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Performance characteristics and egg quality of Commercial Layers Fed Processed Mango Seed Kernel meal at varying inclusion levels

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Abstract

The effect of dietary inclusion of mango seed kernel meal (MSKM) was investigated in commercial layers using 390 twelve weeks growing pullets. The mango seed kernel was cut opened sliced and divided into four equal parts. First part was soaked in cold water for 24 hours then drained and sundried. Second part was soaked in lye for 24 hours drained and sundried while the third part was parboiled for 20 minutes then sundried and the last part was sundried only. These were then used to formulate twelve experimental diets and one control diet. Birds were fed for a period of 8 and 12 weeks during growing and laying phase respectively. Growth performance, egg production and quality parameter were monitored. A significant (P<0.05) difference was recorded in the final weight, weekly weight gain and feed conversion ratio with 15% parboiled having the overall best performance. Egg production performance took a different dimension, birds placed on 10% lye treated MSKM based diet had the best results in feed intake per 30 eggs and cost of feed per tray of egg. Laying birds placed on 20% sundried MSKM based diet was least performed. All parboiled MSKM based diets proved to be better than the control. Haugh unit and yolk index were influenced significantly (P<0.05) by the utilization of differently processed MSKM. Birds fed 15% lye and 15% cold water treated MSKM based diet produced egg with best and least haugh unit respectively.

Key words: Mango seed kernel meal, Processing methods, Growth performance, Egg production and Egg quality.

Introduction

In any enterprise there is a drive for profit making, which involve cutting down of cost of production so as to increase gain. Agricultural enterprise is not left out in such occasion. The rising price of livestock feeds in developing countries which Nigeria is among and the scarcity of feed ingredients have forced the animal scientist to research for alternative, cheaper and readily available protein and energy sources. The search for alternative tropical energy feed resources for maize and other cereal grains in monogastric animal diets has been a continuous major issue as maize is currently facing global shortage (Muriu *et al.,* 2002)

Research have been carrying out on studies of the utilization of various materials such as cassava peel (Ogbona *et al*., 2004, yam peal meal (Iyayi and Awoniyi, 2002), mango seed kernel meal (Odunsi and Farinu, 1997) to mention few. Das *et al*., (1998) as well as Odunsi and Farinu, (1997) elucidated the potential of mango seed kernel as a feed ingredient. The maize replacement potential of mango seed kernel could not exceed 20% because of low palatability and acceptability of the material by the animals. These negative effects were traced to the effect of tannins present in the material (Odunsi and Farinu, 1997). The tannin content can be as high as 0.5% (Ravindran and Rajagufu, 1985). The effect of this anti-nutritional factor can be reduced through processing methods such as soaking, boiling etc. Such treated mango seed kernel meal can be incorporated at expense of maize up to 25% in poultry diets (Reddy, 1975). This work therefore was designed to investigate the effects of four processing methods (sun-drying, soaking, lye treatment and parboiling) on the utilization potential of differently processed mango seed kernel meal (MSKM) in laying bird diets.

Methodology:

Preparation of test ingredient: The graded/collected mango seed kernel was processed as follows:

Sun drying: The freshly collected mango seed kernel was cut open to expose the kernels, sliced into smaller pieces to increase the surface area and then sun-dried.

***Soaking*:** The opened/exposed kernel was soaked in clean water for 48 hours and then sun-dried to a constant weight.

Ash Treatment: Filtrate from mixture of ash and water (Lye) at 100g/It was used to soak the opened kernels for 48 hours. Then, sun dried on a slab till constant weight is attained.

***Parboiling*:** The kernel was soaked in boiling water at 100^0C for 20 minutes after which it was drained and sundried till a constant weight is obtained. All the dried samples were then milled and packed in air tight containers till the time of use.

Experimental diet: The processed MSKM (sun dried, soaked, lye treated and parboiled samples) were used to formulate the experimental diets. Such that; diet I contain 0% MSKM and serve as control diet. Diets II, III and IV contained sun dried mango seed kernel meal at 10%, 15% and 20% inclusion levels respectively. Diet V, VI and VII contained water soaked mango seed kernel meal at 10%, 15% and 20% inclusion levels respectively. Diet VIII, IX and X contained lye treated mango seed kernel meal at 10%, 15% and 20% inclusion levels and parboiled sample of mango seed kernel meal was included at 10%, 15% and 20% inclusion levels into diets XI, XII and XIII respectively. All the diets were iso-nitrogenous and iso-caloric. Tables 1 and 2

Table 1: Composition of Experimental Diets for Growing Pullets

Diets→	Control	Sundried MSKM			Soaked MSKM			Lye treated MSKM			Parboiled MSKM		
Ingredients	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**
Maize	32	22	17	12	22	17	12	22	17	12	22	17	12
MSKM	-	10	15	20	10	15	20	10	15	20	10	15	20
Soy meal	6	7	8	9	7	8	9	7	8	9	7	8	9
PKC	25	24	23	22	24	23	22	24	23	22	24	23	22
Fixed Ingdt.	37	37	37	37	37	37	37	37	37	37	37	37	37
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Analysis													
CP (%)	15.55	15.53	15.63	15.67	15.53	15.63	15.67	15.53	15.63	15.67	15.53	15.63	15.67
Gross Energy (Kcal/kg)	2476	2443	2435	2426	2443	2435	2426	2443	2435	2426	2443	2435	2426

Fixed ingredients, Fish mea l 1%, GNC 4%, Corn bran 13.8%, Wheat offal 12%, Oyster shell 2.5%, Bone 3.0%, Methionine 0.1%, Lysine 0.1%, *Premix 0.25%, Salt 0.25%.
*Premix supplied per kg diet: Vit A; 10,000IU, Vit D; 2,000IU, Vit. E; 2,300mg, Vit K_3; 200mg, Vit B_1; 3,000mg, Vit B_2; 6,000mg, Niacin; 50,000mg, Calcium; 800mg, Panthotenate; 10,000mg, Vit B_6; 5000mg, Vit B_{12}; 250mg, Folic acid; 100mg, Biotin; 50mg, Chloline chloride; 4,000mg, Selenium; 120mg and Anti oxidant; 12,000mg.

Table 2: Composition of Experimental Diets for Laying Birds

	Control	Sundried MSKM			Soaked MSKM			Lye treated MSKM			Parboiled MSKM		
Diets→ Ingredients	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**
Maize	35	25	20	15	25	20	15	25	20	15	25	20	15
MSKM	-	10	15	20	10	15	20	10	15	20	10	15	20
Soy meal	8	9	10	11	9	10	11	9	10	11	9	10	11
PKC	8.3	7.3	6.3	5.3	7.3	6.3	5.3	7.3	6.3	5.3	7.3	6.3	5.3
Fixed Ingredient.	48.7	48.7	48.7	48.7	48.7	48.7	48.7	48.7	48.7	48.7	48.7	48.7	48.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Analysis													
CP (%)	16.35	16.08	16.11	16.16	16.08	16.11	16.14	16.18	16.32	16.22	16.14	16.11	16.13
Energy (Kcal/kg)	2476	2443	2435	2426	2443	2435	2426	2443	2435	2426	2443	2435	2426

Fixed ingredients, Fish meal 2.0%, GNC 7%, Corn bran 20%, Wheat offal 10%, Oyster shell 6.0%, Bone 3.0%, Methionine 0.1%, Lysine 0.1%, *Premix 0.25%, Salt 0.25%.
*Premix supplied per kg diet: Vit A; 1,000IU, Vit D_3; 2,000IU, Vit. E; 2,300mg, Vit K_3; 2,000mg; Vit B_1; 3000mg; Vit B_2; 6,000mg, Niacin; 50,000mg, Calcium; 800mg, Panthotenate; 10,000mg, Vit B_6; 5000mg, Vit B_{12}; 250mg, Folic acid; 100mg, Biotin; 50mg, Chloline chloride; 40,00mg, Selenium; 120mg and Anti oxidant; 12,000mg.

Experimental Birds: Three hundred and ninety (390) twelve weeks growing pullets were used for the experiment. Their average weight was determined before randomly distributing them to 13 groups of 30 birds per group with 6 replicates each.

Vaccination and medication programmes: The vaccination and medication programmes for growing pullet and laying bird were followed accordingly.

Chemical Analysis: Feed samples from each treatment was subjected to proximate analysis as described by AOAC (1990).

Data collection and estimation: Daily feed intake and weekly weight gain was monitored and recorded throughout the feeding trial period. The feed to gain ratio and cost implication of experimental diets were estimated. Data on feed intake, egg production and egg qualities, the internal (Albumen weight and height, yolk weight and height, yolk length, shell weight and thickness) and external qualities (egg weight, egg length and egg width) were collected and documented.

Statistical Analysis: All data collected were analyzed using 3x4 factorial arrangement of SAS 2000 software package. Where significance occurs among the means, Duncan's multiple range test of the same package was employed to separate the means.

Result and Discussion

Table 3 provides the mean values for performance characteristic of layers fed differently processed mango seed kernel meal at varying inclusion levels. Considering the processing methods and inclusion level, the initial weight was not significantly ($p>0.05$) different. But final weight and weekly weight gain were significantly ($P<0.05$) influenced across the processing methods and inclusion levels of lye treated and sundried based diets. Mean value obtained was highest at 10% cold water (1.67kg) and lowest at 20% lye treated (1.54kg).

Considering the processing methods, it was observed that the cold water and sundried mean values decrease as inclusion levels increase though, lye treated and parboiled were inconsistent. The growth rate of growing pullet was impaired as the inclusion level increased. However, it was best supported at 10% Cold water and sun dried as well as 15% inclusion level lye treated and Parboiled MSKM based diets.

A significant (P<0.05) difference was observed on feed conversion ration for processing methods and inclusion levels. 10% cold water, 15% lye treated and parboiled as well as 10% sundried were similar and proved to be better tolerance level for MSKM utilization with respect to the processing methods employed. Probably the birds were less disturbed by the astringent and tannin-proteins combination nature of the tannic acid that impaired the utilization of the nutrient (Santidrian and Marzo, 1989) at the fore mentioned levels which was higher than 25% and 10% replacement level reported by Reddy (1975) and Odunsi (2005) respectively.

Cost of feed per kg was significantly (p<0.05) influenced only by inclusion levels, 10% and 15% inclusion levels were statistically (P>0.05) similar irrespective of the processing methods employed, 20% inclusion level was the same for all the processing methods.

Hen day production was not influenced (P>0.05). It decreased as the inclusion level of MSKM increased regardless of the processing methods employed. However, best egg production performance was recorded from the birds fed parboiled MSKM based diet.

Feed intake per eggs and cost of feed per 30 eggs were not significantly (p>0.05). Insignificant of feed intake per egg per 30 eggs and cost of feed may be attributed to Average daily feed intake. Though highest cost of feed was observed at sundried (₦311.74) and the least cost was at 10% lye treated (₦262.75) while control has (₦ 290.70). The better production performance of the parboiled and lye treated over others including the control implies that probably only a negligible percentage of hydrolysable tannin remains after the treatments. The higher production rate together with reduction in production cost give the utilization of parboiled and lye treated an edge over the sun dried MSKM despite the fact that they were statistically (P>0.05) similar.

Egg quality characteristics of laying birds fed differently processed MSKM based diet were significantly (P<0.05) influenced by the processing methods and varying inclusion levels (Table 4). Egg weight, yolk weight and their percentage were significantly (P<0.05) different with parboiled based diet having the leading values. The depression observed could be attributed to the presence of anti-nutritional factor(s) present in the diet (Oladunjoye *et al.,* 2008). However, adaptation might have plays its role, may be that is the reason for the inconsistency in the values gotten as the inclusion level increased.

The significant variation in haugh unit which is a determining factor of the egg's shelf live could be traced to the alteration in the protein and carbohydrate nature of the diets. The haugh unit recorded in this finding was relatively low compared to what was reported by Odunsi, (2005). The depression observed could be attributed to the presence of anti-nutritional factor(s) present in the diet (Oladunjoye *et al.,* 2008). However, adaptation might have plays its role and might be responsible for the inconsistency in the values obtained.

Table 3: Performance characteristics of layers fed differently processed mango seed kernel meal at varying inclusion levels

Parameters	Inclusion level	Control	Cold water	Lye treated	Parboiled	Sundried
Initial Weight (Kg)	10	1.18±0.03	1.15±0.02	1.17±0.01	1.18±0.02	1.23±0.03
	15		1.19±0.03	1.13±0.02	1.17±0.02	1.13±0.01
	20		1.18±0.01	1.09±0.02	1.16±0.02	1.05±0.02
Final Weight (kg)	**10**	**1.5**±0.02	**1.67±0.02^{a}**	**1.58±0.02^{yb}**	**1.61±0.01^{b}**	**1.63±0.03^{xab}**
	15		**1.64±0.02^{a}**	**1.66±0.02^{xa}**	**1.66±0.02^{a}**	**1.58±0.01^{xyb}**
	20		**1.61±0.03**	**1.54±0.02^{y}**	**1.62±0.03**	**1.55±0.03^{y}**
Weight Gain (g per Week)	10	44.79±3.08	65.18±3.07^{a}	52.08±3.12^{yb}	53.57±3.27^{b}	50.30±2.64^{yb}
	15		56.25±5.03^{ab}	60.01±4.18^{xa}	61.90±3.73^{ab}	51.79±2.45^{yb}
	20		54.46±3.34^{b}	56.55±3.18^{xyab}	58.04±4.49^{ab}	60.07±3.67^{xa}
Average daily feed intake (g)	**10**	**83.33**±3.17	**92.62±3.02**	**90.43±2.67**	**94.90±2.65**	**92.29±2.98**
	15		**93.33±2.94**	**89.14±2.57**	**94.24±2.61**	**93.33±2.83**
	20		**94.48±2.46**	**94.71±3.04**	**93.67±3.17**	**94.43±2.80**
Feed Conversion Ratio	10	13.64±0.73	10.32±0.52^{xb}	12.53±0.79^{xy}	13.17±1.49^{a}	13.72±0.97^{xa}
	15		16.60±3.19^{xa}	10.28±0.74^{yb}	11.90±1.13^{ab}	13.32±0.86^{xab}
	20		13.14±0.90^{xy}	13.47±1.22^{xa}	13.41±0.94	10.81±0.81^{y}
HenDay (%)	**10**	**61.28±3.11**	**64.18±2.94**	**64.30±2.80**	**65.43±2.97**	**63.96±3.01**
	15		**60.44±2.84**	**58.78±3.34**	**64.94±2.95**	**60.24±3.50**
	20		**59.65±3.15**	**58.97±3.21**	**60.22±3.18**	**57.27±3.61**
Cost of Feed per Kg (N).	10	58.63±0.69	59.64±0.73^{x}	59.64±0.73^{x}	59.64±0.73^{x}	59.64±0.73^{x}
	15		58.39±0.61^{xy}	58.39±0.61^{xy}	58.39±0.61^{xy}	58.39±0.61^{xy}
	20		57.14±0.50^{b}	57.14±0.50^{y}	57.14±0.50^{y}	57.14±0.50^{y}
Feed intake per egg (g)	**10**	**152.47±7.99**	**152.48±10.40**	**145.75±7.23**	**152.06±8.88**	**151.07±8.16**
	15		**160.96±8.34**	**165.92±13.83**	**151.76±8.32**	**164.74±9.39**
	20		**170.47±12.32**	**168.16±8.41**	**163.38±9.15**	**182.25±15.09**
Feed intake per 30eggs (kg)	10	4.57±0.32	4.57±0.31	4.37±0.22	4.56±0.27	4.53±0.24
	15		4.83±0.25	4.98±0.41	4.55±0.25	4.94±0.28
	20		5.11±0.37	5.04±0.25	4.90±0.27	5.47±0.45
Cost of feed per 30 eggs (N)	**10**	**267.67±14.82**	**273.76±18.88**	**262.75±15.34**	**273.32±16.99**	**271.63±15.90**
	15		**282.82±15.49**	**290.95±23.92**	**266.84±15.56**	**288.72±16.59**
	20		**292.18±20.74**	**289.48±15.88**	**281.60±17.34**	**311.74±24.93**

^{xy} Means of varying inclusion level in the same Colum having different superscripts were significantly different ($P<0.05$).

^{ab} Means of differently processing methods on the same row having different superscripts were significantly different ($P<0.05$)

Table 4: Egg quality characteristics of laying birds fed fed differently processed mango seed kernel meal at varying inclusion levels

Parameters	Inclusion levels	Control	Sun Dried	Cold Water	Lye Treated	Parboiled
Egg Wt	10	52.00±0.76^{c}	55.69 ± 0.84^{ab}	53.76±0.58^{b}	54.22 ±0.76^{ab}	56.67±0.59^{a}
	15		55.72 ±1.02	55.69± 0.78	55.88± 0.71	54.32± 0.57
	20		56.98± 0.68	54.29±0.70	54.34± 0.58	55.70± 0.85
Yolk Wt	**10**	**12.69±0.40**	**13.49 ± 0.39^{b}**	**12.94±0.29^{yb}**	**13.49±0.42^{yb}**	**14.28±0.31^{xa}**
	15		**13.22± 0.59^{ab}**	**14.24± 0.35^{xa}**	**13.13±0.40^{yab}**	**12.90± 0.30^{yb}**
	20		**14.57± 0.45**	**13.78± 0.40^{xy}**	**14.80±0.45^{x}**	**13.83±0.56^{x}**
Shell Wt	10	7.35±0.18	7.50 ±0.24	7.40 ±0.21	7.46±0.22	7.42±0.21
	15		7.60 ±0.22^{ab}	7.13± 0.18^{b}	7.38± 0.16^{ab}	7.71± 0.22^{a}
	20		7.81± 0.24	7.63± 0.24	7.11±0.20	7.16±0.20
Shell Thickness	**10**	**0.30±0.00**	**0.30±0.00**	**0.31±0.00**	**0.30±0.00**	**0.30±0.00**
	15		**0.30± 0.00^{a}**	**0.30± 0.00^{b}**	**0.29± 0.00^{b}**	**0.29± 0.00^{b}**
	20		**0.31± 0.00^{a}**	**0.30±0.00^{b}**	**0.29± 0.00^{b}**	**0.29± 0.00^{b}**
Yolk colour	10	1.00±0.00	1.09 ±0.05	1.06 ±0.04	1.03 ±0.03	1.03 ±0.03
	15		1.06±0.04^{ab}	1.09± 0.05	1.03±0.03	1.09±0.05
	20		1.06± 0.04	1.09± 0.05	1.15± 0.06	1.09±0.05
Egg Shp Ind	**10**	**9.75±0.12**	**9.815 ± 0.20^{ab}**	**9.67 ±0.1^{yb}**	**10.04±0.15^{ab}**	**10.17±0.11^{xa}**
	15		**9.79±0.17^{a}**	**10.19± 0.11$^{x a}$**	**10.02± 0.10^{ab}**	**9.66±0.15^{yb}**
	20		**10.15± 0.11^{a}**	**10.11±0.16^{xa}**	**9.24± 0.13^{b}**	**9.92±0.16^{yab}**
SSA	10	67.74±0.66	70.19 ±0.73^{ab}	69.52 ±0.51^{b}	68.79 ±0.67^{ab}	71.31±0.52^{a}
	15		70.36± 0.88	70.08±5.48	69.37± 0.62	69.55± 0.50
	20		71.47±0.59	69.73±0.61	68.06± 0.51	70.53±0.74
Haugh Unit	**10**	**81.63±2.18**	**70.93 ±1.71^{b}**	**71.36±1.66^{xb}**	**71.98±2.38^{ya}**	**71.62±2.21^{b}**
	15		**72.22±1.97**	**67.50±1.6^{y}**	**78.04±1.65^{x}**	**72.37±2.46**
	20		**73.79±1.83**	**70.60±1.74^{x}**	**71.85±1.35^{y}**	**73.53±1.22**
% Albumen	10	61.53±0.63	62.73 ± 0.46^{ab}	62.83 ±0.64^{ab}	63.62± 0.92$^{x a}$	60.71±0.59^{yb}
	15		62.34±0.94	62.45± 0.71	62.15±0.82^{xy}	62.62±0.57^{x}
	20		60.78±0.92	61.34±0.58	60.23±1.02^{y}	62.56±0.72^{xy}
% Yolk	**10**	**24.30±0.63**	**24.34 ± 0.55**	**24.33 ±0.42**	**24.02±0.68**	**25.23±0.48^{x}**
	15		**24.24±1.03^{ab}**	**25.14±0.58^{a}**	**24.19±0.58^{ab}**	**23.72±0.56^{yb}**
	20		**25.82±0.66^{ab}**	**24.71±0.72^{b}**	**27.23±0.72^{b}**	**24.81±0.7^{xb}**
Yolk Index	10	0.53±0.03	0.49 ±0.03^{y}	0.52± 0.03	0.52 ±0.03	0.56 ±0.03
	15		0.47± 0.03^{y}	0.52±0.03	0.57±0.03	0.53± 0.03
	20		0.62±0.02^{x}	0.54± 0.03	0.53±0.02	0.59± 0.03

^{xy} Means of varying inclusion level in the same Colum having different superscripts were significantly different (P<0.05).
^{ab} Means of differently processing methods on the same row having different superscripts were significantly different (P<0.05)

Conclusion

The use of MSKM as feed ingredient in growing pullet enhances the growth rate and feed conversion ratio of the birds. It had no negative effect on egg production performance and quality, rather improved the shelf life (Haugh unit; as the inclusion level increased) and production strength at reduced cost input especially at 15% inclusion levels of parboiled and lye treated mango seed kernel meals.

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