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Phytochemistry and Proximate Composition Of Fruit Pulp And Seed Of Desert Date, *Balanites aegyptiaca* (Del.)

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ABSTRACT

Fruit pulp and seed nutritional and anti-nutritional composition of desert date (*Balanites aegyptiaca* Del.) was carried out using standard biochemical procedure. The samples were collected from various locations within the premises of Usmanu Danfodiyo University, Sokoto main campus. Percentage moisture of the ripe samples (seeds and pulp fruit) was analyzed for proximate, minerals, anti-nutritional, ascorbic acid as well as the physicochemical parameters of the seed oil. The results revealed that the seeds and fruit pulp contained high amount of crude protein (9.35% and 3.97%), lipid (25.0% and 20.0%), ash (6.0%), available carbohydrates (56.31% and 75.53%) with calorific value of (487.67 kcal/100 g and 498.0 kcal/100 g) and the pulp contained high moisture content (60.17%). The mineral elements analyzed show that, the fruit (seeds and pulp) is rich in potassium (383.33 mg/100 g and 256.33 mg/100 g), magnesium (23.67 mg/100 g and 10.67 mg/100 g), iron (5.97 mg/100 g and 9.77 mg/100 g), zinc (21.47 mg/100 g and 28.73 mg/100 g), and manganese (3.67 mg/100g and 2.50 mg/100 g) were present relatively in large quantities. The pulp content appreciable concentration of ascorbic acid is 17.97 %. Results of anti-nutritional analysis revealed high content of total oxalate (26.25% and 48.75%) and phytic acid (858.95 mg/100 g and 242.91 mg/100 g). The oil has saponification value (151.20 mg KOH/g oil), iodine (14.53 g/100 g), acid (14.55 mg KOH/g oil) and peroxide (8.06 meq/kg oil) values. The values of various nutrient and mineral elements varied significantly among the fruit parts (seeds and pulp), which implies potential of different parts can be harnessed to better the lots of humanity. This is subject to further validation as the fruits, possessed anti-nutritional factors like oxalate and phytic acid, which need to be tackled appropriately while considering the fruits for value addition as health food.

Keywords: desert date, fruit pulp, nutritional value, seed oil, physicochemical parameters

1.0 INTRODUCTION

The continuous rise in the cost of animal products can partly be blamed on the over- dependence on conventional feed stuff for feed manufacture (Ojewola and Udom, 2005; Oboh, 2006). The trend becomes compounded as plant protein sources such as; soybeans and groundnuts which used to be the conventional sources of protein used locally in animal feed formulation are also used as food by humans (Singh and Singh, 1991). It cannot be out of place that population growth and urbanization continue to result in a constant increase in the price of such food items as soybean and groundnuts, thus contributing to an increased cost of feed production and the market price of animal protein (Oboh, 2006).

One of the ways to increase protein supply for feed formulation is to make more plant proteins available for human consumption and to develop the production of proteins from unconventional sources for animal feeding (Ayssiwede *et al.*, 2011). One of these is the seed kernel of *Balanites aegyptiaca*, known as Desert date in English. It is a desert plant that is widely distributed in the arid zone of Nigeria. It is also found in other African countries such as Senegal and Sudan, as well as in India (Ndoye*et al.*, 2004; Pandey, 2005). The tree is remarkable because it is available during the dry season, when foliage is difficult to obtain and prices of conventional feedstuff are more on the rise, and is found in many kinds of habitat, as it grows in a variety of soil types. Available reports on the nutritional and antinutritional profile of *Balanites aegyptiaca* seed powder shows that the seed powder contains a relatively high amount of protein and lipid. However, in addition to the nutrients, the seed contains high level of antinutritional factors; tannins, oxalate and phytic acid (Samuel *et al*., 1997).

1.1 Aim and Objectives of the Study

This study was designed to determine the nutritional and anti-nutritional composition of fruit pulp and seed of *Balanites aegyptiaca* under the following objectives:

Proximate analysis on nutritional value of the fruit pulp and seeds, assessment of anti-nutritional compositions of fruit pulp and seeds of *Balanites aegyptiaca and* analysis of minerals ascorbic acid and compositions of fruit pulp and seeds *Balanites aegyptiaca.*

2.0 MATERIALS AND METHODS

2.1 Collection and Preparation of Samples

The materials used were stated as follows:
Calorimeter, Oven, H_2SO_4, Conical flask, Physico-chemical parameters, NaOH, Nitric acid, Fruit sample, filter paper and Methyl orange.

2.2 Proximate Analysis

The recommended methods of the Association of Official Analytical Chemists, AOAC (1990) and James (1995) were used for the determination of moisture, ash, crude lipid, crude fibre and crude protein contents of the samples.

2.3 Determination of Moisture Content.

2.3.1 Procedure: Two grams (2.0 g) each of the dried samples were weighed separately in triplicate in a crucible and dried in an oven at 105^{0}C for 24 hrs. The dried samples were cooled in desiccator for 30 min, and then weighed before returning into the oven for further 24 hrs for complete drying and weighted. The percentage moisture is calculated using the following equation:

$$\text{Moisture (\%)} = \frac{w1w2}{w1-w0}x100 \ldots\ldots\ldots\ldots 3.1)$$

Where;

w_0 = weight of empty crucible

w_1 = weight of fresh sample + empty crucible

w_2 = weight of dried sample + empty crucible

2.4 Determination of Ash Content

2.4.1 Principle: A Known weight of the sample is ignited in furnace at 540 ^{0}C to constant weight, the weight of the residue left after ignition is taken to be the ash contents (AOAC, 1990).

2.4.2 Procedure: Ash content was determined by incineration of two grams (2.0g) of the dried sample in a muffle furnace (Lenton Furnaces, England) at 550^{0}C For 6 hrs. The weight of the residue was expressed as percentage ash Content.

Percentage ash content was calculated using equation 3.2

$$\text{Ash (\%)} = \frac{w1-w2}{w1-w0}x\frac{100}{1} \ldots\ldots\ldots\ldots\ldots\ldots..(3.2)$$

Where;

w_0= weight of empty crucible

w_1 = weight of crucible + dry sample

w_2 = weigh of crucible + ash sample

2.5 Determination of crude protein

2.5.1 Principle: This method is based on the reality that, when a food sample is digested with a strong acid usually H_2SO_4, it releases nitrogen which is determined by suitable titrated. The quantity of protein present is then estimated by multiplying the nitrogen concentration by a conversion factor of 6.25 (AOAC, 1990).

Crude protein (%) =

$$\frac{(a-b)x0.01MHClx14c}{6.25x100xdxe} \ldots\ldots\ldots\ldots..(2.7)$$

where;

a = titre value for the digested sample

b = titre value for the blank

c = volume for which the digested was made up
d = volume of aliquot used in digestion
e = weight of dried sample

2.5 Determination of Crude lipid Content

2.5.1 Principle: The principle of this method (soxhlet method) is based on continuous solvent extraction, using a soxhlet extractor (AOAC, 1990).

Crude lipid (%) =

$$\frac{weight\ of\ oil\ extract}{weight\ of sample} x100 \ldots \ldots \ldots \ldots 3.8)$$

2.6 Determination of Crude Fibre Content

2.6.1 Principle: The principle of this is based on the quality of crude fibre lost when a sample is ignited after being digested with an acid and a base (AOAC, 1990).

Crude fibre (%) =

$$\frac{loss\ in\ weight\ on\ ignition}{weight\ of sample} x100 \ldots \ldots \ldots \ldots 3.9)$$

2.7 Estimation of Available Carbohydrate (By Difference)

Available carbohydrate was estimated by difference, by subtracting the total sum of percentage of crude protein, crude lipid, crude fibre and ash from 100% moisture free sample as shown in equation 3.10 (James, 1995).

% carbohydrate = 100% - (%crude protein + % crude lipid + % crude fibre + % ash

2.8 Estimation of Energy Value

The sample calorific values were estimated (in kcal per 100 g) by multiplying the percentage of crude protein, crude lipid and available carbohydrate by factors of 4, 9 and 4 respectively and the product summed up (James, 1995), as shown in equation 3.11.

Energy value (kcal/100g) = [(crude protein x 4) + (crude lipid x 9) + (available carbohydrate x 4)].

2.9 Mineral Analysis

The mineral analyses for the metal element were carried out using Atomic Absorption Spectrometry (AAS) and Atomic Emission Spectrometry.

2.10 Minerals Analysis Using Atomic Absorption Spectrometry (AAS)

2.10.1 Principle: The mineral contents (calcium, magnesium, iron, zinc, copper, manganese, lead, chromium, nickel, cobalt and cadmium) were analysed using Atomic absorption spectrometry (AAS). The method gives a good precision and accuracy (Ojeka and Ayodele, 1995; Umar, 2010).

$$x\ (mg) \frac{x\ (mg)}{100\ g} = \frac{x(\ ppm)\ x\ volumeof\ sample\ made}{weight\ of\ sample}$$

2.11 Analysis of sodium and Potassium using Atomic Emission Spectrometry (AES)

2.11.1 Procedure: The flam photometer (Model 400. Corning U.K) was stabilized for 30 min. Before the galvanometer reading was adjusted to zero with distilled water and subsequently aspirated alongside with the blank and samples solutions. Calibration curves were plotted from which the concentration of sodium and potassium (X) were **determined** (appendixes III and IV respectively) and their actual concentration calculated using equation 3.13

$$x\frac{mg}{100\ g} = \frac{x\ (ppm) x\ volume\ of\ sample\ made}{weight\ of\ sample\ x10} \ldots\ldots\ldots.(3.13)$$

2.12 Determination of Phosphorus

2.12.1 Principle: phosphorus was determined by calorimetric means using the Vanadomolybdate (blue) method (AOAC, 1990). i.e.

$$p\frac{(mg)}{100\ g} = \frac{p\ (ppm) xsample\ weight\ (g)}{aliquote\ (cm3) xsample\ weight\ (g)} x100 \ldots\ldots (3.14)$$

2.13.0 Anti-nutritional Analysis

2.13.1 Determination of total oxalate

2.13.2 Procedure: Two grams (2.0 g) of the ground powder was put into a 250 cm^3 volumetric flask containing 190 cm^3 of distilled water and 10 cm^3 of 6M HCL. The content was digested for 1hr in a boiling water-bath, cooled, made up to the volume and filtered using Whatman No.1 filter paper. Three 50 cm^3 aliquot of the filtrate were then taken in to beakers and to each, 20 m^3 of 6M HCL were added. The content of the beaker were then evaporated to halt its original volume and filtered. The precipitates were washed several times with warm distilled water. The solutions were heated at 100 ^0C, cooled and filtered to remove precipitate containing ferrous ions. The filtrate were then boiled, 10 cm^3 of 5% C_aCL_2 Solution were added with constant stirring and allowed to stand overnight. Blank was treated in a similar manner but without the sample.

1 cm^3 of 0.01M $KMnO_4$ ≡ 2.25 mg anhydrous oxalic acid.

2.14 Determination of Phytate

2.14.1 Principle: The method reported by Ola and Obah (2000) was used.

2.14.2 Procedure: Four grams (4.0 g) of the powder sample were soaked in 100 cm^3 of 2% HCl (v/v) for 3 hrs and filtered. The filtrate (25 cm^3), 0.3% NH_4SCN (5 cm^3) and distilled water (53.5 cm^3) were mixed together and titrated against standard $FeCl_3$ solution containing 0.00195 g Fe/cm^3 until a brownish yellow colour persisted for 5 min. Phytin-Phosphorus (1 cm^3 Fe= 1.19 mg phytin-phosphorus) was determined and the phytate content was calculated by multiplying the value of phytin-Phosphorus by 3.55.

2.15 Determination of Cyanogenic Glycoside

2.15.1 Principle: This is based on the reaction between alkaline picrate and hydrogen cyanide (HCN) resulting in an orange colour which was measured at 490 nm (AOAC, 1990).

2.16 Determination of Nitrate

2.16.1 Principle: The nitrate in the sample was determined using the calorimetric method of IITA (1988).

$$\text{Saponin}\ \frac{mg}{100\,g} = \frac{weight\ of\ saponin\ residue}{weight\ of\ sample} \times 100$$

The standards are used to plot a calibrated curve from which the concentration of NO_3^- is calculated using equation 3.15.

$$NO3\ \frac{mg}{100} = \frac{p(ppm) x volume\ of\ solution\ (cm3)}{aliquote\ (cm3) x sample\ weight\ (g)} \quad (3.15)$$

2.17 Determination of saponin

2.17.1 Test for Saponin

Two (2) gram of the powdered samples were placed into test tubes, 5 ml of water was added and were shaken thoroughly, the whole tube was observed to fill with bubbles which last for some minutes. The presence of bubbles indicates the presence of saponin (Harbone, 1998).

2.18 Determination of Vitamin C (Ascorbic Acid)

2.18.1 Principle: vitamin C content in the sample was determined using the method of (Izuagie, 2007; Umar, 2007). The iodide ions (IO_3^-) react with the iodide ions in the presence of acid to produce triiodide ion as shown in equation 3.17.

$$I_3^{2-} + 6H^+ \longrightarrow 3I + 3H_2O \ldots\ldots 3.17)$$

The triiodide ion produced will oxidize the ascorbic acid into dehydroascorbic acid as in equation 3.18:

$$C_6 H_8 O_6 + I + H2O \longrightarrow C_6H_6O_6 + 3I^- 2H^+ \ldots\ldots\ldots\ldots(3.18)$$

Ascorbic acid dehydro ascorbic acid

Excess triiodide ion (the one remaining after reacting ascorbic acid) is then titrated with standard thiosulphate solution as in equation $I_3^- + 2S_2O_3^2 I$...........(3.19)

2.19 Data analysis

All determinations were carried out as in triplicates and presented as means ± S.D. of the means. Same superscripts means there was no significant difference (P≤0.05) and where superscripts differ, it means that there was a significant difference (P≤0.05).

3.0 RESULTS

Results of the proximate, minerals content, vitamin C content, anti-nutritive analyses and physicochemical of *Balanites aegyptiaca* fruits part (seeds and pulp) were summarized in Table 1, 2, 3 and 4 respectively.

Table 1: Proximate Compositions and Vitamins C content of *Balanites aegyptiaca* fruit (g/100g D

Parameter	Seeds	Fruit Pulp
Moisture	5.67±0.47[b]	60.17±0.62[a]
Ash	6.0±0.14[a]	0.50±0.00[b]
Crude protein	9.36±0.29[a]	3.97±0.11[b]
Crude lipid	25.0±0.82[a]	20.00±0.50[a]
Crude Fibre	3.33±0.62[a]	trace[b]
Available Carbohydrate	56.31±0.50[a]	75.53±0.37[a]
Calorific Value (kcal/100g)	487.67±6.55[a]	498.00±2.50[a]
Vitamin C (mg/100g wet weight		17.97±0.09

The data are Mean ± standard deviation of three replicate determinations
Values within a row with different superscripts are significantly different (P<0.05).

Table 2:Minerals Composition of Balanites Aegyptiaca (mg/100 g DW)

Mineral Element	Seeds	Fruit Pulp
K	383.33±12.47[a]	256.33±10.47[b]
Na	203.33±11.55[a]	153.33±6.47[b]
Ca	4.67±0.47[a]	6.67±0.47[b]
Mg	23.67±2.25[a]	10.67±0.47[b]
Zn	21.47±2.05[a]	28.73±3.06[b]
Fe	5.97±0.05[a]	9.77±0.95[a]
Cu	2.23±0.09[a]	2.37±0.09[a]
Mn	3.67±0.05[a]	2.50±0.00[a]
P	2.10±0.00 [a]	2.60±0.00[a]
Pb	0.30±0.00 [a]	0.50±0.00[a]
Cr	0.40±0.00[a]	0.60±0.00[a]
Co	1.07±0.05[a]	1.20±0.00[a]
Cd	3.47±0.05[a]	1.63±0.05[a]

The data are mean ±standard deviation of three replicates.
Values within a row with different superscripts are significantly (P< 0.05) different.
ND = Not Detected

Table 3: Anti-Nutritional Composition of Balanites Aegyptiaca Fruit (mg/100 g DW)

Anti-nutritional Factor	Seeds	Fruit pulp
Cyanogenic glycosides	0.96±0.02[a]	0.08±0.00[b]
Nitrate	0.39±0.04[a]	0.56±0.03[a]
Oxalate	26.25±5.30[b]	48.75±5.30[a]
Phytate	858.95±13.14[a]	242.91±8.62[b]
Saponin	3.20±0.40[a]	2.60±0.35[a]

The data are mean ± standard deviation of three replicates. Values within a row with different superscripts are significantly ($P<0.05$) different.

Table 4: Physico-Chemical Parameters of Balanites Aegyptiaca Seed Oil.

Parameters	Value
Specific gravity at 25^0C	0.65 ± 0.04
Refractive index at 25^0C	0.67 ± 0.08
Saponification Value (mgKOH/g oil)	151.20 ± 0.16
Iodine value (g/100 g)	14.53 ± 0.06
Peroxide value (meq/kg oil)	8.06 ± 0.49
Acid value (mg KOH/g oil)	14.55 ± 0.26

Mean ± standard deviation of three replicates.

3.0 RESULTS AND DISCUSSION

Obtained results show that, *Balanites aegyptiaca* pulp showed high moisture content (60.17± 0.63%) while that of the seed is low (5.67± 0.47%). There almost the same as (5.06%) reported by Lockett *et al.* (2000) for *B. aegyptiaca* pulp. High moisture content was reported to cause a mould problem during storage and delivery. On the other hand, low moisture content of the seed is an indication of good storage quality with minimal microbial attack (Hassan *et al.,* 2006).

Respective ash content of *Balanites aegyptiaca* seed and pulp are 6.0 ± 0.14% and 0.50% respectively. The ash obtained was almost the same when compared to 6.97% reported by Locketts (2000) for *B. aegyptiaca* fruit pulp. Ash content of the sample gives an idea about the minerals content of the food material; high concentration of various mineral elements speed up metabolic processes and improve growth and development(Bello *et al.,* 2008).This implied that, the seed were rich in mineral contents.

The crude protein content of 9.36 ± 0.29 % and 3.97 ± 0.11% was found in the seed and pulp of *Balanites aegyptiaca* respectively. The protein content was high when compared to 5.4% as reported by Lockett (2000). The high crude protein content indicates that the seed could be an important source for protein supplement. Protein deficiency may cause growth retardation, muscles wasting. Abnormal swelling of the belly and collection of fluids in the body (Zarcada *et al.,* 1997).

Crude lipid content of pulp (25.0 ± 0.82%) and seeds (20.00 ± 0.50%), the seed crude lipid content was compared to that of locust bean seeds (20.30 g/100 g). However, since the fruits were high in crude lipid, it could be a good source of edible vegetable oil if well harnessed, and could complement the conventional source. Lipid provide the body with maximum energy; approximately twice that of protein and carbohydrate and facilitate intestinal absorption of solute vitamins-A, D, E and K (Dreon *et al.,* 1990).

Crude fibre content for the seed was 3.33 ± 0.62% and trace in the pulp. Fibre is known its absorptions of trace element in the gut (Abolaji, 2007). For that fibre intakes should be low in nutrition of infants and pre-school children (Eromosele and Eromosele, 1993; Bello *et al.,* 2008).

Available carbohydrate content of the seed and pulp were 56.31 ± 0.50% and 75.53 ± 0.37% respectively. The available carbohydrate content for the pulp was comparable to 68.75 ± 0.89% reported for *Parkia biglobosa* pulp by Bello *et al.,* (2008).The major function of carbohydrate is to provide the body with energy.

Vitamin C in *Balanites aegyptiaca* pulp was 17.97 ± 0.09 mg/100 g. The vitamin C obtained is relatively higher than 1.26±0.12 mg/100 g reported by Hassan *et al*. (2011). The Recommended Dietary Allowance (RDA) of vitamin C is 60 mg/day for male adult thus, the pulp of *Balanites aegyptiaca* can supplement the daily vitamin C requirement.

Potassium content of the seeds and pulp of *Balanites aegyptiaca* fruits were 383.33 ± 12.47 mg/100 g and 256.33 ± 12.47 mg/100 g respectively. The seed had high (383.33 ± 12.47 mg/100 g) compared to the pulp. The daily allowance of potassium is 2000 mg/100 g (NRC, 1989; Hassan *et al.,* 2006). It was reported that, plant food are usually high in potassium (Hassan *et al.,* 2008). High amount of potassium in the body was reported to increase iron utilization (Adeyeye, 2002). The sodium content of the seeds and pulp of *Balanites aegyptiaca* fruits were 203.33± 20.5 mg/100 g and 153.33 ± 12.47 mg/100 g respectively. Sodium plays an important role in osmotic regulation of the body fluids and transmission of nerve impulses. N_a/K ratio in the body is important because it help in controlling high blood pressure. N_a/K ratio of less than one is recommended (Yusuf *et al.,* 2007). The N_a/K ratio obtained in this work is about 0.53 for the seed and 0.60 for pulp, which indicate that the *B. aegyptiaca* could be useful in the lowering blood pressure.

Calcium content of the seeds (4.67 ± 0.47 mg/100 g) and pulp (6.67 ± 0.47 mg/100 g) are low. The calcium content is lower than 196.63 mg/100 g for *Parkia biglobosa* as reported by Hassan *et al.* (2011). Calcium help in regulation of muscles constrictions transmit nerve impulse and bone formation Schauss, (1995). The recommended dietary allowance (RDA) for calcium is 800 mg/day FNB, (1974). Calcium intake, especially from regular use of calcium supplements may be associated with increased risk of kidney stone. Magnesium is an activator of many enzyme systems and maintains the electrical potential in nerve (Onibon *et al.,* 2007). Phosphorus contents of the seed and pulp are 2.10 ± 0.00 mg/100 g and 2.60 ± 0.00 mg/100 g respectively. The value reported for the seeds is low compared to 10.14 mg/100 g reported by Hassan *et al.* (2006) for *C. pentandra* seeds. Phosphorus is responsible for cell division, reproduction and the transmission of hereditary traits (Adeyeye, 2002). Phosphorus is related to Calcium for bones, teeth and muscles growth and maintenance (Umar *et al.,* 2007).

Zinc content of the seeds (21.47 ± 0.05 mg/100g) and pulp (28.73 ± 0.006 mg/100g).The zinc content of the fruit is low when compared to 28.48 reported by Lockett *et al.* (2000). The zinc content in the sample indicates that *B. aegyptiaca* fruit could play a major role in normal body development, since zinc is an essential element in protein and nucleic acid synthesis (Abitogun *et al.,* 2010). Iron content of the seeds (5.97 ± 0.05 mg/100g) and pulp (9.77 ± 0.12 mg/100 g) are low compared to 27.78% reported by Cook *et al.* (1998). Iron is an important element in the diet of pregnant women, nursing mothers and infants to prevent aneaemia (Oluyemi *et al.,* 2006). The recommended daily allowance (RDA) for men is 7 mg/day and 12-16 mg/day for pregnant women NHMRC (1991) and Abitogun *et al.*(2010). Cupper content of the seeds (2.23 ± 0.09 mg/100 g) and the pulp (2.37 ± 0.09 mg/100 g).The cupper obtain is lower than 18.92 mg/100g reported by Lockett (2000).

Manganese content of seeds and the pulp were 3.67 ± 0.05 mg/100 g and pulp 2.50 ± 0.00 mg/100 g respectively. Recommended dietary allowance is 2-5mg (NRC, 1989; Hassan *et al.,* 2006). Hence values for seeds and pulp that, the fruit could be a good source of manganese. Manganese is desirable in the body as it support the immune system, regulates blood sugar level and is involve in the production of energy and cell. Lead content of the seeds and pulp of *B. aegyptiaca* fruits were 0.30 mg/100 g and 0.5 mg/100 g respectively. The lead provision of tolerable weekly intake (PTWI) IS 0.214 mg/100 g for 60 kg person (Lobet *et al.,* 2003). Chromium in trivalent state is an essential trace element that potentiates insulin action and influences carbohydrate, lipid and protein metabolism (Duran *et al.,* 2007). Nickel was not detected in both the seeds and pulp of *B. aegyptiaca* fruits. Cobalt is an essential trace element by virture of its function as component of vitamin B_{12} (Cyanocobaltamin), and it is the vitamin B_{12} in food not the element cobalt that is essential (Hassan *et al.,* 2006). This indicates that *B. aegyptiaca* fruit could be a good source of vitamin B_{12}.

The cyanogenic glycoside (hydrocyanic acid) content obtained for the seeds and pulp of *B.*

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aegyptiaca were 0.96 ± 0.02 mg/100 g and 0.08 ± 0.00 mg/100 g respectively. It could be observed that, hydrocyanic acid value obtained in the seeds was higher than the value obtained in the pulp. However, the result showed that the presence of hydrocyanic acid in the pulp could be regarded as negligible when compared to the toxic level (35 mg/100 g) as reported by Isong *et al.* (1999). Consumption of high levels of cyanide is related to the life threatening problems such as, spastic paraparentis known as konzo. The nitrate content of the seeds was (0.39 ± 0.04 mg/100 g) and pulp (0.56 ± 0.03 mg/100 g).The value in this study are low compared to the recommended daily intake level of 3.7 mg/kg body weight equivalent to 220 mg for 60 kg person (Hassan *et al.*, 2011).

4.0 CONCLUSION

The result of the proximate and minerals analysis showed that, the fruit could be considered as rich in protein, lipids carbohydrates, minerals elements such as Potassium, sodium, magnesium, zinc and calcium and also rich in vitamin C (ascorbic acid). The level of anti-nutritive in the fruit are not alarming rate, the fact that the quantities of these non – essential substances are low in the sample showed they need little processing before they are consumed. The result of the physico-chemical properties of the oil, suggests that, the oil may be of high oxidative stability due to its low iodine value; low saponification value indicate that, the oil cannot be used for making soaps. However, the low saponification value also suggests that a small molecular structure for the oil molecule. The result suggests that, the fruits if consumed in sufficient amount could contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against disease arising from malnutrition.

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