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National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

EFFECT OF DIFFERENT PROCESSING METHODS ON THE NUTRITIONAL COMPONENTS OF *DELONIX REGIA* (FLAMBOYANT) SEEDS FOR AQUA FEED

[1]Oyegbile, B., [2]Yola, I. A. and [2]Abdullahi, B. A.
[1]Nuhu Bamalli Polytechnic, Zaria, Kaduna State.
[2]Bayero University, Kano, Nigeria
Corresponding author: bigm4real@gmail.com

ABSTRACT

This study was conducted to determine the effect of different processing methods on the nutritional components of *Delonix regia* (flamboyant) seeds. One hundred grams (100g) of seeds were weighed separately for each processing method (cooking, CFS; Fermentation, FFS and Raw, RFS). The processed seeds were dried and grounded into homogeneous powder using a hammer mill. Proximate and anti-nutritional components were determined using standard methods. The different processing methods had significant ($P<0.05$) effect on the proximate composition and anti-nutritional components of *Delonix regia* (Flamboyant) seeds. Fermentation as a processing method recorded the following percentage reduction on the anti-nutritional components: 78, 74, 71, 73, 75, 81 and 92% for phytate, oxalate, flavonoids, saponin, alkaloids, tannin and cyanide respectively. While cooking as a processing method had the following percentage reduction: 86, 80, 78, 79, 92, 88, and 95% for phytate, oxalate, flavonoids, saponin, alkaloid, tannin and cyanide, respectively. It is therefore concluded that cooked and fermented *Delonix regia* seeds could serve as a supplement for other conventional protein sources.

Keywords: *Delonix regia*, processing methods, nutritional content, anti-nutritional factors.

INTRODUCTION

A lot of emphasis has been made on the use of plant protein sources like soya beans cake (Nyirenda et al., 2000; Koumi et al., 2009). Groundnut cake (Ovie and Ovie, 2007), cotton seed cake (Mbahinzireki et al., 2001; Elsaidy and Gaber, 2003) and rape seed meal (Burel et al., 2009). But there is the challenge of competition for these conventional plants by livestock and humans. There is therefore the need to produce an economically viable, palatable and environmentally friendly feed. Research is currently directed towards the use of unconventional protein sources especially from plant products like leaves, seeds and other agricultural by products (Siddhuraju and Becker, 2003; Olvera-Novoa et al., 2002; Ali et al., 2003; Bake et al., 2009). In Africa the high cost of formulated commercial fish feed is a major constraint to its growth and expansion in the agricultural sector (Hecht, 2007) and this has prompted a concerted effort, particularly in Nigeria to seek alternative feed ingredients. A lot of legumes are left unutilized due to the presence of anti-nutritional components, one of such legumes is *Delonix regia* (Flamboyant) seeds. The presence of these anti-nutritional factors can be reduced through processing (Abdullahi and Abdullahi, 2005). This research is therefore aimed at evaluating the effects of different processing methods on the nutritional components of *Delonix regia* (Flamboyant) seeds meal thereby assessing its potential in supplementing conventional protein feed ingredients.

MATERIALS AND METHODS

Location of the study and collection of *Delonix regia* (flamboyant) seed

Matured and dry pods of *Delonix regia* (flamboyant) containing the seeds were collected from the annex campus of Nuhu Bamalli Polytechnic Zaria, Kaduna State, Nigeria. Seeds were collected by opening the pods manually. The average seeds per pod is between 30-37 weight of 100 seeds is 42.5g.The collected seeds were hand-picked for selection of healthy seeds.

Processing of seeds

One hundred grams (100g) of seeds were weighed separately for processing, one part for cooking, the second for fermentation and the third left as raw.

Fermentation of *Delonix regia* (flamboyant) seeds

The seeds were soaked in water for 12hours. The soaked seeds were drained and allowed to ferment naturally by tying in polythene bag and kept in a dark cupboard for 72hours without the addition of yeast (Udensi et al., 2006). The fermented seeds were air dried for two days before grinding into homogenous powder using a hammer mill.

Cooking of *Delonix regia* (flamboyant) seeds:

The seeds were boiled at 100^{o}c for 80mins and were allowed to cool by sun drying and later grounded to homogenous powder using a hammer mill (Bake et al., 2014).

Raw *Delonix regia* (flamboyant) seeds:

The raw seeds were sundried for two days and were milled into a homogenous powder using a hammer mill.

Proximate Analysis:

The differently processed seeds were taken for the analysis of nutritional and anti - nutritional components using the methods described by AOAC (2000). The anti –nutritional factors determined includes phytate, alkaloids, tannin, saponin, oxalate, cyanide and flavonoid. All analysis was carried out in triplicates.

Data analysis:

The data obtained was subjected to one-way analysis of variance (ANOVA). Significant ($P<0.05$; 0.01) differences in means were separated using Duncan's Multiple Range Test.

RESULT

The result of the effect of different processing method on the proximate composition of *Delonix regia* (Flamboyant) seeds is presented in Table 1. There were significant differences ($P< 0.001$) across the treatments for crude protein, moisture, ash, ether extract, crude fibre and nitrogen free extract. Fermentation (FFS) had the highest concentration of crude protein and fibre in *Delonix regia* seeds while cooked *Delonix regia* seeds (CFS) had the highest values for moisture (7.02) ash (3.51), ether extract (10.26) respectively. Cooking increase the concentration of crude protein, moisture, ash, ether extract and energy while fermentation increase the concentration of crude protein, moisture, ash and crude fibre.

Table 1: Proximate composition of differently processed *D.regia* (Flamboyant) Seeds.

PARAMETER (g/100g)	**RFS**	**CFS**	**FFS**	**P VALUE**
Crude Protein	17.38 ± 0.07^{c}	26.25 ± 0.07^{b}	29.38 ± 00.1^{a}	0.0001***
Moisture	4.39 ± 0.05^{c}	7.02 ± 0.05^{a}	6.24 ± 0.04^{b}	0.0001***
Ash	2.81 ± 0.02^{c}	3.51 ± 0.06^{a}	3.02 ± 0.03^{b}	0.0001***
Ether extract	9.75 ± 0.05^{c}	10.26 ± 0.04^{a}	9.54 ± 0.04^{b}	0.0001***
Crude fibre	12.86 ± 0.04^{b}	12.69 ± 0.05^{b}	13.85 ± 0.07^{a}	0.0001***
Nitrogen free extranet	52.81 ± 0.02^{a}	40.27 ± 0.06^{b}	37.39 ± 0.10^{c}	0.0001***
Energy (kcal/J)	2250	2240	2240	

^{abc} means with different superscripts across the columns are significantly Different (P<0.05)
RFS – Raw *D.regia* (Flamboyant) Seeds
CFS- Cooked *D.regia* (Flamboyant) Seeds
FFS – Fermented *D.regia* (Flamboyant) Seeds

The result of the effect of different processing method on the anti-nutritional component of *D.regia* seed are presented in Table 2. Processing method has a significant effect (P < 0.001) on phytate, oxalate, flavonoids, saponin, alkaloids, tannin and cyanide. Cooking had higher percentage reduction than fermentation in all the anti-nutritional components (Phytate, 0.12 mg/100g and 0.19mg/100g; oxalate, 0.18mg/100g and 0.23/100g ; flavonoids 0.62mg/100g and 0.80mg/100g; saponin 0.55mg/100g and 0.71mg/100g; tannin 0.17mg/100g and 0.26mg/100g; cyanide 0.30mg/100g and 0.05mg/100g for cooked (CFS) and fermented (FFS). *Delonix regia* seeds respectively. The value of the anti-nutrient was higher in the unprocessed seeds (RFS) than the processed *Delonix regia* seeds.

Table 2: Anti-nutrients composition of differently Processed *Delonix regia* (Flamboyant) Seeds

ANTI-NUTRIENTS (MG/100G)	**RFS**	**CFS**	**FFS**	**P VALUE**
Phytate	0.86 ± 0.03^{b}	0.12 ± 0.02^{a}	0.19 ± 0.03^{a}	0.0001***
% Reduction		86	78	
Oxalate	0.90 ± 0.03^{b}	0.18 ± 0.05^{a}	0.23 ± 0.02^{a}	0.0001***
% Reduction		80	74	
Flavonoids	2.78 ± 0.01^{c}	0.62 ± 0.04^{a}	0.80 ± 0.03^{b}	0.0001***
% Reduction		78	71	
Saponin	2.62 ± 0.05^{c}	0.55 ± 0.02^{a}	0.71 ± 0.05^{b}	0.0001***
% Reduction		79	73	
Alkaloid	2.51 ± 0.03^{c}	0.19 ± 0.04^{a}	0.63 ± 0.02^{b}	0.0001***
% Reduction		92	75	
Tannin	1.40 ± 0.15^{b}	0.17 ± 0.02^{a}	0.26 ± 0.05^{a}	0.0001***
% Reduction		88	81	
Cyanide	0.60 ± 0.02^{b}	0.03 ± 0.01^{a}	0.05 ± 0.02^{a}	0.0001***
% Reduction		95	92	

^{abc} Means with different Superscript across the column are significantly (P< 0.05) different
*** - Highly Significant
RFS – Raw *Delonix regia* (Flamboyant) Seeds
CFS- Cooked *Delonix regia* (Flamboyant) Seeds
FFS – Fermented *Delonix regia* (Flamboyant) Seeds

DISCUSSION

The crude protein value obtained in this study of 26.25% and 29.38% for CFS and FFS respectively is higher than the value obtained by Balogun et al. (2004) which was 22.49% after boiling *D.regia* seeds at 100^{o}C for 80mins. It is also higher than the value obtained by Gabriel et al. (2007) which was 25.11% for cooked seed. The differences might be due to differences in environmental conditions like nature of soil, processing conditions and the period of harvesting (Gabriel et al., 2007). Francis et al. (2001) and Solomon et al. (2007) reported that heat treatment reduces and inactivates levels of secondary compounds in seeds meals substantially. The result obtained from this study tends to agree with this pattern.

Cooking was significantly better ($P<0.001$) than fermentation and raw for all the anti-nutritional components with exception in phytate, oxalate, tannin and cyanide in which fermentation was similar to cooking. Recent studies (Abdullahi and Abdullahi, 2011) shows that boiling seeds reduces the concentration of the anti-nutritional content which agrees with the findings of this research.

CONCLUSION AND RECOMMENDATION

The range of crude protein values of cooked and fermented *Delonix regia* seed obtained in this study shows that cooked and fermented *Delonix regia* seeds could serve as a supplement for other conventional protein.

Percentage reductions were recorded as follows; phytate 86:78%, oxalate 80:74%, flavonoids 78:71%, saponin 79:73% alkaloids 92:75% tannin 88:81% and cyanide 95:92% for CFS and FFS, respectively.

This implies that cooking as a processing method reduced the antinutritional factors effectively than fermentation due to the fact that cooking was able to breakdown the non-starch polysaccharides and reduce leaching of nutrient in *Delonix regia* seeds.

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