Effects of Processing on Nutritional Content of *Delonix regia* Seeds Incubated *In Vitro* With *Pennisetum purpureum*.

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Abstract

The effect of processing on the nutritional values of *Delonix regia* seeds incubated with *Pennisetum purpureum* in terms of proximate, gas production characteristics, methane production, predicted metabolizable energy, organic matter digestibility and short chain fatty acids production were determined. Five treatments (T1, mixture of soaked Delonix regia seed and *Pennisetum purpureum*; T2, mixture of raw *Delonix regia* seed and *Pennisetum purpureum*; T3, mixture of roasted *Delonix regia* seed and *Pennisetum purpureum*; T4, mixture of boiled *Delonix regia* seed and *Pennisetum purpureum*; T5, 100% *Pennisetum purpureum* which serves as control) were allowed. In vitro gas production techniques for 24 hours were used to determine the nutritive value of 50% *Delonix regia* seed and 50% *Pennisetum purpureum*. The crude protein ranged from 13.38 to 15.71g/100g DM among the treatments while crude fibre was between 20.10 and 21.40g/100g DM , ether extract ranged from 1.90 to 3.12g/100g DM and ash 7.77 to 12.34g/100g DM. Methane (ml/200mg DM) production indicated T3 (50% roasted *Delonix regia* seed and 50% *Pennisetum purpureum*) was highest and least in T5 (100% *Pennisetum purpureum*). The potential gas production 'a+b' ranged from 12.33 to 28.33mL/200mg DM). The highest potential gas production 'a+b' value of 28.33mL/200mg DM was obtained in T1 compared to other dietary treatment. The result obtained shows that there were significant differences ($p<0.05$) among the treatments which indicated that T1 (50% soaked *Delonix regia* seed and 50% *Pennisetum purpureum*) has the highest value of Metabolisable Energy (ME), Organic Matter Digestibility (OMD), Short chain fatty acids (SCFA) have the potential benefit which can be used as supplement for ruminant feeding during dry season.

Key words: Processing, Nutritional Content, *Delonix regia* seeds, *Pennisetum purpureum*, incubated, In vitro.

Introduction

Ruminants are good at converting grasses, legumes, weeds and browse plants that are totally inedible to man to flesh. Limited and inadequate supply of forage with low quality feed in dry season eventually results in retarded growth of animals and reduction in milk and meat production 1. Feeding animals with grass/ legumes mixtures have been reported to give better animal performance and productivity than feeding grasses or legumes alone because the nutrient intake is balanced. Producing and properly preserving high quality grasses and legumes can reduce the costs, thereby making feed readily available and improving productivity. 2

Elephant grass and *Delonix regia* seeds are available in abundance in almost all ecological zones in Nigeria and can be conserved for dry season feeding. They are not consumed by human and very cheap to obtain. The nutritive value of ruminant feed is determined by the concentration of its chemical component as well as rate and extent of digestion. In vitro gas methods used in estimating

the digestibility and metabolisable energy (ME) of ruminant feeds 3, measuring digestion of insoluble carbohydrate based on the assumption that the amount of gas produced from a feed incubation reflects the production of short chain fatty acids (SCFA) which are the major sources of energy for ruminants. This study therefore determined the effect of processing on the nutritional value of mixture of *Delonix regia* seed meal and *Pennisetum purpureum* in terms of proximate composition and in vitro gas production.

Materials and Method

The in vitro study was carried out at the Central Laboratory of the Department of Animal Science, University of Ibadan, Nigeria. *Delonix regia* pods were harvested within and outside Moor-Plantation Ibadan and the seeds were removed from the pods manually. Also, four weeks re-growth of elephant grass *(Pennisetum purpureum*) was obtained from existing pastures at Moor Plantation Ibadan and mixed at ratio 50:50 with *Delonix regia* seed meal. seeds and *Pennisetum purpureum* were divided into five treatments: T1 (50% soaked and 50% *Pennisetum purpureum*) 1kg of seeds was soaked in 2 litres of water for 24 hours, drained and sundried for 3 days.T2 (raw) which did not undergo any processing. T3 (roasted) 1kg of seeds was roasted in dry frying pan on a hot plate at 60^{o}c for 45 minutes. T4 (boiled) 1kg of the seeds was poured into boiling water for 40 minutes, drained and sundried for 3 days. T5 four weeks re-growth of elephant grass were chopped and air dried.

Chemical Analysis: Each treatments samples (T1-T5) were ground in hammer mill separately and subjected to proximate analysis according to the standard method of 4, to determine the percentage Crude Protein (CP), Ether Extract (EE), Crude Fibre (CF), Moisture content, Ash content and Nitrogen Free Extract (NFE).

In Vitro Gas Production and Statistical Analysis.: Rumen fluid was obtained from several Red Sokoto goats using stomach tube before the morning feed. The use of rumen liquor and buffer (9.8g $NaHCO_3$+2.77g Na_2HPO4+0.57g KCl+0.47g NaCl+0.12g $MgSO4.7H_2O$+0.16g/litre $CaCl_2.H_2O$) (1:4, v/v) under continuous flushing with CO_2 for incubation was as reported by (9). The gas production was measured at 3, 6, 9, 12, 15, 18, 21 and 24 hour. After 24 hour post incubation 6ml of 10M NaOH solution was introduced as described 5 to estimate methane. Metabolizable energy (ME,MJ/Kg DM) and Organic Matter Digestibility (OMD %) were estimated as established by 3and short chain fatty acids (SCFA) was calculated as reported by 6 using 24 h post incubation. ME = 2.20 +0.136*Gv+ 0.057*CP +0.0029*CF, OMD = 14.88+ 0.889Gv +0.45CP + 0.651XA; SCFA = 0.0239*Gv – 0.0601, where Gv, CP, CF,and XA are net gas production (ml/200mgDM), crude protein, crude fibre and ash of the incubated samples respectively. Data obtained were subjected to analysis of variance and means were compared where significant using Duncan Multiple Range F- test 7, 8.

Results and Discussion

Table 1 showed the proximate composition of mixture of processed *Delonix regia* seeds and *Pennisetum purpureum* at ratio 50:50. The dry matter ranged between 93.91- 94.86, the highest value was observed in T1 (94.86%) followed by T5 (94.72%), T4 (94.38%), T2 (94.09%) and the least was T3 (93.91%). Crude fibre ranged from 20.10-21.40% among the treatment with T2 recording the highest value (21.40%), T5 (21.20%) observed in this experiment were similar to 22.00% reported by 9. High level of crude fibre has been acknowledged by 10 to be inversely related to feed digestibility and nutrient availability. Crude protein ranged from 13.38%-15.71% with T4 (15.71%) recording the highest value and least value recorded in T2 (13.38%). 13.98% obtained for *Pennisetum purpureum* was higher than 8.60% reported by 9. This could be as a result of age since samples used for this

experiment were harvested at 4 weeks of re-growth. Grasses get lignified with age which has been shown to reduce their digestibility *11*. Ash content ranged between 7.77%-12.34%, the highest value observed in T5 (12.34%) and lowest value was T3 (7.77%). Table 2 showed the in vitro gas production parameters of mixture of processed *Delonix regia* seeds and *Pennisetum purpureum* at ratio 50:50. The metabolizable energy (ME) ranged between 4.75- 6.85, highest values of metabolizable energy was observed in T1 (6.85) and the least was T5 (4.75). The values of ME obtained among treatments were significant. The Organic Matter Digestibility ranged from (40.16-51.49%) with T5 (40.16) having the least value and T1 (51.49) observed the highest value. Short chain fatty acid ranged between 0.23-0.62, methane (ml 200mg/DM) production in this study ranged between 5.00-14.00, the highest value was obtained in T3 (14.00) followed by T2 (12.50) and the least value was T5 (5.00). There were significant difference ($p<0.05$) among the treatments. Highest value of ME (6.85Mj/kg DM), OMD (51.49%) and SCFA (0.62mol) are consistently recorded for in T1 (50% soaked *Delonix regia* and 50% *Pennisetum purpureum*). This showed that mixture of soaked *Delonix regia* seeds and *Pennisetum purpureum* could have the highest potential to make energy available to ruminant which correlate with report of 12 that higher short chain fatty acid (SCFA) or volatile fatty acid (VFA) such as butyrate and acetate suggest a potential to make energy available to ruminants. Table 3 showed the soluble 'a' fraction of the sample which ranged from 3.70-8.33, the value for the absolute 'a' used ideally reflects the fermentation of the soluble fraction; the extent of gas production 'b' and 'a+b' described the fermentation of the insoluble but degradable fraction of the sample. The values obtained in this study ranged between 8.63-20.00 and 12.33-28.33. The rate of gas production 'c' ranged from 0.51-1.18. 13 reported that factors that determine the rate of gas production during fermentation depends on the nature and level of fibre, the presence of secondary metabolites and potency of rumen liquor for incubation; the mixture of *Delonix regia* seeds and *Pennisetum purpureum* will be higher than that of 100% *Pennisetum purpureum* grass in gas production.

Conclusion: The study has shown that different processing methods increase crude protein contents, reduce crude fibre. The result obtained T1 (50% soaked seeds and 50% *Pennisetum purpureum*) showed the highest potential gas production including the metabolizable energy (ME), organic matter digestibility (OMD) and short chain fatty acid (SCFA) compared to other treatment.

Table 1: Proximate composition (%) of processed *Deloni xregia* seed and *Pennisetum purpureum* mixture at 50:50

Parameters	T1(soaked)	T2(raw)	T3(roasted)	T4(boiled)	T5(control)
Dry matter	94.86	94.09	93.91	94.38	94.72
Crude fibre	20.40	21.40	20.29	20.10	21.20
Crude protein	14.01	13.38	13.76	15.71	13.98
Ash	7.87	7.93	7.77	8.09	12.34
Ether extract	2.38	3.12	2.11	2.83	1.90
Nitrogen Free Extract	55.34	54.17	56.07	53.27	50.58

Table 2: In vitro gas production (ml/200mg/DM) parameters of processed *Delonix regia* seeds incubated with *Pennisetum purpureum*.

Parameters	T1	T2	T3	T4	T5	SEM
ME	6.85^{a}	5.47^{bc}	5.49^{bc}	6.24^{b}	4.75^{c}	2.10
SCFA	0.62^{a}	0.37^{bc}	0.37^{bc}	0.48^{b}	0.23^{c}	0.39
OMD	51.49^{a}	42.06^{bc}	42.13^{bc}	47.36^{b}	40.16^{c}	0.33
CH_4	10.00^{bc}	12.50^{b}	14.00^{a}	11.00^{bc}	5.00^{c}	0.50

+SEM= standard error of mean,^{a,b,c} mean on the same row with different superscript are significantly differents($p<0.05$)

Table 3: In vitro gas production characteristics (ml/200mg) of processed *Delonix regia* seeds incubated with *Pennisetum purpureum*

Parameters	T1	T2	T3	T4	T5	SEM
A	**8.33^{a}**	**6.30^{b}**	**4.00^{bc}**	**8.30^{ba}**	**3.70^{c}**	**0.33**
B	**20.00^{a}**	**11.70^{bc}**	**14.00^{b}**	**14.36^{ab}**	**8.63^{c}**	**0.37**
a+b	**28.33^{a}**	**18.00^{bc}**	**18.00^{bc}**	**22.66^{b}**	**12.33^{c}**	**0.16**
C	**1.18^{a}**	**0.75^{bc}**	**0.75^{bc}**	**0.94^{b}**	**0.51^{c}**	**0.67**

a= intercept (gas produced from the soluble fraction)b= gas production from the insoluble fraction.a+b= potential extent of gas productionc= gas production rate constant for the insoluble fraction (b)SEM= Standard error of mean ^{abc} mean on the same row with different superscript are significantly different ($p<0.05$)T1 50% soaked Delonix regia and 50% Pennisetum purpureumT2 50% raw Delonix regia and 50% Pennisetum purpureumT3 50% roasted Delonix regia and 50% PennisetumpurpureumT4 50% boiled Delonix regia and 50% Pennisetum purpureumT5 100% Pennisetum purpureum.

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