



Evaluation of the Chemical and Phytochemical Constituents of *Alchornea cordifolia* Leaf Meal as Potential Feed for Monogastric Livestock

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Date Received:

15-Mar-2014

Date of Accepted:

15-Apr-2014

Date Published:

15-Apr-2014

Abstract:

Phytochemical constituents, proximate and mineral composition of *Alchornea cordifolia* (Schum and Thonn) Muell. Arg. (Euphorbiaceae) (Christmas bush) leaf meal obtained from the Campus of Niger Delta University was investigated in order to evaluate its nutritional value for non-ruminant livestock since it is well known that the presence of antinutrients and toxic substances severely limits the nutritional benefits of leaf meals. The result of proximate composition showed that the leaf meal contained moisture (9.96±0.40%), crude protein (17.94±0.41%), carbohydrate (39.53±0.21 %), crude fat (4.34±0.23%), fatty acid (3.47±0.24%) energy (3.37 kcal-^g), ash (11.38±0.26%) and crude fibre (16.85±0.16 %). Elemental analysis revealed that the minerals detected in the leaf meal and their concentrations were Calcium (288 mg^{-kg}), Magnesium (22 mg^{-kg}), Potassium (7.25mg kg⁻¹), Copper (32.5mg^{-kg}), Iron (192.5 mg^{-kg}) Manganese (58.35 mg^{-kg}) and Cobalt (40 mg^{-kg}). Aluminium, zinc, Phosphorus, Selenium and Sodium were not detected. The quantitative analysis of the detected phytochemicals in the leaf meal were Phytate (1.21%), Oxalate (0.86 %), Saponins (2.04%), Phenols (1.16 %), Cardiac glycosides (0.11 %) and Hydrocyanic acid (22.30 mg^{-kg}) while alkaloids, anthraquinones, tannins, flavonoids and steroids were not detected. The results showed low concentrations of all the phytochemicals. The nutritional quality of plants and vegetables are severely limited by the presence of antinutrients (oxalate, phytate) and toxic substances (cyanide, nitrate,). The low values of this substance in *Alchornea cordifolia* is an indication that the leaf meals may be recommended for non-ruminant and human consumption. The results obtained in the present study indicate that the leaf meal made from *Alchornea cordifolia* leaves contain nutrients and mineral elements that make the product comparable to other leaf meals such as Gmelina leaf meal, Leucena leucocephala leaf meal, Ipomea batatas leaf meal, Gliricidia leafmeal and cassava leaf meal

Keywords: Anti-nutrients, *Alchornea cordifolia*, Christmas bush, leafmeal, minerals, phytochemical screening, proximate analysis

Introduction

Most wild tropical plants used as leafy vegetables and herbs are increasingly being abandoned by rural people. Recently in Nigeria an increasing interest in wild vegetables and herbs for non-ruminant feed purposes has been noticeable. *Alchornea cordifolia* (Schum and Thonn) Muell. Arg. (Euphorbiaceae) Christmas bush, Bambani (Hausa), Ubebe (Igbo), Ipa/epa (Yoruba) Epie (Ijo) Ebe-uhosa (Edo) is a small scandent sprawling tree or shrub, much branching

(Arbonnier, 2004, NNMDA, 2006) found growing ubiquitously in Niger Delta region of Nigeria as a herb or shrub and grows up to 1-5 m in height in damp places and in the forest zone from Guinea to S. Nigeria and across W. Africa to Sudan, Congo and Angola. (Kimbonguila *et al.*, 2010a, Ndangui *et al.*, 2010). *Alchornea* grows very well in tropical environment and it is available in Nigeria all year round without irrigation. *Alchornea* possess the ability to provide

large quantities of high quality forage matter all-year-round as well as the ability to maintain a sustainable environment through foliage droppings thus replenishing the soil. It has been reported that vegetables contain vitamins, essential amino acids, minerals, antioxidants and protein (Fasuyi, 2006) needed for monogastric animal's body metabolism and health care. **Cheeke (1987)** reported that tropical forages are rich in protein, potassium, calcium and phosphorus, though high in indigestible fibre. Another report indicated that the leaves are cherished by ruminants and are used by subsistence farmers who harvest them for their livestock (Udedibie and Opara, 1998; Okoli *et al* 2003). The leaves have also been reported to be high in xanthophylls and when incorporated into broiler or layer diets result in yellow colouration of the shank and egg yolks, respectively (Udedibie and Opara, 1998). All parts of *Alchornea cordifolia* plant are reported to possess useful phytochemicals of high medicinal value of human and veterinary importance and constitute an important raw material in folk medicines. *Alchornea cordifolia* leaf constitute as a good source of several alkaloids, antioxidants, antitumor and antibacterial compounds (Adeshina *et al*, 2011). *Alchornea* leaf is considered an untapped indigenous vegetable. No attention has been paid to this plant which contributes significantly to nutritional security in some rural communities in Africa. Its inclusion in the diets of monogastric livestock and other poultry birds may reduce cost of production. The aim of the present study was to investigate the proximate and chemical composition, the phytochemical and anti-nutritional constituents of *Alchornea cordifolia* leaf meal (ACLM) in order to assess its nutritional/medicinal potentials in non-ruminant livestock production.

MATERIALS AND METHODS

Plant materials: The experimental leaves of *Alchornea cordifolia* were collected from Niger Delta University campus) on 14th November, 2011. The leaves were air-dried for 15 days and milled and sieved into a powder. The powder was stored under dry conditions before analysis.

Chemical analysis

Proximate analysis: The moisture contents were determined by drying at 105°C in an oven, until a constant weight was reached. For ash determination, the plant samples were weighed and converted to dry ash in a muffle furnace at 450°C and at 550°C for incineration. The Kjeldahl method was used for crude protein determination. Total fat contents were determined by extraction with hexane, using a Soxhlet apparatus. Carbohydrates were determined by the difference of the sum of all the proximate compositions from 100%. Energy values were obtained by multiplying the carbohydrate, protein and fat by the Atwater

conversion factors of 17, 17 and 37 respectively (Kilgour, 1987). The crude fat was converted into fatty acid by multiplying with a conversion factor of 0.80 (Greenfield and Southgate, 2000).

Mineral analysis: Mineral analyses were carried out according to Martin-Prevel *et al.* (1984).

Elemental analyses were carried out using an atomic absorption spectrophotometer and a flame photometer to determine calcium, sodium, potassium, magnesium and manganese content. Aluminum, iron and phosphorus were determined colorimetrically. The concentration of each element in the sample was calculated on a dry matter basis.

Preparation of extracts: The extraction of active principles was carried out in the solvent mixture (methanol-chloroform and ethanol-water) using a percolation method, according to the procedures described by Harborne (1988) and Biyiti *et al.* (1988).

Preliminary phytochemical screening: The extracts of *Alchornea cordifolia* was dissolved in solvents until total dissolution. The extracts thus obtained were subjected to qualitative analysis following the methods described by Trease and Evans (1989); Harborne (1998) and Kokate (2001). Phytochemical analysis was conducted to determine the presence of Alkaloids, Anthraquinones, Phenols, Flavonoids, Glycosides, Saponins, Steroids, Tannins and Triterpenoids.

Phytochemical Screening for Phytin, Oxalate, Tannin, Alkaloid, Flavonoid, HCN and Phenols

The quantitative extraction and precipitation of phytin in the *Alchornea cordifolia* leaf powder was done by the method of Wheeler and Ferrel (1971) while iron in the precipitate was determined as described by Makower (1970). Phytin was determined by using a 4:6 Fe/P ratio to calculate phytin phosphorous and multiplying the phytin phosphorous by 3.55 factor (Young and Greaves 1940). Oxalate content was determined by the titrimetric method of Moir (1953) as modified by Ranjhan and Krishna (1980). Where extracts were intensely coloured, they were decolourised with activated charcoal (Balogun and Fetuga 1980). The polyphenols (tannic acid) were determined by extracting the leaf meal (250mg in 10ml of 70% aqueous acetone) for 2hrs at 30°C using Gallenkamp orbital shaker (Survey, UK). Pigments and fats were first removed from the leafmeal by extracting with diethyl ether containing 1% acetic acid. Thereafter, the total polyphenols (as tannic equivalent) were determined in 0.05, 0.2 or 0.5ml aliquot using Folin Cocalteu (Sigma) and standard tannic acid (0.5mg/ml) as described by Makkar and Goodchild (1996). The HCN (cyanide) was determined after an initial extraction for 2 – 3 min of 5 – 8g material in 0.1M H₃PO₄ by a 2M H₂SO₄ (100°C for 50 min) hydrolysis followed by

reaction with chloramines-T pyridine barbituric acid (Konig Reaction). KCN dried over concentrated H₂SO₄ was used to calibrate the standard curve from a stock solution containing 75mg KCN/100ml. Alkaloid determination was done using Harbone (1973) method while flavonoid determination was through the method described by Boham and Kocipai-Abyazan (1974).

Statistical analysis

The results obtained were presented as mean ± standard deviation and analyzed as simple percentages

RESULTS

Table 1 summarizes the proximate composition of the *Alchornea cordifolia* leaf meal (ACLM). The result revealed low moisture contents of 9.96±0.40%. The protein value of (17.94±0.41%) is high. The result showed that the fat (4.34±0.23%) and fatty acid (3.47±0.24%) content was low while the ash contents (11.38±0.26%) in the leafmeal was high. The carbohydrate, crude fibre and caloric value content of the sample (39.53±0.21%, 16.85±0.16% and 3.37kcal-^g) was quite high. The mineral composition is presented in Table 2. The minerals detected in ACLM were calcium, magnesium, potassium, manganese, iron, while aluminium, phosphorus, selenium, sodium and zinc were not detected. Analysis of the leafmeal showed that Calcium (288mg-^{kg}), was the most abundant mineral followed by Iron (192.5mg-^{kg}) Manganese (58.35mg-^{kg}), Cobalt (40 mg-^{kg}), Copper (32.5mg-^{kg}), Magnesium (22.0mg-^{kg}), while Potassium (7.25mg-^{kg}) were detected in very low concentrations. The results of the phytochemical screening (Table 3) showed the qualitative and quantitative analysis of the detected phytochemicals and anti-nutrients in the leaf meal as Phytate (1.21%), Oxalate (0.86 %), Saponins (2.04%), Phenols (1.16 %), Cardiac glycosides (0.11 %) and Hydrocyanic acid (22.30 mg-^{kg}) while alkaloids, anthraquinones, tannins, flavonoids and steroids were not detected.

Table 1 :Proximate Composition ACLM (%)

Moisture	9.96±0.40
Total fat	4.34±0.23
Fatty acid	3.47±0.24
Crude proteins	17.94±0.40
NFE	43.53±0.21
Total ash	11.38±0.26
Crude Fibre	12.85±0.16
Energy (Kcal-^g)	3.367

Each value represents means±standard deviation of three replicate determinations

Table 2: Mineral contents of ACLM

Element	Content (mg/kg)
Calcium	288mg- ^{kg}
Magnesium	22mg- ^{kg}
Potassium	7.25mg- ^{kg}
Cobalt	40 mg- ^{kg}
Manganese	58.35mg- ^{kg}
Iron	192.5mg- ^{kg}
Copper	32.5mg-^{kg}

Table 3: ACLM Phytochemical and Anti-Nutrients (Water extract) Qualitative Quantitative (%)

Alkaloids	-	
Anthraquinones	-	
Flavonoids	-	
Cardiac glycosides	+	0.11
Saponins	+	2.04
Steroids	-	
Tannins	-	
Triterpenoids	-	
Phenols	+	1.16
Anti-Nutrients		
Phytate	+	1.21
Oxalate	+	0.86
HCN	+	22.3mg-^{kg}

+ = Present, - = Absent

DISCUSSIONS

According to Emebu and Anyika (2011) products that have low fat values normally have high moisture content. Moisture content is a widely used parameter in the processing and testing of food. It is an index of the water activity of many foods. Iheanacho and Udebuani (2009) reported that high moisture content provides for greater activity of water soluble enzymes and coenzymes needed for the metabolic activities of the leaf. The low moisture content of the leafmeal recorded in the present study indicates that they would not be easily susceptible to microbial attack during storage and would have a long shelf life. It is also indicative of low total solids (Ogungbenle, 2006; Adepoju *et al.*, 2006). The moisture values of ACLM was higher than those reported for the leaves of *C. petiolata* (6.82%) (Omoyeni and Aluko, 2010), *M. oleifera* (5.9%) (Yameogo *et al.*, 2011) and some edible fruits and seeds ranging between 8.82% and 12.66% (Dike, 2010). The **crude protein**(17.94%) content of the ACLM obtained in this study was similar to 16.10% obtained by Ahamefule *et al* (2006). The CP of this study was relatively high and compared favourably with that recorded for *Leuceana* (21.4%) by Odedire and Babayemi (2004), 15.2% recorded for *G. Africanum* (Mensah *et al.*, 2008), 16.52% in *Azelia Africana* (Ogunlade *et al.*, 2011). This value was high when compared to 11.67% reported for *B. oleracea*

(Emebu and Anyika, 2011) and 8.80% in *Annona senegalensis* (Yisa et al., 2010). However, it was lower than 32.95% recorded for undefatted leaves of *A. hybridus* (Iheanacho and Udebuani, 2009).

As observed for kale (Emebu and Anyika, 2011) the protein content of the leafmeal makes it suitable for consumption and it is a rich source of vegetable protein.

The carbohydrate content of the sample (39.53%) was found to be high, however, this value was lower than the 52.32% reported for *Pachira glabra* and 45.92% for *A. africana* seed (Ogunlade et al., 2011), 52.18% for *Amaranthus hybridus* (Akubugwo et al., 2007) and 75.74% for *I. astragalina* (Gafar et al., 2011) and above the range of 15.40-30.40% reported for some leafy vegetables (Iheanacho and Udebuani, 2009).

According to Emebu and Anyika (2011) most leaves are generally not good sources of carbohydrate. As far as vegetables are concerned, some of them are rich sources while others contain traces of the nutrients. They provide the animal body with a source of fuel and energy that is required to carry out daily activities (Yisa et al., 2010).

The total fat content of 4.34% observed in this study was similar to that of Ahamefule, et. al (2006) who observed 5.60% which was very low compared to that of the leaves of *A. senegalensis* (24.0%) (Yisa et al., 2010), *P. gabra* (15.29%), *A. africana* (16.35%) seed (Ogunlade et al., 2011), *Moringa oleifera* (17.1%) (Dike, 2010). However, this fat value was higher than the 0.26% in *B. oleracea* (Emebu and Anyika, 2011), 0.40% in *Talinum triangulare* (Dike, 2010), 1.29% in *Carica papaya* (Oloyode, 2005) and the leaves of some selected vegetables which ranged from 0.08-0.40% (Bangash et al., 2011). The low fat content indicated that the leaves contain low quantities of lipid biomolecules (Iheanacho and Udebuani, 2009) and cannot serve in non-ruminant nutrition as a source of these biomolecules that are important for body metabolism.

The energy value of the leaves (3.367 Kcal^{-g}) was significantly lower than the (58.46 kcal/100 g) reported for *B. oleracea* (Emebu and Anyika, 2011) and 360.55 cal/100 g for *C. citratus* (Asaolu et al., 2009) but lower than the 1086 KJ/100 g reported for *Pterocarpus mildbraedi* (Akinyeye et al., 2010).

The high ash content of 11.38% in the leafmeal was higher than the values (5.20%) reported by Ahamefule, et. al (2006) for *Alchornea*, (4.34%) for *R. glabra* and (4.03%) for *A. africana* (Ogunlade et al., 2011), 1.33% in kale (*B. oleracea*) leaf (Emebu and Anyika, 2011), but lower when compared to those of certain vegetables such as *P. mildbraedi* (20.6%) (Akinyeye et al., 2010), *Talinum triangulare* (20.05%) (Akindahunsi and Salawu, 2005), *A. hybridus* (17.70%) and *C. pepo* (15.20%) (Iheanacho and Udebuani, 2009). The ash content is an indication of the mineral contents of the leaves. The average ash content of ACLM suggests an average mineral composition and rather good or high organic

components (Egharevba and Kunle, 2010).

The results of the mineral analysis of *Alchornea cordifolia* leafmeal is given in Table 2. The low levels of macro minerals observed in this study indicated that *Alchornea cordifolia* is a poor macro mineral source. The major minerals present in the leaves were calcium, iron, manganese, cobalt, copper, magnesium and potassium

Though the result showed the low levels of these elements, they acted as inorganic cofactors in metabolic processes. In their absence, there could be impaired metabolism (Iheanacho and Udebuani, 2009). Since calcium helps in bone formation and blood coagulation. Potassium functions principally as the cation of the cell and also in nerve and muscle excitability. Potassium is an intracellular cation and with sodium it controls the electric potential of the nerves and the osmotic pressure of the body (Adeyeye and Aye, 2005). Most vegetables are rich in magnesium (more than 500 mg/kg fresh weight) (FAO/WHO, 2001). Contrary to the result of the present study magnesium was detected in low amount. Although magnesium was found in little concentration in this study it is also known to prevent cardiomyopathy, muscle degeneration, growth retardation, alopecia, dermatitis, immunologic dysfunction, gonadal atrophy, impaired spermatogenesis, congenital malformations and bleeding disorders (Chaturvedi et al., 2004). Iron is a key element in the metabolism of almost all living organisms. In monogastrics, iron is an essential component of hundreds of proteins and enzymes (Beard and Dawson, 1997; Fairbanks, 1999). According to Geissler and Powers (2005) iron as an essential trace metal plays numerous biochemical roles in the body, including oxygen binding in haemoglobin and acting as an important catalytic center in many enzymes, for example the cytochrome. Thus the leaves can be recommended for diets with iron deficiency (anaemia).

The qualitative and quantitative analysis of the phytochemical constituents of ACLM (Table 3) showed the presence of phenols (1.16%), saponins (2.04) and cardiac glycosides (0.11%).

However anthraquinones, alkaloids, steroids and tannins were not detected in the present study but Farombi (2003) observed that the leaves contain. Isopentenyl guanidine, alkaloids, cardiac glycosides, saponins, phenolic and terpenoid compounds. The pharmacological and biochemical actions of phytochemicals have been widely reported by Amadi et al. (2006) Each of these phytochemicals is known for various protective and therapeutic effects (Asaolu et al., 2009). For instance, phenols are known to possess antibacterial, anti-inflammatory, anti-allergic, antiviral antioxidant, antimutagenic, anticarcinogenic, and antineoplastic activity (Alli, 2009., Beta et al., 2005; Marinova et al., 2005). Epidemiological studies have also correlated the consumption of plant produce with

high phenolics to reduction of cardio-cerebrovascular diseases and cancer mortality (Hertog *et al.*, 1997). The phenolic content of 1.16 % obtained from the ACLM may confer some of the biochemical advantages mentioned earlier to its users. Saponins are abundant in many foods consumed by animals and man (Cheeke, 1971). The Saponin content of ACLM in this study (2.04%) is very low and when compared to other plant leaves such as Alfalfa (1.4-17.1%) (Livingston *et al.* 1984, Price *et al.*, 1987) Green pea (3 1.8- 42.4%) (Price *et al.*, 1986) American ginseng (*Panax quinquefolium* L.) Young leaves (14.2-26.4%) (Li *et al.*, 1996) Mature leaves (41.4-55.8%) (Li *et al.*, 1996) Sugar beet leaves (58%) (Price *et al.*, 1987) Saponins possess a carbohydrate moiety attached to a triterpenoid or a steroidal aglycone and have the property of precipitating and coagulating red blood cells. Some of the characteristics of saponins include formation of foams in aqueous solutions, hemolytic activity, cholesterol binding properties and bitterness (Sodipo *et al.*, 2000; Okwu, 2004). Saponins form a group of compounds, which on consumption at high levels causes deleterious effects such as hemolysis and permeabilization of the intestine (Cheeke, 1996; Price *et al.*, 1987). Saponins have also been shown to have hypocholesterolemic as well as anticarcinogenic effects (Korathkar and Rao, 1997). The cholesterol lowering effect in animals and humans is reported to be through the formation of mixed micelles and bile acids into micellar bile acid molecules (Okenfull *et al.*, 1984) They have antioxidation effects in animals (Enwere, 1998). Glycosides, have been reported to exert inhibiting activity against most bacteria (Camacho-Corona *et al.*, 2008; Al-Bayati and Sulaiman, 2008).. Saponin-glycosides are very toxic to cold-blooded organisms, but apparently not to mammals (Hostettmann and Marston, 1995)), thus indicating the pesticidal potentials of ACLM

Cardiac glycoside have been used for over two centuries as stimulants in case of cardiac failure (Trease and Evans, 1989). The presence of these secondary metabolites in the leaves is important as these compounds confer biological activities to the plants (Corthout and Kotra, 1995). This determine the medicinal value of these edible vegetable leaves. These results showed that ACLM is a good source of medicinal and nutritional substances with low concentration of some antiphysiological factors such as phytates (1.21±%), oxalates (0.86±%) and (HCN 22.3±mg^{-kg}) in it which could slightly decrease the overall benefits of this plant. A major factor limiting the wide use of many plants is the ubiquitous occurrence in them of these range of natural compounds capable of eliciting deleterious effects in man and animals. These compounds known as antinutrients are of different types and widely distributed in the plant kingdom (Osagie and Offiong, 1998). The anti-nutritional factors; HCN,

oxalates and phytates were present in varying amounts in ACLM .

Phytates has been reported to reduce the bioavailability of trace element and minerals (Apata and Ologhobo, 1989). The phytate content of ACLM (1.21mg/100g) is, however, below the range reported for most vegetables. **Zhou (1995) indicated that phytates occur naturally as a mixed potassium, magnesium and calcium salt in complex diets . Phytic acid and iron form insoluble complexes that are not available for absorption under the pH conditions of the small intestine. In addition phytic acid is also known to inhibit the availability of other divalent minerals such as Zn and Mg. Inhibition of iron absorption as a result of dietary phytate can also be partially counteracted by activation of native or the addition of extrinsic phytase to phytate-rich diets or by chemical hydrolysis of the phytate present (Sandberg et al.,1996; Biehl et al., 1997; Pallauf et al., 1999).** In contrast to its anti-nutritive effects, the potential benefits of phytic acid, such as a delayed postprandial glucose absorption (Yoon *et al.* 1983), a decrease in plasma cholesterol and triglycerides (Katayama, 1995), as well as a change in the bioavailability and therefore toxicity of heavy metals such as cadmium (Rimbach & Pallauf, 1998) and lead (Rimbach *et al.*, 1998) have recently been discussed in the literature Also, in vitro studies clearly demonstrated that phytic acid reduced cell proliferation in different cell lines, including erythroleukaemia and human mammary cancer cells Oxalates are present in most plant based diets and are important anti-nutritive compounds (Oscarsson and Savage 2006) because oxalates can form non-absorbable insoluble salts with Ca²⁺, Fe²⁺, and Mg²⁺, rendering these minerals unavailable (Savage *et al.* 2000; Quinteros *et al.* 2003; Oscarsson and Savage 2006; Savage *et al.* 2009). A diet high in soluble oxalates can increase the risk of kidney stone formation and may reduce calcium absorption (Holmes and Assimos, 2004). It has been reported that the greater part of the oxalic acid in plants is present in the form of soluble oxalates (Gad *et al.* 1982), by combining with Na⁺, K⁺ or NH₄⁺ (Noonan and Savage 1999). The oxalate concentration in forage can vary widely both between different species of plants and within species of the same plant. There are also other factors involved in assessing the oxalate content of plants These include soil nutrient status, plant part (petiole/leaves/tubers) and climatic conditions. The highest levels of oxalates are found in the following species: *Amaranthus* (amaranth); *Colocasia* (Taro or Old Cocoyam) and *Xanthosoma* (New Cocoyam); *Spinacia* (spinach) (Noonan and Savage 1999). According to Holloway *et al.* (1989), the total oxalate levels in taro (*Colocasia esculenta*) and sweet potato (*Ipomoea batatas*) were 278-574 mg/100 g fresh weight (FW), and 470 mg/100 g FW (Mosha *et al.* 1995). Total oxalate levels in tropical yam (*Dioscorea alata*) tubers were

reported in the range 486-781 mg/100 g DM but may be of little nutritional concern since 50-75% of the oxalates were present in the water-soluble form and therefore would leach out during cooking (Wanasundera and Ravindran 1992). Oxalates are considered anti-nutrients as well as toxins. They render calcium unavailable by binding the calcium ion to form insoluble calcium oxalate complex. The absorption of zinc, calcium, magnesium, iron and copper may be reduced in the intestinal tract by phytate forming insoluble compounds. Zinc is mostly affected. It has been shown that calcium potentiates the negative effect of phytate on zinc absorption (Forbes *et al.*, 1984). Phytate react with protein to form a phytate – protein complex (phytate-cation-protein complex). This is believed to account for mineral and protein bioavailability associated with the consumption of phytate rich food or feed materials (Aletor, 1993). Oke (1969) has shown that on a dry weight basis, some of the Nigerian vegetables may be superior to milk as gross sources of calcium except that the calcium is not available due to the presence of oxalic acid and is bound as insoluble calcium oxalate. High oxalate diet can increase the risk of renal calcium absorption. Oxalate contents of ACLM is however, lower than those associated with renal problems (Marshall *et al.*, 1967). The anti-nutritional contents of ACLM is low, much lower than is obtainable in most Nigerian vegetables implying that, the overall nutritional value of ACLM may not be affected. Some researchers have been able to develop methods to reduce the toxic and inhibitory substances in plants with anti-nutritive chemicals. The processing methods included application of chemicals, water, thermal and biotechnological treatments before consumption (Bressani, 2002; Diallo and Berhe, 2003). The hydrogen cyanide (HCN) from cynoglycosides was reduced by brief sun drying after air drying. The liberated HCN may be lost through volatilization during sun drying or converted to thiocyanides (Montgomery, 1980). The use of any of these processing methods on the leaves may be of value.

CONCLUSION:

The aim of this study was to determine the mineral proximate nutrient and anti-nutrient composition of ACLM. Our results have shown that ACLM extracts are a fairly good source of phytochemicals, minerals and minor quantities of antinutrients which have been reported to have varying biochemical and physiological activities. The benefit of these phytochemicals can only be derived with proper processing of the extracts or moderation on dosage. The study provided some knowledge on the nutritional value of the leaves when fed as leaf meals to monogastric animals. From the results, the ACLM could serve as a supplementary diet for monogastric animals, supplying their body with nutrients such as minerals, protein and energy. The

presence of secondary metabolites *e.g.* phenols, tannins and cardiac glycosides in very small amounts in ACLM contributes to its medicinal value, thus the plant may be significantly important as feed additives and veterinary health management.

ACKNOWLEDGMENTS:

We wish to acknowledge the assistance rendered by our H.O.D in the person of Professor E.B. Ngodigha for his contributions and criticisms

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