



Influence of *Monodora myristica* and *Xylopiia aethiopic*a Seed as Feed Additives on the Performance of New Zealand Weaned Rabbits

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Abstract

A feeding trial was conducted to evaluate the performance of thirty-two (32) weaned rabbits fed diets containing *Xylopiia aethiopic*a (selim pepper) seed meal (XSM) and *Monodora myristica* (African nutmeg) seed meal (MSM). Four experimental diets (T₁, T₂, T₃ and T₄) were formulated such that Treatment 1 being the control group received diet containing neither MSM nor XSM. Treatment 2 and 3 received diets containing 1% each of XSM and MSM while treatment 4 received mixture of both XSM and MSM at 0.5% each. The treatments were replicated four times with two rabbits per replicate and a total of eight rabbits (4 males and 4 females) per treatment in a randomized complete block design. The trial lasted for 12 weeks. Result showed no significant differences ($P>0.05$) in final weights and total weight gain of the rabbits across the treatments. Significant ($P<0.05$) increase in feed intake was obtained in T₃. However, feed conversion ratio was similar in the four treatments. Sex effect indicated no significant difference ($P>0.05$) in weight gain and feed conversion ratio. However, significant differences ($P<0.05$) were observed for feed intake with male rabbits on diet 2 recording the least value. No mortality was recorded in the course of the experiment. It is therefore recommended that 1% of *Monodora myristica* can be used as additive in rabbit diet to improve feed intake and weight gain or its combination with *Xylopiia aethiopic*a to maintain weight gain especially for the rabbit bucks.

Keywords: Performance, weaned Rabbits, *Xylopiia aethiopic*a (selim pepper), *Monodora myristica* (African nutmeg)

Introduction

Domestic rabbit (*Oryctolagus cuniculus*) plays a vital role as a source of animal protein in the human diet, especially in developing countries (Amaefule *et al.*, 2005; Hassan *et al.*, 2012). They are good converters of feed to meat and can efficiently utilize up to 30% crude fibre in the diet compared to poultry which requires less than 10% (Egbo *et al.*, 2001). The alteration of gut microbiota, drug resistance and residual effect on meat product are some of the critical factors that discourage the use of synthetic additives. Hence, the use of phytogenics as a replacement for synthetic antibiotics suffices as a better option in improving livestock performance as well as meat quality and safety for humans (Hedayata *et al.*, 2013). The use of *Xylopiia aethiopic*a and *Monodora myristica* as feed additive in

rabbit feed becomes imperative because of their beneficial health and preservative importance (Martin *et al.*, 2001). This study was conducted to investigate the effect of *Xylopiia aethiopic*a and *Monodora myristica* on the performance of growing rabbits.

Materials and Methods

Experimental Location

The study was conducted for a period of 84 days at the Department of Animal Science Teaching and Research Farm, Akwa Ibom State University, Obio Akpa Campus. The area is situated between latitude 5°17'N and 5°27'N and longitude 7°21'E and 7°58'E with an annual rainfall of ranging from 3500 – 5000mm and monthly temperature range of 24 – 26°C and a relative humidity between 60 – 90% (SLUK-AK, 1994).

Experimental sample preparation

Monodora myristica (MSM) otherwise known as African nutmeg and *Xylopi aethiopica* (XSM) usually called Selim pepper seeds were purchased from Abak market in Akwa Ibom State. They were washed thoroughly and sundried. The dried *Xylopi aethiopica* was ground into powder while the *Monodora myristica* seed were toasted before being ground into powder. The ground materials were stored in polythene bags under room temperature till usage (Coleman *et al.*, 2017). Four isocaloric and isonitrogenous experimental diets (T₁, T₂, T₃ and T₄) were formulated such that Treatment1 (control) contained neither MSM nor XSM. Diets 2 and 3 contained 1% each of XSM and MSM while diet 4 was the mixture of both XSM and MSM at 0.5% each in a randomized complete blocked design. The ingredient and nutrient composition of experimental diets are shown in Table 1.

Experimental animals/design

A total of 32 (16 males and 16 females) mixed breed weaned rabbits aged 7 weeks were purchased from a private farm in Uyo, Akwa Ibom State. They were weighed and randomly distributed into four treatment groups of 8 rabbits (4 males and 4 females) each in a randomized complete blocked design. The treatments were replicated four times with two rabbits per replicate. Each sex group in a replicate was housed separately in a 3-tier hutch. The animals were kept for 2 weeks to adapt to the experimental environment. Feed and drinking water were offered *ad libitum* to the experimental animals. The hutches, water troughs and feed troughs were thoroughly cleaned, washed at regular interval and the environment was often cleared to maintain good hygiene. The trial lasted for 12 weeks.

Table 1: Ingredient and nutrient composition of the experimental diet for rabbits

Ingredient	T ₁ (control)	T ₂ (XSM 1%)	T ₃ (MSM 1%)	T ₄ MSM+XSM (0.5%+ 0.5%)
Maize	50.000	50.00	50.00	50.00
Soya bean meal	18.50	18.50	18.50	18.50
Fish meal	1.50	1.50	1.50	1.50
Wheat offals	27.00	27.00	27.00	27.00
Bone meal	2.00	2.00	2.00	2.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Vit/min Premix**	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Crude protein (%)	18.21	18.21	18.21	18.21
M.E (Kcal/kg)	2978.34	2978.34	2978.34	2978.34

* Vitamin-mineral premix provided per kg the following: Vit. A 1500 IU; Vit.D₃ 3000 IU; Vit.E 30 IU; Vit.K 2.5mg; Thiamine B₁ 3mg; Riboflavin B₂ 6 mg; Pyrodoxine B₆ 4 mg; Niacin 40 mg; Vit. B₁₂ 0.0 mg; Pantothenic acid 10 mg; XSM = *Xylopi aethiopica* seed meal (selim pepper), MSM = *Monodora myristica* seed meal (African nutmeg)

Chemical Analysis of the test material

Samples of *Monodora myristica* seed meal (MSM) and *Xylopi aethiopica* seed meal (XSM) were analyzed to determine their

proximate composition using standard procedure (AOAC, 1990). The following components were determined; dry matter content, crude protein, ether extract, total ash,

and nitrogen free extract. Also, phytochemical analysis for major constituents (spectrophotometry, precipitation and emulsion formulation methods) was carried out on the two spices according to methods described by Harborne (1973) and Sofowora (1993).

Data collection and statistical analysis

Initial body weights of the rabbits were taken at the commencement of the experiment using an electronic scale. Weekly body weights of each rabbit were taken and recorded. The live weight gain was calculated as the difference between previous weight and weights recorded in the following week. The feed intake per

rabbit per day was calculated as the difference between feed offered and spilled/left over feed (after 24 hours of feeding). The feed conversion ratio was calculated as ratio of feed intake to weight gain after a week of feeding, using the formula: Feed conversion ratio = feed intake/weight gain (Nuamah *et al.* 2019). Survival was calculated as ratio of ratio of survived rabbits to stocked rabbit multiplied by 100, using the formula: survival = survived rabbits/stocked rabbits x 100. Data collected were subjected to analysis of variance (ANOVA) according to Steel and Torrie (1980) and mean separation by Duncan's Multiple Range test (Duncan, 1955).

Table 2: Proximate analysis of *Xylopiya aethiopic* and *Monodora myristica* seed powder

Parameter	<i>Xylopiya aethiopic</i>	<i>Monodora myristica</i>
Moisture	8.66	8.60
Crude protein	6.21	4.75
Fat	7.62	7.62
Crude fibre	15.31	1.51
Ash	5.24	1.67
Carbohydrate (nitrogen-free extract)	67.61	78.43
Metabolizable energy (Kcal/100g)	347.80	390.97

Table 3: Phytochemical analysis of *Xylopiya aethiopic* and *Monodora myristica* seed powder

Phytochemicals	<i>Xylopiya aethiopic</i> (selim pepper)	<i>Monodora myristica</i> (African nutmeg)
Alkaloids	+	+
Tannin	+++	+
Saponin	++	+
Flavonoids	++	++
Phenolic compounds	++	++
Glycoside	+	+
Oxalate	++	-
Hydrogen cyanide	+++	-
Haemagglutinin	+++	-

+ Trace presence, ++ moderately present, +++ present in high concentration, - absent

Results and Discussion

The proximate composition of *Xylopiya aethiopic* and *Monodora myristica* seed powder is shown in Table 2. *Xylopiya aethiopic* had 8.66% moisture, 6.21% crude

protein, 7.62% fat, 15.31% crude fibre, 5.24% ash, 67.61% carbohydrate (nitrogen-free extract) and 347.80Kcal/100g energy. *Monodora myristica* contained 8.60% moisture, 4.75% crude protein, 7.62% fat,

1.51% crude fibre, 1.67% ash, 78.43% carbohydrate and 390.97kcal/100g energy. The protein, fat, fibre, ash and carbohydrate of *Xylopiya aethiopic*a seed meal were close to values reported by Lawrence *et al.* (2017). The moisture content and metabolizable energy did not agree with Ituen and Alonge (2011) and Lawrence *et al.* (2017).

Likewise, the ash content and energy of *Monodora myristica* were close to values (2.41, 402.77) reported by Borquaye *et al.* (2017). Protein content was close to values (6.27) reported by Udofia and Alozie (2015) while moisture was twice the values (11.26, 14.61) reported by Udofia and Alozie (2015); Borquaye *et al.* (2017). The differences in proximate composition may be due to the disparity in soil characteristics, growth conditions, variation in genetical makeup, climatic conditions at their areas of cultivation and differences in analytical procedures employed (Guerrero *et al.*, 1998; Ozcan, 2004; Agu *et al.*, 2017).

The phytochemical composition of *Xylopiya aethiopic*a and *Monodora myristica* seed powder is shown in Table 3. In *Xylopiya aethiopic*a, tannin, hydrogen cyanide and haemagglutinin was present in high concentration (+++), saponin, flavonoids and phenolic compounds and oxalate were moderately present (++) while alkaloids and glycoside was present in trace amount (+). The concentration of flavonoids and phenolic compounds in *Monodora myristica* seed powder was observed to be moderate (++). Alkaloids, tannin, saponin and glycoside were present in trace quantity (+). Oxalate, hydrogen cyanide and haemagglutinin were absent (-). Result obtained in the current research is close to those reported by Udofia and Alozie (2015) and Bassey *et al.* (2011) for *Xylopiya aethiopic*a and *Monodora myristica* respectively.

Table 4 presents the results on the effect of *Xylopiya aethiopic*a, *Monodora myristica* seed powder and sex on performance of rabbits. The final weights and total weight gain of the rabbits at the end of the experiment showed no significant ($P>0.05$) differences across the treatments. T₃ (MSM) recorded the highest value while T₂ (XSM) recorded the lowest value. The reduction in weights of animals fed T₂-based diets agrees with Obodo *et al.* (2013) who reported a reduction in body weight and growth rate of wistar rats fed aqueous solution of *Xylopiya aethiopic*a. Similar findings have also been reported by Eze (2012) and Woode *et al.* (2011) in wistar rats as well as Chike and Adienbo (2011) in guinea pigs. The reduction in body weight can be attributed to the active ingredients such as xylopic acid in the test material (Chike and Adienbo, 2011; Woode *et al.* 2011). *X. aethiopic*a has been reported by Ogbuagu *et al.* (2020) to have anti-androgenic properties due to the presence of xylopic acid and androgen is known to have building up properties. This may also be a contributing factor to the decreased weight gain in the study animal. Furthermore, reduction in feed intake may also be a contributing factor leading to a reduced body weight in T₂. This agrees with Adefegha and Oboh (2012) who investigated the effect of *X. aethiopic*a on normal rats. Significant ($P<0.05$) differences were also recorded across treatment groups with regards to feed intake. Animals placed on T₃-based diet recorded highest feed intake values while the lowest was observed for animals placed on T₂-based diet. This agrees with Ukoha (2016) who fed 1% of *Monodora myristica* to broiler birds. Ukoha (2011) also reported a high feed intake in broilers fed mucuna bean-based diet supplemented with *Monodora myristica* at 0, 0.5 and 1% levels. The high feed intake may be attributed to the increased flavonoids from the essential oil component which enhanced taste and appetite in the animals (Wenk, 2002). Feed conversion ratio showed a reduction from 4.51 (T₂) to 3.79 (T₃), indicating slight

improvement though not significant ($P>0.05$). This could support the report that phyto-additives increase feed efficiency of pigs and poultry (Karaskova *et al.*, 2015; Igweye *et al.*, 2021). Sex effect of diet showed no significant ($P>0.05$) difference in final weight. This implies that the additives included in the diet did not have negative effect on final weight in both sexes of the rabbits. This result is in line with the reports of Okanlawon *et al.* (2020) who fed rabbits with diets supplemented with turmeric powder. Significant ($P<0.05$) differences were also observed for feed intake between the male and female rabbits. This implies that the additives included in the diet had a positive effect on appetite in both sexes. This result is in agreement with Tumova *et al.* (2019) for male and female broiler chickens but disagrees with Okanlawon *et al.* (2020)

who fed diets supplemented with turmeric powder to male and female rabbits. The feed conversion ratio indicated no sex effect ($P>0.05$). This implies that the additives included in the diet did not impair nutrient utilization in either the male or female rabbits. This result is in tandem with Bello *et al.* (2015) who reported no significant difference ($P>0.05$) in feed conversion ratio of rabbits raised under different frequency of litter change. No mortality was recorded in the course of the experiment. This could be attributed to the antimicrobial, antibacterial and antifungal properties of both *Xylopiya aethiopica* and *Monodora myristica*. This corroborates the reports of Egbewande *et al.* (2021) and Ogbuewu *et al.* (2019) who observed that spices lower mortality.

Table 4: Performance of growing rabbits fed XSM and MSM as additive

Parameters	Sex	T ₁ (control)	T ₂ (XSM 1%)	T ₃ (MSM 1%)	T ₄ MSM+XSM (0.5%+ 0.5%)
Initial bodyweight (g)	M	722.75±135.33	768.25±135.33	739.00±135.33	747.50±135.33
	F	780.25±97.81	747.75±97.81	768.50±97.81	768.75±97.81
	Means	751.50±78.90	758.00±78.90	753.75±78.90	758.13±78.90
Final bodyweight (g)	M	1680.50±141.39	1428.75±141.39	1728.25±141.39	1674.00±141.39
	F	1672.25±95.76	1730.25±95.76	1712.25±95.76	1668.75±95.76
	Means	1676.38±84.54	1579.50±84.54	1718.25±84.54	1671.38±84.54
Total body weight gain (g)	M	932.75±94.65	576.00±94.65	889.50±94.65	876.50±94.65
	F	892.00±90.83	967.50±90.83	955.00±90.83	900.00±90.83
	Means	912.38±69.68	771.75±69.68	922.25±69.68	888.25±69.68
Average daily weight gain (g)	M	84.80±8.14 ^a	53.07±8.14 ^b	93.05±8.14 ^a	81.96±8.14 ^a
	F	81.09±8.31	87.93±8.31	85.80±8.31	81.82±8.31
	Means	82.94±9.75	70.50±9.75	89.94±9.75	81.89±9.75
Total feed intake (g)	M	3588.66±2.00 ^b	3308.42±2.00 ^c	3742.97±2.00 ^a	3582.22±2.00 ^b
	F	3552.47±3.81 ^b	3412.20±3.81 ^d	3750.14±3.81 ^a	3535.44±3.81 ^c
	Means	3570.57±34.31 ^b	3360.31±34.31 ^c	3746.56±34.31 ^a	3558.83±34.31 ^a
Average daily feed intake (g)	M	326.24±3.81 ^{ab}	316.65±3.81 ^b	340.27±3.81 ^a	325.75±3.81 ^{ab}
	F	322.95±1.58 ^b	319.37±1.58 ^b	340.92±1.58 ^a	321.40±1.58 ^b
	Means	324.60±1.66 ^b	318.01±1.66 ^b	340.60±1.66 ^a	323.58±1.66 ^b
Feed conversion ratio	M	3.85±0.71	5.97±0.71	3.66±0.71	3.97±0.71
	F	3.98±0.71	3.63±0.71	3.97±0.71	3.93±0.71
	Means	3.91±0.62	4.51±0.62	3.79±0.62	3.95±0.62
Survival (%)	M	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00
	F	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00

^{abc}Means in the same row not sharing common superscript are significantly different ($P<0.05$)

Conclusion and recommendation

Based on results obtained in this trial, it is concluded that supplementing rabbit diets with *Xylopiya aethiopica*, *Monodora myristica*, or their combination caused no impairment on the feed conversion ratio and weight gain (except for male rabbit on diet 2) but improved feed intake significantly in both male and female rabbit on *Monodora myristica* based diet. It is therefore recommended that 1% of *Monodora myristica* be used as additive in rabbit diet to improve feed intake and weight gain or its combination with *Xylopiya aethiopica* to maintain weight gain specially for the rabbit bucks. However, further research with higher levels of inclusion for both *Xylopiya aethiopica* and *Monodora myristica* is recommended.

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