Proximate, Mineral and Anti-nutritional Composition of *Cucurbita Maxima* Fruits Parts

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ABSTRACT

Proximate, mineral and anti-nutritional composition of Cucurbita maxima fruit parts (seeds, coat and pulp) was carried out using standard analytical methods. The results were discussed using T-test at P≤0.05. The proximate parameters determined were crude protein, crude fibre, moisture, ash, carbohydrate, crude fat and energy value. The high values of crude protein (13.42±0.02%) and carbohydrates (58.71±0.02%) were obtained for the pulp. The coat had the highest crude fibre (6.80±0.07%) and moisture (5.51±0.05%) values while the seeds had the highest ash (3.97±0.02%), crude fat (50.96±0.06%) and energy value (616.33±0.52 Kcal/100g). The Sodium and potassium contents were determined using flame photometer model JEANWAY PFP7, while calcium, iron, manganese, zinc and copper were determined using atomic absorption spectrophotometer model HULK 211 and phosphorus was determined using UV/Visible spectrophotometer model 752 .High values of most of the mineral elements were from the seed sample with the exception of iron (55.98±0.04 mg/100g) and manganese (21.99±0.04 mg/100g) whose values were high in the coat while the highest value of copper (12.01±0.01 mg/100g) was obtained in the pulp The anti nutritional factors contents of the parts of the fruits of this plant were least in the seeds compared to other parts of the fruit. Thus, the seed contains more nutrient than other parts of the fruit. Therefore the fruit can be use for both plant and animal food.

INTRODUCTION

Cucurbita maxima is a guard like squash belonging to the genus *cucurbita* and the family *curcubitaceae.* Other species in this genus include *Curcubita mixta*, *Curcubita pepo* and *Curcubita moschota*[1]. It is known by various names: for instance, it is known as pumpkin or winter squash in English, *kabewa* in Hausa, *ebeshe* in Nupe, *Ogbokolo, Okoro, Anya* in Igbo and *Elegede, Isi*, in Yoruba. The name pumpkin was derived from the Greek word pepon meaning "large melon". Later Americans changed it to the word "pumpkin". It plant bears a fruit having a thick orange or yellow shell containing about 90% water. Some of the fruits are dark-green, pale-green, orange, yellow, white and grey[1].This is attributed to orange pigments whose main composition is alpha and beta carotenes and have moderate contents of carbohydrate, vitamins and minerals[1]. It may vary in shapes from oblate to tetragon. The skin is smooth and usually lightly grooved. It is propagated by seeds

and matures between four to five months after germination[3]. Within four weeks of germination, it completely covers the soil thus helping in weed control[4]. It is an annual herb which is prostrate or climbing with a soft stem rooting at nodes. The leaves are alternate, simple digitately lobed bearing spirally coiling tendrils. The inflorescence of this plant is auxiliary and borne in leaf axils while the flower is unisexual, yellow and cup shaped. The fruit is a berry with a hard rind sometimes patterned bearing numerous seeds[5].

The fruit of *Cucurbita maxima* weighs between 4 to 34 kg born on the stems which are rigid, spiky, angular and generally soft. It is a monoecious plant having both male and female flowers on the same plant. The seeds are characteristically flat, asymmetrically oval and light green in colour[1].

In Nigeria it is a traditional vegetable mainly grown for its leaves, fruits and seeds. It is Consumed in variety of ways including boiling (the leaves and fruits), by roasting or baking (the seeds)[6]. Different parts of this plant have been used for medicinal purposes. For instance, the leaves have been reported to be haematinic, analgesic and effective for the treatment of burns. The leaves have also been used traditionally to relieve intestinal inflammation, dyspepsia and stomach disorder[7]. The fruits have been reported as excellent sources of vitamins A which the body needs for healthy growth of the eye and protection from disease[8 9]. They are also reported to be rich in dietary fibre and vitamins D and E [6, 4].

The growing awareness in recent years of the health promoting and protecting properties of non-nutrient bioactive compounds found in fruits and vegetables has prompted an increased attention to vegetables as vital components of daily diets. This thus underscores the significance of vegetables as vital dietary components in Sub-Saharan Africa. In this region, leafy vegetables have long been used as ingredients of soups thus playing a pivotal role in the nutrition of this region. In this vein, the World Health Organization's (WHO) global initiative on increased consumption of fruits and vegetables has recommended a minimum daily intake of 400g of fruits and vegetables[10]. One of the effective ways of achieving the objectives of WHO on food security is through the exploitation of available plant materials in order to satisfy the needs of the increasing population. Knowledge of the nutritive value of local dishes, soup ingredients and local foodstuffs is thus necessary in order to encourage the increased cultivation and consumption of those that are highly nutritive. In this wise the nutrients of the staple carbohydrate foods of the poor who cannot afford enough protein foods of animal origin can easily be supplemented. Therefore, the need to study other sources of concentrated plant proteins that are widely grown in tropical countries cannot be overemphasized. Although, several novel plant protein sources have been suggested for this purpose, cultural food selection, amongst other factors, have minimized the use of some plants as protein sources. In addition, lack of proper knowledge, especially on their nutritive values, methods

of production, preservation and full exploitation forms another important deterrent towards the use of some of these plants[11]. Data on the nutrient composition of C. maxima grown in Sakpe village is scanty, fragmentary and inadequate. A comprehensive data is necessary. This study was therefore undertaken to explore the nutrional content of this popularly grown fruit in Edati Local

MATERIALS AND METHODS

Sample collection and pre-treatment

Fresh matured pumpkin fruits were collected from different farms in Sakpe village, Edati Local Government Area of Niger state. They were carefully washed with water. The samples were prepared into 3 parts: peel (bark), flesh (pulp), and seed, washed and dried in the laboratory. The dried seeds were shelled manually to remove the seed kernel. The dried samples were made into powder with pestle and mortar and stored in air tight container separately prior the analysis.

Determination of proximate composition

The proximate analysis of samples (flour) for moisture, crude fat, crude fibre, protein and ash were determined using the method described by AOAC[12]. The protein content was determined using micro kjeldahl method (N x 6.25) and the carbohydrate was calculated by difference. The energy value was estimated by multiplying the protein, crude fat and total carbohydrate by a water factors, 4, 9 and 4 respectively[11].

Determination of mineral composition

1g of each of the sample was digested in a 250cm^3 beaker with 20cm^3 of acid mixture (650cm^3 of conc. HNO_3 80cm^3, $HClO_4$ and 20cm^3 H_2SO_4 acids). The mixture was heated on a hot plate at about 100ºC for until the colour became clear. The warm digest were filtered into 500cm^3 volumetric flasks and diluted to mark with distilled water. Appropriate dilutions were made for each of the element. The digested samples were stored in plastic sample bottles for metal analysis. Blank samples were prepared in the same way to ascertain the effects of the reagent's purity on the metal levels[13]. Sodium Potassium was determined using Jean way Digital flame photometer model (PFP 7) while other minerals apart from phosphorus were determined using Buck scientific Atomic absorption spectrophotometer (BUCK 210VGP) and phosphorus in the sample was determined using vanadomolybdate reagent at 420nm using Jean way colorimeter (model 6051)

Determination of anti-nutritional factors

Total Akaloids

The method described by Harborne[14] was used to determine the total alkaloids. 0.5g of the sample was dissolved in 96% ethanol - 20% H_2SO_4 (1:1). 1ml of the filtrate was added to 5cm^3 of 60% tetraoxosulphate (VI), and allowed to stand for 5min. Then; 5cm^3 of 0.5% formaldehyde was added and allowed to stand for 3h. The reading was taken at absorbance of 565nm. The extinction coefficient (E_{296}, ethanol {ETOH} = 15136M^{-1}cm^{-1}) of vincristine was used as reference alkaloid.

Saponins.

Saponin was determined using the procedure described by Oloyed[15]. Flour sample of 0.5g of the sample was added to 20cm^3 of 1NHCl and was boiled for 4h. After cooling it was filtered and 50cm^3 of petroleum ether was added to the filtrate for ether layer and evaporated to dryness. 5cm^3 of acetone ethanol was added to the residue. 0.4cm^3 of each was taken into 3 different test tubes. 6cm^3 of ferrous sulphate reagent was added into them followed by 2cm^3 of concentrated H_2SO_4. It was thoroughly mixed after 10min and the absorbance was taken at 490nm. Standard saponin was used to establish the calibration curve.

Tannin

The tannin component was determined using the method described by AOAC[12]. 0.2g of sample was measured into a 50cm^3 beaker. 20cm^3 of 50% methanol was added and covered with para film and placed in a water bath at 77-80^{O}C for 1hr. it was shaken thoroughly to ensure a uniform mixture. The extract was quantitavely filtered using a double layered whatman No.41 filter paper into a 100cm^3 volumetric flask, 20cm^{3}water added, 2.5cm^3 Folin-Denis reagent and 10cm^3 of Na_2CO_3 were added and mixed properly. The mixture was made up to mark with water mixed well and allowed to stand for 20min for the development of a bluish-green colour. The absorbencies of the tannic acid standard solutions as well as samples were read after colour development on a UV-spectrophotometer model 752 at a wavelength of 760nm.

Phytic acid.

The phytic acid content was determined using a modified indirect colorimetric method of Wheeler and Ferrel[16]. The method depends on an iron t phosphorus ratio of 4:6 and is based on the ability of standard ferric chloride to precipitate phytate in dilute HCl extract of the sample. 5g of the sample was extracted with 20cm^3 of 3% trichloroacetic acid and filtered. 5ml of the filtrate was used for the analysis; the phytate was precipitated as ferric phytate and converted to ferric hydroxide and soluble sodium phytate by adding 5cm^3 of 1M NaOH. The precipitate was dissolved with hot 3.2M HNO_3 and the absorbance and immediately at 480nm. Preparation of standard curve for phytic acid was done as follows: standard curve of different $Fe(NO_3)_3$ concentrations was plotted against the corresponding absorbance of spectrophotometer to calculate the ferric iron concentration. The phytate phosphorus was calculated from the concentration of ferric iron assuming 4:6 iron: phosphorus molar ratio.

Cyanide

Cyanide content was determined by alkaline picrate method according to Wang and Filled method as described by Onwuka[13]. 5g of powdered sample was dissolved in 50ml of distilled water in a cooked conical flask and the extraction was allowed to stand over-night, filtered. 1cm^3 of sample filtered was mixed with 4cm^3 alkaline picrate in a corked test tube and incubated in a water bath for 5mins. After colour development (reddish brown colour) the absorbance was read at 490nm, the absorbance of the blank containing 1ml distilled water and 4ml

alkaline picrate solution was also recorded. The cyanide content was extrapolated from cyanide standard curve prepared from different concentration of KCN solution containing 5-50µg cyanide.

Oxalate

Oxalate in the sample was determined by permanganate titrimetric method as described by AOAC[12]. 2g of the sample flour was suspended in 190cm^3 of distilled water in 250cm^3 volumetric flask, 10cm3 of 6M HCI was added and the suspension digested at 100^0C for 1hr, cooled, then made to the mark before filtration. Duplicate portion of 125cm^3 of the filtrate were measured into beakers and 4 drops of methyl red indicator added. This is followed by the addition of cone. NH_4OH solution drop wise until the test solution changes from salmon pink colour to a faint yellow colour (pH 4-4.5). Each portion is then heated to 90^0C, cooled and filtered to remove precipitate containing ferrous ion. The filtrate is again heated to 90^0C and 10cm^3 of 5% $CaC1_2$ solution added while being stirred constantly. After heating, it was cooled and left overnight at 5^0C. The solution was then centrifuged at 2500rpm for 5mins, the supernatant decanted and the precipitate completely dissolved in 10cm^3 of 20% (v/v) H_2SO_4 solution. The total filtrate resulting from the digestion was made up to 300cm^3. Aliquots of 125cm^3 of the filtrate was heated until near boiling and then titrated against 0.05M standardized $KMnO_4$ solution to a faint pink colour which persisted for 30s. The calcium oxalate content is calculated using the formula:

$$\frac{T \times (Vme)\ (Df) \times 10^5}{(ME) \times Mf} \quad (mg/100g)$$

Where T is the titre of $KMnO_4$ (cm^3), Vme is the volume-mass equivalent 1cm^3 of 0.05M $KMnO_4$ solution is equivalent to 0.00225g anhydrous oxalic acid), Df is the dilution factor V_T/A (2.5 where V_T is the total volume of titrate (300ml) and A is the aliquot used (125ml $KMnO_4$ redox reaction), ME is the molar equivalent of $KMnO_4$ in oxalate and Mf is the mass of flour used.

All experiments were performed in triplicate. The results obtained were subjected to statistical analysis using mean standard deviation and analysis of variance (ANOVA) as described by Duncan multiple range test to determine the level of significance between different samples and extraction methods. Significance was set at $p \leq 0.05$.

RESULT AND DISCUSSION

The result of the proximate composition of *C maxima* (Seed, Bark and pulp) are presented in Table 1. At P<0.05The values of 7.93±0.02, 12.63±0.04 and 13.42±0.02 % obtained as protein contents of seed, bark and pulp respectively, these values were lower than the 25.89% reported for *Cucurbita mixta* by Shobha[17]. However, the values were higher than the 3.89±0.58% reported for healthy *Cucumis melo* var.agrestis by Adekunle and Oluwo[18]. This values were lower than values (14-42%) for seeds and (0.2-2.7%) for the fruit pulp which is higher as reported for *C maxima* by Karanja *et al*[11].The level of protein in these indicates that they can contribute to the daily

protein requirements for humans which is based at 23-56g as stipulated by NRC[19].

Table 1 Proximate composition of *C maxima* seeds bark and pulp (%)

PARAMETER	PARTS		
	Seeds	Bark	Pulp
Protein	7.93±0.02[a]	12.63±0.07[b]	13.42±0.02[c]
Fibre	2.55±0.02[a]	6.80±0.07[b]	2.85±0.01[c]
Moisture	3.02±0.02[a]	5.51±0.05[b]	5.01±0.01[c]
Ash	3.97±0.02[a]	2.23±0.03[b]	3.06±0.02[c]
Carbohydrate	31.50±0.01[a]	53.95±0.05[b]	58.71±0.02[c]
Crude fat	50.96±0.06[a]	18.84±0.02[b]	16.70±0.01[c]
Energy value(Kcal/100g)	616.33±0.52[a]	435.70±0.09[b]	438.84±0.07[c]

The moisture content of 3.02±0.02, 5.51±0.07 and5.01±0.01 was recorded for seed, bark and pulp respectively. These values were lower than 74.37% for *cucurbita spp* reported by Aruah *et al*[6] and (75-91.33%) for the pulp and (4.4-15.2%) for the seeds of *C maxima* as reported by Karanja *et al*[11]. Similar values of 4.50±0.73 was reported for *Cucumis melo* var.agrestis by Adekunle and Oluwo[18]. The moisture content of any food is an index of its water activity[20] and it is used as a measure of stability and susceptibility to microbial contamination[21].

The respective values of 2.55±0.02, 6.80±0.07 and2.85±0.01 were obtained as the crude fibre contents of seeds, bark and pulp, similar values of 2.55±0.08% and 3.07% were recorded for *Curcubita maxima* seeds by Amoo *et al*[22] and Karaye *et al*[11] and lower (11.21-24.98%) for the seed as reported by karanja *et al* (2013) Except bark which is a little higher. Fibre helps in the maintenance of human health and has been known to reduce cholesterol level in the body[23]. A low fibre diet has been associated with heart diseases, cancer of the colon and rectum, varicose veins, phlebitis, obesity, appendicitis, diabetes and constipation[24, 25]. The fibre contents of vegetable varies owing to many reasons including growth condition (climate, soil), time of harvest and species[11].

The crude fat contents of 50.96± 0.06, 18.84± 0.02 and 16.70± 0.01 % were recorded for seed, bark and pulp respectively which were higher compared with 1.69% for *cucurbita* spp seeds reported by Aruah *et al*[6] and similar to that those obtained for cucurbit seeds (41-54%) by Achu *et al*[26]. However, the values were lower than the 52.13± 0.12% of *cucurbita maxima* seed reported by Amoo *et al*[22]. Dietary fats function in the increase of

Palatability of food by absorbing and retaining flavours[27]. Fats are also vital in the structural and biological functioning of the cells and help in the transport of nutritionally essential fat soluble vitamins[28]

The ash contents of the seed, bark and pulp were 3.97± 0.02, 2.23± 0.03 and 3.06± 0.02 % respectively. These values were lower than the 7.45% of *cucurbita spp* reported by Aruah *et al*[6].Though these values were higher than the 2.48± o.18% of *cumis melo* var. agrestis seeds reported by Adekunle and Oluwo[18]. The proportion of ash content is a reflection of the mineral contents present in the food materials of the mineral contents present in the food materials[28].

The values of 31.50± 0.10, 53.95±0.05 and 58.71± 0.02 % obtained as carbohydrate contents of seed, bark and pulp respectively which were higher compared with the value of 6.39± 2.66% repoted for *Arachis hypogaea* by Loukou *et al*[29] and lower compared to 66.64±0.10% reported for *C maxima* reported by Adebayo, *et al*[30]. The carbohydrate content obtained from these samples can be used to ranked *Cucurbita maxima* as carbohydrate – rich fruits due to relatively high carbohydrate content of fruits make it a good quality food.

The calculated energy values of 616.33± 0.52, 435± 0.09 and 438.84± 0.07 Kcal/100g for seed, bark and pulp respectively. The differences in energy values between the three samples could be attributed to differences in the fat contents and other calorific components of each sample.

Table 2. Mineral composition of *C maxima* seeds, pulp and bark(mg/100g)

Parameters	samples		
	Seed	Pulp	Bark
Sodium	172.70±0.41[a]	57.79±0.85[b]	58.22±0.63[b]
Potassium	397.53±1.18[a]	184.34±1.24[b]	185.12±1.21[b]
Phosphorus	1644.60±10.78[a]	5.82±0.12[b]	5.80±0.08[b]
Calcium	100.42±0.39[a]	27.63±0.09[b]	27.83±0.02[b]
Iron	7.80±0.01[a]	53.67±0.19[b]	55.98±0.04[c]
Manganese	1.86±0.07[a]	20.33±0.38[b]	21.99±0.04[b]
Zinc	26.01±0.01[a]	1.45±0.03[b]	1.10±0.06[b]
Copper	12.01±0.01[a]	12.01±0.01[a]	10.00±0.15[b]

The results of mineral contents of seed, bark and pulp were as presented in Table 2. At $P<0.05$

The sodium contents of the samples were 172.70±0.41, 57.79±0.85 and 58.22±0.63 mg/100g for seed, pulp and bark respectively. A similar value of 68.58±16.85mg/100g was reported for *cucurbita maxima*[31] except seed

(172.70±0.41mg/100g) which is higher. The daily requirement of sodium for male and female between 9 and 50years is 1500mg which has been recommended as an adequate intake while after the age of 59years, 1300mg has been considered as adequate by U. S. food and Drug Administration[32]. The potassium concentration for bark, seed and pulp were 185.12±0.48, 397.52±1.18 and 184.34±1.20mg/100g respectively. The values obtained here is lower than the 358.67ppm reported for *cucurbita maxima* by Amoo *et al*[22]. Potassium plays an important role in the human body and sufficient amounts of it in the diet protect against heart disease, hypoglycaemia, diabetes, obesity and dysfunction. Adequate intake of this mineral from the diets has been found to lower blood pressure by antagonizing the biological effects of sodium[33].

The iron contents of bark, seed and pulp were 55.98±0.04, 7.80±0.01 and 53.67±0.19 mg/100grespectively. These values were higher the the 13.66± 1.60mg/100g for pumpkin seed kernels reported by Mohammed[31] except seed (7,80±0.01mg/100g) which is low. Iron deficiency is a major problem in women's diets in the developing world, particularly among pregnant women and especially in Africa[34]. This implies that, these samples will serve as blood building foods and should be desired for human and animal feeds formulations.

The phosphorus contents of the samples were 1644.60±10, 5.82±0.12 and 5.80±0.08mg/100gfor seed, pulp and bark respectively. A similar value of 1036.82±4.72mg/100g *C maxima* reported by Mohammed[31] but this is higher than pulp and bark recorded in this work. The phosphorus intake helps in bone growth, proper kidney function and cell growth. It also plays a role in maintaining the body's acid-alkaline balance[35].

The Zinc concentrations of seed, pulp and bark were 26.01±0.01, 1.4±0.03 and 1.10±0.06 mg/100g respectively. The pulp and bark were similar to the value of 1.0±0.06mg/100g for pumpkin seed kernels reported by Mohammed[31] but lower than the seed value. Vegetarians everywhere are at risk of zinc deficiency. High values of zinc are usually associated with high-protein food stuff, whereas low levels are obtained from food rich in carbohydrates[36].

The calcium contents of seed, pulp and bark were 100.42±0.39, 27.63±0.09 and 27.83±0.20 respectively. These values were lower as compare to 294.74ppm for *cucurbita maxima* reported by Amoo *et al*[22]. Calcium is an essential mineral for bone development.

The manganese contents of the samples were 1.86±0.07, 20.33±0.88 and 21.99±0.04 mg/100g seeds, pulp and bark respectively. These values were higher than the 17.93ppm for *cucurbita maxima* expect for the seed that is lower than the values reported by Amoo *et al*[22].

The copper contents of seed, pulp and bark were 12.01 ±0.01, 12.10±0.01 and 10.00±0.15 mg/100g respectively. These values were higher than the 0.30±0.05mg/100g for *cucurbita maxima* reported by Mohammed[31]. Copper stimulates the immune system to fight infections, repair injured tissues as well as to

promote healing. Copper in Pregnant mothers increase the risk
of health problems in their foetuses and infants[37]. In general, the high mineral contents of these
samples showed that they can be consumed along With other foods in order to provide the required essential minerals for man and his farm Animals.

The results of anti-nutritional composition of seed, pulp and bark of *C. maxima* were presented in the table 3. The oxalate contents of the 0.43±0.02, 0.23±0.01 and 0.31±0.35 mg/100g were obtained for the seed, bark and pulp respectively. These values were high compared to the 0.02±0.10 mg/100g for *Cucurbita pepo L.* reported by Elinge *et al*[38]. Oxalate is a concern because of its negative effect on mineral availability, presence of oxalate in food causes irritation in the mouth[39] and interfere with absorption of divalent minerals particularly calcium by forming insoluble salts[40]. The level of oxalate in the samples is not high to pose any health threat.

Table 3. Anti-nutritional composition of seed, bark and pulp for *Cucurbita maxima*

Parameters	Samples		
	Seed	Bark	Pulp
Oxalate	0.43±0.02^{a}	0.23±0.01^{b}	0.31±0.35^{a}
Saponins	3.42±0.07^{a}	1.09±0.02^{b}	3.05±0.32^{c}
Alkaloids	4.20±0.01^{a}	1.30±0.01^{b}	8.22±0.04^{c}
Cyanides	0.49±0.01^{a}	0.63±0.06^{b}	0.87±0.01^{c}
Tannins	2.84±0.01^{a}	2.94±0.06^{b}	4.52±0.01^{c}
Phytate	0.35±0.00^{a}	0.68±0.01^{b}	4.03±0.01^{c}

values are means ±SD of three determinations

Different superscripts along the same row are significantly different (P≤0.05)

The saponins values of the 3.42±0.07, 1.09±0.02 and 3.05±0.32 mg/100g were reported for the seed bark and pulp respectively. These were in agreement with the 0.11±0.01% for *C. Lonatus* reported by Nwaoguikpe *et al*[41] Saponins are extremely poisonous, as they cause heamolysis of blood[42].

The phytate contents of the seed, bark and pulp were 0.35±0.00, 0.68±0.01 and 4.03±0.01 respectively. These values were lower compared to the pumpkin pulp (0.62±0.11mg/kg) reported by Adebayo *et al*[30]. The problem with phytate in food is that it can bind some essential mineral nutrients in the digestive tract and can result in mineral deficiencies. Therefore, the low phytate content obtained from these samples suggests them to be good source of food to man and its animal especially in the feeds formulation[23].

The alkaloids contents of the seed, bark and pulp were 4.20±0.02, 1.30±0.01 and 8.22±0.04 respectively. These values were higher compared to the 0.13±0.01 reported for *C. Lonatus* by Nwaoguikpe *et.al*[41]. Alkaloids cause gastrointestinal and neurological disorders especially in doses in excess of 20 mg/100 g sample[43].

The cyanide contents of the seed, bark and pulp were found to be 0.49±0.01, 0.63±0.06 and 8.22±0.04 respectively. These were high compared to the 0.13 mg/100g for *C. pepo L.* reported by Elinge *et al*[38]; this shows that the level of the acid in the samples is within the acceptable range for human consumption. Only plants with more than 200mg of hydrocyanic acid equivalent per 100g fresh weight are considered harmful[44].

The values for tannins were 2.84±0.01, 2.94±0.06 and 0.87±0.01 for seed, bark and pulp respectively. These values were high compared with the 0.36±0.10 for pumpkin pulp reported by Adebayo *et al*[30]. The levels of tannins in these samples were very low and so could limit the absorption of the vital nutrients[45].

CONCLUSION

The results obtained from this study shows that *C maxima* is a good source of protein, fats, fibre, and essential minerals such as sodium, potassium, iron, phosphorus, zinc and calcium. The low anti-nutrient content of this fruit shows that it could be exploited as good dietary sources for humans and animal feeds formulations. The oils obtained from the seed have the potentials for use as vegetable oil, food, pharmaceutical and industrial applications. Thus more attention be given to the cultivation and utilisation of *C maxima* as other conventional plant protein and oil sources and if cultivated on commercial scale could provide employments, serve as a source of foreign exchange and will complement other conventional animal protein sources for human consumption.

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