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PROXIMATE ANALYSIS AND MINERAL COMPOSITION OF *JATROPHA CURCAS*

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ABSTRACT

Jatropha curcas plant is one of the most important tropical vegetables in the world. *Jatropha curcas* leaves were analyzed for their proximate composition and mineral elements using standard procedures. The result indicated high concentrations of phosphorus, (87.96 mg/100g); moderate amount of sodium, (23.62 mg/100g) and

INTRODUCTION

Jatropha is a genus of over 170 plants from the Euphorbiceaus family commonly found and utilized across most of the tropical and subtropical regions of the world. Among the different species of *Jatropha*; *Jatropha curcas* leaves has a wide range of uses and promising various significant benefits to human and industry. It has a yield per hectare of more than four times that of soybeans and ten times of corn. *Jatropha* is suitable for quick and efficient domestication compared with other woody species (Achten *et al.*, 2010).

Jatropha curcas (*J. curcas*) or physic nut is a non-edible multipurpose shrub. It is a medicinal herb that is a member of the plant family Euphorbiaceae, and an uncultivated non-food wild species with branched and erect parts growing up to 6 m in height and predominantly found in tropical and subtropical regions of the world

(Najda *et al.*, 2013). The Greek root (ja tros) from which the genus name *Jatropha* was derived means "doctor" implying ancient medical uses of the plant in its centre of origin in Latin America (Neuwinger, 2004). Different parts of the plant have been used as ethno-medicine in different countries for centuries (Naengchomnong *et al.*, 2006).

Synthetic drugs have been proven to have adverse effects on human health, become increasingly expensive and also relatively out of reach. Therefore natural products are gaining attention as an alternative for health care (Abdelgadir and Vanvtaden, 2013). Traditional medicine is cheaper than synthetic medicines and is a potential source of new drugs. Most of plant species are used as food supplement along with their oral decoctions. *Jatropha curcas* L. is a specie of flowering plant in the spurge family *Euphorbiaceae*. It is a multipurpose shrub that grows throughout the arid, semi-arid tropical and subtropical regions of the world (Prasad *et al.*, 2012). It is called Lapalapa by the Yorubas, Cinidazugu by the Hausas, Olulu idu/Uru by the

calcium, (17.2 mg/100g); appreciable concentrations of potassium, (13.98 mg/100g); magnesium (8.23 mg/100g), and iron (3.23 mg/100g) respectively in the leaves of *Jatropha curcas.* The ash content, crude fiber, fat and moisture content for *Jatropha curcas* leaves are 14.00 %, 0.4 %, 5.00 % and 4.00 % respectively. The fat content for *Jatropha curcas* leaves are 12 % and 11.5 % respectively. The protein content for *Jatropha curcas* leaves was found to be 6.02 %. The mineral composition showed substantial amounts of important elements such as Fe, Ca, Na, Mg, Zn, P and K. The outcome of this study suggests that the leaf of *Jatropha curcas* have very good medicinal potentials, meet the standard requirements for drug formulation and serve as good sources of energy and nutrients. This result shows that the plant is rich sources of nutrients and minerals essential for human growth and development.

Keywords: Nutritional, proximate, mineral, *Jatropha curcas* leaves.

Igbos, Omangba by the Iyedes in Benue State and Itiakpa by the Urhobos in Delta State. It is now widely cultivated in both tropical and sub tropical regions around the world (Prasad *et al.,* 2012). *Jatropha curcas* leaves have been widely used (sometimes) indiscriminately as remedies for various diseases and ailment, therefore this study is poised to evaluate the proximate and mineral composition of *Jatropha curcas* leaves. All is aimed at confirming its use in traditional remedies.

MATERIALS AND METHODS

Apparatus

All the apparatus that were used for this research work were made/available at Department of Science Laboratory Technology, Chemistry/Biochemistry Unit, Federal Polytechnic Offa, Kwara State, Nigeria. The equipments used for this research work include; filter paper, burette, conical flask, beaker, measuring cylinder, pipette, water bath, condenser, round bottom flask, thimble, and timer.

Reagents

Most of the reagents used in this research work are of analytical reagent grade. These reagents includes; ethanol, diethyl-ether, 0.1M potassium hydroxide solution, phenolphthalein, sodium hydroxide, sodium thiosulphate (0.1M, 0.002M), starch indicator, hydrochloric acid (0.5M), carbon tetrachloride.

Sample Collection and Preparation

Jatrropha curcas leaves used in this research was obtained from Atari Area, Offa Kwara State. The leaves were identified by a botanical scientist in the Department of Science Laboratory Technology (Chemistry/Biochemistry unit). The leaves were removed from the twigs properly rinsed with clean water and air dried at 25°C (room temperature), mean morning and night temperature of 24°C and mean noon temperature of 27°C in a well aerated atmosphere and prevented from direct sunlight to avoid denaturation of vital phytoconstituents. Dried leaves were ground using a mortar and pestle, sieved and kept in

an air-tight glassware container and stored at room temperature until when needed.

Proximate Analysis

Moisture content, total ash, crude fiber, crude lipid, were determined using standard methods (AOAC, 1999) while protein was determined by the Kjeldahl method (Pearson, 1976). Carbohydrate was determined by the difference i.e. 100– (others+ Nitrogen).

Crude Fiber

5 g of powdered leaf was measured into a beaker and 40 ml of 2 M sodium hydroxide and 40 ml of 2 M hydrochloride acid solution were added. The resultant solution was then filtered, dried and weighed. The dried residue was ashed for 3 hrs at 550 °C. The weight of residue was determined as follows:

$$\text{Percentage Crude fiber} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Weight of sample}} \times 100 \qquad (3.1)$$

Crude Lipid

5g of each sample was weighed into a separating funnel; 30 ml of diethylether was added to the separating funnel and shaken vigorously for 1 min. The tap was opened to extract into a beaker. This procedure was repeated with 20 ml and 10 ml of diethylether on the sample in the separating funnel. The filtrate was concentrated in the oven at 100 °C and then cooled in a desiccator. The weight of residue was determined as follows:

$$\text{Percentage Crude Lipids} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of sample}} \times 100 \qquad (3.2)$$

Moisture Content

5 g of each sample were measured and then placed in the oven at 150° C for 3 hours, drying to constant weight. The moisture content was determined thus;

$$\text{Percentage Moisture Content} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Weight of sample}} \times 100 \qquad (3.3)$$

Total Ash

5 g of powdered leaf was measured into a crucible and placed in a furnace for 5 h at 5500 C until whitish grey ash was obtained from the crucible. The crucible was then reweighed.

$$\% \text{ Total Ash} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Weight of sample}} \times 100 \quad (3.4)$$

Total Nitrogen

Powdered leaf samples (12.5 g) was mixed with 100 ml of TCA (7.5 % trichloroacetic acid) and homogenized for 1 min and filtered. Then, 20 ml of the filtered sample was transferred to the distillation apparatus. A few drop of antifoaming agent (silicon antifoam) and 2 ml of 20 % Boric acid solution and a few drops of indicator (mixed indicator 0.1 g Bromo cresol green + 0.2 g methyl orange) were added. This mixture was distilled, collected and titrated with 0.05 M hydrochloric acid.

Concentration (c) = (T x 0.7 x 190)/ V (3.5)

Where

T = Volume of HCl used in titration,

V = volume of filtered sample used

Mineral Analysis

The mineral contents namely; phosphorus, potassium, sodium, iron, calcium and magnesium were determined using dry ashing procedure as described by Association of Analytical Chemist (AOAC) (1990). About 2 g of the sample was pre-ashed in a crucible for 1 - 2 hours until the sample is completely charred on a hot plate. The pre-ashed sample was then placed on a muffle furnace and ashed at 500 °C for about 3 hours or until the ash turned white. After ashing, the sample was cooled and weighed and then transferred into a 50 ml volumetric flask by carefully washing the crucible with 5 ml of 30 % HCl. The solution was diluted to the 50 ml volume with iodized water. The solution was then used for individual mineral determination using spectrophotometer and flame photometer.

Determination of Phosphorus (P) Concentration

5 ml of the digest of each sample was measured and put into 50 ml volumetric flasks. 10 ml of vanadomolybdate was then added to each sample and the volumes of the 50 ml volumetric flasks made up with

distilled water. The flask content was thoroughly mixed by shaking and kept for 30 minutes. A yellow colour which developed was read at 430 mm wavelength on a spectrophotometer. Percentage transmittance was recorded and absorbance level determined. The Phosphorus content was then determined using a standard curve developed from a standard phosphorus solution (AOAC, 1990).

Determination of Potassium (K) Concentrations

The Flame Photometry method was used to determine the potassium concentrations. The digest was diluted and the potassium emissions measured in air-acetylene flame. A calibration curve of potassium emission against concentration was drawn and compared to that of a standard solution (AOAC, 1990).

Determination of Iron (Fe) Concentration

Aliquots of standard sample and blank were pipetted into test tubes and absorbance measured at 248 nm using air-acetylene flame. Calibration curve of absorbance was then drawn against the concentration of iron to determine the iron concentration (AOAC, 1990).

Determination of Calcium (Ca) Concentration

5 ml aliquot of the sample solution was measured and 10 ml of 10 % KOH solution added followed by 1ml of 30% triethanolamine. Three drops of 10 % KCN solution and a few crystals cal-red of indicator were added and mixed thoroughly by shaking. The mixture was then titrated with 0.02 N EDTA solution from a red to blue end point. Calcium concentrations were then calculated (AOAC, 1990).

Determination of Sodium (Na) Concentration

The sample solution was pipetted 1.0 mL, diluted in a 50-mL volumetric flask with demineralized water. Subsequently the solution was pipetted 2.0 mL, diluted in a 10-mL volumetric flask with demineralized water (AOAC, 1990).

Determination of Magnesium (Mg) Concentration

5 ml aliquot of the sample solution was measured into a 100ml conical flask. 5 ml ammonium chloride – ammonium hydroxide buffer solution

was then added followed by 1 ml of triethanolamine. Three drops of 10 % KCN solution and few drops of EBT indicator solution were then added. The flask content thoroughly mixed by shaking and then titrated with 0.02 N EDTA solution from a red to blue end point. Magnesium titrated with 0.02 N EDTA solution from a red to blue end point. Magnesium concentrations were then calculated (AOAC, 1990).

RESULTS AND DISCUSSION

Proximate Composition of *Jatrropha curcas* Leaves

The proximate composition of *Jatrropha curcas* leave sample including protein, crude fibre, fat, carbohydrate, moisture and ash contents are presented in Table 1. The protein content of *Jatrropha curcas* leave sample was found to be 6.02 %. The crude fibre content of *Jatrropha curcas* leave sample was found to be 0.4 %. The fat content of *Jatrropha curcas* leave sample was found to be 5.00 %. The carbohydrate content of *Jatrropha curcas* leave sample was found to be 70.58 %. The moisture content of *Jatrropha curcas* leave sample was found to be 4.00 %. The ash content of *Jatrropha curcas* leave sample was found to be 14.00 %.

Table 1: Proximate Composition of *Jatrropha curcas* Leaves

Nutrient (Test Parameter)	*Jatrropha curcas* (%)
Protein	6.02
Crude Fibre	0.4
Fat	5.00
Carbohydrate	70.58
Moisture	4.00
Ash	14.00

Mineral Composition of *Jatropha curcas* Leaves

The mineral composition profile of *Jatropha curcas* leave samples are presented in Table 2. The calcium content of *Jatropha curcas* leave was found to be 17.22 mg/100g. The zinc content of *Jatropha curcas* leave was found to be 0.50 mg/100g. The magnesium content of *Jatropha curcas* leave was found to be 8.23 mg/100g. The potassium content of *Jatropha curcas* leave was found to be 13.98 mg/100g. The iron content of *Jatropha*

curcas leave was found to be 3.23 mg/100g. The sodium content of *Jatropha curcas* leave was found to be 23.62 mg/100g. The phosphorus content of *Jatropha curcas* leave was found to be 87.96 mg/100g.

Table 2: Mineral Content of *Jatropha curcas* Leaves

Nutrient (Test Parameter)	*Jatrropha curcas* (%)
Ca	17.22
Zn	0.55
Mg	8.23
K	13.98
Fe	3.23
Na	23.62
Pb	0.04
P	87.96

DISCUSSION

The proximate analysis of the leaves indicated an appreciable amount of moisture content (4.00 %) (Table 1) which was lower compared to *Ocimum gratissimum* leaves reported by Idris *et al*. (2011) and higher than *Ipomoea batatus* (3.4 %) reported by Sun *et al.* (2014). The result also showed that *Jatropha curcas* leaves contain high ash content (14.00 %). The value was higher than what was obtained from its seed (6.00 %) as reported by Odoemelam, (2005) *Jatropha Curcas* leaves had 6.02 % of protein and 70.58 % of carbohydrate. This crude protein was higher than the value reported by Ahmed, (2014) for *Ipomoea batatus* leaves (5.37 %) dry weight. *Jatropha curcas* leave had high content of carbohydrate compared to (51.80 %) in *Moringa Stenopetala* leaves (Abuye *et al.,* 2003), and was also higher than the value of (18.35 %) of *Jatropha curcas* seed (Ayodele *et al.,* 2000). Carbohydrates serve as stored forms of energy as glycogen in the liver. It also provides a primary source of energy (Hassan *et al.,* 2011). The Crude lipid content is low (5 %) when compared with the value reported for *Jatropha curcas* seeds (Hassan *et al*., 2007). Also the leaves of *Jatropha curcas* had a lower concentration of crude fiber (0.4 %), when compared with the leaves of *Ipomoea batatus* (12.67 %) (Ahmed, 2014). Fibre plays a role in the prevention of diseases by reducing the

level of cholesterol, high blood pressure and constipation (Hassan *et al.,* 2011). Thus, *Jatropha* leaves could be valuable sources of dietary fibre.

The minerals composition of the *Jatropha Curcas* leaves is presented in the Table 2. The mean value recorded for calcium, magnesium, potassium, sodium, zinc, iron and phosphorus were 17.22 mg/100g, 8.23 mg/100g, 13.98 mg/100g, 23.62 mg/100g, 0.50 mg/100g, 3.23 mg/100g and 87.96 mg/100g respectively. The concentration of calcium was found to be higher than what was obtained for Vetiver grass (0.48 mg/100g) as reported by Falola *et al.* (2013). Calcium helps in regulating the passage of nutrients through cell walls and the correct contraction of the muscles. It also helps in the clothing of blood and the transfer of the signal by the nerves. It is sufficiently adequate compared to the recommended quantity for lactating goats (Hassan *et al.,* 2011). The value obtained for magnesium is higher than that obtained in *Andropogon gayanus* (2.74 mg/100g) as reported by Waziri *et al.* (2013). Magnesium provides bone and tooth strength, helps in blood clothing, aids nerves impulse transmission required for muscles contraction (Gordon, 2000). The value for potassium is also lower compared to *Celosia argentea* leaves (5200 mg/100g), *Chenopodium album* (6938 mg/ 100 g) and *Solanum nigrum* (3084 mg/100g) as reported by (Oluyemi *et al.*, 2006) also potassium is essential for keeping a normal water balance between the cell and body fluids, that is, it plays an important role in proper heart function (Gardon, 2000). The concentration of sodium in *Jatropha Curcas* leaves is lower than the value (96.56 mg/100g) reported by Waziri *et al*. (2013) on the analysis of *Andropogon gayanus* grass, Sodium function as electrolytes and plays key role in ion and extracellular fluid balance and a major factor in nerves impulse transmission (Gardon, 2000). The leaves are rich in sodium and hence could serve as a sodium supplement in diet, also as a source of calcium, magnesium and potassium, through their value are relatively high. Na is the major element of the extracellular fluid and is a key factor in retaining body fluid. In conjunction with K, through creation of electrical potential, nerve impulses are conducted and the contraction of muscles is enabled. It participates in facilitating the absorption of nutrients such as glucose and amino acids in the small intestine. However, high levels of Na are associated with hypertension

and high blood pressure. The presence of Ca, Mg and K collectively are known to reduce hypertension and blood pressure as well as used in the prevention and treatment of high blood pressure (Hassan *et al.,* 2007). Therefore, their presence in the leave gives a positive weight to the nutritional importance of the *J. curcas* plant.

There was abundance of Fe in the leaves of *J. curcas*. Fe is important in immune function, cognitive development, temperature regulation and energy metabolism (Dolui *et al.,* 2004). It is also required for the synthesis of haemoglobin and myoglobin while its deficiency causes anaemia. It is therefore an important diet in pregnant and nursing women, infants and elderly people to prevent anaemia and other related diseases (Dolui *et al.,* 2004)

Conclusion

The present study on the determination of proximate and mineral composition of *Jatropha curcas* leaves were carried out using standard analytical methods. The *Jatropha curcas* leaves contain an appreciable amount of nutrients (protein, fibre) and mineral elements (calcium, potassium, iron and sodium) and should be included in diets to supplement the body's daily need. From the results obtained *Jatropha curcas* leaves has high percentage of crude fiber, Ash and lipid. High percentage of ash indicate that leaves could be an important source of mineral element particularly the micronutrient The protein content could supplement the conventional food material in the supply of daily protein requirement. The results of this investigation on the mineral composition of *Jatropha curcas* leaves show the presence of Na, Mg, P, Ca, K, Fe and Zn, this suggest that *Jatropha curcas* leaves has great potentials for human nutritional purposes. *Jatropha curcas* leaves can be used to discover bioactive natural products that may serve as leads in the development of new pharmaceuticals and cosmetic research activities. Further studies are on how *Jatropha curcas* leaves can be more useful in human nutrition in form of dietary supplements and possibly for livestock feed production.

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