



Comparatives Study Of Proximate, Mineral And Phytochemical Composition Of Selected Medicinal Plant Used As Phytogenic Feed Additive

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ABSTRACT

The result of the proximate analysis of the various leaf meal indicated that *Moringa oleifera* had the highest crude protein content of 22.51 percent, a crude ash content of 14 percent and ether extract of 0.80 percent respectively. *Spondiummombin* leaf meal had the highest crude fiber content of 20 percent. The mineral analysis showed that *Azadirachta indica* leaf meals had the highest calcium level of 0.5 percent, magnesium 0.04, potassium content of 121.33 parts per million and sodium content of 60 parts per million. The photochemical analysis of the various leaf meal revealed that *Azadirachta indica* leaf meal had the highest concentration of, phytate 1.50 oxalate 2.10 and tannin 0.089 respectively. *Moringa* leaf meal contained the least levels of oxalate at 0.68 and saponin 9 percent. While *Spondiummombin* had the highest concentration of saponin, and the least concentration of phytate at 1.20 and tannin at 0.013 percent respectively. The results indicated that the various leaves meals evaluated contained varying amount of the proximate, minerals and phytochemicals substances, hence, their regular use are recommended.

INTRODUCTION

Phytogenic growth enhancers, also known as natural growth enhancers or non-antibiotic growth enhancers, are extracted from herbs, spices, or other plants and used as feed additives. Aromatic herbs and spices are supplied to feed or water due to their quantity of chemicals with antibacterial, antiviral, and antioxidant effects (Burt, 2004; Karásková et al. 2015).

In order to boost production, animal feed is supplemented with phytogenic feed additives that enhance digestibility, nutrient absorption, and pathogen elimination from the animal's stomach. Phytogenic additives can promote digestion by enhancing saliva production, the functions of the liver, pancreas, and intestines' enzymes, as well as gut function, morpho histology, and metabolism (Mendel et al. 2017; Abdelli et al. 2021). The use and application procedures of phytogenic feed additives may differ significantly depending on the botanical source, processing, and composition. However, being a relatively new class of feed

additives, there is currently a dearth of knowledge regarding their applications and uses. Natural growth enhancers (NGPs), also referred to as non-antibiotic growth enhancers, are a class of feed additives that go by the name "phytochemicals." Both plants and plant extracts are used to produce these NGPs. Essential oils make up these extracts from plants (Windisch et al. 2008). They are frequently viewed as effective substitutes for antibiotic growth enhancers (AGPs) in the production of poultry feed additives (Windisch et al. 2008).

The bulk of phytogenic feed additions are extracts from plant materials such flowers, buds, seeds, leaves, twigs, bark, herbs, timber, fruits, and roots. When compared to synthetic antibiotics or inorganic compounds, these substances of plant origin are thought to be natural, less harmful, residue-free, and the best feed additives for animals (Swelum et al. 2021). Phytochemicals have antimicrobial, antifungal, antiparasitic, antiviral, antitoxicogenic, and insecticidal properties (Kholif et al. 2021). In addition to extracts or essential oils, phytogenic feed additives can be available in solid,

dry, and powdered forms. Animals have used plants, herbs, vegetables, fruits, and other natural materials to treat a range of diseases in their natural habitat. The discovery and application of such natural materials will aid in the successful replacement of laboratory-made antibiotics, saving the Nigerian government millions of dollars in annual chicken medicine imports (Igugo R U 2022).

Description of the study area.

The study was carried out at the Agbani campus of the Enugu State University of Science and Technology (ESUT). The address is 450 meters above sea level, at 670 4 North Latitude and 803 East Longitude (Anikwe et al. 2017). The region receives between 1700 and 2010mm of rainfall per year. The rainy season runs from April to October, and the dry season runs from November to March, creating a bimodal climate pattern. According to Anikwe et al. (2017), the soil has an isohyperature regime and is classified as a typical paleudult of the Order ultisol (Anikwe et al.2016).

Experimental materials and Preparation

The *Moringa oleifera* (drum stick) and *Azadirachta indica leaves*(neem) were collected from ESUT commercial farm premises while *Spondiasmombin* leaf was collected from Umueze in Nkanu West Local Government Area, Enugu State. The leaves were dried on a well cleaned cemented floor. They were evenly spread and regularly turned to encourage fast and even drying. To make each leaf meal, the leaves were ground separately using a hammer mill when they were crispy while still retaining the greenish coloration. Various leaf samples were analysed to determine their proximate composition, mineral profile, and phytochemical composition. The analysis was conducted at the Animal Science Laboratory, University of Nigeria, Nsukka.

Proximate analysis

By drying the sample at 105°C in an oven until a consistent weight was attained, the moisture content was ascertained. The leaves samples were weighed and converted to dry ash in a muffle furnace at 450 and 550°C for incineration in order to determine the overall ash content. Using a Soxhlet equipment and hexane extraction, the crude fat content was measured. These

determinations were made in accordance with the AOAC (2006). The estimation of crude protein was done using the Kjeldahl method. The amount of carbohydrates was calculated by subtracting the sum of each proximate composition from 100 percent. Carbohydrate, protein, and fat levels were multiplied by the corresponding Atwater conversion factors of 17, 17, and 37 to produce energy values (Kilgour, 1987).

Minerals analysis

In accordance with Martin-Prevel et al. (1984) mineral analyses were performed. The concentration of calcium, sodium, potassium, and magnesium was evaluated using an atomic absorption spectrophotometer. On a dry matter basis, the concentration of each element in the sample of leaves was determined.

Phytochemical analysis

Afrosimetric saponin quantification was done while phytochemical analysis was carried out to evaluate the presence of phytate, saponin, flavonoid, tannin, and oxalate (Koziol, 1991). Flavonoid contents were determined using the gravimetric technique (Haborne, 1993). Triplicate samples were used for all analyses.

The analysis of the leaf meals used in the feeding trials is presented in Table; 1

Table; 1 Proximate composition of selected medicinal plant leaf meals

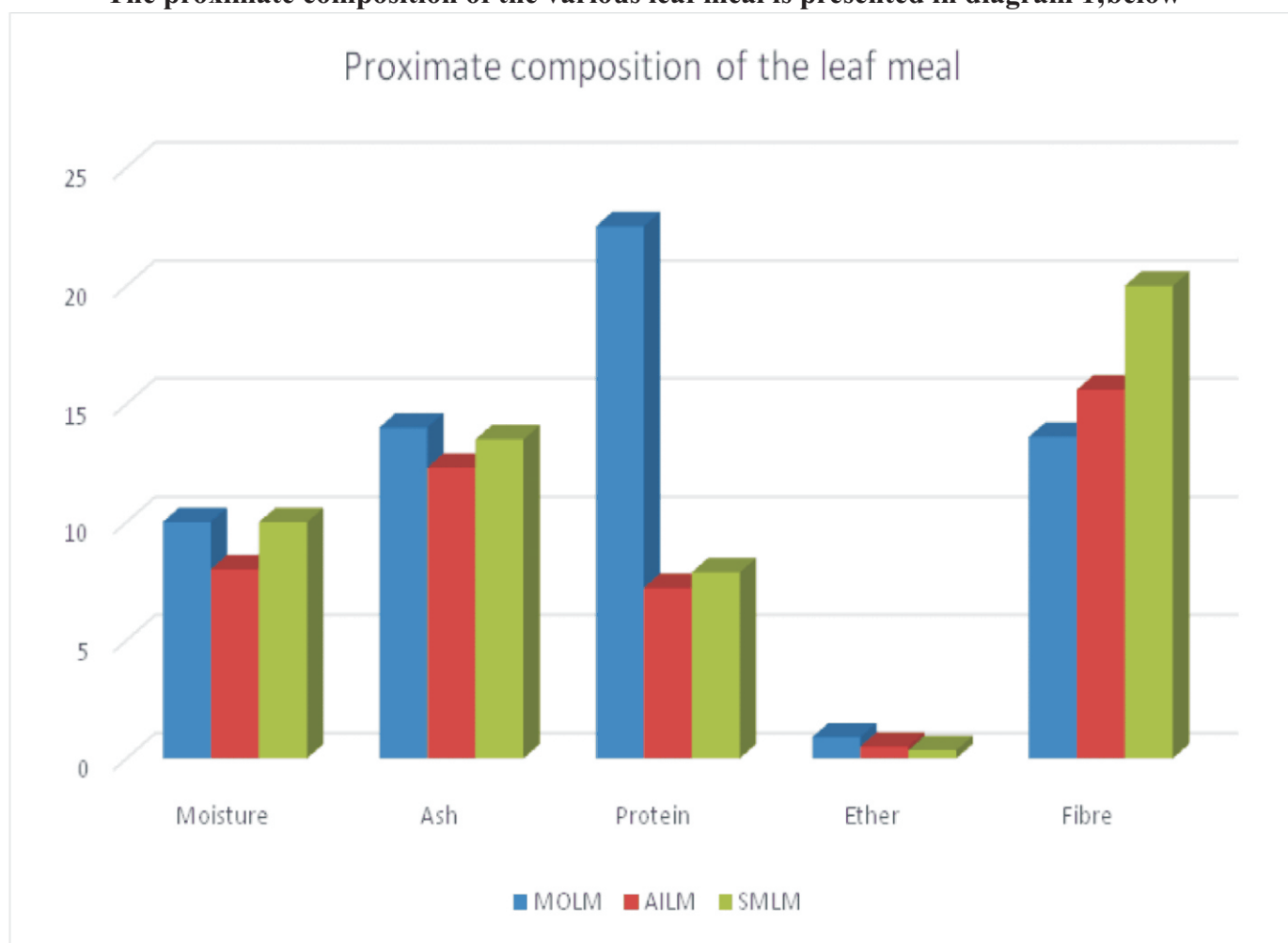
| Composition (%) | T ₂ | T ₃ | T ₄ |
|-----------------|----------------|----------------|----------------|
| | MOLM | AILM | SMLM |
| Moisture | - 10.00 | 8.00 | 10.00 |
| Ash | - 14.00 | 12.30 | 13.50 |
| Protein | - 22.51 | 7.32 | 7.88 |
| Ether | - 0.90 | 0.50 | 0.35 |
| Fibre | - 13.60 | 20.60 | 15.60 |

MOLM *Moringa oleifera* leaf meals.

AILM *Azadirachta indica* leaf meals.

SMLM *Spondiasmombin* leaf meals

The proximate composition of the various leaf meal is presented in diagram 1;below



Moisture

The proximate composition of the leaf meals showed that (T₆) 2.5 percent combination of *Moringa oleifera* and *Spondiasmombin* had the highest moisture content of 17.50, this was followed by (T₈) 1.6 percent combination each of *Moringa oleifera* + *Azadirachta indica* and *Spondiasmombin* leaf meals (16.50), this was closely followed by (T₅) being 2.5 percent combination each of *Moringa oleifera* and *Azadirachta indica* leaf meals (12.50), the 2.5 percent combination each of *Azadirachta indica* and *Spondiasmombin* had a moisture content of 10.60 percent, while 5 percent level only of *Spondiasmombin* had a moisture content of 10 percent.

Moringa oleifera leaf meal analysis at 5 percent level had a moisture content of 10 percent, while (T₃) 5 percent inclusion level of *Azadirachta indica* had the least moisture content of 5 percent.

The analysis indicated that the moisture content of T₆, T₈ and T₅ is high. This high moisture content of these leaf meals samples indicates that they may be easily susceptible to spoilage if not well preserved (Omorieg and Osagie, 2011).

Ash

The ash content of the leaf meals showed that T₂ (14 percent) had the highest ash content followed by T₄ (13.50), T₃ (12.30), T₇ (10.00), T₅ (9.00), T₆ (8.00) and T₈ (7.00) percent respectively. The ash content of T₂, T₄, and T₃ was high. The high ash content denotes the high mineral elements present in the sample; therefore, these leaf meals contain a good amount of mineral (Abiodun et al. 2017).

Protein

The crude protein content of the leaf meals, as shown by the proximate analysis, showed that T₂ had the highest crude protein content of about 22.51

percent. This was followed by T₅ (20.55 percent), T₈ (20.11 percent), T₆ (19.70 percent), T₇ (16.60 percent), T₄ (7.88 percent) and least for T₃ with a crude protein content of 7.22 percent. The crude protein content of T₂, T₅, T₈ and T₆ were high, thus showing that it is an excellent source of protein because it gives over 12 percent of the caloric value from protein.

Ether extract

The oil content of the leaf meals was highest for T₅ (1.03 percent), T₂ (0.90), T₈ (0.85), T₃ (0.50), T₆ (0.45), T₄ (0.33) and T₇ (0.29) respectively. The crude fat of the test ingredients was low in all the test ingredients except for T₅. Crude fat through rich

in energy and enhancing taste deteriorates with time, giving rise to rancid taste or smell. Crude fat is also implicated in certain cardiovascular disorders (Anitia et al. 2006).

Fibre content

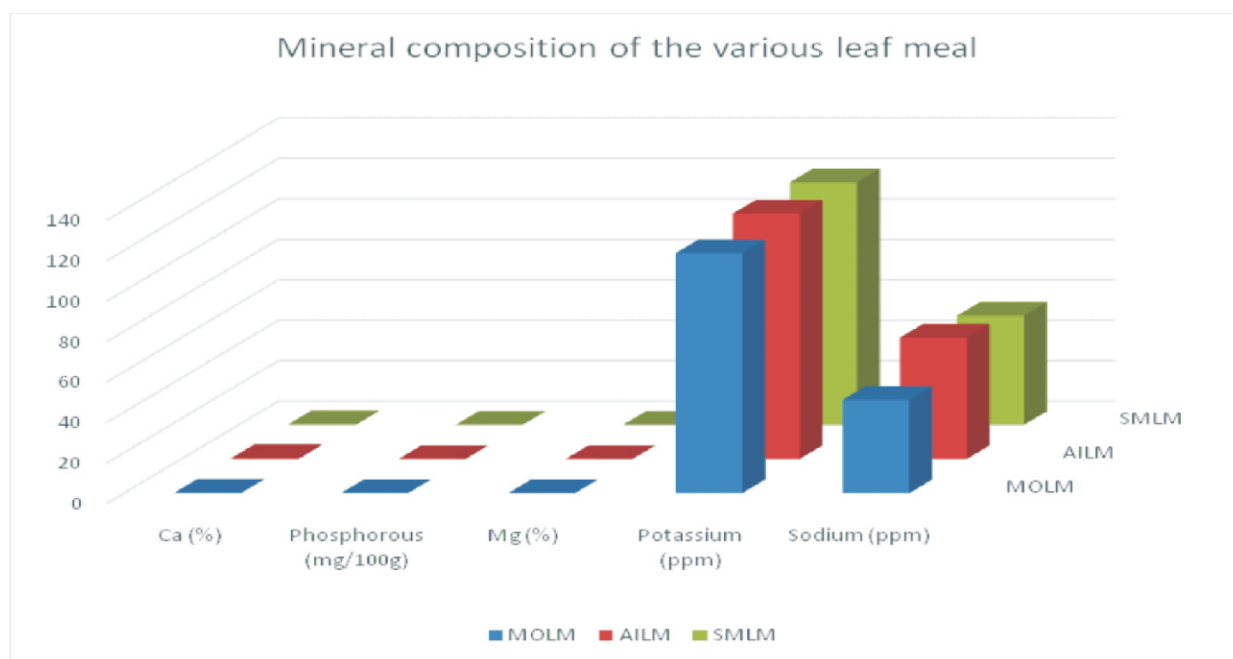
The result of the proximate analysis showed that the fibre content of the leaf meals was highest for T₃ (20.0) followed by T₄ (15.60), T₂ (13.60), T₇ (10.00), T₅ and T₈ (9.00) each respectively and T₆ (7.00) percent respectively. The high fibre content of T₄, T₃ and T₂ makes them an excellent source of dietary fibre. Fibre can lower the serum cholesterol level, heart disease, constipation, lowers blood sugar and a certain form of cancer (Ishida et al. 2000).

The mineral analysis of the leaf meals used in the study is presented in Table 4.2 below;

Table 2:: Mineral composition of the leaf meals

| Composition | MOLM | AILM | SMLM |
|-----------------------|--------|--------|--------|
| Ca (%) | 0.12 | 0.50 | 0.44 |
| Phosphorous (mg/100g) | 0.089 | 0.45 | 0.089 |
| Mg (%) | 0.009 | 0.04 | 0.035 |
| Potassium (ppm) | 118.60 | 121.33 | 120.00 |
| Sodium (ppm) | 46.00 | 60.00 | 54.00 |

MOLM *Moringa oleifera* leaf meals.
 AILM *Azadirachta indica* leaf meals.
 SMLM *Spondiasmombin* leaf meals



Calcium

The mineral composition of the leaf meals showed that the calcium content of the *Azadirachta indica* leaf meals was highest at 0.50 percent followed by 0.44 percent of *Spondiasmombin* leaf meals, while the least content of calcium of 0.12 percent of *Moringa oleifera* was the least. Calcium is involved in blood coagulation, maintenance of cell integrity and intracellular cement substance (Okaka and Okaka, 2001). Calcium also helps in regulating muscle contraction and young animals and foetuses for developing healthy bones and teeth (Oluyemi et al. 2006). Calcium deficiency is characterized by decalcification and rickets in animals, predisposing them to bone weakness, fractures and in laying hens it causes a decrease in laying.

Phosphorus

The phosphorous content of *Moringa oleifera* and *Spondiasmombin* leaf meals is 0.089ppm respectively, while neem leaf meals is 0.045ppm. Phosphorus plays a key role in normal kidney functioning and transferring nerve impulses (Igile et al. 2013). Phosphorus deficiency is associated with bone problems, decreased growth and appetite, and reduced productive performance.

Magnesium

The magnesium level of the leaf meals was 0.036 ppm for *Spondiasmombin*, 0.09 ppm for *Moringa oleifera* leaf meals and 0.04 ppm for neem. The magnesium content of all the leave

meals was the same for those reported by Aginde et al.(2003). Magnesium is important in most reactions involving phosphate transfers, essential in the structural stability of nucleic acid and intestinal absorption of electrolytes in the body (Igile et al. 2013). Magnesium deficiency can cause acute neuromuscular problems, characterized by incoordination or convulsions.

Potassium

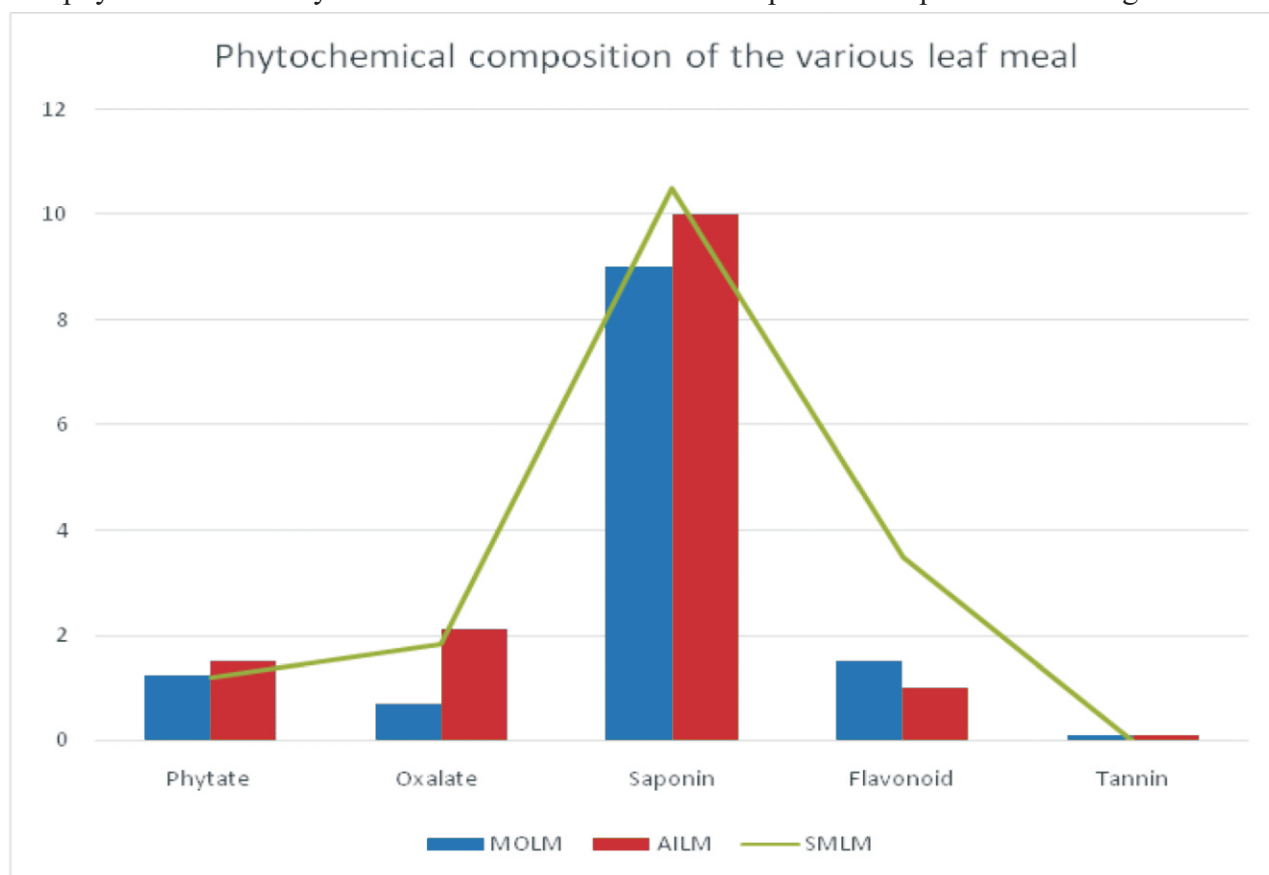
The mineral analysis of the leaf meals showed that the potassium content of neem is 121.33 (ppm) while that of *Spondiasmombin* and *Moringa oleifera* leaf meals is 120 and 118.60 (ppm) respectively. Potassium plays an important role in maintaining body weight and regulates water and electrolyte balance in the body and tissue (National Research Council, 1989). Potassium deficiency is associated with muscle problems such as weakness or tetany, as well as changes in feed intake habits.

Sodium

The result of the sodium content of the leaf meals showed that Neem contained 600ppm while *Spondiasmombin* and *Moringa oleifera* contained 54.00 and 46ppm, respectively. The sodium content was low for all the leaf samples. This shows the usefulness of all the leaf meals in treating heart-related diseases (Ayinde et al. 2003). Common deficiency symptoms are Lack of appetite, a decline in growth, loss of weight and production, decreased blood levels

Phytochemical composition

The phytochemical analysis of the leaf meals used in the experiment is presented in diagram 2:



Table; 3 Phytochemical composition of the various leaf meals

| Composition (%) | MOLM | AILM | SMLM |
|-----------------|-------|-------|-------|
| Phytate | 1.25 | 1.50 | 1.20 |
| Oxalate | 0.68 | 2.10 | 1.85 |
| Saponin | 9.00 | 10.00 | 10.50 |
| Flavonoid | 1.50 | 1.00 | 3.50 |
| Tannin | 0.078 | 0.089 | 0.013 |

MOLM *Moringa oleifera* leaf meals.

AILM *Azadirachta indica* leaf meals.

SMLM *Spondiasmombin* leaf meals

Phytate

The result of the phytochemical analysis of the leaf meals indicated that; the phytate content was highest for Neem (1.50) percent followed by *Moringa oleifera* leaf meals (1.25) percent and least for *Spondiasmombin* (1.20) percent. Though phytate is an anti-nutritional substance, it also reduces digestion of starch and the absorption of sugar from feed, which helps modulate blood sugar

levels (Awoyinka et al. 2007). Additionally, phytic acid influences how fats are digested and how cholesterol is made, and it reduces the risk factors for cardiovascular disease (Pearson, 1976).

Oxalate

According to the phytochemical component of the various leaf meal. Neem leaf meals had the highest oxalate level (2.10), followed by

Spondiasmombin leaf meals with an oxalate content of 1.85 percent, and *Moringa oleifera* leaf meals with an oxalate content of 0.68 percent. At gut pH, oxalate salts are weakly soluble, and oxalate has been shown to reduce calcium absorption in monogastric animals. Oxalate, for example, binds to calcium to form complexes (calcium oxalate crystals). By preventing the body from receiving and using calcium, these oxalate crystals cause diseases including rickets and osteomalacia. When calcium crystals grow around the kidney's tubules, renal stones may develop. The creation of oxalate crystals is assumed to occur in the digestive system. Because oxalate makes calcium available to the body, it is problematic in legumes because high-oxalate diets increase the risk of renal calcium absorption. (Traore et al. 2000; Morrissey and Osbourn, 1999).

Saponin

The saponin concentration of *Spondiasmombin* leaf meals was 10.50 percent, while Neem contains 10 percent and *Moringa oleifera* leaf meals contained 9 percent, according to the phytochemical analysis of the leaf meal. Saponin has antibacterial properties, suppresses mildew, and protects plants from insect attacks. Saponin mixture present in plants and plant products possesses diverse biological effects when present in an animal body.

Numerous studies have demonstrated that saponins' membrane-permeabilizing, immunostimulant, hypercholesterolemic, and anticarcinogenic properties affect animal development, feed intake, and reproduction (Morrissey and Osbourn, 1999; Takechi et al. 1999; Traore et al. 2000).

Flavonoid

The flavonoid content of the leaf meals is 3.50 percent for *Spondiasmombin* leaf meals, 1.50 percent for *Moringa oleifera* leaf meals and 1 percent for Neem leaf meals. Flavonoids have gained recent attention because of their broad biological and pharmacological activities in these orders.

Numerous biological effects of flavonoids have been noted, including antibacterial, cytotoxic, anti-inflammatory, and antitumor actions. Nearly all groups of flavonoids are well known for their ability to function as potent antioxidants that can

defend the body against free radicals and reactive oxygen species. Atmani et al. (2009); Tapas et al. (2008). Flavonoids have been found to offer a wide range of beneficial qualities, including anti-inflammatory, enzyme-inhibiting, antibacterial, oestrogenic, anti-allergic, antioxidant, vascular, and cytotoxic antitumor action.

Tannin

The phytochemical analysis of the various leaf meals showed that Neem leaf meal contained the highest level of tannins (0.089) percent, followed by *Moringa oleifera* leaf meals 0.078 percent and 0.013 percent contained in *Spondiasmombin* leaf meals.

Tannins are secondary metabolites that are widely present in leaves, fruits, and bark. It is well known that complexes between proteins and tannins' hydroxyl and carbonyl groups can reduce protein digestion and inhibit the body from using crucial minerals and amino acids (Dolara et al. 2005; Serrano et al. 2009). In nature, there are two distinct types of tannin groups: (a) hydrolysable tannins, which are composed of gallotannins and ellagitannins, and (b) condensed tannins, which are composed of proanthocyanidin.

Tannins from plants have long been extracted and used as astringents, diuretics, and efficient treatments for stomach and duodenal tumours. They are also utilized in medicines for antiseptic, antioxidant, and hemostatic purposes (De Bruyne et al. 1999; Dolara et al. 2005). Consumption of tannin has been linked to a reduction in the frequency of chronic diseases (Giner-Chavez, 1996; Serrano et al. 2009).

Conclusion

The study revealed that all the leaf meal contains varying amount of proximate, minerals and phytochemical substances which confirms its use as medicinal plant source. In conclusion, these commonly available plant leaves are good sources and potent bioactive compounds which could be used for therapeutic purposes or as precursors of synthetic drugs.

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