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Moringa oleifera Lam. as a Traditional Medicine: A Case Study of Bauchi State University, Gadau Main Campus

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Abstract:
Zogale (Moringa oleifera Lam.) has a lot of potentials uses, we need to find out and record, in Bauchi State University, Gadau. Result recorded from this work will be of important experimental data for supporting the formulation of policies to boost cultivation and increase utilization of Zogaleproducts within the campus. This study tried find out the erudition of Bauchi State University, Gadau community on M. Oleiferavaluableness. Data were collected between August and September, 2015 from 40 respondents within the campus by questionnaire method that was well structured. Freshly dried harvested Zogale leaves was ground to obtain leaf concentration and assess the vitamins, and proximate composition. Internationally recognized analytical procedures was employed for the proximate analysis which record a moisture content of 6.05±1.20%, ash content 3.65±0.72, crude lipids 12.95±0.21%, crude fiber 3.05±0.28%, crude protein 15.45±0.18% while the carbohydrate content recorded was 58.85±0.20%. The vitamin composition of the leaves indicated that Vitamin B_6 which valued 25,262±0.365mg/ml, vitamin A 4.836±1.228mg/ml and vitamin C 0.489±0.112mg/ml.

Keywords: *M. oleifera: Moringa oleifera, NARICT: National Research Institute for Chemical Technology, Kaduna State, Nigeria.*

1. Introduction

Zogale (*Moringa oleifera Lam*) is gaining a lot of popularity in Gadau town and Nigeria at large. The tree is also commonly called ben oil, drumstick tree, kelor tree, and mother's best friend, never die tree, mlonge, moonga, mulangay and numerous others. It is a native tree to the Himalayas foothills in India, but it is presently grown in other parts of India, South and Central America, Sri Lanka, Caribbean island, Cambodia, Philippines and Africa (Hsu *et al.,* 2006). In Nigeria it is mostly grown in the northern part and locally known as *Zogale* among the Hausa speaking people. The Yoruba of South-West Nigeria call it *ewe ile* or *igiiyaanu* (because of its many medicinal uses). Regardless of the ample data recorded on the medicinal properties of Zogale, there is the need for more data on the antimicrobial properties and additional uses Lar *et al.,* (2011). Moringa tree is among the plants that grow fast, and it can reach a height of 12meters and a diameter of 30cm with a canopy (Anwar*et al.,* 2005). It can be cultivated or nurtured on soil with low humidity which is the main reason for the plant wide distribution Ndabigengesere, *et al.,* (1995).

Moringa tree leaves, stems, seeds and roots are edible and due to their anti-oxidant properties, the plant is regarded as a healthful food (Farooq *et al*., 2012). If you have a drumstick plant on your garden that symbolizes, you have a doctor at home, this is because itis the best medicine for most of the common diseases Ashfaq *et al*., (2011). Mori *et al*., (2009); Ashfaq *et al*., (2011) and Tesfay *et al*., (2011) reported that Zogale tree contain an adequate quantities protein, iron (Fe), calcium (Ca), amino acids and antioxidants, which could provide nutrition for poor people.

The questions here are: Do people know the nutritional and medicinal benefits of Zogale? Which part of this plant possesses more medicinal and nutritional benefits? And which part of this plant attracts more attention from users. These are very important questions and ths study tried to answer some of it.

2. Materials and Methods

2.1. Research Design

The study included survey and laboratory work. Certain questions were given to the people of Bauchi State University, Gadau Campus. While the laboratory work was carried out to determine the percentage composition of crude protein, crude fiber, crude lipid, crude ash, moisture, carbohydrate, vitamin A, vitamin B and vitamin C in the dried Moringa leave.

2.2. Population of the Study

The research work concerned with the students and staff responses about the *Moringa oleifera* plant in Bauchi State University, Gadau Campus the target population was 40 respondents. The study population cut across only one campus in the University, which is made up of two faculties, namely Faculty of Sciences and Faculty of Art and Education, which consist 19 Departments and 6 principal offices listed below

Principal Offices
1. Bursary Division
2. Library Division
3. Office of the Vice Chancellor
4. Registry Division
5. Security Division
6. Student Affairs Division

Table 1: Distribution of principal offices of main campus

Faculty of Sciences	Faculty of Arts and Education
1. Department of Biochemistry	1. Department of Arabic
2. Department of Biological sciences	2. Department of Biology Education
3. Department of Chemistry	3. Department of Chemistry Education
4. Department of Anatomy	4. Department of English
5. Department of Mathematics	5. Department of English Education
6. Department of Microbiology	6. Department of Hausa
7. Department of Pharmacology	7. Department of Islamic studies
8. Department of Physics	8. Department of Physics Education
9. Department of Physiology	
10. Department of Public Health	
11. Department of Science Laboratory Technology	

Table 2: Distribution of Department from two faculties of main campus

2.3. Sample and Sampling Technique

By considering the target population, simple random sampling technique base was adopted for the study. In that, it would give an accurate representation of various field of study within the Campus. And Moringa leaves were also collected within the campus from every angle to ensure that the result obtained was clearly from every Moringa leave that was situated within the campus

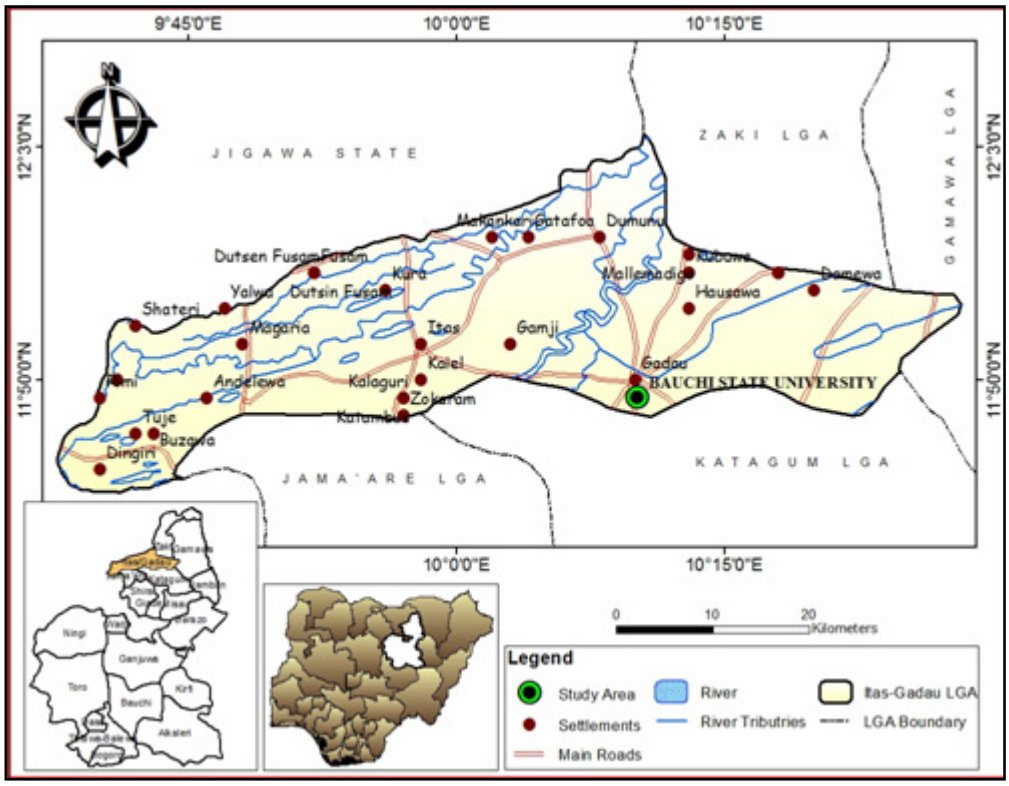

Figure 1: Map of Itas Gadau L.G.A showing Bauchi State University on spot

2.4. Instrument for Data Collection

The instrument for collecting data was an adopted questionnaire with permission from the author (Kasolo, 2010). The format of the questionnaire formulated in this research consist of both two types of questionnaire (i.e. open and closed ended questionnaire)

For the laboratory research work, the procedures stated by AOAC in the year 1990, suggested the following instrument and chemicals in finding out the percentage composition of what has been stated above,

Oven, Dessicator, Weighing balance, Muffle furnance, Soxhlet apparatus, heating mantle, Condenser, Kjeldahl apparatus, 500ml round bottom flask, Petroleum ether (40^0- 60^0C), 250ml conical flask. Others includes0.1M HCl, 0.25M H_2SO_4, 0.31M NaOH, 1000ml round bottom flask, UV Visible spectrophotometer, Test tubes, Spatula, Propanol, Methanol, Moter and pestle and Siever.

2.5. Instruments Corroboration and Consistency

Constant use of the above mentioned equipment in NARICT (National Research Institute for Chemical Technology) Zaria, Kaduna State in Nigeria, confirmed the instruments reliability. The research was also conducted there for accuracy of the result obtained.

The questionnaire consists of three sections, section one deals with the personal characteristics of the respondents, while sectioned two deals with the medicinal benefit of the plant sample. And the last section contains other uses of Zogalesuch as the nutritional benefits.

3. Method of Data Collection

Trained colleagues have assisted on the administration and collection of the questionnaire from the student and staff of the university. For proximate analysis, the following procedures provided by AOAC (1990), was adopted by NARICT staff.

3.1. Collection and Authentication of Plant Material

The fresh leaves of Zogale were collected from Bauchi State University, Gadau Campus, Itas/Gadau Local Government Bauchi State. It was validated by a taxonomist in the herbarium of the University, by comparing the plant material with specimens in another herbarium at Bayero University Kano (BUK) Biological Sciences Department. The leaves of Zogale were dried in the department laboratory for three days, after which it was crushed to powdery form with a pistil and mortar Bukar *et al.,* (2010)

3.2. Method for UV-VISSIBLE Analysis (Vitamins)

A gram was carefully and gently measured from the sample and placed in the test tube. Then 10ml of the solvent (propanol for FAT soluble vitamins VIT A, and methanol for WATER soluble vitamins VIT C, B_6) was added and allow to stand for 2hrs to extract properly. The sample was then filtered and the filtrate was run in the UV-VISSIBLE SPECTROPHOTOMETER for concentration of vitamins against a set of standard (vitamin calibration curve) Vinoth *et al.,* (2012)

4. Proximate analysis

4.1. Moisture Content Determination

A neat container was dehydrated in an oven at 105^0C, it was cooled and weight (W_1). A container with a label was used, 2g was measured from the sample and inserted in a container with a label, and it was re-weighed (W_2). The oven was used again to dry the container to get a constant weight (W_3). The percentage moisture was calculated thus$\%\ \text{moisture content} = \frac{w_3 - w_2}{w_2 - w_1} \times 100$ Aina *et al.,* (2012) Oko *et al.,* (2015)

4.2. Ash Content Determination

Another neat container was also laced in an oven at 100^0C for 10mins to dry. It was also Cooled and measured (W_1) 2g was then measured from the sample and placed in the measured container and weighed (W_2). Igniting the sample was the next step before putting it in a muffle furnace set at 550^0C for a period of 8hrs to get appropriate ashing. The ash in the container was cooled and measured (W_3), then the ash content percentage was calculated as$\%\ \text{ash content} = \frac{w_3 - w_1}{w_2 - w_1} \times 100$Oko *et al.,* (2015) and Aina *et al.,* (2012)

4.3. Determination of Crude Lipid Content

500ml flask with a round bottom with some anti-bumping granules (alumina, calcium carbonate, calcium sulfate, carbon, etc.) was measured (W_1) then petroleum ether (300ml) at 40-60^0C used for extraction was inserted into the flask with a build-in sohxlet extraction unit. 20g of the sample in the extractor thimble was attached to the sohxlet extraction unit. The flask with a round bottom, together with the condenser where attached to the sohxlet extractor and cold water was allowed to circulate Oko *et al.,* (2015). Heating mantle was then switched on then the heating rate was controlled so that the solvent was refluxing at a stable rate, for 6hrsAina *et al.,* (2012). A well-functioning oven of good standard was used to dry the oil at 70^0C for an hour, a desiccator was used to cool the flask with a round bottom containing the oil, and then measured (W2) Oko *et al.,* (2015). The crude lipid content was calculated thus$\%\ \text{crude lipid content} = \frac{w_2 - w_1}{\text{weght of the sample}} \times 100$Oko *et al.,* (2015)

Figure 2: sohxlet extraction unit

4.4. Crude Fiber Content Determination

100ml of 0.25M sulphuric acid solution and 2g of the sample were mixed in a flask with a round bottom and boiled for 30 minutes under reflux then the resulting hot solution filtered under suction with alacrity (Aina *et al.,* 2012). Hot water was used to wash the insoluble water to make it acid free, then moved into a flask with 100ml of hot 0.31M of sodium hydroxide solution and boiled again for another 30 minutes and filtered fast under suction Oko *et al.,* (2015). A based free insoluble residue was obtained after boiling water was used to wash it and then dried in an oven at 100^0C to a constant weight (C_1) Aina *et al.,* (2012). A muffle furnace was used to incinerate it at 550^0C for 2 hours and measured again (C2) Oko*et al.,* (2015)

Calculation

$$\text{The loss weight on incineration} = \frac{C_1 - C_2}{\text{weight of original sample}} \times 100$$

4.5. Determination of Nitrogen and Crude Protein

4.5.1. Protein Digestion

Exactly 1.5g of the defatted sample in a filter paper without ash was added to a 300ml kjeldahl flask, then 25ml of H_2SO_4in addition to mixed digested catalyst (separate measurements) was added to a kjeldahl flask then, the flask was moved to the kjeldahl digestion device (Aina *et al.,* 2012). A clear green colour was obvious after complete digestion, which was cooled and diluted distilled water (100ml) Oko *et al.,* (2015).

4.5.2. Distillation of the Digest

500ml kjeldahl flask with some anti-bumping chips and 20ml of the diluted digest was mixed, then 40ml of 40% NaOH was gently added by the side of the flask, afterwards a conical flask (250ml) with a mixture 4 drops of mixed indicator and 50ml of 2% Boric acids was used to trap the liberated ammonia Oko *et al.,* (2015). Kjeldahl flask with the conical flask were positioned on top of the kjeldahl distillation equipment, and the tube are connected into the kjeldahl flask and conical flask, then was subjected to heat to distill NH_3 out, and the resulting distillate mixed with a Boric acid solution Oko *et al.,* (2015). After green colour was visualized, a complete distillation of ammonia was obtained, after which distillate was titrated using 0.1mHCl Oko *et al.,* (2015).

Calculation:

$$\%\ \text{of}\ N_2 = \frac{14 \times M \times V_t \times T_v \times 100}{\text{Weight of Sample (mg)}} \times V_a$$

$$\%\ \text{of Crude Protein} = \%\ N_2 \times 6.25$$

Where

M = Actual molarity of acid

T_v = Titre Volume of HCl used

V_t = Total Volume of diluted digest

V_a = Aliquot Volume distilled

Figure 3: Kjehldahl Apparatus

Figure 4: Kjehldahl conical flask

4.6. Carbohydrate Determination by Difference

Carbohydrate content determination was carried out by difference, then the percentage sum of ash, moisture, crude protein, crude lipid, and crude fiber was deducted from 100 Oko *et al.,* (2015).

Calculations:

$$\%\ \text{total of Carbohydrate} = 100 - (\%\ \text{moiture} + \%\ \text{Ash} + \%\ \text{Lipid} + \%\ \text{Protein} + \%\ \text{Fibre})$$

4.7. Method of Data Analysis

For the purpose of data analysis, descriptive statistics was used to give the summary of the data collected from questionnaire in terms of mean percentage.

5. Results and Discussion

5.1. Personal Characteristics of the Respondent

Result obtained from figure 5: shows that the majority (68%) of the respondent were males while the remaining (32%) were females. Figure 6: shows that majority (77.5%) of the respondents fall within the range of 20 to 30 years, while reasonable proportion (12.5%) were within 31 to 41 years. The 42 to 52 and 53 to 63 class interval of the ages of the respondent shares the remaining 10% equally. Figure 7: also reveals that (77.5%) of the respondents were students from Bauchi state university main campus, while sizeable (22.5%) proportion of were staffs within the campus. This means that different categories of people from different part of the country were sampled to know their view on Zogale. The respondents confirm that they all have used or witness people using Zogale tree for one purpose or the other. Which indicated that the respondents would be able to respond to the questionnaire on the utilization of Zogale within the country Nigeria appropriately, thus the data recorded were reliable. Another issue or data collected from the respondent is that the leaves of the plant are of nutritional benefit hence confirm the edible characteristics of the Moringa tree and these support the idea suggested by Fahey, 2005 that "all part of the plant is edible and have long been consumed by human".

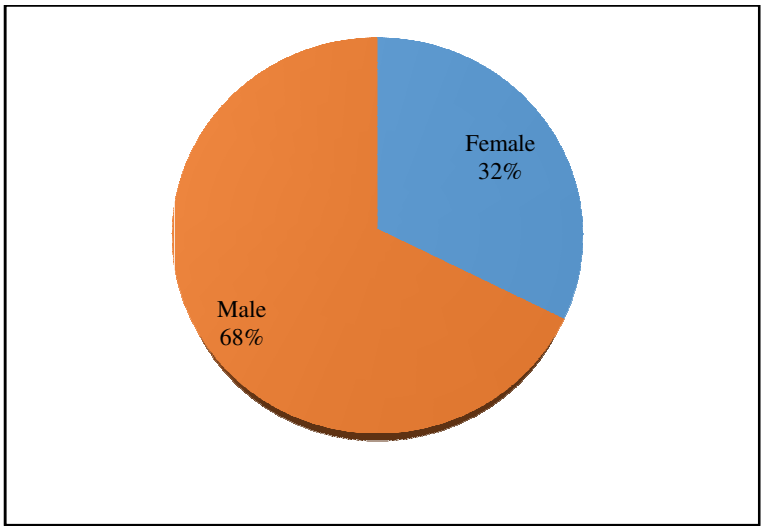

Figure 5: Sex of the Respondent

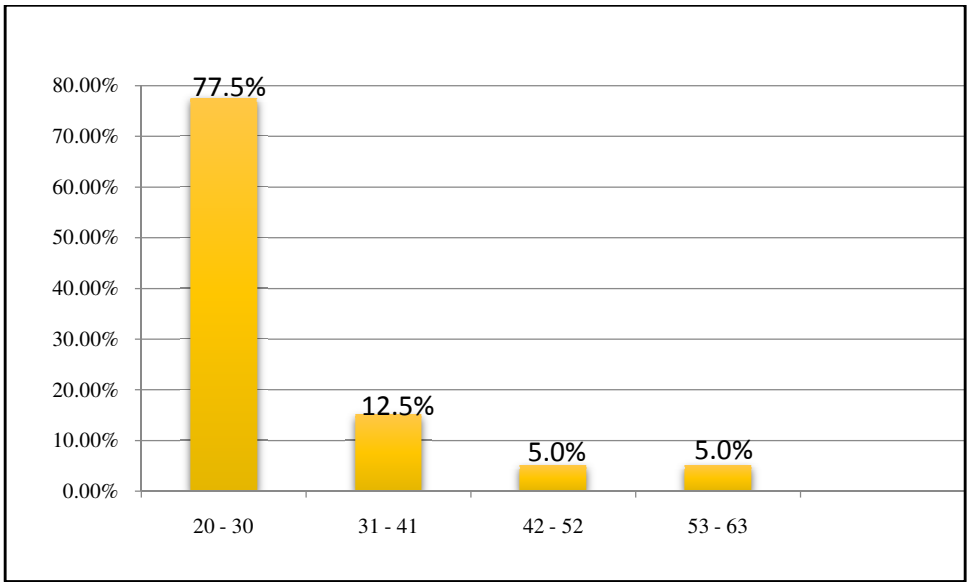

Figure 6: Age of the Respondent

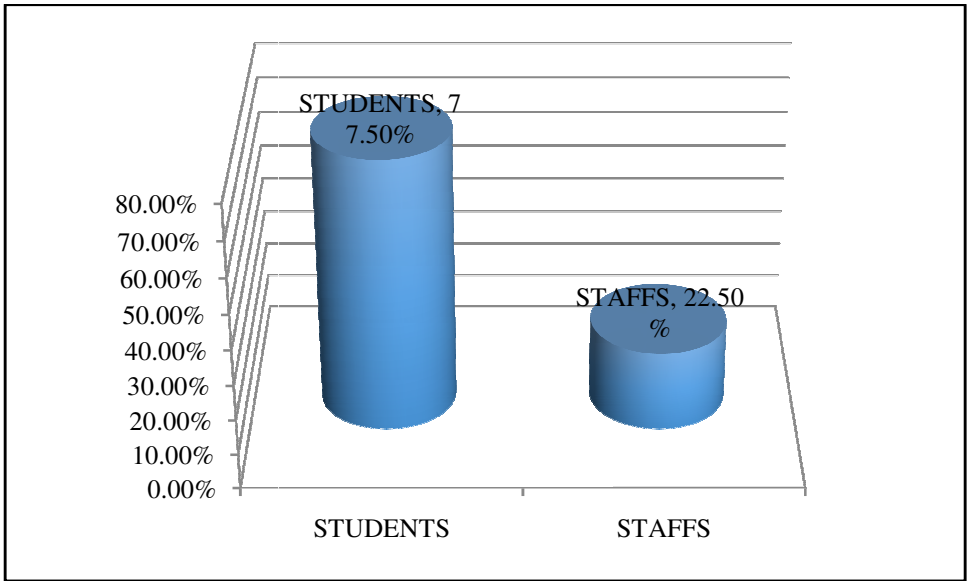

Figure 7: Occupation of the Respondents

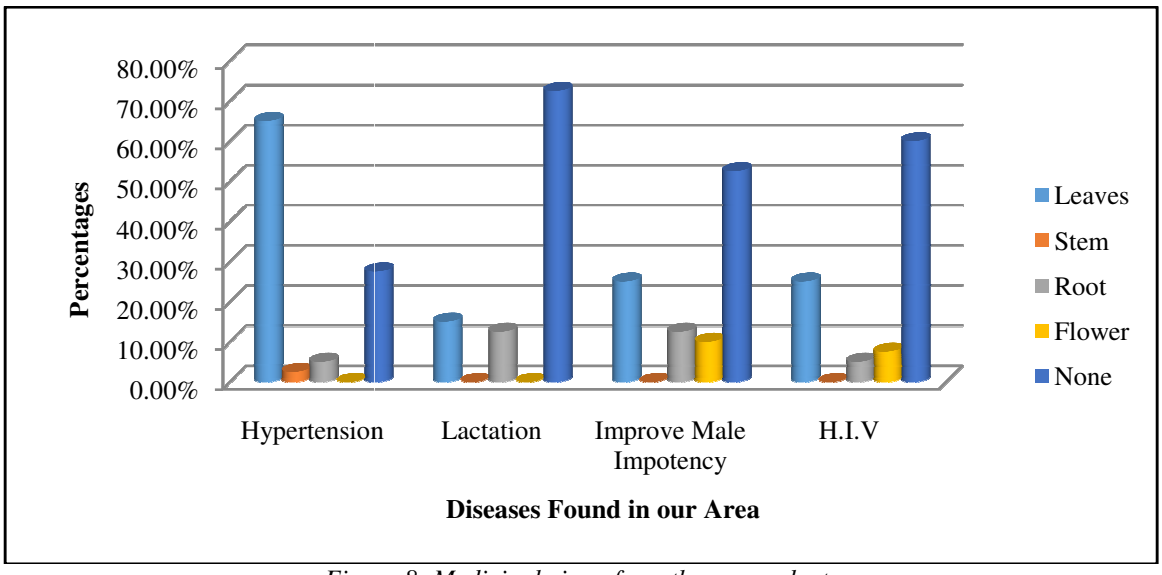

Figure 8: Medicinal views from the respondents

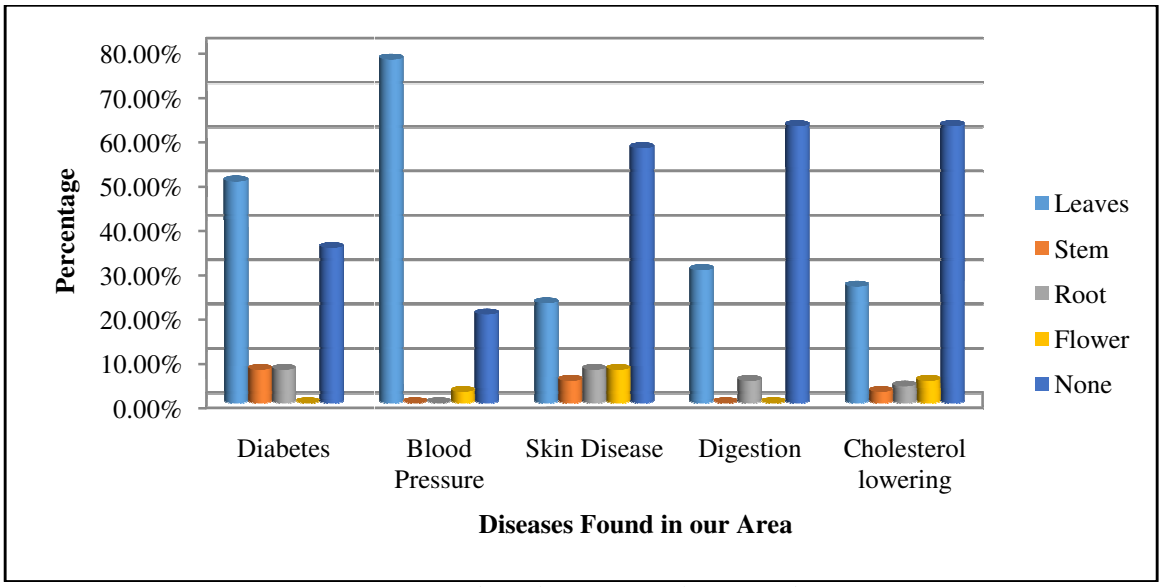

Figure 9: Medicinal views from the respondents

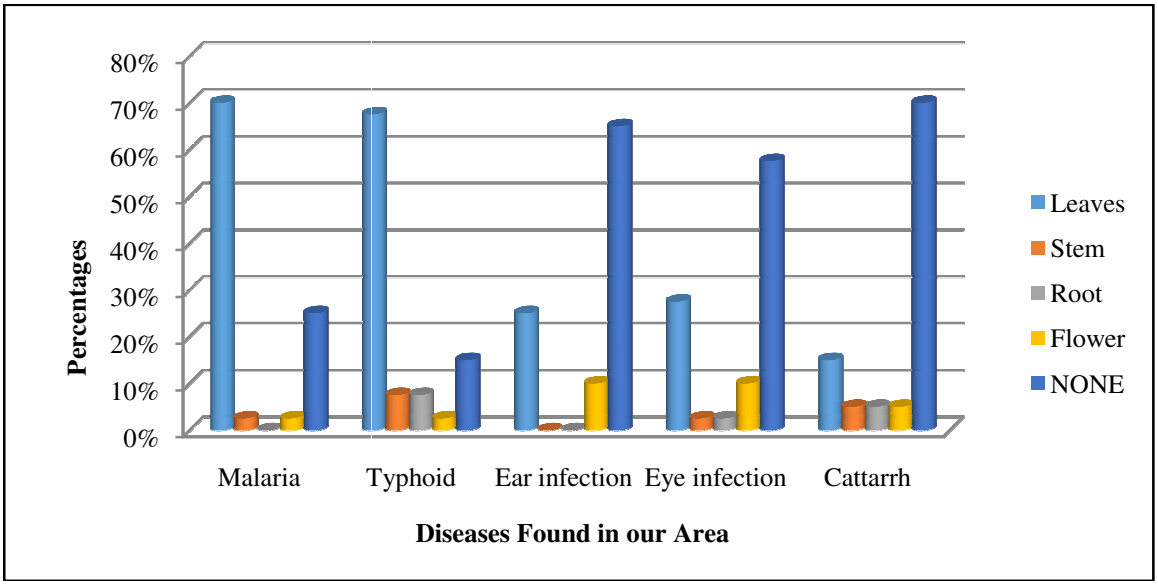

Figure 10: Medicinal views from the respondents

Uses of Moring a Medicinally	Medicinal Views from Respondents	
	Yes (%)	No (%)
Typhoid	85.00	15.00
Blood pressure	80.00	20.00
Malaria	75.00	25.00
Hypertension	72.50	27.50
Diabetes	65.00	35.00
Male Impotency	47.50	52.50
Eye Infection	42.50	57.50
Skin Disease	42.50	57.50
H.I.V	40.00	60.00
Digestion	37.50	62.50
Cholesterol	37.50	62.50
Ear Infection	35.00	65.00
Catarrh	30.00	70.00

Table 3: Medicinal views from the respondents

From the table 3 above, different views from the respondent were suggested and show that the majority (85.00%) of the respondent have utilized Zogale tree for the treatment of typhoid, the plant part mostly used as shown from figure 10 was the leaves (67.5%). And

the 7.5%, 7.5% and 2.5% used the stem, root and the flower respectively for same purpose. About 80.00% of the respondent sampled used the plant to treat blood pressure. However, figure 10 reveals that 77.5% and 2.5% used the leaves and the flower, respectively for the treatment of blood pressure. Also, majority (75.00%) of the respondents used Zogaleto cure Malaria, and from figure 10, 70.00, 2.50 and 2.50% of the respondent did used the leaves, stem and flower respectively. Additional therapeutic uses pointed out by the respondents consist treatment of Diabetes (65%), Hypertension (72.5%), improvement of the male impotency (47.5%), treatment of H.I V (40.00%), remedy for skin diseases (42.5%), digestion, ear infection and cholesterol lowering (37.5%) each, eye infection (42.5%) and treatment of catarrh (30.00%) The parts of the plants that were mostly used for these purposes were the leaves Stevens *et al*., (2013). They believe that Zogalele*aves* cure the ailments mentioned and many of them use it at primary health care level before seeking help at health facilities. Reports reveal that there are 43 uses of *M. oleifera* leaves around the globe (Fahey, 2005). This research work is also in support of (Mughal *et al*.,1999 and Stevens *et al.,*2013) that Zogale has numerous medicinal uses, which have been recognized for long by old system of medicine. Kasolo*et al.,* (2010) carried out a research on the phytochemicals and uses of Zogale leaves in some local rural communities, concluded that 24 medical conditions can be treated with the leaves, these include malaria, hypertension, diabetes, impotence in men and dermal disease. Also a study carried outby Oduro, (2008) proves that the plant was used for the treatment of nineteen medicinal problems viz: eye and ear infection, cholesterol lowering, digestion and common cold (catarrh). It is a state of alertness that various traditional uses of *Moringa* in Nigeria as documented in this survey are supported by the recent review of Farooq *et al*. (2012). This is in conformity with our findings on the traditional uses of Zogale in Nigeria.

5.2. Proximate Analysis

The table below shows the result obtained from the leaves of the Moringa in Bauchi state university Gadau.

Macronutrient In feed	**Average Reading in (%)**	**Standard Error**
Moisture	6.05	± 1.20
Ash	3.65	± 0.72
Crude Lipid	12.95	± 0.21
Crude Protein	15.45	± 0.18
Crude Fiber	3.05	± 0.28
Carbohydrate	58.85	± 0.20

Table 4: Proximate composition of Zogaledried leaves

The research work showed from table 4 that, the Moringa leaves contain nutritious compounds. The 15.45% crude protein content observed here is worth mentioning, even though it is lower than that obtained in sunflower seed cake's (35.88%) which is commonly used for protein concentration (Mapiye *et al*., 2010). The value was also higher than 8.44 ±0.05% reported for *Solanummicrocapon* leaf protein concentrates by Fuglie, (1999). This substantial amount of protein (crude) in Zogale will enhance human and other animal diet. Some studies have recorded different protein contents between the range of 16, 22.42, 23.27, 27.4 and 40% (Sarwatt *et al.,* 2004; Reyes-Sanchez *et al.,* 2006; Oduro *et al.,* 2008; Sanchez-Machado *et al.,* 2009). The crude protein content recorded is of particular nutritional significance as it may meet animals and human's protein and energy requirements and boost the immune system against diseases (Kyriazakis and Houdijk, 2006; Brisibe *et al.,* 2009). This can increase the efficiency of the immune system against parasite infection in the intestines, due the activities of amino acids (Kyriazakis and Houdijk, 2006).

Zogale ash content is somewhat low 3.65 ± 0.72 the value was lower than 6.00±0.63, reported for fresh leaves of *Moringa oleifera* (Akindahunsi and Salawu*,* 2005). Evidence have shown that the, at the early stage, the plant contains significant small percentage of ash content 5.75 - 9.25%. Some minerals are not fully established at this stage, this means it may not be available to man (Hassan, *et al.,* 2013). This is greater compared to some vegetable species *Cochorus Olitorius* (0.32) %, *Rosselle* (0.46) %, *Amaranthus hybridus* (0.41) % and *Telfaira Oceidentalis* (0.68%)these figures signify a substantial amount of mineral element (Saidu and Adunbarin, 1998).

The value of crude fiber obtained for driedZogale leaf concentrates was 3.05 ± 0.28 which is obviously lower than5.43±0.23 reported for Moringa leaf (Akindahunsi and Salawu*,* 2005). But the result of Zogaleleaf has higher crude fiber content than *Cnidoscoluschayamansa* (0.92%), *Solaniumnodiflorum* (0.78%) *Seneciobiafrae* (0.92%) (Bamishaiye, *et al.,*2011). Potential carcinogens could be removed as a result of digestive tract cleaning properties of fiber, thus less cholesterol in the system.

Zogale crude lipid value recorded was 12.95± 0.21 higher than 2.43±0.47% reported for fresh leaf of *Moringa oleifera* (Sodamade. *et al*.,2013). Lipids are good source of energy, and it has the capacity to remedy certain disorders, cancer and aging (Hassan *et al.,* 2013).

Protein concentration moisture value of Zogale leaf was 6.05±1.20 lower than9.00±2.30% reported for fresh leaf of *Moringa oleifera* leaf (Sodamade, *et al.,* 2013). Rate of absorption and assimilation in the system is determined by moisture Hassan *et al*., (2013).

The carbohydrate content is very higher 58.85±0.20, more than that obtained by Sodamade*et al.,* (2013) which was 3.82±0.31, although close to (57.01±0.01) recorded by (Aina, 2012). Carbohydrates are the main source of energy and are vitally important to the efficient functioning of many systems and tissues in the body.

Vitamins	Concentrations(mg/100ml)
Vitamin A	4.836 ± 1.228
Vitamin B_6	25.262 ± 0.365
Vitamin C	0.489 ± 0.112

Table 5: Vitamins composition of dried Zogale dried leaves

The vitamin A content value obtained from the dried leaves of Zogale is 4.839±1.228mg/100ml. The presence of beta-carotene has been used medicinally to treat various disorders such as *erythropoietic, protoporphyria*, and it can also be used to reduce the risk of breast cancer in women before menopause, and the risk of age-ralated macular degeneration. According to Koushik, *et al.,* (2006) 2-7mg is the daily average beta-carotene intake, which was projected for a pooled analysis of 500,000 women in the Europe, Canada and USA from this report, our result from Table 4 show that Moringa leaf is safe for nutritional purposes.

The value obtained for Vitamin B_6 from our work here was 25.262mg/100ml and various reports suggested that this could reduce the level of pyridoxine in female with diabetes type 1 and individuals that have rheumatoid arthritis, systematic inflammations, liver disease, and even those infected with H.I.V (Ulvik,*et al*., 2014). With this, *Moringa oleifera* leave has place in the field of medicinal plants to play a role.

Another important vitamin that its content is analyzed in the Moringa leaves is ascorbic acid (vitamin C). It is a naturally occurring compound with antioxidant properties. It dissolves well in water and give a mildly acidic solution. Its new name was derived from "a" meaning "no" and "scorbutus" meaning "scurvy". Scurvy is a disease caused by a deficiency of vitamin C. because it is derived from glucose, many animals are able to produce it, but humans require it as part of their nutrition (Lachanpelle, *et al.,* (2010). Ascorbic acid and its potassium, potassium and calcium salt are commonly used as antioxidant food additives (Hassan *et al.,* 2013). From this work, the value of vitamin C content obtained is 0.489±0.112mg/100ml.

6. Conclusion

The results of the proximate and vitamins analyses of the whole leaf extract revealed the presence of appreciable amount of nutrients in leaves of *M. oleifera*. This proves why leaves of this plant are used as food supplement and essential for infants, adults and nursing mothers.

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