EFFECTS OF RAW, COOKED AND DEFATTED MELON SEEDS ON PERFORMANCE CHARACTERISTICS AND MINERAL RETENTION OF BROILER CHICKENS

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ABSTRACT

This study was carried out to determine the effects of raw, cooked, toasted and defatted melon seeds on performance characteristics and mineral retention of broiler chickens. The plant seeds were fed to the birds at 15% level . A total of 200 day old broiler chicks of the Marshall strain were randomly allocated to five dietary groups in a completely randomized design. The experiment lasted for five weeks. Feed intake was similar between birds fed the control diet and those fed cooked melon seeds , but significantly reduced in birds fed raw melon seed. Body weight gain (BWG), feed conversion efficiency (FCE) and protein efficiency ratio (PER) were higher in birds fed cooked melon seeds , but significantly reduced in the birds fed raw and defatted melon seeds respectively. Birds fed on toasted melon seeds however ranked next to those fed on cooked melon seeds in BWG, FCE and PER values respectively. Nitrogen, calcium, phosphorus and iron retention were markedly reduced in birds fed on raw melon seeds. Phosphorus and iron retention were however similar between those fed on toasted and defatted melon seeds respectively. Over all, the best significant improvements in the response indices were obtained in birds fed on cooked melon seeds as the birds fed on the diet competed favorably with the control group. It is therefore recommended that cooked melon seeds are best incorporated into diets of broiler chickens.

Keywords: *Melon seeds, processing, broilers, performance characteristics*

INTRODUCTION

In recent times, the poultry industry in sub Sahara Africa has witnessed increasing cost of production far above what local farmers can afford. This is often attributed to certain animal feed ingredients, such as the conventional soya beans and groundnut that are daily becoming scarce and expensive. The scarcity of these grains is mostly associated with a dwindling local production and competition between man and animal. Moreover, in recent times, there has been a continuing search for solutions to the problems arising from the high cost of feeding, of which many researchers have looked for alternatives to these conventional grain legumes. Much work have been done on the use of lesser known and underutilized grain legumes and oil seeds such as kidney beans (Emiola et al., 2005), jack bean (Essien and Udedibie, 2007), benne seed (Akanji et al., 2008) and lima beans (Ologhobo, 1992). However, available literature shows that little work has been done on the use of melon as an alternative to the conventional grain legumes.

Melon seed (Citrullus vulgaris) is a protein rich oil seed. According to Nwokolo (1986) it is a cheap and readily available oil seed which may reduce feed cost and make poultry production more profitable. Oyenuga (1978) earlier reported that unextracted "full fat" melon seeds are rich sources of oil contents (51 to 55%) and crude protein (32.5 to 38.7%). However, melon seeds have been reported to contain anti-nutritional factors that are similar to most grain legumes, among which are trypsin and chymotrypsin inhibitors. Trypsin inhibitors in kidney beans were reported to depress nutritive value of proteins, inhibit growth and stimulate pancreatic hypertrophy in broiler chickens and rats (Emiola et al., 2005) .

Attempts to upgrade the use of toxic leguminous grains have been reported. The processing methods include autoclaving (D'Mello and Walker, 1991), dry urea treatment plus toasting (Udedibie and Carlini, 1998) and potassium bicarbonate ($KHCO_3$) plus autoclaving (D'Mello and Walker, 1991). These methods are however cumbersome and consequently expensive. There is therefore the need to look at other simpler processing methods. Hence, this study was carried out to examine the effects of raw, aqueous- heated , dry -heated and defatted melon seed on performance characteristics and nutrient utilization of growing broiler chickens.

MATERIALS AND METHODS

Raw melon seeds (Citrullus vulgaris) sourced from the Teaching and Research Farm, Olabisi Onabanjo University, Ago Iwoye, Nigeria were processed through aqueous heating, dry heating and defatting respectively.

Aqueous heating: A batch of the air-dried melon seeds was processed through aqueous-heating using method described by Akanji (2002) with slight modifications. The seeds were soaked in fresh water (250g seed/litre of water) for 24 hours and then cooked in fresh water (250g seed/ litre of water) for 1 hour. Both the soaking and cooking water extracts were discarded. The cooked seeds were oven-dried at 40^{o}C , bagged and labeled cooked melon seeds.

Dry heating: Another batch of air-dried melon seeds was processed through dry heating using the method described by Emiola et al., (2005) . The seeds were toasted in an oven at 130^{o}C for 30 minutes. The seeds were stirred at interval of 10 minutes in the oven to allow for uniform dry heating. Thereafter, the seeds were air-dried, bagged and labeled toasted melon seeds.

Defatting: Oil was extracted from the melon seeds by adopting the traditional method as described by Nwokolo (1986) with slight modifications. A fresh batch of air-dried melon seeds was first milled into powder, kneaded with hot water for thirty minutes until oil flowed out from the seeds. Thereafter, the kneaded melon dough was put into a jute bag and the oil was further extracted under pressure by placing heavy stone on it for 12 hours. After extraction of the oil, the residue of the seed was oven-dried, bagged and named defatted melon seed.

Birds and management: A total of 200 day-old broiler chicks of the Marshall strain were randomly divided into 5 groups of 40 chicks in a completely randomized design. Each group was further sub-divided into 4 replicates of 10 birds. Feed and water were provided *ad libitum.* All necessary medications were carried out. The average feed intake and the weight gain were determined per week in grams. The feed conversion efficiency was calculated as the ratio of gram body weight gain to gram feed intake. The experiment was terminated at the end of the fifth week.

Experimental Diets: Five starter broiler rations were formulated on least-cost basis mainly from maize-soybean meal basal diet (Table 1). The raw, cooked, toasted and defatted melon seeds were incorporated into the diets at 15% level respectively. Minor adjustments were made in the maize, soybeans, fish meal and palm kernel meal to make the diets isonitrogenous and isocaloric. 0.30% of methionine was added to each diet to ensure that the amino acid was not limiting for the birds.

Chemical Analysis: Analytical methods of A.O.A. C. (1984) were used to determine the proximate compositions of the raw, cooked, toasted and defatted melon seeds respectively. In the fifth week of the experiment, faecal samples were collected from 16 live birds per group (4 birds per replicate group) and dried in oven in readiness for determination of apparent mineral retention (%dry matter basis) for nitrogen, calcium, phosphorus and iron. The mineral retention was obtained as:

$$\frac{\text{Mineral intake (gDm)} - \text{Mineral indroppings (gDm)}}{\text{Mineral intake (gDm)}} \times 100$$

Statistical Analysis: Statistical analysis was carried out by using Analysis of Variance. Where significant, means were separated by using Duncan Multiple Range Test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Table 1: Percentage Composition of Experimental Starter Diets

	CONTROL	RMS	CMS	TMS	DMS
Maize	53.00	50.00	49.71	51.50	52.70
Soybean meal	30.00	18.55	18.70	18.81	18.60
Melon seed	-	15.00	15.00	15.00	15.00
Fish meal	8.50	9.00	9.15	7.26	6.26
Palm kernel meal	1.50	0.15	0.14	0.13	0.14
Palm oil	3.00	3.00	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30
Calculated crude	23.20	23.10	23.21	23.17	23.44
protein (%) Calculated	12.05	11.56	11.66	11.59	11.49

metabolizable energy (MJ)

RMS = Raw melon Seeds; CMS = Cooked melon Seeds, TMS = Toasted melon Seeds; DMS = Defatted Melon Seeds

Table 2: Proximate Composition of Raw, Cooked, Toasted and Defatted Melon Seeds

	CP	EE	CF	ASH	CARBOHYDRATE
RMS	43.86[c]	21.05[a]	7.00	4.00	22.20[b]
CMS	43.34[c]	20.71[a]	6.34	3.78	22.3[b]
TMS	46.39[b]	21.38[a]	6.74	3.98	20.01[c]
DMS	57.17[a]	5.96[b]	6.32	3.68	24.77[a]
SEM	±0.89	±0.34	±0.11	±0.17	±0.16

Means with different superscripts across the row are significantly different ($p<0.05$)
RMS = Raw Melon Seeds, CMS = Cooked Melon Seeds, TMS = Toast Melon Seeds; DMS = Defatted Melon Seeds, CP = Crude protein, EE = ether extract; CF= crude fibre, SEM = Standard Error of Mean

Table 3: Performance Characteristics of Broiler Chickens Fed With Raw, Cooked Toasted and Defatted Melon Seeds

GROUP	F.I (gm\wk)	W.G (gm\wk)	FCE	PER	
Control		224.7a	146.39a	0.67a	2.83a
RMS		194.6d		103.6d	
0.51c	2.31d				
CMS		223.8a		143.7 a	
0.64a	2.75ab				
TMS		210.1b	121.1b	0.58b	2.68b
DMS		207.9 b	114.1c	0.55bc	2.53c
SEM		±2.17		±1.79	
±0.03	±0.11				

RMS = Raw Melon Seeds, CMS = Cooked Melon Seeds, TMS = Toasted Melon Seeds; DMS = Defatted Melon Seeds, FI = Feed Intake, WG = Weight gain; FCE = Feed Conversion efficiency, PER = Protein Efficiency ratio, SEM = Standard Error of mean.

Table 4: Mineral Retention of Birds fed raw, cooked, toasted and defatted melon seeds

Diets	Nitrogen (%)	Calcium (%)	Phosphorus (%)	Iron (%)
Control	74.16a	70.85a	69.21a	70.78a
RMS	62.27c	58.11c	54.38c	60.71b
CMS	70.19b	68.54ab 68.81a	69.23a	
TMS	68.03b	66.18b	60.18b	61.34b
DMS	63.05c	62.11c	59.21b	61.11b
SEM	0.25	0.34	0.27	0.26

The proximate composition of the raw, cooked, toasted and defatted melon seeds are presented on table 2. Crude protein content was increased in the defatted melon seeds and toasted melon seeds, but decreased in the cooked melon seeds respectively. The ether extract was higher in the raw, cooked and toasted melon seeds, but highly reduced in the defatted melon seeds respectively. The crude fibre and ash contents were similar in the raw, cooked, toasted and defatted melon seeds respectively. The results showing the performance characteristic of the broiler chickens are presented on Table 3. Feed intake was similar between birds fed on the control diet and those fed on cooked melon seeds, and between those fed on defatted and toasted melon seeds respectively. The least feed intake was however obtained in birds fed on raw melon seeds. The weight gain was significantly increased in birds fed

on cooked melon seeds, but similar to those fed on the control diet. Birds fed on raw melon seeds gave the least weight gain. The feed conversion ratio (FCR) and protein efficiency ratio (PER) of the birds fed on control diet and on cooked melon seeds were similar respectively. The FCR was also similar between birds fed on toasted and defatted melon seeds respectively. The least FCR and PER were however obtained in birds fed on raw melon seeds respectively.

Data obtained on the mineral retention (table 4) show the highest value of nitrogen retention in birds fed on control diet. Followed next were the birds fed on cooked melon seeds and on toasted melon seeds, with values similar to each other. Calcium, phosphorus and iron retention were similar between birds fed on control diet and on cooked melon seeds, but markedly reduced in birds fed raw melon seeds respectively. Phosphorus and iron retention were also similar between birds fed on toasted melon seeds and on defatted melon seeds respectively.

The results obtained on crude protein of the raw, cooked, toasted and defatted melon seeds in this study agree with the findings of Nwokolo (1986). However, the crude protein (CP) content obtained in the raw melon seeds in this study is higher than CP content of raw soya beans, (*Glycine max*), bambara groundnut, and raw jack beans (Akanji , 2002). Also, the crude fiber contents obtained in the melon seeds used in this study are lower than those reported by Apata (1990) on grain legumes such as sweet Lupines (11.30-16.80%) and raw jack beans (Akanji, 2002). The ether extract contents obtained in the melon seeds are lower than the value of benne seeds (Akanji and Ologhobo, 2007) but similar to soybeans (Akanji, Ologhobo and Emiola, 2007). Nwokolo (1986) classifies melon seeds as excellent source of dietary oil. Lutz and Prytulski (2008) reported that oil from grain legumes and most oil seeds is rich in unsaturated fatty acids. The ash contents obtained in the melon seeds in this study are close to values reported in grain legumes (Apata, 1990).

The low values of feed intake in birds fed on raw melon seeds in this study can be attributed to the presence of inherent anti-nutritional factors as reported by Akanji (2002). Raw melon seed is known to contain some quantity of protease inhibitor (Lutz and Prytulski, 2008) that is enough to reduce feed intake. Akanji *et al* (2007) reported significant negative correlation between feed intake and trypsin inhibitor in adult exotic cockerels fed on raw jack beans and on Bambara groundnut respectively. Moreover, the significant improvements in feed intakes of birds fed on cooked and on toasted melon seeds can be attributed to the heat treatments applied to the seeds. This is consistent with the reports of Essien and Udedibie (2007) that trypsin inhibitor and phytoheamaglutonin are reduced or eliminated by heat treatments. Toasting is however known to leave some residual amounts of trypsin inhibitor activity; hence the relative lower amount of feed intake in birds fed on toasted melon seeds when compared to those fed on cooked melon seeds.

The reductions in weight gain in birds fed on raw and on defatted melon seeds in this study are similar with the results obtained when birds were fed on raw kidney beans (Emiola et al., 2005), raw benne seed (an oil seed containing much of

tannin and oxalate in its hulls) (Akanji et al., 2007) and on defatted jack beans (Ologhobo et al., 1993) respectively. The trypsin inhibitor located in the cotyledons of raw melon seeds is known to reduce growth in birds (Udedibie and Carlini, 1998). The defatted melon seed used in this study probably contained residual amount of trypsin inhibitor.

The values obtained on feed conversion efficiency (FCE) and protein efficiency ratio (PER) in this study are consistent with reports of Essien and Udedibie (2007) who attributed low efficiency of feed utilization of birds fed on raw and on toasted jack beans to inherent toxic factors. Akanji (2002) had earlier reported significant correlation between feed conversion efficiency and each of haemagglutinin and trypsin inhibitor in broiler chickens fed on raw and on fermented jack beans. Udebie and Carlini (1998) were of the views that even minute amounts of residual trypsin inhibitor and haemagglutinin in processed jack bean could constituent a problem to proteolytic digestion and therefore tend to accumulate in the animals by binding to the intestinal wall, thereby reducing the efficiency of feed utilization. The significant improvement in the FCR and PER values of birds fed on cooked melon seeds in this study suggest better protein metabolism and utilization.

The results obtained on mineral retention in this study are in agreement with the reports of Lorenzon and Olsen (1992). They were of the opinion that raw plant seeds rich in toxic factors enhance shedding of the brush border membranes and decrease in villus length in rats with a conspicuous effect on mineral absorption. Kim et al., (1976) reported that anti-nutritional factors can have in vivo inhibition of brush border dipeptidases which interfere with the transport of nitrogen through the absorptive cells of the gut and contribute to faecal-nitrogen losses. The lower values of iron retention in birds fed on raw and on defatted melon seeds are likely to have negative effect on haemoglobin and red blood cells of the birds. This is suggestive of anemia in the birds.

CONCLUSION

The effects of raw, cooked, toasted and defatted melon seeds on broiler chickens were determined. Crude protein was increased in defatted melon seeds. The performance characteristics were poor in birds fed on raw melon seeds. Birds fed on toasted and on defatted melon seeds shared similarities in performance characteristics, but not up to those fed on cooked melon seeds. The toasting and defatting of the melon seeds showed the seeds probably contained residual amounts of trypsin inhibitor. It is therefore recommended that cooked melon seeds are best incorporated into diets of broiler chickens.

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