NUTRIENTS PROFILE AND POST IN-VITRO PARAMETERS FOR DIETARY INCLUSION OF *Delonix regia* SEED MEAL FOR SUSTAINABLE RUMINANT ANIMAL PRODUCTION

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Abstract
This study was conducted to assess the nutrients profile and post in-vitro parameters for dietary inclusion of *Delonix regia* seeds meal (DSM) for sustainable ruminant animal production. Four experimental treatments were formulated with wheat offal 42%, orange pulp meal 20%, bone meal 2% and salt 1%, palm kernel cake (PKC) and DSM was varied as T1 (35/0), T2 (20/15), T3 (15/20) and T4 (0/35) respectively, each treatment were replicated and analyzed for the proximate composition and in-vitro analysis. Results shows that there was a significant difference ($P<0.05$) in the nutrients and fiber fractions (CP, EE, ash, OM, NFE, NDF, ADF and hemicellulose) across the experimental treatments, CP ranges between 10.50 – 13.60%, decreases as the inclusion of DSM increases. Similar ($P>0.05$) DM was recorded across the experimental treatments. Post in-vitro parameters indicated that the methane gas volume was significantly ($P<0.05$) influenced with the dietary inclusion of DSM across the experimental treatments, T2 had the highest volume of CH_4 (0.61ml), least was recorded for T1 (0.47 ml). Similar value ($P>0.05$) was recorded for 24hrs gas production, CH_4 percentage, CH_4 reduction percentage, dry matter digestibility (DMD), organic matter digestibility (OMD), metabolizable energy and fermentation efficiency across the experimental treatments. Conclusively, the nutrients profile of the experimental treatments justifies the utilization of DSM for sustainable ruminant animal production, similar value observed for the post in-vitro parameters is an indication that inclusion of DSM will go a long way to resolve the challenges of feed and feeding for ruminant animal production.
Key words: Nutrients profile, in-vitro, *Delonix regia*, Ruminant and sustainable

Introduction

The quest for alternative feed ingredients for sustainable ruminant animal production has been the priority of the farmers and ruminant nutritionist in recent years. Most of these alternative feedstuffs has to be the one that will meet the nutritional requirement of the animals and at the same time environmental friendly.
Delonix regia seed has been reported to have a potential as a feed resources for farm animals especially ruminant animal. Nutritional profile of *D. regia* seeds subjected to different processing methods has been reported by Evien (2017).
Nutrients composition alone cannot alone use to adjudge the nutritional potential or value of a particular feed ingredient. The in-vitro degradability method is a laboratory estimation of assessing the potential nutritive value of the feed. It is also a method that is reproducible and parameters obtained correlate well with in-vivo trials (Fajemisin, 2002).

Despite the nutritional values of this neglected seed, its dietary inclusion with different feed ingredients has not been exhausted. In lieu of these, this study intend to examine the nutrients profile and post in-vitro parameters for dietary inclusion of *Delonix regia* seed meal for sustainable ruminant animal production.

Materials and method

Collection of experimental materials and composition of experimental treatments

Matured *Delonix regia* fruits was harvested from *Delonix regia* trees and the seeds were collected, discarded seeds was also being gathered within the University of Port Harcourt community, sundried and milled to have DSM. Citrus pulp were gathered within the university community sun dried and milled to have orange pulp meal. Palm kernel cake, wheat offal, bone meal and salt were purchased from feed mill within the Port Harcourt metropolis. Four different experimental treatments were composed on percentage level as shown in Table 1.

Table 1: Percentage composition (%) of dietary inclusion of *Delonix regia* seed meal

	Experimental treatments			
Feed ingredients	T1	T2	T3	T4
Wheat offal	42	42	42	42
Orange pulp meal	20	20	20	20
Palm kernel cake	35	20	15	-
Delonix regia seed meal	-	15	20	35
Bone meal	2	2	2	2
Salt	1	1	1	1

Three (3) replicates of each samples were grounded with a Thomas Willey Laboratory Mill-Model 4 and passed through 1-mm sieve. Proximate composition of the experimental treatments was determined according to AOAC (2000), while neutral detergent fibre (NDF) was determined according to Van Soest *et al*. (1991).

In-vitro Digestibility trial

The in-vitro trial was carried out at the laboratory of Department of Animal Science, University of Benin, Benin City, Edo State, Nigeria. The method adopted was as described by Babayemi *et al*. (2006).

Calculation for post incubation parameters

Organic matter digestibility (OMD) was estimated as: OMD = 14.88 + 0.889 GV + 0.45 CP + 0.651 ash (Menke and Steingass, 1988).

Short-chain fatty acids (SCFA) were estimated as: SCFA = 0.0239 GV − 0.0601 (Getachew *et al*., 1999).

Metabolizable energy (ME) was calculated as: ME = 2.20 + 0.136 GV + 0.057 CP + 0.00029 CF (Menke and Steingass, 1988).

The Fermentation Efficiency (FE) was calculated as: Fermentation Efficiency (FE) = Dry matter Digestibility (g/kg)/ Total Gas Volume (mL/g)

Statistical Analysis

The study was conducted using completely randomize design (CRD). All data obtained were subjected to the analysis of variance (ANOVA). Means were separated using Duncan's Multiple Range Test SAS (1999) package.

Results and Discussion

The nutrients profile and fiber fractions (DM%) of dietary inclusion of *Delonix regia* seeds meal was showed in Table 2. There was a significant difference (P<0.05) in the nutrients and fiber fractions (CP, EE, ash, OM, NFE, NDF, ADF and hemicellulose) across the experimental treatments. Similar (P>0.05) DM was recorded across the experimental treatments. The CP decreases as the inclusion of *Delonix regia* seeds meal increases, CP ranges between 10.50 – 13.60%. The CP contents of the experimental treatments (10.50 - 13.60%) were above the critical lower limit (7% CP) which forage intake by ruminants and rumen microbial activity could be negatively affected (Van Soest, 1994 and Norton, 2003). The CP content recorded for this experimental treatments was far above the 7 to 8 % CP suggested as threshold for sufficient utilization of feed by MacDonald *et al*. (1995). Therefore, the experimental treatments would provide the adequate nitrogen requirement for the rumen microorganisms to maximally digest the main components of dietary fibre leading to the production of volatile fatty acids (Trevaskis *et al*. 2001; Lamidi and Ogunkunle, 2016) which in turn facilitate microbial protein synthesis (Lamidi and Aina, 2013).

Table 2: Nutrients profile and fiber fractions (%) of dietary inclusion of *Delonix regia* seeds meal

	Experimental treatments				
Parameters	T1	T2	T3	T4	SEM
Dry matter	92.00	92.50	92.01	92.04	0.21
Crude protein	13.60^{a}	13.00^{b}	12.75^{b}	10.50^{c}	0.72
Ether extract	7.01^{c}	7.54^{bc}	8.85^{b}	10.30^{a}	0.63
Ash	5.00^{b}	12.50^{a}	7.50^{b}	7.50^{b}	0.96
Organic matter	95.00^{a}	87.50^{b}	92.50^{b}	95.00^{a}	0.93
Nitrogen free extract	58.74^{a}	49.45^{c}	55.40^{b}	60.99^{a}	1.62
Neutral detergent fibre	21.14^{ab}	22.66^{a}	22.70^{a}	21.11^{b}	0.60
Acid detergent fibre	19.77^{a}	18.62^{b}	18.74^{b}	18.89^{b}	0.36
Hemicellulose	2.34^{c}	4.03^{a}	3.96^{b}	2.21^{c}	0.41

a, b, c Means on the same row with different superscripts differ significantly (P<0.05).

Table 3 indicated the Post in-vitro parameters of dietary inclusion of *Delonix regia* seeds meal. The methane gas volume was significantly influenced with the dietary inclusion of *Delonix regia* seeds meal across the experimental treatments, T2 had the highest volume of CH_4 (0.61ml), least was recorded for T1 (0.47 ml). There was no significant difference (P>0.05) in the 24hrs gas production, CH_4 percentage, CH_4 reduction percentage, dry matter digestibility (DMD), organic matter digestibility (OMD), metabolizable energy and fermentation efficiency across the experimental treatments.

The gas production is a nutritionally wasteful product (Mauricio *et al*., 1999) but provides a useful basis from which ME, OMD and SCFA may be predicted (Fajemisin *et al*., 2015). Meanwhile, the similar value of SCFA in the experimental treatments probably showed an increased proportion of acetate and butyrate but may mean a decrease in propionate production (Babayemi *et al*., 2006).

Table 3: Post in-vitro parameters of dietary inclusion of *Delonix regia* seeds meal

	Experimental treatments				
Parameters	T1	T2	T3	T4	SEM
Gas production (24hrs)	45.33	41.33	44.00	49.33	1.59
Methane gas volume (ml)	0.47^{c}	0.61^{a}	0.53^{ab}	0.54^{ab}	0.02
Methane percentage (%)	21.33	24.67	23.33	26.67	0.51
Methane reduction percentage (%)	87.88	85.98	86.74	84.85	0.96
Short chain fatty acid	1.02	0.93	0.99	1.12	0.04
Dry matter digestibility (%)	66.93	61.00	78.03	82.30	1.63
Organic matter digestibility (%)	66.01	62.48	64.84	69.53	1.40
Metabolizable energy (MJ/kg DM)	9.58	9.03	9.40	10.12	0.22
Fermentation efficiency	1.48	1.48	1.81	1.67	0.05

a, b Means on the same row with different superscripts differ significantly (P<0.05)

Conclusion and recommendations

Conclusively, the nutrients profile of the experimental treatments justifies utilization of *Delonix regia* seeds meal for sustainable ruminant animal production considering the CP (10.50 – 13.60%). The similar value observed for the post in-vitro parameters is an indication that inclusion of *D. regia* seeds meal will be a perfect feed resources for ruminant animal production compared to other conversional feed resources such as palm kernel cake.

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