Evaluation of Nutritional and Anti Nutrional Characteristics of *Terminalia Catappa* Leaves

Mahmoud A.A.[1], Ahmed W.[2], Abubakar A[3], Salim Y[4].

[1-4]*Department of Chemistry, Abuakar Tafawa Balewa University Bauchi, Nigeria*

***Abstract:*-In Africa, deficiency disease due to lack of proteins is common. Under-nutrition in Nigeria is mainly due to poverty, inadequate energy intake as well as protein and micronutrients owing to poor nutrition education. Animal and animal products are very expensive as source of nutrients in developing countries . Discovery of alternative protein sources is a major need in Africa and Nigeria in particular. The food seeds rich in protein particularly legumes could effectively reduce the level of malnutrition. This research, seeks to evaluate the nutritional and anti-nutritional characteristics of the Leaves of the *Terminalia Catappa*. Standard method was adopted to extract the leaves of the plant. The parameters determined includes anti nutritional values such as oxalate 1.50 ± 0.01 mg/100g, phytate 0.45 ± 0.00 mg/100g and hydrogen cyanide 1.10 ± 0.01 mg/100g. and proximate analysis was used to determined the parameters such as ash content 1.2 %, crude protein 0.2%, lipid 40.2%, crude fibre 10.3%, moisture 8.7 %, carbohydrate 39.4% and food energy 520 g/cal. The results indicated that the leaves were very high in carbohydrate, fat, but low in protein, and ash contents with moderate crude fiber levels. This indicates that it could be a good source of oil, carbohydrate.**

***Keywords*: *Terminalia Catappa*, Leaves, Proximate, Anti-nutrional Value and Nutritional characteristics**

I. INTRODUCTION

Since creation, man has used plant as source of food and drug (Mahmoud *et al*.,2019;Rosmary and Donatus, 2012). The use of fats and oils by man dates back to antiquity (Mahmoud *et al*., 2019; Emmanuel *et al.,* 2009). Vegetable oils are widely consumed domestically in Nigeria (Kayode, 2015, Nkafamiya *et al.,* 2010) . Almost every part of the tree; roots, trunk, bark, leaves, flowers, fruits and seeds, is known to have some uses. They could also contribute to the supply of nutrients to the soil via nitrogen fixation as leguminous does(Mahmoud *et al*.,2019).

The consequences of malnutrition in the under developed or developing countries like Nigeria cannot be over emphasize; this tragedy is mostly found in the rural areas. This can be attributed to mere ignorance of food trees around them. Approximately 33 g of protein are lost each day by the average adult male and can be replaced in the diet. The body has no means of storing amino acids, but the reserves are depleted in only a few hours (Mbah *et al*.,2013; Ukoha ,2003)

Terminalia catappa is a large tropical tree in the family combretaceae that is native to the tropical regions of Asia, Africa and Australia, known for its nutritional fruit and possession of medicinal benefits. It is a tall, semi-deciduous, erect, medium to large sized tree 10 to 25 m tall. It is found in almost all the regions of the country as it thrives well in the tropics, hence its name tropical almond. It has a single stem which grows to a height of about 10 m and then branches horizontally with leaves at the end of the branches that form a rosette (Anuforo *et al*., 2017). The fruit is a sessile, laterally compressed, oval-shaped drupe. This drupe is 2.5 inches long and mature from green to yellow or red during the summer. The outside husk is corky fiber with an inner thin green flesh. The inside holds the edible, almond-like kernel(Anuforo *et al*.,2017) . Fruit colour changes from green in young to dark purplish red at full maturity. Rind of the fruit is light, pithy or corky tissue and float in the sea and thus dispersed by ocean currents. Each fruit contains a cream-coloured seed, which encloses the kernel (nut). The fruit endocarp (pod) which is considered to be of little or no significance is often discarded as waste after the fruit is being harvested, thereby constituting a menace to the environment. It is a contributor of municipal waste (Deng *et al.,* 2012). However, studies have revealed that they are good sources of important nutrients, supplying the body with minerals salts, vitamins and certain hormone precursors, protein, energy and essential amino acid(Marcel and Bievenu,2012; Amaechi,2009) . The leaves and fruit of *Terminalia catappa* are astringent. The leaves act as a vermifuge (especially the red leaves), serve as analgesic, as well as, used to treat yaws while the kernel of the fruit when mixed with beeswax stops putrid exudation and bloody faeces (Anuforo *et al*., 2017). The bark and root bark are useful for bilious fever, diarrhoea, thrush, remedy for sores and abscesses and recommended as a mild laxative and a galactagogue for women, but too frequent use causes diarrhea (Anuforo *et al*., 2017). The flesh and kernel of the fruits are eaten raw, sun dried or roasted. The leaves, roots and bark are however used for treating diseases such as anemia, hypertension, malaria, fever and asthma, the leaves have been shown to protect against acute liver injury produced by some hepato-toxicants (Anuforo *et al*., 2017) . The kernel can be eaten raw or roasted and has an almond-like taste. Sun-dried kernels yield 34-54% of bland, yellow, semi-drying oil that is edible but becomes turbid on standing (Anuforo et al., 2017). The oil is mainly used in cooking. The flesh of the fruit is also edible but is often fibrous and not very tasty in spite of the pleasant smell. The kernel is also rich in lipids; a viable source of extractable edible oil used for cooking while the foliage is used as a feed for silkworms and other animal feed

and provides a source for timber, gum or resin and tannin or dyestuff (Anuforo *et al*., 2017)

II. MATERIALS /EQUIPMENT

mortar & pestle provided, rotary shaker(Bio Techno Lab Mumbai India)and retort stand were used, water bath HHW420(B-scientific England), heating mantle, beaker, *Terminalia catappa leaves* and Reflux condenser were also provided.

Chemical and Reagent

Distilled water, Dam's reagent together with some important reagent such as carbon tetra chloride,(May and Baker limited DangenHam England) diethyl ether (Sigma Aldrich Germany) and ethanol(JHD China) were used , then sodium hydroxide(JHD China), potassium hydroxide(JHD China), starch solution, phenolphthalein indicator (Sigma Aldrich Germany) and glacial acetic acid, Ammonia, Hydrochloric acid, N-Hexane, sulphuric acid, (E.merck,Darmstadt Germany), Boric acid(BDH Chemicals limited poole England), Iron(iii)chloride, potassium iodide, ammonium thiocyanate, orthophosphoric acid, Silver nitrate (HEZEDATONG CHEMICAL CO., LTD Sandong-China) were also be provided, sodium thiosulphate, ethanoic potassium hydroxide were also used in this project work.

Sample Collection and Preparation

The leaves of *Terminalia catappa* was collected form the girls hostel premises within Abubakar Tafawa Balewa University Yelwa campus Bauchi and was authenticated at Botanical garden, Biological Sciences Department, Abubakar Tafawa Balewa University, Bauchi, Bauchi state.

Preparation of Sample

The leaves were air dried at room temperature. They were then grounded into fine powder using mortar and pestle. The powder was then stored in polyethene bags for later use in order to avoid contamination.

Proximate Analyses

The estimation of the various parameters namely; moisture content, total ash content, crude protein, crude lipids, crude fibre and total carbohydrate were carried out according to standard procedures. The recommended methods of the Mahmoud *et al*., 2019; AOAC, 1990 were used.

Oil (Lipid) Content

The lipid content was determined by extracting the fat from 10g of the sample using n-hexane in a soxhlet apparatus. The weight of the lipid obtained after evaporating off the n-hexane from the extract gave the weight of the crude lipid in the sample.

Determination of Ash content

A 2 g of the powdered sample of *Terminalia Catappa* was weighed (W_1) into a pre-weighed empty crucible (W_0) and placed into a furnace at 650^0C for 3 hours. The ash was cooled in a desiccator and weighed (W_2). The weight of the ash was determined by the equation below:

$$\% \text{ Ash} = \frac{\text{wt.crucible and ash} - \text{wt of crucible}}{\text{wt crucible and sample} - \text{wt of crucible}} \times 100 \text{---i}$$

Where, W_0 = Weight of empty crucible (g).
W_1 = Weight of crucible + powdered sample (g).
W_2 = Weight of crucible + ash sample (g).

Determination of Crude Protein/ Nitrogen

The crude protein content was estimated using the macro kjeldahl method (AOAC, 1995). A 2 g of the powdered sample of *Terminalia Catappa* was introduced into the digestion flask, followed by the addition of 6 g of kjeldahl catalyst and 25ml of teraoxosulphate (VI) acid. The mixture was put into a digestion block and heated in a fume cupboard until it turns green. On cooling, the mixture was filtered into a 100ml volumetric flask and made to mark with distilled water. 15 ml of the mixture was poured into the distillation apparatus along with 25 ml of 40% NaOH solution. The content in the flask was heated to boil; the ammonia distillate was condensed and collected in a 10 cm^3 Boric acid, using a universal indicator. The digest in the indicator was titrated with 0.05 M H_2SO_4.

The nitrogen content was calculated using;

$$\%Nitrogen \frac{0.014\ X\ Titre\ value\ Xvol\ of\ Normality\ of\ acid}{wt\ of\ sample\ X\ vol\ of\ aliquot} X\ 100 \text{---} ii$$

The crude protein was calculated using

% Crude Protein = % Nitrogen X 6.25 ---------- *iii*

Determination of Crude Fibre content

A 2 g moisture and fibre free sample of *Terminalia Catappa* was put into a 400 ml beaker with 200 ml of 1.25% H_2SO_4 added to it and left to boil for 30 minutes. The solution was filtered and to the residue was added 200ml of 1.25% NaOH solution, and also left to boil for 30 minutes. On cooling, it was washed and filtered with 1% dilute HCl and the residue was transferred into a weighed crucible and dried to a constant weight at 100^0C. After drying, it was ashed in a muffle furnace. The weight of the ash was then determined. The loss in weight due to ignition is equal to crude fibre.

Where M1 Weight of crucible with content before ashing, M2 Weight of crucible with content after ashing Mo sample weight

$$\% \text{ Crude Fibre} = \frac{M1-M2}{Mo} X\ 100 \text{ ---------iv}$$

Determination of Carbohydrate

The carbohydrate content was deduced using the formula below;

Carbohydrate = 100 – (% Moisture + % Protein + % Lipid + % Ash + % Fibre). ----------v

Determination of gross food energy

The gross food energy was estimated according to the method of Rosemary and Donatos (2012) by using the equation.

FE = (% CP x 4) + (% CHO x 4) + (% Fat x 9). ---------vi

Where FE = Food energy (in g / cal)
CP = Crude Protein
CHO = Carbohydrates.

Determination of Anti nutritional Values

Oxalate Determination

The titration method as described by Mahmoud *et al*., 2019; Agbaire, 2011 was followed. 1 g of sample was weighed into 100 ml conical flask. 75 ml 3M H_2SO_4 was added and stirred for 1 hr with a magnetic stirrer. This was filtered using a Whatmann No 1 filter paper. 25 ml of the filtrate was then taken and titrated while hot against 0.05 M $KMnO_4$ solution until a faint pink colour persisted for at least 30 sec. The oxalate content was then calculated by taking 1.0 ml of 0.05 ml $KMnO_4$ as equivalent to 2.2 mg oxalate (Mahmoud *et al*.,2019;Agbaire,2011, Chinma, & Igyor 2007).

Phytate determination

The phytate of the samples was determined through phytic acid determination using the procedure described by Mahmoud *et al*.,2019; Emmanual and Stella, 2014. This entails the weighing of 2 g of sample into 250 ml conical flask. 100 ml of 2% conc. HCl was used to soak the sample in the conical flask for 3 h and then filtered through a double layer filter paper 50 ml of the sample filtrate was placed in a 250 ml beaker and 107 ml of distilled water added to give/improve proper acidity. 10 ml of 0.3% ammonium thiocyanate solution was added to sample solution as indicator and titrated with standard iron chloride solution which contained 0.00195 g iron/ml and the end point was signified by brownish-yellow colouration that persisted for 5 min. The percentage phytic acid was calculated.

Determination of Hydrogen Cyanide:

The alkaline Titration procedure adopted by Mahmoud *et al*., 2019;A.OA.C. 1995 was used. A 10 g of sample was soaked in a mixture of 200 cm^3 of distilled water and 10 cm^3 of orthophosphoric acid. The mixture was left overnight to release all bounded hydrocyanic acid. The mixture was distilled until 150 cm^3 of distillate was collected. 20 cm^3 of distillate was taken into a conical flask containing 40 cm^3 of distilled water. 8 cm^3 of 6 mol/dm^3 aqueous ammonia and 2 cm^3 of 2 % potassium iodide solution were added. The mixture was titrated with 0.02 mol/dm^3 silver nitrate to faint but permanent turbidity.

III. RESULT / DISCUSSION

Table 1: Concentration of the anti-nutritional factors in *Terminalia Catappa* leaves (mg/100g)

Anti-nutritional Factor	Mean standard deviation mg/100g
Oxalate	1.50 ± 0.01
Phytate	0.45 ± 0.00
Hydrogencyanide	1.10 ± 0.01

Values are Mean± Standard deviation (N=4)

Table 2: Proximate Composition of *Terminalia Catappa* leaves

Parameter	Concentration(% dry matter)
Ash	1.2±0.02
Crude protein	0.2±0.01
Crudelipid	40.2±0.00
Crudefibre	10.3±0.10
Moisture	8.7±0.05
Carbohydrates	39.4±0.01
Foodenergy g/calories	520±0.01

Values are mean Standard deviation (N=4)

Discussion

Also (Jones and Michel 1996) reported that the anti-nutritive content of *Terminalia Catappa* leaves are compounds that limit the wide use of many plants due to their ubiquitous occurrence of them as natural compounds capable of eliciting deterious effects in man and animal. The *Terminalia Catappa* leaves in table 1 revealed that the anti-nutritive content such as oxalate 1.50 ± 0.01, hydrogen cyanide 1.10 ± 0.01 and phytate 0.45 ± 0.00 respectively. The low level of anti-nutritional factors may not pose any serious nutritional problems when this fruits is consumed. It is known that high content of these anti-nutrients exerts negative effects on the bioavailability of some mineral nutrients (Agbaire *et al.,* 2011)

The proximate analysis of leaves of *Terminalia catappa* as shown in table 2 revealed the presence of nutrients namely: protein 0.2±0.01, carbohydrate 39.4±0.01 fibre 10.3±0.10, ash 1.2±0.02 moisture 8.7±0.05 with high fat 40.2±0.00, . This is similar to the work done by Offor *etal.*,2015 The proximate composition (%) recorded 8.6, 1.1, 40.0, 0.2, 10.2 and 39.9 for moisture, ash, fat, protein, crude fibre and carbohydrate respectively . The results indicated that the leaves were very high in carbohydrate, fat, but low in protein, and ash contents with moderate crude fiber levels. This indicates that it could be a good source of oil, carbohydrate.

IV. CONCLUSION

From the results of the study, it can be concluded that *Terminalia catappa* leaves has a higher level of carbohydrate, fat, but low in protein, and ash contents with moderate crude fiber levels. This indicates that it could be a good source of oil, carbohydrates. It is therefore a very

promising raw material for various industries. Also it would serve as useful dietary supplements. Therefore, this leaves must not be overlooked anymore. The high carbohydrates and lipid value of the leaves and low level of anti-nutrient indicates its potentials usefulness in animal and poultry feed supplements

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