein and fatty acid could be affected by factors such as location, climatic conditions, species, age and soil type. Therefore, the objective of this work was to determine the amino acid and fatty acid profile of moringa seed obtained in Osogbo, Osun State, Nigeria.

MATERIALS AND METHODS

Moringa seeds were purchased at Oja-Oba market, Nigeria. The seeds were dried, milled and packaged in polyethylene bag.

Analyses

Proximate composition of the flour was determined using modified methods of AOAC (2006)

Total antioxidant capacity

The total antioxidant capacity was evaluated by phosphomolybdenum method as described by Nabasre and Bratatti (2007). The assay was based on the reduction of Mo (VI) to Mo (V) by the sample and subsequent formation of a green phosphate/Mo (V) complex at acidic pH. Extract solution in ethanol (0.3 mL; 100 $\mu\text{g mL}^{-1}$) was mixed with reagent solution (3 mL; 0.6 M sulphuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). A blank composed of 3 mL of reagent solution and methanol was also prepared. All tubes were capped and incubated in boiling water bath at 95 °C for 90 min. Absorbance of samples were read against blank at 695 nm. The antioxidant capacities of samples were expressed as mg Ascorbic Acid Equivalent per gram of sample (mg AAE g^{-1}).

Amino acid determination

The sample (10 g) was weighed into 250ml conical flask and the sample was defatted using soxhlet extraction apparatus. The defatted flour was hydrolyzed with 6M HCl three times for complete hydrolysis to be achieved. The amino acid content of the flour recovered was concentrated and 1ml of the extract was introduced into the gas chromatography (HP 6890, powered with HP ChemStation Rev. A 09.01 [1206] Software). The content was concentrated to 1 μl for gas chromatography analysis before injected into the injection port

of GC. Carrier gas was Nitrogen, Inlet temperature was 250°C, column dimension 30m × 0.25mm × 0.25 µm. Initial temperature was 60°C, first ramping at 12°C for 2 min, while second ramping at 15°C for 8 min. Detector temperature for the analysis was 320°C.

Fatty acid profile determination

Fatty acid composition was determined using Gas Chromatography (HP 6890 powered with

HP ChemStation Rev. A 09.01 [1206] Software). Oil sample (50mg) was esterified for five minute at 95°C with 3.4 ml of the 0.5M KOH in dry methanol. The mixture was neutralized by using 0.7M HCl and 3 ml of 14% boron trifluoride in methanol was added. The mixture was heated for 5 minutes at the temperature of 90°C to achieve complete methylation process.

The Fatty Acid Methyl Esters were thrice extracted from the mixture with redistilled nhexane. The content was concentrated to 1 µl for gas chromatography analysis and 1 µl was injected into the injection port of GC. Carrier gas was Nitrogen, Inlet temperature was 250°C, column dimension 30m × 0.25mm × 0.25 µm. Initial temperature is 60°C, first ramping at 12°C for 2 min, while second ramping at 15°C for 8 min. Detector temperature was 320°C (Awolu *et al.*, 2013).

RESULTS

Proximate and antioxidant composition of moringa seed flour are shown in Table 1. Moringa seed flour contains protein (28.08 %), fat (45.84 %) and crude fibre (7.73 %). The anti-oxidant value was 38.12 mgAAEg⁻¹. Amino acid profiles of Moringa seed flour are shown in Table 2. The predominant amino acid in *Moringa oleifera* seed was glutamate with highest value (14.83 g/100g), followed by arginine (8.31 g/100g) and aspartate (7.2 g/100g). Table 3 showed the amino acid score of *Moringa oleifera* flour. The amino acid score showed that moringa seed flour was limiting in lysine (55), leucine (85.91), valine (89.71) and threonine (98.82) for pre-school children. Table 4 showed the fatty acid composition of moringa seed oil. The major fatty acid composition of *Moringa oleifera* seed oil were oleic acid (72.59 mg/100 g), behenic acid (7.33 mg/100g), palmitic acid (6.77 mg/100g), arachidic acid (4.86 mg/100g) and stearic acid (3.29 mg/100g).

DISCUSSION

Moringa oleifera was classified as protein source due to the high protein contents and has potential to improve nutrition, boost food security, foster rural development and support sustainable land care (National Research Council, 2006). Crude protein of soybean was

higher than the moringa seed while the oil yield of moringa was higher than that of soybean (USDA, 2007). Proteins are needed in the body for repair and replacement of worn-out tissues, serve as antibodies, primary sources of amino acids and the building block of cellular protein Adeleke and Odedeji (2010). The seed contain appreciable amount of crude fibre which aid in digestion process. It contributes to the bulk density which could help in the bowel movement, lower blood cholesterol and helps prevent cancer of the colon (Hung *et al.*, 2004). Antioxidant value observed was slightly higher than that of 37.94 mgAAEg⁻¹ reported by Ogbunugafor *et al.* (2011). Antioxidant fights against free radicals in the body thereby preventing cancer in human. It intercepts free radical and protects cells from the oxidative damage that leads to aging and disease (Olayinka *et al.*, 2012).

Table 1: Proximate and anti-oxidant composition of Moringa seed flour

Parameter	Value
Protein (%)	28.04±0.86
Fat (%)	45.84±0.42
Crude fibre (%)	7.73±0.10
Total anti-oxidant (mgAAEg ⁻¹)	38.12±0.09

The amount of amino acid in the flour was 77.43 g/100g which was higher than soybean (36.49 g/100g) and Africa pumpkin seed (48.60 g/100g) (USDA, 2007; WHO, 2003). Methionine had lower value (1.04 g/100g) in moringa seed flour. Moringa seed flour contained all the essential amino acid needed for growth and repairs of worn out tissues in the body. This corroborates the report of Olugbemi *et al.*, (2010) that *Moringa oleifera* is a good source of vitamins and amino acids

Table 2: Amino acid profile of *Moringa oleifera* seeds

Names	Amount g/100g of samples
Glycine	4.95
Alanine	3.03
Serine	4.50
Proline	2.28
Valine	3.14
Threonine	3.36
Isoleucine	4.36
Leucine	5.67
Aspartate	7.15
Lysine	3.19
Methionine	1.04
Glutamate	14.83
Phenylalanine	4.10
Histidine	2.40
Arginine	8.31
Tyrosine	2.66
cysteine	2.23
Total	77.43

The percentage (%) score of the essential amino acids in moringa seed was compared with those of the reference standard amino acids profile for foods established for pre-school children and adults by WHO/FAO/UNU (1985) (Table 3). The results indicated that most of the essential amino acids in moringa seed scored above 100% of the reference standard

value for adults established by WHO/FAO/UNU (1985). This showed that *Moringa oleifera* is a source of essential amino acids for adult. Leucine, lysine, valine and threonine of moringa seed had amino acid scores below 100 % indicating the limiting amino acid in pre-school children. The amino acid score of moringa seed compared well with beef and other protein sources such as peanut flour and soy protein. The chemical scores of beef ranged from 85-94 limiting in valine, aromatic amino acids while soy protein score ranged from 58-96 limiting in valine when compared with the FAO reference pattern (FAO/WHO, 1973, Seligson and Mackey, 1984). Chemical score for peanut flour ranged from 39 to 65 with lysine being the limiting amino acid (Seligson and Mackey, 1984).

Table 3: Amino acid score of *Moringa oleifera* flour

Essential amino acid	WHO Ideal protein		Amino acid concentration (g/100 g)	Percentage Amino acid score	
	Children	Adult		Children	Adult
Isoleucine	2.8	1.3	4.36	155.71	335.38
Leucine	6.6	1.9	5.67	85.91	298.42
Lysine	5.8	1.6	3.19	55.00	199.38
Total sulphur Amino Acid	2.5	1.7	3.27	130.80	192.35
Total aromatic amino acid	6.3	1.9	6.76	107.30	355.79
Threonine	3.4	0.9	2.66	98.82	373.33
Valine	3.5	1.3	3.14	89.71	241.54
Histidine	1.9	1.6	2.40	126.32	150.00

A = WHO/FAO/UNU ideal protein for pre-school children aged 2 to 5 years; B = WHO/FAO/UNU idea protein for adult. Percentage (%) amino acid score = (amino acid in sample/ideal) × 100. Source: WHO/FAO/UNU (1985).

Moringa seed oil contained higher value of unsaturated fatty acid and this compared well with the soybean oil and melon oil (WHO, 2003). The oil has four major unsaturated fatty acid including, oleic, linoleic acid, linolenic acid and Palmitoleic acid which are essential in human diet. Oleic acid was the predominant fatty acid in moringa oil with lower values in the saturated fatty acid composition. Oleic acid lowers the risk of heart attack and aids in cancer prevention. The oil serves as a good source of fat in human nutrition.

Table 4: Fatty acid profile of *Moringa oleifera* seed oil

Name	Amount mg/100g
Lauric acid	0.06
Myristic acid	0.14
Palmitic acid	6.77
Palmitoleic acid	1.11
Margaric acid	0.16
Stearic acid	3.29
Oleic acid	72.59
Linoleic acid	1.19
Linolenic acid	0.67
Arachidic acid	4.86
Behenic acid	7.33
Erucic acid	0.26
Lignoceric acid	1.56

CONCLUSION

Moringa seeds compared well with soybeans and other legumes in their nutritional value. It serves as good source of essential amino acids for adult and the fatty acid composition were predominantly the unsaturated types which are good for the body. The higher

antioxidant in the seed flour helps to fight the free radicals in the body thus preventing formation of cancerous cells.

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