EFFECT OF DIFFERENTLY PROCESSED MANGO SEED KERNEL MEAL ON PERFORMANCE OF BROILER CHICKENS

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Abstract

An experiment was conducted to evaluate the effects of differently processed mango seed kernel meal (MSKM) on broiler chickens for eight weeks. The processing methods include: soaking for 24 and 72hours, boiling and soaking and boiling. The level of anti-nutritional factors and performance of broiler chickens were obtained. The results indicated that the different processing methods reduced the anti-nutritional factors: boiled and soaked has the best percentage reduction of tannin (84.31%), and oxalate (37.08%), Boiled mango seed kernel has the highest percentage reduction of saponin (35.68%) and flavonoid (34.15%), while Soaked for 24hours reduces alkaloid (47.43%) better compared to boiling (32.87%). Two hundred and twenty-five (225) day old broiler chicks were randomly allotted to five dietary treatments with three replicates of 15 birds each in completely randomized design. The experimental diets consisted of raw, soaked for 24hours, soaked for 72hours, boiled and soaked and boiled mango seed kernel meal included at 10% in both broiler starter and finisher diets designated as T1, T2, T3, T4 and T5. The performance results show that final weight at the finisher phase were significantly (P<0.05) higher in T2 (1583.33g) compared to all other treatments. The average water intake in the finisher was significantly (P<0.05) higher in birds fed soaked 72hours (T3) and soaked and boiled MSKM than the other treatments. There were no significant differences in the feed intake, weight gain, feed conversion ratio in both the starter and finisher phase. Treatment 5 recorded the lowest feed cost per kg weight gain (306.31₦/kg) in the starter phase while at the finisher phase it ranges from 231.46-297.54₦/kg in T5 and T4 respectively. From the experiment conducted, it is therefore concluded that different processing method can be used to reduce the effect of anti-nutritional factors and mango seed kernel can be used in broiler diet without adverse effects on the birds, although soaked for 24 hours' mango seed kernel gave the best result.

Keywords: mango seed kernel, anti-nutritional factors, broiler chickens, performance

Introduction

Mango seeds contain some anti-nutritional factors such as tannin, phytic acid, oxalic acid, trypsin inhibitors etc. Tannins are responsible for astringent taste, low digestibility of the feed, hence reduced feed intake due to reduction in palatability and /or acceptability (Rafiu *et al.,* 2014), which is in contrary to its good source of soluble carbohydrates (Diarra and Usman, 2008). Drying, soaking, leaching and fermentation have been reported to be simple means of detoxifying these feed sources to reduce the presence of anti-nutrients and toxic components (Aregheore, 1998). Boiling has been reported to be effective in reducing the tannin content of mango kernel (Diarra and Usman 2008). Similarly, boiling reduced the tannin content of the kernel from 9.89 to 1.26%, representing about 87.26% reduction (Diarra *et al*. 2011). Diarra *et al.* (2010) reported no adverse effect of boiling on the crude protein, crude fibre, ether extract and nitrogen free-extract of the kernel. This research is aimed at determining the effect of differently processed mango seed kernel on anti-nutritional factors content and growth performance

Materials and Methods

Experimental Site:

The experiment was conducted at the Poultry Unit of Bauchi State College of Agriculture Bauchi Teaching and Research farm. Bauchi State occupies a total land area of 49,119 km² representing about 5.3% of Nigeria's total land mass and is located between latitudes 9° 3' and 12° 3' North and longitudes 8° 50' and 11° East (BSD, 2009).

Experimental Design and Management of Birds

A total of two hundred and twenty-five (225) broiler chicks were used for the experiment. They were randomly divided into five treatment groups of 45 chicks per group in a completely randomized

design (CRD) consisting of three replicates of 15 birds each. Birds were reared on a deep litter, with feed and water provided *ad libitum*. Left over feed and body weight of birds were monitored on a weekly basis for the starter and finisher phases of the experiment and routine vaccines were given as recommended. All feed not consumed were removed, weighed and deducted from feed given daily to get the daily feed intake. Daily water consumption is obtained by subtracting left over water from the total volume of water supplied.

Collection and Processing of Mango seed into Mango Seed Kernel Meal

Mango Seed Kernel were collected from various locations in Sibire, Ardo kola LGA of Taraba State. The kernels were obtained by cutting the seed coat using a knife or crushed with a hammer. The Mango Seed Kernel (MSK) obtained were divided into five parts. The parts processed either by soaking for 24 and 72 hours, boiling and soaking for 24 hours and boiled.

Soaking of mango seed kernel for 24 hours

The Mango Seed Kernel were soaked in water for 24 hours at the rate of 100g per 1.5 litre of water in containers. The water was changed at regular intervals of 8 hours. The Mango Seed Kernels were then removed and sundried. The dried MSK were then milled before incorporation into the diets.

Soaking of mango seed kernel for 72 hours

The Mango Seed Kernel were soaked in water for 72 hours at the rate of 100g per 1.5 litre of water in containers. The water was changed at regular intervals of 8 hours for 3 days. The Mango Seed Kernels were then removed and sundried. The dried MSK were then milled before incorporation into the diets.

Boiling of mango seeds kernel

The Mango Seeds Kernel were put in boiling water at the rate of 100g per 1.5 litre of water at 100^{o}C temperature for 30 minutes. The sample were removed, drained, sun dried, and milled before incorporation into the diets.

Soaking for 24 hours and boiling of mango seeds kernel

The Mango Seed Kernel were soaked in water for 24 hours at the rate of 100g per 1.5 litre of water in containers. The Mango Seeds Kernel was put in boiling water at the rate of 100g per litre and half of water at 100^{o}C temperature for 30 minutes. The sample was removed, drained, sun dried, and milled before incorporation into the diets.

Experimental Diets

Five broiler starter and finisher diets were formulated. Diet 1 was the control 10% raw MSKM, diet 2, 3,4 and 5 contained soaked for 24 hours, soaked for 72 hours, soaked for 24 hours and boiled and boiled MSKM respectively all at 10% level of inclusion as replacement for maize.

Determination of anti-nutritional factors in mango seeds kernel

The anti-nutrient compositions of raw and differently processed samples of mango seed kernel were determined by the methods, Mega (1982) and Fasset (1966).

Results and Discussions

Effects of processing Methods on the Levels of Anti-Nutritional Factors in Mango Seed Kernel

The values obtained for anti-nutritional factors shows that the raw mango seed kernel were higher than those processed. The reduction of tannin content in this study (78.43%) for boiled MSKM is in agreement with the findings of Mbajunwa (1995) and Diarra and Usman (2008). These authors observed that cooking is an efficient method of reducing the tannin content of feeds. This level is however, higher than the 75% reduction obtained by Diarra and Usman (2008) under the same conditions of heat and time, probably due to differences in the solubility of the tannins in mango kernel varieties. The reduction in tannin level obtained with boiling mango seed kernel in this study, agrees with the report of Kaankuka *et al*., (1996) who observed that cooking was effective in reducing tannin content of soybean seeds. However, the percentage (78.43% and 84.31%) for both boiled and soaked and boiled were higher than 77.06% reported by Chia *et al*. (1997) after cooking *Phaseoulus angularis* and *D. lablab* for 60 minutes.

The percentage of saponin (raw mango kernel) 11.07% is higher than 2.96% reported by Orayaga *et al.,* (2018). Percentage reduction of Alkaloid, Oxalate and Flavonoid ranged from 32.87-47.43%, 12.92-37.08% and 16.58-34.15% respectively which agree with Dakare *et al.,* 2012) 22.6 -90.6%, 11.1 -65.1%, 16.4 -95.1% respectively. Processing methods was observed reduces the quantity of anti-nutritional factors in mango seed kernel.

Performance of Broiler Chickens Fed MSKM

The increased weight gains as well as final body weight during the finisher phase of broiler chickens fed differently processed mango seed kernel meal could be due to the fact that during boiling, some of the nutrients might have been denatured as reported by Parsons *et al*. (1992) and the leaching of soluble proteins in processing water. Mbajunwa (1995) also reported the leaching of soluble minerals in water. This could be the reason for the reduced weight gain and final weight of birds that were fed boiled mango seed kernel. The weight gain of the started phase ranged from 17.55-20.32g/b/d is similar to 14.40-20.42 g/b/d as reported by Diarra and Usman (2008). The average feed intake (94.93-105.64 g/b/d), average weight gain (33.97-47.68 g/b/d) and feed conversion ratio (2.25-2.96) of the finisher phase is similar to 104.15-109.06 g/b/d feed intake, 30.25-38.85g/b/d weight gain and 2.81-3.47 feed conversion ratio as reported by Orayaga *et al.,* (2015).

Conclusion and Recommendation

Different processing method can be used to reduce the effect of anti-nutritional factors. MSKM can be used in broiler diet without adverse effects on the birds, although soaked for 24 hours' mango seed kernel gave the best result. Other processing methods other than soaking and boiling that will help detoxify and improve the nutritive value of mango seed kernel should be investigated.

Table 1: Composition of Broiler Starter Diets (1-4 weeks)

	Treatments				
Ingredients	**Control Raw**	**Soaked for 24 hours**	**Soaked for 72 hours**	**Boiled**	**Soaked and boiled**
	T1	**T2**	**T3**	**T4**	**T5**
Maize	38.86	38.86	38.86	38.86	38.86
Full-fat Soya bean	34.44	34.44	34.44	34.44	34.44
MSKM	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Wheat Offal	10.00	10.00	10.00	10.00	10.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	0.50	0.50	0.50	0.50	0.50
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
T OTAL	**100**	**100**	**100**	**100**	**100**
Calculated analysis					
ME (Kcal/Kg)	2,917.67	2,917.67	2,917.67	2,917.67	2,917.67
Crude Protein %	23.00	23.00	23.00	23.00	23.00
Crude fibre %	4.60	4.60	4.60	4.60	4.60
Ether Extract %	3.84	3.84	3.84	3.84	3.84
Calcium %	1.39	1.39	1.39	1.39	1.39
Phosphorus %	0.89	0.89	0.89	0.89	0.89
Lysine %	1.66	1.66	1.66	1.66	1.66
Methionine %	0.54	0.54	0.54	0.54	0.54

* Premix: Composition of vitamin per kg is as follows: Vitamin A, 8000iu; Vitamin D31600iu; Vitamin E5iu; Vitamin K 0.200mg; Vitamins B, thaimine B. 0.5mg; Riboflavin B2 4mg; Pyridoxine B6 0.015mg; Niacin 0.015mg; B12 0.01mg; Pantothenic acid 0.5mg; folic acid 0.5mg and Biofin 0.020mg; chlorine chloride 0.02mg; Anti-oxidant 0.125g and Minerals (Mn, Zn, Fe, Cu, I, Si Co) 0.056g.

MSKM- Mango Seed Kernel meal

ME- Metabolizable Energy

Table 2: Composition of Broiler finisher diets (5-8 weeks)

Ingredients	Treatments				
	Control Raw	**Soaked for 24 hours**	**Soaked for 72 hours**	**Boiled**	**Soaked and boiled**
	T1	**T2**	**T3**	**T4**	**T5**
Maize	46.79	46.79	46.79	46.79	46.79
Full-fat Soya bean	26.01	26.01	26.01	26.01	26.01
MSKM	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Wheat Offal	10.00	10.00	10.00	10.00	10.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	0.50	0.50	0.50	0.50	0.50
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
T OTAL	**100**	**100**	**100**	**100**	**100**
Calculated analysis					
ME (Kcal/Kg)	2978.32	2,978.32	2,978.32	2,978.32	2,978.32
Crude Protein %	20.00	20.00	20.00	20.00	20.00
Crude fibre %	4.29	4.29	4.29	4.29	4.29
Ether Extract %	3.92	3.92	3.92	3.92	3.92
Calcium %	1.54	1.54	1.54	1.54	1.54
Phosphorus %	0.93	0.93	0.93	0.93	0.93
Lysine %	1.43	1.43	1.43	1.43	1.43
Methionine %	0.40	0.40	0.40	0.40	0.40

* Premix: Composition of vitamin per kg is as follows: Vitamin A, 8000iu; Vitamin D31600iu; Vitamin E5iu; Vitamin K 0.200mg; Vitamins B, thaimine B. 0.5mg; Riboflavin B2 4mg; Pyridoxine B6 0.015mg; Niacin 0.015mg; B12 0.01mg; Pantothenic acid 0.5mg; folic acid 0.5mg and Biofin 0.020mg; chlorine chloride 0.02mg; Anti-oxidant 0.125g and Minerals (Mn, Zn, Fe, Cu, I, Si Co) 0.056g.

MSKM- Mango Seed Kernel meal
ME- Metabolizable Energy

Table 3: Effects of Processing Methods on the Anti-Nutritional Factors in Mango Seed Kernel

Parameters	Treatments				
	Control Raw T1	Soaked for 24 hours T2	Soaked for 72 hours T3	Boiled T4	Soaked and boiled T5
Tannin (%)	0.51	0.20	0.12	0.11	0.08
Reduction (%)		60.78	76.47	78.43	84.31
Saponin (%)	11.07	10.50	8.12	7.16	7.20
Reduction (%)		5.15	26.65	35.68	34.96
Alkaloid (%)	22.02	11.05	15.10	14.11	11.41
Reduction (%)		47.43	42.44	32.87	45.72
Oxalate (Mg/g)	2.40	2.09	1.70	1.89	1.51
Reduction (%)		12.92	29.67	21.25	37.08
Flavonoid (%)	6.15	5.13	5.07	4.05	4.20
Reduction (%)		16.58	17.56	34.15	31.71

Table 4: Performance and Cost-Benefit of Broiler Chickens Fed Differently Processed Mango Seed Kernel at Starter Phase

Parameters	Treatments					
	Control Row T1	Soaked for 24 Hours T2	Soaked for 72 hours T3	Boiled T4	Soaked and boiled T5	SEM
Initial body weight (g)	120.00	122.22	126.67	124.45	126.67	4.66NS
Final body weight (g)	488.89	548.89	513.33	502.22	546.67	30.50NS
Av. feed intake (g/b/d)	44.75^{b}	52.27^{a}	48.15^{b}	45.32^{b}	49.09^{ab}	2.38
Av. weight gain (g/b/d)	17.55	20.32	19.47	17.99	20.00	1.16NS
Feed to gain ratio	2.55	2.57	2.47	2.52	2.47	0.10NS
Water intake (ml/d)	1194.60^{b}	1296.66^{a}	1276.51^{ab}	1190.16^{b}	1227.78^{ab}	40.04
Feed cost/weight gain (₦/kg)	317.32	322.32	307.68	312.63	306.31	
Mortality (number)	0.00	0.00	0.00	0.00	0.00	0.00

^{a,b}: means within the same row bearing different superscripts are significantly different (P<0.05)
NS: No Significant Difference
SEM: Standard Error of Mean

Table 5: Performance and cost-benefit of Broiler Chickens Fed Differently Processed Mango Seed Kernel at Finisher Phase

	Treatments					
Parameters	**Control Row**	**Soaked for 24 Hours**	**Soaked for 72 hours**	**Boiled**	**Soaked and boiled**	**SEM**
	T1	**T2**	**T3**	**T4**	**T5**	
Initial body weight (g)	603.33[b]	671.11[a]	676.67[a]	579.99[b]	676.44[a]	25.98*
Final body weight (g)	1216.67[bc]	1583.33[a]	1400.00[ab]	1033.33[c]	1450.00[ab]	95.67*
Av. Feed intake(g/b/d)	101.50	105.64	101.26	94.93	100.75	4.75NS
weight gain (g/b/d)	36.65	47.68	41.99	33.97	46.32	9.02NS
Feed to gain ratio	2.96	2.25	2.48	2.94	2.48	0.71NS
Water intake (ml/d)	1724.38[ab]	1700.21[ab]	1931.88[a]	1580.63[b]	1879.58[a]	105.42*
Feed cost/weight gain (₦/kg)	294.30	234.50	254.17	297.54	231.46	
Mortality (number)	5	5	2	4	2	

[a,b,c]: means within the same row bearing different superscripts are significantly different (P<0.05)

NS: Not Significant

SEM: Standard Error of Mean

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