

Proximate Analysis, Mineral Contents and Functional Properties of *Moringa Oleifera* Leaf Protein Concentrate.

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Abstract: Freshly harvested *Moringa oleifera* was authenticated and processed for its vegetable leaf protein concentrates and analysed for proximate composition, functional properties and mineral composition. The proximate analysis was evaluated using standard analytical procedures. The proximate analysis reveal the moisture content to be 9.00mg/100g, ash content 6.00mg/100g, crude fat 2.43mg/100g, crude fibre 5.43mg/100g, crude protein 39.13mg/100g and carbohydrate content is 38.21 mg/100g. The mineral content of the leaves indicated that Ca, Mg, Zn, Mn, and Na are the most abundant. The water absorption capacity, fat absorption capacity, emulsion capacity, foaming stability revealed good functional properties.

Keywords: Leaf Protein Concentrate, Proximate Analysis, Mineral Content, Functional Properties, Vegetable

I. Introduction

Recently, researchers have become convinced that nutrients found in fruits and vegetables do more than just prevent deficiency diseases for instance beriberi or rickets. The most publicized findings reveals that certain Vitamin or Vitamins precursors in produce, notably Vitamin C; beta carotene as well as polyphenols are powerful anti oxidants which are helpful in the prevention of muscular damage caused by oxidation process of some food substances that could lead to muscle degeneration, cardio vascular disease and cancer (Yonkers 1988 and Islam et,al 2002).

Furthermore, interest has grown in the utilization of what have come to be known as multipurpose plants. One such plant is *Moringa Oleifera* the most widely cultivated in Africa, Central and South America, Srinlanka, India, Mexico, Malayia, Indonesia and Philipines (FAO 1999).It is considered one of the worlds most useful tree, as almost all parts of this plant have been used for various treatments of ascites, rheumatism and venomous bites, and also as cardiac and circulatory stimulants.(Caceres et al 1992). Several parts of *Moringa Oleifera* have been reported to show antitumor,antinuclear, anti inflamatory, and antipyretic effects.

However, one of the challenges confronting under developed countries apart from epidemic and endemic disease is malnutrition. Malnutrition causes a great deal of human suffering and is associated with more than half of all deaths of children worldwide. Malnutrition severely impacts on the socio economic development of a nation because a work force that is stunted both mentally and physically may have a reduce work capacity. The consequence of poverty, poor health and poor nutrition has a multiplier effect on the general welfare of the population and also contributes significantly towards keeping a population in a downward trend of poverty and nutritional insecurity (Lowell 2006). .

The fact that *Moringa* leaf plays a role in fighting malnutrition in some parts of Africa; it is hardly consumed as a vegetable in the most Africa diet except by a few ethnic groups. Based on this, the present study examines the proximate composition, dietary minerals and functional properties of *Moringa oleifera* vegetable leaf protein concentrates.

II. Materials And Methods

Preparation of *Moringa* leaf protein concentrates: *Moringa oleifera* leafy vegetables were purchased from nearby farm settlement beside biological garden of Emmanuel Alayande College of Education in Oyo.

The leaves of the vegetable were plucked and the stems were trimmed. Leaf concentrates were obtained by pressing the leaves through the locally produced mincer. The pulped juice was separated from crushed fibre by passing the mixture through cotton cloth followed by pressing with a screw press.

The pulped green juice was coagulated by steaming between 80° c and 90° c in order to coagulate the leaf concentrate. The coagulants was then washed with water, pressed and air dried prior to chemical analysis; amino acid composition, functional properties and mineral content.

Proximate and mineral analysis:- proximate composition of the leaf protein concentrates were determined by adopting procedures of association of analytical chemist (AOAC 1995).

Mineral Analysis: The samples (1.0g) were weighed and subjected to dry ashing in a well cleaned proclaim crucible at 550°C in a muffle furnace. The resultant ash was dissolved in 5.0ml of HNO₃/ HCl/ H₂O (1:2: 3) and heated gently on a heating mantle until brown fumes disappeared. 5.0ml of distilled water was added to each of

the sample in crucible and heated until colourless solution was obtained. The mineral solution was filtered into a 100.0ml volumetric flask through filter paper, and the volume was made to the mark with distilled water. The solution was analysed in triplicate for its elemental composition using parking Elmer 403 model of atomic absorption spectro photometer (Adeyeye and Omotayo 2011).

Functional properties

Water and oil absorption capacity: The water and oil absorption capacity of samples were determined as described by a method (to determine water absorption capacity) or oil (to determine water oil absorption capacity) added to 100g samples in a centrifuge tube. The determination was carried out in triplicates. Foaming capacity and stability were determined by whipping of the sample with 50ml distilled water (Coffman and Garcia 1977).

III. Results and Discussion

Table 1: Proximate Composition of *Moringa Oleifera*

| | | |
|---------------|-------|-------|
| Moisture | 9.00 | ±2.30 |
| Ash | 6.00 | ±0.63 |
| Crude Fat | 2.43 | ±0.47 |
| Crude fibre | 5.43 | ±0.23 |
| Crude Protein | 39.13 | ±0.16 |
| Carbohydrate | 38.21 | ±0.31 |

Table 1 showed the results of proximate analysis of Moringa leaf protein concentrates. The result revealed that Moringa leaf protein concentrates contained appreciable amount of crude protein (39.13 ± 0.16) this value is higher than 17.01 ± 0.10 reported for moringa leaf by Ogbe and John 2012 and 27.51 ± 0.00 reported by Ibok et al.,2008. The values were however lower than 41.49 ± 0.01 , reported for *Cnidoscoulous acinitopholis* but greater than $8.44 \pm 0.05\%$ reported for *Solanum microcapon* leaf protein concentrates by Faboya et al., 2012. The presence of significant quantity of crude protein in Moringa means that Moringa leaf protein concentrates could be used as nutritionally valuable healthy ingredient to improve protein deficiency of man diet or animal.

Moisture value of *Moringa oleifera* leaf protein concentrates was $9.00 \pm 2.30\%$ lower than 76.53 ± 0.02 reported for moringa leaves but fall in range with 7.6 ± 0.6 and $6.6 \pm 0.6\%$ reported for *Telfeira occidentalis* and *Amarathus hybridus* leaf protein concentrates respectively (Adeyeye and Omotayo 2011). Moisture in food determines the rate of food absorption and assimilation within the body. It also determines the keeping quality of food. The reported value indicated that moringa oleifera leaf protein concentrates may not be stored at room temperature for a long period of time.

Ash content of *Moringa oleifera* is 6.00 ± 0.63 , Ash on food determine largely the extent of mineral matters likely to be found on food substance. The value was higher than those reported for vegetable species (Saidu and Adunbarin 1998) that is *Talium triangulare* (0.62)%, *Rosselle* (0.46)%, *Cochorus Olitorius* (0.32)% *Telfaira Oceidentalis* (0.68%) and *Amaranthus hybridus* (0.41)% the reported value of ash indicated that they were good source of mineral element.

Crude fat value of *Moringa oleifera* was $2.43 \pm 0.47\%$ higher than 0.5% reported for moringa Oleifera powder (Mensah et al., 2012) but fall in range with 2.73 ± 0.03 reported for *Moringa oleifera* (Ibok et al., 2008). Fat in food determine the amount of energy available. A diet providing 1-2% of its caloric energy as fat is said to be sufficient to human beings as excess fat consumption yields certain cardio vascular disorder such as atherosclerosis, cancer and aging (Davidson et al., 1975) and (Corel et al., 2002).

The value of crude fibre obtained for *Moringa oleifera* leaf protein concentrates was 5.43 ± 0.23 . The values was lower than 9.25 ± 0.007 reported for moringa leaf (Ibok et al., 2008) but higher than 3.5% reported for Moringa leaf meal (Elkhalifa 2007). The values were however higher than those reported by (Aletor and Fasuyi 1999) for *Amaranthus hybridus* which was 1.7. Fibre taken as part of diet cleanses the digestive tract by removing potential carcinogens from the body and hence prevents the absorption of excess cholesterol. Fibre also adds bulk to food and reduces the intake of excess starchy food which is the characteristics of the diet of the indigenes in this locality and hence guards against metabolic conditions such as hypertension and diabetics mellities.

Carbohydrate content of *Moringa oleifera* vegetable leaf protein concentrates is 3.82 ± 0.31 . The value was lower than that reported for Moringa leaf (Ibok 2008) but yet the proportion observed for Moringa leaf concentrates is adequate enough to meet the required energy. Carbohydrates and lipid are the principal sources of energy. The values of carbohydrates content in these samples per 100g can provide a lower calorie of energy.

Table II.
Mineral Composition of *Moringa Oleifera*

| Minerals | Concentration Mg/100g |
|----------|-----------------------|
| K | 23.20 ± 0.31 |
| Na | 214.00 ± 0.02 |
| Ca | 723.00 ± 0.04 |
| Mg | 677 ± 0.16 |
| P | 5.00 ± 0.12 |
| Fe | 187.00 ± 0.03 |
| Mn | 252.00 ± 0.15 |
| Cu | 55.00 ± 0.08 |
| Zn | 548.00 ± 0.04 |

Table II present the mineral constituents of *Moringa oleifera* vegetable leaf protein concentrates. Potassium concentration of $23.20 \pm 0.31\text{mg}/100\text{g}$ was obtained for moringa oleifera leaf protein concentrates. High amount of potassium in the body was reported to increase iron utilization (Adeyeye 2002) and beneficial to people taking dulretics to control hypertension and suffer from excessive excretion of potassium, through body fluid (Arinathan et al, 2003). The value is higher than $14.55 \pm 0.17\text{mg}/100\text{g}$ reported for astragalina leaves (Gafar et al, 2011). The recommended daily allowance of potassium is 2000mg for adults. (NRC 1989). *Moringa Oleifera* can contribute 1.16% of the recommended daily allowance.

Sodium concentration is $214.00 \pm 0.21\text{mg}/100$. Sodium is an important sources of electrolytes within the body. The recommended daily allowance of sodium is 500mg for adult (NRC 1989). This indicated that *Moringa oleifera* can contribute 42.8% of the recommended allowance.

Calcium and phosphorous containing substances are required by children, pregnant and lactating woman for bones and teeth development. The value of calcium is $723.00 \pm 0.14\text{mg}/100\text{g}$ and phosphorus is $5.00 \pm 0.12.\text{mg}/100\text{g}$ The value of calcium is close to the recommended daily allowance of 800mg per day for both adults and children (NRC 1989). While phosphorus is lower than the recommended daily allowance.

The concentration of magnesium is $677.00 \pm 0.16\text{mg}/100\text{g}$ this value is higher than the reported value of *Solanum microcapon* and *Cnidoscoulous acinitopholis*, leaf protein concentrates which are $88.60 \pm 0.21\text{mg}/100\text{g}$ and $98.30 \pm 0.61\text{mg}/100\text{g}$ respectively (Faboya et al 2012). The recommended daily allowance for magnesium for adult male is 350mg (NRC1989). This indicated *Moringa Oleifera* a leaf protein concentrates could furnish man with twice amount of required value of magnesium.

The iron concentration is $187.00 \pm 0.03\text{mg}/100\text{g}$. Iron required for the formation of haemoglobin and its deficiency leads to anaemia (Turan et al 2003) the value was higher than $28.97 \pm 0.04\text{mg}/100\text{g}$ reported for astragalina leaves (Gafar et al, 2011).

The concentration of Manganese is $252.00 \pm 0.15\text{mg}/100\text{g}$, copper concentration was $55.00 \pm 0.08\text{mg}/100\text{g}$ and zinc concentration was $548.00 \pm 0.04\text{mg}/100\text{g}$. The concentration of these three minerals were higher than the recommended daily allowance. Manganese is required for building immune system, regulation of blood sugar level and production of energy. Copper is also required in one body for enzyme production and biological transfer of electron within the body. Zinc plays a vital role in gene expression, regulation of cellular growth and acts as a co enzyme for carbohydrates, protein and nucleic acids metabolism. This indicated that moringa oleifera leaf protein concentrated would be adequate for a diabetic and fatigue patient.

Table III
Functional properties

| | |
|-----------------------------|--------|
| % oil absorption capacities | 111.72 |
| % FC | 14.00 |
| % FS | 2.00 |
| % EC | 37.00 |
| % ES | 63.00 |

AC – oil absorption capacity
FC – Foaming capacity
FS – Foaming Stability
EC – Emulsion capacity
ES – Emulsion Stability

Table III present functional properties of moringa oleifera leaf protein concentrates oil absorption capacity value of 111.72 is lower than 305.09 ± 0.42 reported for *Xanthosoma saggitifolia* but higher than

22.94 ± 0.14 reported for *laetucea caudatus* by (Faboya et al 2012). Oil absorption capacity plays a vital role in food formulation due to mouth feel of food (Kinsella 1976).

Foaming capacity 14.00% were closer to those reported for *Talium triangulare* (22.1), *Amaranthus cruentus* (18.9) and *Telfeira occidentalis* (19.2) protein concentrates by (Fasuyi 2006).

Emulsion capacity (37.00) and Emulsion stability (63.00) were higher than (4.00) emulsion stability reported for leaf protein concentrates for *Lactuca caudatus* but emulsion stability was lower than 45.00% reported by (Faboya et al 2012).

IV. Conclusion:-

Leaf protein concentrates of *Moringa oleifera* is nutritionally adequate and given the promising source of dietary minerals in most developing countries. It is however important to stress that leaf protein concentrates is not food on their own but it contains nutritional potential that could find application in food ingredient, infant formula, food supplement and food formulation.

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