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Nutrient and Anti - Nutrient Composition of *Jatropha*(*Jatropha curcas*) Fruit Pericarp and Seed Coat, Cocoa (*Theobroma cacao*) and Kola-nut(*Cola nitida*) Pods

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ABSTRACT

The cost of raw material for the production of animal feed calls for the evaluation and ascertaining the adequacy of some lesser known potential agricultural products for their nutrient content and anti- nutritional factors to determine the type of processing or supplementation required to transform them into nutritive feed. The proximate composition and mineral content were carried out on jatropha fruit pericarp (JF) and seed coat (JS), kolanut pod (KP) and cocoa pod (CP). The result shows that JS has highest protein content of 16.18% followed by JF 9.47% while KP had the least protein of 3.58%. Carbohydrate content of JS was the highest (48.87%) followed by KP 37.92% with CP 30.92%. The lipid content of (8.15, 7.40 7.05 and 5.65) % respectively were recorded for JF, JS, CP and KP. JF had the highest ash content (20.8%) followed by CP 14.65 %. Moisture content was relatively low in JS (9.0%) and JF 8.4% and high in CP 13.8 % and KP (16.05%), Mineral content of both cocoa and kolanut pods were relatively richer in Mn and Fe than in both samples of jatropha, while jatropha sample was richer in Ca and Zn content. There was generally low Zn record in all the samples, while mg content is within 12.50 and 13.21 ppm. Nutrient content in all samples indicates that they could possibly be incorporated into animal feed. Antinutritional factors records for CP and KP were of higher values of tannin, saponin, nitrite, nitrate, and oxalic and phytic acid, while JS and JF had the least nitrate, nitrite, tannin, oxalic and phytic acid content and, JS had the least saponin. The results provide a prerequisite information which assist in transforming the studied agricultural residue into the required inexpensive highly nutritive feeds.

Key words: Nutrient, Antinutritional factors, *Jatropha* Fruit Pericarp, *Jatropha* Seed coat, Cocoa pod, Kola-nut pods

Introduction

A major task in animal husbandry is the provision of animal feed. Livestock industries face a lot of challenges in terms of source and cost of feeds. The major part of ingredient such as ground nut cake, maize, guinea corn and soya beans compete greatly with the high demand for human consumption (Payne and Wilson, 1999). The presence of potential toxic compound and antinutritional components in feed can reduce nutrient availability and can compromise the immune system of the animal with concomitant predisposition of the animal to various disease conditions. The knowledge of antinutritional factor in the source of the feed will offer the need to ensure reducing to non lethal threshold through adequate processing method (Okafor *et al.* 2008).

The source and the cost of feed discourage many potential animal husbandry. The high cost which brings down the profit margin of this venture indeed discourages the business expansion. Sendride, (2009) The use of cheaper and lesser known conventional raw-materials for the formulation of animal feeds, has been described as a low cost route to improve animal performance (Ilelaboye and Pikuda 2009). Of-course kolanut and cocoa pods. *Jatropha curcas* fruit pericarp and seed coat are all renowned agro-industrial wastes Adeyi (2010). They are plant products of which there is no comprehensive information, especially the functional properties for their incorporation of these material ingredients into animal husbandry feed.

The purpose of this study is to evaluate these agricultural wastes for their potential nutrients and innate antinutritional factors and thus provide prerequisite information which is necessary to determine the type of processing or supplementation required to transform them to required inexpensive highly nutritive feeds. Therefore nutritional values and antinutritional factors of *Jatropha curcas* fruit pericarp and seed coat, cocoa (*Theobroma cacao*) and kola-nut (*Cola nitida*) pods, were carried out, so as to have information on their nutrient composition for their potential animal feed ingredient. Utilization of these products as agricultural feed for herbivores will lead to converting agricultural wastes to agricultural wealth.

Materials and Methods

Samples and sample preparation

Theobroma cacao pod and *Cola nitida* pod were collected from their main farm plantation in Akure, Ondo State and Iloffa in Kwara State respectively while *Jatropha curcas* was collected from *Jatropha curcas* plantation University of Ilorin, Ilorin Kwara state, all in Nigeria. The cocoa pod and the kola nut pod were split open and the pods were sundried. The *Jatropha curcas* was de-shelled and both the fruit pericarp and seed coat were sundried separately.

Chemical analyses

Reagents: cadmium metal, sulphanilic acid, N-(1-Naphthyl) ethylenediamine hydrochloride, sodium tungstate, orthophosphoric acid, potassium Permanganate, sodium hydroxide, sulphuric

acid, Calcium chloride; methyl red, bromocresol green, trypsin and potassium dihydrogen Orthophosphate used in the analysis were of Analytical grade

Standard methods of the association of official analytical chemist (AOAC,2011), were used to determine the moisture, crude protein, crude fat, total ash and crude fibre contents of each sample. Each analysis was carried out in triplicate.

$$\% \text{ moisture} = \frac{(\text{weight of sample before drying} - \text{weight of sample after drying})}{\text{Weight of sample before drying}} \times 100$$

The dry matter was used in determination of the other parameters

Moisture content

The quantity 2g of each sample were weighed and transferred into already cleaned and dry beakers. The samples were placed in an oven maintained at 100°C -1005°C after 16 hours the samples were transferred to a dessicator at room temperature to cool. The new weight was then determined.

Ash was determined by the incineration of 2.0g sample placed in a muffle furnace maintained at 550°C for 6 hours.

Ash content

$$\text{Ash content of the sample} = \frac{\text{weight of ash}}{\text{weight of dried sample}}$$

Crude protein

This was estimated by measuring the amount of nitrogen (n) in the sample with use of 6.25 multiplier based on the reported assumption of all the nitrogen are present as protein and protein consist of 16% of N' (Bennick, 1994). Crude protein was

determined by kjedahl method using the ammonia distillate with standard 0.10M HCl. The volume of the acid which turned the distillate to a permanent pink colour was taken as the titre value. The % nitrogen was obtained as follows

$$\% \text{ Nitrogen} = \frac{\text{titre value} \times 140 \times \text{total vol of the sample}}{100\text{mg} \times \text{sample weight (g)} \times \text{aliquat volume added}}$$

$$\% \text{ crude protein} = \text{nitrogen} \times 6.25$$

Crude fat

This was obtained by exhaustively extracting 1.0 g of each sample in soxhlet apparatus using petroleum ether (boiling

point range 40—60°C) as extract. The percentage crude lipid was obtained by the following expression

$$\% \text{ crude lipid} = \frac{\text{increase weight of soxhlet}}{\text{weight of the sample used}}$$

Crude fibre

This was obtained by digesting 2.0g of sample with H_2SO_4 and NaOH and incinerator. The residue was ashed in a

muffle furnace maintained at 55°C to a constant weight. % Crude fibre is then obtained as follows

$$\% \text{ crude fibre} = \frac{\text{weight of sample before ashing} - \text{weight of sample after ashing}}{\text{weight of the sample}}$$

Total carbohydrate

This was obtained by difference.

$$\% \text{ carbohydrate} = 100 - (\% \text{ crude protein} + \% \text{ crude fat} + \text{ash})$$

then filtered into a 100 ml volumetric flask and made up to the mark with distilled water. The mineral contents (Mn Fe Zn Ca Mg) of the solutions were determined using atomic absorption spectrophotometer.

Each analysis was repeated thrice

Mineral content determination

The ash content of the sample contain all the minerals in the sample (Blades,2000) the specific mineral contents of each sample were determined by atomic absorption spectrophotometry after dry ashing of the sample. A measured quantity of the ash sample was transfers into digestion flask and dissolve in 30cm³ of concentration HNO_3 and 10 ml of conc. HCL and the mixture was heated on a hot plate .The solution was

Determination of Antinutritional factors.

Oxalic acid was determined quantitatively by redox titration with standard solution of potassium permanganate, according to the procedure of Day and Underwood,(1986). A method similar to that of Hudson and El-Difrawl (2011) was used to determine saponin. Phytic acid determined according to the procedure of Ruales and Nair (2012). Tannic acid was determined in accordance with the procedure of AOAC (2011), Nitrate and nitrite were analyzed by the methods of Alexeyer,(2010) .

Result and Discussion

The nutrient composition (presented on table 1) show that the carbohydrate content which constitute an important source of

readily available energy (Adamafio,2008) ranged from 48.87—30.00% with jatropha seed coat having the highest carbohydrate content while cocoa pod had the lowest

carbohydrate. This result is found to correlate with the report of analysis on related samples. The result of protein content is 16.18% and 9.47% for JS and JF respectively, while for CP and KP, 7.78% and 3.58% protein respectively were observed. Lipid which is known to serve as energy reserves for animal (Ajewole and Adeyeye 1992) was found to be 8.15, 7.40, 7.05 and 5.65% in JF JS CP and KP respectively. *Jatropha* samples are much richer in lipid. This is a reflection of high lipid content (38.0%) reported in *jatropha* seed, (Ilelaboye and Pikuda (2009) the lipid value for KP was slightly lower than lipid value reported *kolanut* seed (Odebunmi *et al.*, (2009)

Crude fibre refers to a combination of cellulose, hemicelluloses and lignin (Longe, and Ogedegbe, 1989; Bennick, 2012). The crude fibre content was much lower in the two *Jatropha* samples (JF 17.75% and JS 13.15%) almost the same with the result reported for *jatropha* seed. The two pods had high crude fibre values, the result was expectedly lower than reported crude fibre value in *cocoa* seed (Adamafio, 2008). The lower fibre content in *jatropha* samples is found to be normal as high level of fiber produce adverse effect on the growth performance of ruminants. (Longe, and Ogedegbe, 1989; Bennick, 2012). The values of crude fibres obtained for the two pods are in accordance with those reported in literatures (Adeyi, 2010).

Moisture content in this study was found to be the lowest in JS (9.0%) followed by JF 8.4% & highest in KP (16.05%). The observed result is very related to values

obtained for related samples in literature. The ash content which is an indicator of minerals content show the following results JF is 20.8%. followed by CP 14.65% & low in JS 5.4% and KP 3.1%. Mineral The result of mineral composition presented in table 2 shows that both *cocoa* and *kolanut* pods were richer in Mn & Fe than *Jatropha* samples. *Jatropha* samples contain more of Ca, Mg & Zn. Concentration of Zn is generally low in all the samples, just as observed in the literature (Odebunmi *et al.*, 2009). The result of antinutritional factors presented in table 3 revealed that *Cola nitida* and *Theobroma cacao* appeared to have higher values of tannin, saponin, nitrite, nitrate, and oxalic and phytic acid *J. curcas* fruit pericarp had the least nitrate, nitrite, tannin, oxalic and phytic acid content. while, *J. curcas* seed coat has the least saponin. All the values reported for the samples were lower than 3100 mg/100 g reported for *Mucuna* (*Mucuna utilis*) bean seed (Ravindran and Ravindran 1988). Phytate content of all the samples under study were higher than 810.50 mg/100 g reported for pigeon pea (*cajanus cajan* L) and 480.0mg/100 g reported for *T.cucumenna*. (Ilelaboye and Pikuda 2009; Oloyo, 2002). The values of tannin (8.50-25.40) obtained for the samples used in this study were lower than 760 mg/100 g reported for *Mucuna* (*Mucuna utilis*) beans seeds but higher than the value (2.23 mg/100 g) reported for pigeon pea (*Cajanus cajan* L). The values for saponin were comparably higher than 700 mg/100 g reported for quinoa (*Chenopodium quinoa wild*) seeds (Ruales and Nair, 2012).

The oxalate values were comparably higher than the values obtained for some under-utilized crop seeds in Nigeria (Balogun and Fetuga, 1988). Nitrate present were relatively non-toxic constituents in food but may be considered as a potential hazard since they are the precursor of nitrites the actual toxic substances. The nitrate level was within safe limit and cannot pose any danger to the animal (Afolabi *et al*, 1985.)

Conclusion

The study shows that there were variation in the concentration of the various the nutrient and anti-nutrient factor. The result shows the need for careful selection in term of quality of nutrient and limited presence of anti-nutritional factors for incorporation of raw

material source in animal feed. (Umar I.M (2004); Arosemena *et al*, 1995) The relatively high nutritive value of the two samples from *J. curcas* and low antinutritive factors are good indices as stuff for animal feeds. In general the result of this study will assist in determining the type of processing or supplementation required to transform studied agricultural waste into the required inexpensive highly nutritive feeds

Table 1: Proximate composition of cocoa pod, kolanut pod, *Jatropha curcas* pericarp and seed coat

Parameters	Kola nut pod	Cola nut Pod	Jatropha Seed coat	Jatropha Fruit Pericarp
Moisture content	16.05 ± 0.09	13.50 ± 0.06	9.00 ± 1.0	8.40 ± 0.08
Fat content	5.65 ± 0.13	7.05 ± 0.17	7.40 ± 0.21	8.15 ± 0.26
Protein content	3.58 ± 0.15	7.78 ± 0.05	16.18 ± 0.16	9.47 ± 0.09
Crude fibre content	33.70 ± 0.11	26.10 ± 0.16	13.15 ± 0.11	17.75 ± 0.09
Ash content	3.10 ± 0.07	14.65 ± 0.05	5.40 ± 0.09	20.80 ± 0.01
Carbohydrate content	37.92 ± 0.22	30.92 ± 0.16	48.87 ± 0.21	35.43 ± 0.18

Values are means ± standard deviations of triplicate determinations

Table 2: Mineral content of *Jatropha curcas* pericarp & seed coat, cocoa pod, and kolanut pod.

Parameters	Kola nut pod	Cola nut Pod	Jatropha Seed coat	Jatropha Fruit Pericarp
Mn Conc.(ppm)	10.01±0.002	12.1 ± 0.002	7.8± 0.002	7.8±0.002
Fe Conc.(ppm)	40.92±0.002	45.01±0.002	14.00±0.002	22.30±0.002
Ca Conc.(ppm)	16.01±0.003	18.01±0.003	19.10±0.003	22.14±0.003
Mg Conc.(ppm)	12.78±0.002	12.56±0.002	13.21±0.002	12.56±0.002
Zn Conc.(ppm)	0.42± 0.002	0.45± 0.002	0.48±0.002	0.51.± 0.002

Values are means ± standard deviations of triplicate determinations

Table 3: Antinutritional factors in *Jatropha curcas* Pericarp and Seed Coat, Cocoa (*Theobroma cacao*) and Cola-Nut (*Cola nitida*) Pods

Antinutrient	<i>Jatropha curcas</i>) Fruit pericarp (mg/100g)	<i>Jatropha curcas</i>) Seed coat (mg/100g)	<i>Theobroma cacao</i> Pod (mg/100g)	<i>Cola nitida</i>) Pod (mg/100g)
Tannin	8.50 ± 0.18	9.10 ± 0.10	19.60 0.12	25.40 ± 0.07
Oxalic acid	24.93 ±1.2	29.50 ± 0.88	86.60 0.94	94.50 ± 1.60
Sapolin	910.20 ± 1.80	856.67 ± 1.60	1300.54 ± 2.0	560.10 ± 0.99
Phytic acid	256.00 ± 0.05	319.50 ± 2.23	624.32 ± 1.3	353.89 ± 1.7
Nitrate	7.00 ± 0.26	9.11 ± 0.31	18.13 ±0.21	14.67 ± 0.51
Nitrite	14.00 ± 0.02	25.62 ± 0.90	54.04 ± 0.57	57.49 ± 0.60

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