

BAP -09

Effects of Processing Methods on Proximate Composition and Anti-Nutritional Components of Rolfe (*Daniellia oliveri*) Seed

S.A. Okunade¹, A.O. Isah², K.O. Yusuf², O.A. Olafadehan³, O.J. Makinde⁴, and J. Ajayi⁵

¹Department of Animal Production Technology, Federal College of Wildlife Management, PMB 268, New Bussa, Nigeria; ²Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, Nigeria; ³Department of Animal Science, University of Abuja, Abuja, Nigeria; ⁴Department of Animal Science, Federal University, Gashua, Nigeria; ⁵Department of Basic Sciences, Federal College of Wildlife Management, New Bussa

Corresponding author: S.A. Okunade; E-mail: saokunade2013@gmail.com; Phone: +234 703 0294 808

Abstract

This study aimed to determine the effect of different processing methods on the proximate composition and anti-nutritional factors (ANF) of Rolfe (*Daniellia oliveri*) seed. Dehiscent seeds of *Daniellia oliveri* (DO) were collected and subjected to different processing methods (fermentation, sprouting, cooking, toasting and toasting-decortications) under close monitoring. Dry matter and ash contents were highest ($p < 0.05$) in toasted seeds. Crude protein (CP) was highest and lowest ($p < 0.05$) in toasted-decorticated and cooked seeds respectively. Toasting-decortication reduced crude fibre (CF) relative to other processing methods. Cooking had the lowest ($p < 0.05$) ether extract among the processing methods. Although toasting-decortication appears to be the most effective processing methods to enhance the nutritive potential of DO seeds. This study shows that DO seeds can serve as feed ingredient in livestock feeds to increase CP content without toxic consequences.

Keywords: *Daniellia oliveri*, processing method, proximate composition, anti-nutritional factors

Introduction

Provision of quality feed in proper quantity facilitates good livestock production. However, nutrition remains one of the limiting factors in livestock production especially in developing countries of the world. Feeding livestock especially ruminants is becoming more difficult among our local farmers who depend largely on undeveloped natural seasonal pastures and crop residues. Economic recession coupled with devaluation of Nigeria currency which reduces the purchasing power of the farmers makes supplementation with concentrate feeds almost impossible for these local farmers (Okunade *et al.*, 2017).

Recently, the price of groundnut cake (GNC) and soybean meal (SBM), the two major conventional plant protein sources for livestock feeds in the tropics, has risen steadily due to high demands as a result of intensification of livestock production to feed the teeming human population. This scenario requires intensified advocacy for cheap alternative feed resources such as lesser-known legume seeds for ruminant feeding. *Daniellia oliveri* (DO) seed, a lesser-known legume seed, could be a promising alternative to conventional protein sources used in ruminants ration. Different traditional processing methods such as toasting, cooking, fermentation, etc. can reduce anti-nutritional factors and raise nutrients bioavailability in most of these lesser-known legume seeds (Rajab *et al.*, 2010).

The present study therefore investigated the effects of different processing methods for *Daniellia oliveri* seeds on nutrient composition and anti nutritional factors.

Materials and Methods

This study was carried out at the Federal College of Wildlife Management, New Bussa, Niger State, Nigeria. *Daniellia oliveri* seeds were collected from several stands of the tree within the College premises by hand-picking the dispersed seeds under the mature trees. Extraneous materials of the seeds were removed by hand. About 500 g of clean raw seed milled and oven dried at 50°C served as the control. The raw seeds were wrapped in a blanched banana leaves and allowed to ferment for 4 days. Sprouting of the seeds was carried out by soaking the seeds overnight; the seeds were allow to germinate at room temperature for 5 days by keeping them in trays lined with 2 cm thick wet sawdust. Another 500 g seed were cooked at 100 °C at a seed: water ratio of 1: 10 w/v. for 2 h in an aluminium pot on a Gallenkamp thermostat hot plate. The water was drained and the cooked seed oven dried at 50 °C. Sand toasting of 500 g sample of the seeds was done in open pan under controlled temperature of 100 °C for 15 minutes. The seeds were continuously turned until the seeds cracked and their endosperm turned brown with toasty smell. The toasted seeds were decorticated to give only cleaned seed kernels. All the processed seed samples were ground to pass through a 1 mm sieve before analysis.

Proximate composition and anti-nutritional compounds (tannins, saponins, phytic acid and oxalate) were determined following the procedure of AOAC (2005).

Data collected was subjected to one way Analysis of variance in Complete Randomized Design using version 9.1 of SAS software (SAS, 2001). Significantly different means were separated using Duncan's procedure and considered significant at $p < 0.05$.

Results and Discussion

The nutrient composition of the raw seed (Table 1) varied slightly from previous works (Adubiaro, *et al.*, 2011; Okunade *et al.*, 2017), but compared favourably with most tropical legume seeds (Fasoyiro *et al.*, 2012). All the nutrient compositions and energy were affected by the processing methods. Toasting increased DM content more effectively because of the heat application which removed much of the moisture content compared with other methods. Except fermentation, all processing methods increased ($p < 0.05$) CP content relative to the raw seeds. Toasting-decortication had the highest CP content ($p < 0.05$), while cooking had the lowest ($p < 0.05$) CP. The decrease in CP content of cooking may be attributed to the leaching of soluble proteins (Obiakor *et al.*, 2014). The CF content of raw DO seeds agree with previously reported value of 6.70% DM (Osman, 2007). The lowest ($p < 0.05$) CF level of toasted-decorticated seed implies that the bulk of the fibre in the coat; hence, its removal drastically reduced the fibre content. The generally high CP and low fibre contents of the DO seeds display its nutritive value and thus, it's potential as a substitute for conventional protein sources in livestock nutrition. Ash content varied among the processing methods with toasting increasing it ($p < 0.05$), while the other processing methods reduced it.

Table 1: Effect of processing methods on proximate composition of *D. oliveri* seed (g/100 g DM)

Parameters	DM	CP	CF	ASH	EE	NFE
Raw	96.06 ^b	30.86 ^d	6.98 ^d	4.29 ^b	6.56 ^a	50.31
Fermentation	92.55 ^c	30.21 ^d	7.95 ^b	3.94 ^c	6.03 ^{bc}	51.87
Sprouting	87.17 ^d	34.13 ^b	5.02 ^e	3.28 ^d	6.02 ^{bc}	51.55
Cooking	93.55 ^c	28.38 ^e	7.56 ^c	3.10 ^d	5.56 ^c	54.28
Toasting	97.27 ^a	32.28 ^c	8.42 ^a	4.69 ^a	6.68 ^a	49.05
Toasting-decortication	95.68 ^b	37.45 ^a	2.68 ^f	4.05 ^{bc}	6.46 ^a	50.36
SEM	0.50	0.38	0.08	0.14	0.22	0.34

^{abcdef} Means in the same column with different superscripts differ significantly ($p < 0.05$).

The lowest ash level of recorded for cooked seeds was similar to ash level reported by (Obiakor *et al.*, 2014), or *Mucuna sloanei* seeds. The lowest ash content recorded in cooked DO seeds may be as a result of leaching of some minerals into the cooking water. Raw and toasted seed meals had higher ($p < 0.05$) EE than fermented and sprouted seed meals. Cooking was more effective than other methods in reduction of fat, which was in agreement with the report of Osman (2007) who observed high lipolytic enzyme activity, which breaks down triglyceride to simple fatty acids, sterol esters and polar lipids, in soaked, cooked and germinated seeds. The processing methods had no ($p > 0.05$) effect on NFE.

Processing of feed ingredients has been found to reduce or remove the anti-nutritional factors (ANF). In the current study, the applied processing methods significantly reduced the ANF of the seed meals (Table 2). The results agree with that of Shaahu *et al.* (2015). However, toasting-decortication was the most effective method for reducing tannins, saponins, oxalate and phytate in the seeds obviously because these ANF are mainly concentrated in the seed coat of legumes (Rajni *et al.*, 2012).

Table 2: Effect of processing methods on anti-nutritional composition of *D. oliveri* seed (g/100 DM)

Parameters	Tannins	Saponins	Oxalate	Phytate
Raw	3.88 ^a	2.28 ^a	0.24 ^a	4.07 ^b
Fermentation	3.60 ^b	1.56 ^{bc}	0.05 ^c	2.69 ^e
Sprouting	3.00 ^c	1.61 ^{bc}	0.22 ^a	3.02 ^d
Cooking	3.01 ^c	1.52 ^{bc}	0.15 ^b	5.12 ^a
Toasting	3.16 ^c	2.06 ^{ab}	0.10 ^{bc}	3.40 ^c
Toasting-decortication	2.05 ^d	0.98 ^c	0.07 ^c	2.09 ^f
SEM	0.12	0.39	0.03	0.14

^{abcdef} Means in the same column with different superscripts differ significantly ($p < 0.05$).

Therefore, decortications (removal of the seed coat) must have eliminated a significant proportion of these anti-nutritional factors. Besides, most of the ANF is heat labile, especially tannins. The generally low concentration of ANF in relative to the tolerable level by ruminants is indicative of the possibility of utilising the seed meal as a feed ingredient without jeopardizing the health of animals consuming such feed, particularly ruminants. For example the tannins and phytate contents of the seeds are lower than <5% being reported as beneficial tannins (Frutos *et al.*, 2004) levels in ruminants.

Conclusion and Recommendation

The processing methods applied in this study were effective in improving the nutrient composition of raw *D. oliveri* seeds and also effectively reduced the anti-nutritional factors thereby making the DO seed meals promising alternative plant protein source in livestock feed. Combining more than one processing method as in the case of toasting-decorticating may give the best result.

References

- Adubiaro, H.O., Olaofe, O., Akintayo, E.T., (2011). Chemical composition, calcium, zinc and phytate inter-relationships in *Albizia lebbek* and *Daniellia oliveri* seeds. *Oriental J. Chem.*, 27(1), 33 – 40.
- AOAC, (2005). Official method of analysis 18th edition, Association of Official Analytical Chemists. Washington D.C., USA.
- Fasoyiro, S., Yudi, W. and Taiwo, K. (2012). Processing and utilization of legumes in the tropics. *Trends in vital food and control engineering*, InTech.
- Frutos, P., Hervás, G., Giráldez, F.J. and Mantecón, A.R. (2004). Tannins and ruminant nutrition: Review. *Spanish J. Agric. Res.*, 2: 191–202.
- Obiakor-Okeke, P.N., Chikwendu, J.N. and Anozie, T. (2014). Effect of different processing methods on the chemical, functional and microbial properties of *Mucuna sloanei* seeds (Ukpo). *Inter. J. Nutr. Food Sci.*, 3: 551-559.
- Okunade, S.A. and Olafadehan, O.A. (2017). Rolfe (*Daniellia oliveri*) seed meal as a protein source in locally produced concentrates for lambs fed low quality basal diet. <http://dx.doi.org/10.1016/j.jssas.2017.02.001> (In press).
- Osman, M.A. (2007). Effect of different processing methods, on nutrient composition, antinutritional factors, and in vitro protein digestibility of Dolichos lablab bean (*Lablab purpureus* (L.) Sweet). *Pakistan J. Nutr.*, 6: 299–303.
- Ragab, H. I., Kijora, C., Abdel Ati, K.A. and Danier, J. (2010). Effect of traditional processing on the nutritional value of some legumes seeds produced in Sudan for poultry feeding. *Inter. J. Poult. Science*, 9: 198-204.
- Rajni, M., Nagi, H.P.S., Priyanka, S. and Savita, S. (2012). Effect of processing on chemical composition and anti-nutritional factors in chickpea flour. *J. Food Sci. and Eng.*, 2: 180-186
- SAS (2001). Statistical Analytical Systems, Users Guide Version 9.1, SAS Institute Inc., Cary, North Carolina, USA.
- Shaahu, D.T., Carew, S.N. and Ikurior, S.A. (2015). Effect of processing on proximate, energy anti-nutritional factor, amino acid and mineral composition of Lablab seed. *Inter. J. Sci. Technol. Research*, 4: 1-3.