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Research Article

Phytochemical Screening, Proximate and Mineral Analysis of *Moringa Oleifera* Leaf in Kano, Northern Nigeria

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Abstract

Plants generally contain chemical compounds both nutritional and non-nutritional which may be used and applied in nutritional and pharmaceutical industries. The study was aimed to evaluate phytochemical constituents and to determine the nutritional components of *Moringa oleifera* in Kano, Northern Nigeria. The leaves were air dried for two weeks, then grounded into a fine powder and extracted using water and ethanol by maceration. The extract was subjected to phytochemical screening, proximate and mineral analysis using conventional laboratory methods. The result of phytochemical screening showed that the Moringa leaf extract contained alkaloid, saponins and flavonoids, reducing sugar, glycoside, anthraquinones, tannin and terpenoids. The proximate composition of the leaf presented as carbohydrate with 59.86%, protein 15.23%, fats 2.38%, crude fibre 9.26%, moisture content 4.42% and ash content 8.85%. The result of mineral analysis showed that the leaf of *Moringa oleifera* contain calcium (1.93%), potassium (0.95%), magnesium (0.39%), zinc (59.37ppm), phosphorous (28.85ppm), iron (105.20ppm) and copper (7.05ppm). The presence of the phytochemicals and nutrients in *Moringa* leaf has authenticated its usefulness by traditional herbalists in ethno medicine and potentials in drug formulation and as well used as food supplement.

Keywords

Mineral Analysis; *Moringa Oleifera*; Phytochemical; Proximate Analysis

Introduction

Today, there is increase in human population in the world which is greatly accelerating requirement, which subsequently threatens environmental conservation and increasing the gap between the availability and accessibility of resources as well as meeting of human necessities, hence, the depletion of natural resources. Plant scientists are therefore exploring and investigating good quality fodders that can fulfill the life necessities of both human beings and livestock in an economical way without degrading natural resources. Over the last few years, under-utilized crops and trees have captured the attention of plant scientists, nutritionists, and growers [1].

Moringa oleifera Lam., popularly called the "miracle tree" is a monogenetic plant in the family Moringaceae. It has long been cultivated and all its parts been consumed and used for a variety of purposes across the tropics [2]. This is because if its impressive range of nutritional and medicinal values [3]. It is the most widely cultivated species of a monogeneric family. The Moringaceae that is native to the sub-Hamalayan tracks of India, Pakistan Bangladesh and Afghanistan. It is widely grown and cultivated in the northern part of Nigeria where it is locally called Zogale among the Hausa speaking people. The leaves are considered to offer great potential for those who are nutritionally at risk and may be regarded as a protein and calcium supplement [4]. Plants are the richest sources of drugs for traditional and modern medicines [1]. The medicinal value of *Moringa oleifera* is due to the presence of bioactive components called phytochemicals. Bamishaiye *et al.* [5] found that the leaves extract of the plant

contains alkaloids, tannins, phenolics, saponins, flavonoids and steroids. The leaves and green fresh pods are used as vegetables by man and are rich in carotene and ascorbic acid (vitamin C) with a good profile of amino acids [6]. They are also used in livestock feed and the twigs are reported to be very palatable to ruminants [7]. The leaves of the plant are edible in nature and very nutritious and hence, consumed in Nigeria as vegetable.

Nutritional analysis indicates that *Moringa* leaves contain a wealth of essential disease preventing nutrients which make it suitable to be included in diets as food supplement [8]. *Moringa* leaves have been used to combat malnutrition, especially among infants and nursing mothers and hasten uterine contraction during child birth in pregnant women [9]. It has been reported that the leaves of the plant contain the following mineral compositions; sodium (11.86), potassium (25.83), calcium (98.67), magnesium (107.56), zinc (148.54), iron (103.75), manganese (13.55) among others in parts per million and nutrients such as carbohydrate (45.43%), protein (16.15%), fat (9.68%), crude fibre (9.68%), moisture (11.76%) and ash (10.64%) [9].

In ethnomedicine, *Moringa oleifera* leaves have been used by local traditional healers in treatment of various diseases such as diarrhea dysentery and skin infection. In certain case of diabetes, *Moringa* can also use to stabilize sugar level and can stabilize arterial tension. The leaves have been found to possess antitumour, antipuretic, antiepileptic, antiflammatory, anti-ulcer, antispasmodic, diuretic and antihypertensive and antioxidant properties [10]. In this view, the study was aimed to evaluate the phytochemical compositions and determine the nutritional components of *Moringa oleifera* in Kano, Northern Nigeria.

Materials and Methods

Collection and Identification of Plant's Leaves

The plant's leaves used in this study were obtained from *Moringa* trees from garden at Sabon-titi along Panshekara road in Kano metropolis. Identification and authentication of the plant's leaves was done at Herbarium in the Department of Plant Science, Bayero University Kano with the following voucher number BUKHAN 011 and voucher specimen were deposited in the herbarium for references. The leaves were dried in the shade for 2 weeks, then grounded into fine powder under laboratory condition using sterile pestle and mortar and stored in air tight container for further use.

Extraction of *Moringa oleifera* Leaf

Distilled water and ethanol were used for extraction process. For water extraction, 25 g of each of the grounded leaf was extracted by successive soaking for 3 days using 250 mL of distilled water in a sterile conical flask [11]. The extracts were filtered using Whatman filter paper and the filtrate was evaporated to dryness in water bath until a solid residue is obtained. The solid concentrated filtrate (now the extract) was then stored in universal bottles in the refrigerator at 4°C before use. For ethanol extract, 25 g of the powdered plant part was extracted by soaking the powder in 250 mL of ethanol for 2 days with intermittent shaking [11]. The mixture was filtered using Whatman No.1 filter paper and the filtrate was evaporated to dryness using rotary evaporator until solid residue is obtained. The solid residues were reconstituted in 30% DMSO at stock concentration, stored in the refrigerator at until used.

Phytochemical Screening

Phytochemical screening of the extracts was conducted to ascertain the presence of bioactive component present in the leaves of *Moringa oleifera*. Presence of alkaloid, saponin, glycoside, tannin, flavonoids, steroid, terpenoid, phenol, anthraquinones and reducing sugar were determined using procedure described by Sofowora [12].

Proximate Analysis

Proximate analysis of the *Moringa* leaves was conducted to determine the ash content, crude protein, crude fibre, crude lipid, carbohydrate and dry matter using methods described by Udo and Oguwele [13]; James [14] and Association of Official Analytical Chemist (AOAC) [15]. The proximate parameters were expressed in percentage (%).

Mineral Analysis

The mineral composition of the leaves including potassium (K), calcium (Ca), magnesium (Mg), zinc (Zn), phosphorous (P) and iron (Fe) were determined using the atomic absorption spectrophotometer, as described the methods of AOAC [15]. Phosphorus was determined colorimetry method. Calcium, magnesium and potassium were recorded in percentage while iron, zinc, phosphorus, manganese and copper were recorded in parts per million (ppm).

Results

Phytochemical Screening

The result of phytochemical constituent of *Moringa oleifera* aqueous and ethanol leaves extracts is presented in (Table 1). The results indicate the presence of alkaloid, saponins, and flavonoids, reducing sugar, glycoside, anthraquinones, tannin and terpenoids.

Proximate Analysis

The qualitative and quantitative proximate analysis of *Moringa oleifera* leaves is presented in (Table 2) below. The qualitative proximate composition of whole leaf extract of *Moringa oleifera* in g/100g showed the extract contain carbohydrate, protein, fats, fibre, moisture and ash while the quantitative analysis result was presented as carbohydrate with 59.86%, protein 15.23%, fats 2.38%, crude fibre 9.26%, moisture content 4.42% and ash content 8.85%.

S/N	Phytochemicals	Test	Aqueous extract	Ethanol extract
1	Alkaloid	Wagner's test	+	+
2	Saponin	Foam test	+	+
3	Phenol	Ferric chloride test	-	-
4	Flavonoid	Lead acetate test	+	+
5	Glycoside	Fehling test	+	+
6	Tannin	Gelatin test	+	+
7	Reducing sugar	Fehling test	+	+
8	Anthraquinone	Benzene test	+	+
9	Steroid	Acetic test	-	-
10	Terpenoid	Salkowski test	+	+

Key: + = Presence of phytochemical, - = Absence of phytochemical.

Table 1: Phytochemical composition of *Moringa oleifera* aqueous and ethanol leaf extracts.

S/N	Nutrient	Composition (%)
1	Carbohydrate	59.86
2	Protein	15.23
3	Fats	2.38
4	Crude fiber	9.26
5	Moisture content	4.42
6	Ash content	8.85

Table 2: Proximate Analysis of Moringa oleifera Leaf.

Mineral Analysis

The mineral analysis of *Moringa oleifera* leaves is presented in Table 3. The mineral composition analysis of the leaves indicate the presence of calcium (1.93%), potassium (0.95%), magnesium (0.39%), zinc (59.37ppm), phosphorous (28.85ppm), iron (105.20ppm) and copper (7.05ppm)

S/N	Mineral	Composition (%)
1	Potassium (%)	0.95
2	Calcium (%)	1.93
3	Magnesium (%)	0.39
4	Zinc (ppm)	59.37
5	Phosphorous (ppm)	28.85
6	Iron (ppm)	105.2
7	Copper (ppm)	7.05

Table 3: Mineral Analysis of *Moringa oleifera* Leaf.

Discussion

Phytochemicals are secondary metabolites and non-nutritive chemicals produced by plant that possessed protective and diseases preventive properties. The finding of this study revealed that the *Moringa* leaves extract contain alkaloid, saponins, flavonoids, reducing sugar, glycoside, anthraquinones, tannin and terpenoids. Several studies were conducted to screen for phytochemical components of *Moringa* leaves. The findings of the present study were in conformity with several studies conducted to study phytochemical composition of *Moringa* leaves extracts [16,17]. The phytochemicals possessed several medicinal properties and hence, used in pharmaceutical industries for manufacture of drugs. Therefore, the presence of these bioactive components in *Moringa* leave extracts could account for the medicinal properties of the leaves for treatment of various diseases such as atherosclerosis, arthritis, diabetes nausea, asthma, skin antiseptic, diarrhea, dysentery, colitis and cancer. Alkaloids comprising a large group of nitrogenous compounds are widely used as cancer chemotherapeutic agents, anaesthetics and Central Nervous Stimulants [16,18]. Alkaloids are known to play some metabolic roles and control development in living system [17,19]. Flavonoids have been shown to have antifungal activity *in vitro* [20]. The flavonoids induce mechanisms that may kill cancer cells and inhibit tumor invasion [21]. The potent antioxidant activity of flavonoids reveals their ability to scavenge hydroxyl radicals, superoxide anions and lipid peroxy radicals, this may be the most important function of flavonoids [22].

Saponins have been shown to possess both beneficial (cholesterol lowering) and deleterious (cytotoxic; permeabilization of the intestine) properties [23,24]. Studies have illustrated the beneficial effects of saponin on blood cholesterol levels, cancer, bone health and stimulation of the immune system. Due to its ability to form froth, soap is being produced locally from it for bathing. Tannins are polyphenols that are obtained from various parts of different plants belonging to multiple species. Tannins can also be effective in curbing hemorrhages as well as restrict bare swellings. While tannins are proved haemostatic, they are also beneficial when applied on mucosal coating in mouth. Hence, herbs possessing tannins are widely used as mouthwashes, eyewashes, snuff and even as vaginal douches and also treat rectal disorders

[25]. Terpenoids have been found to be useful in the prevention and therapy of several diseases, including cancer. Terpenoids are also known to possess antimicrobial, antifungal, antiparasitic, antiviral, anti-allergenic, antispasmodic, antihyperglycemic, anti-inflammatory and immunomodulatory properties [26].

The results of the present study indicate that the qualitative proximate composition of leaf extract of *Moringa oleifera* contain carbohydrate, protein, fats, fibre, moisture and ash while the quantitative analysis result was presented as carbohydrate with 59.86%, protein 15.23%, fats 2.38%, crude fibre 9.26%, moisture content 4.42% and ash content 8.85%. This indicated the higher content of carbohydrate when compared to the rest. The higher carbohydrate content may be useful in making *Moringa oleifera* leaf a good source of energy for the body. The presence of moisture, ash, lipid and protein in of *Moringa oleifera* leaf suggests that *Moringa oleifera* leaf maybe useful for body building, prevention of ageing while the high dietary crude fibre content will help in bowel movement. This important nutrient composition in *Moringa* leaves provide a justification that the leaves could be used as food. Finding of this study indicated low fat content in *Moringa* leaf, and low-fat foods are known to reduce cholesterol level [27]. This result was inconformity with that of Bamishaiye *et al.* [5] who found *Moringa* leaf to contain carbohydrate (55.14%), moisture (6.3%), protein content (28.08%), crude fiber (10.11%), ash (9.25%), fat (2.5) and pH (6.27).

According to the result of this study, the mineral analysis of *Moringa* leaf extract contained some important essential minerals, calcium (1.93%), potassium (0.95%), magnesium (0.39%), zinc (59.37ppm), phosphorous (28.85ppm), iron (105.20ppm) and copper (7.05ppm). The presence of such minerals in the leaves of *Moringa oleifera* could be utilized as a nutritionally valuable and healthy ingredient for food. These mineral elements could be valuable in improving immune system and preventing malnutrition related diseases. Mineral elements are required for normal growth, activities of muscles and skeletal development (such as calcium), cellular activity and transport of oxygen (copper and iron), chemical react ion in the body and intestinal absorption (magnesium), fluid balance and nerve transmission (sodium and potassium), as well as the regulation of acid-base balance (phosphorus). Iron is useful in prevent ion of anemia and other related diseases [28]. Manganese plays a role in energy production and in supporting the immune system [29]. Zinc is useful for protein synthesis, normal body development and recovery from illness [29].

Conclusion

Based on the findings of the present study, the present study, phytochemical constituents, proximate and minerals components of *Moringa oleifera* leaf were determined. The phytochemical components of *Moringa* leaf contain alkaloid, saponins, and flavonoids, reducing sugar, glycoside, anthraquinones, tannin and terpenoids. The results of the proximate and mineral analyses of the whole leaf indicated the presence of considerable amount of nutrients. The presence of the phytochemicals has authenticated its usefulness by traditional herbalists in ethno medicine and potentials in drug formulation and development. In addition to that, the presence of nutrients proves why leaves of *Moringa* can be used as food supplement.

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