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Original Article

Effects of Replacing Maize with Graded Levels of Boiled Mango Kernel Meal on the Carcass and Sensory Characteristics of Indigenous Guinea Fowl (*Numida meleagris*) Meat

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ABSTRACT

A study was conducted to evaluate the effect of Boiled Mango Kernel Meal (BMKM) on the carcass characteristics and sensory qualities of guinea fowl meat. Dietary maize was substituted with four levels of inclusion of BMKM at 0% (T1), 10% (T2), 15% (T3) and 20% (T4). Forty-eight, 16 week old birds; 12 birds per treatment were randomly selected from a total of 120 birds used for the study. The birds were weighed, slaughtered, and viscera separated from the carcass. Carcass was chilled at -1°C for 24hours, and sectioned into the primal wholesale cuts i.e. breast, wings, thighs and drumstick and each part was weighed. Hot dressing and cold dressing percentages were also taken. Breast and thigh muscles were used for sensory evaluation to assess the sensory attributes i.e. colour, off-odour, juiciness, tenderness, flavour and flavour-liking of the meat. Data obtained were analyzed using the General Linear Model (GLM) of ANOVA component of Minitab. Where significant differences were found, means were separated using Tukey Pair-Wise comparison, at 5% level of significance. The results indicated that the use of BMKM in place of maize in guinea fowl diets had no significant effects on carcass (P>0.05) and sensory characteristics (P>0.05) of the meat. Cost of acquiring 100kg BMKM was GH ¢60.00 ($20.00) whiles 100kg maize was GH ¢150.00 ($50.00). It was concluded that the use of BMKM up to 20 % in guinea fowl diets has no adverse effect on the carcass and sensory characteristics of the meat.

Keywords: Mango kernel meal, carcass characteristics, sensory evaluation, guinea fowl, boiled.

INTRODUCTION

The domestic guinea fowl (*Numida meleagris*) is indigenous to Africa, and are kept in almost every household in Northern Ghana where their production has assumed socio-economic importance. They exist in different strains such as pearl, lavender and white (Dei and Karbo, 2004). The guinea fowl is important in providing good quality meat, eggs and security remedy for unprepared circumstances such as ready cash to buy other agricultural inputs or pay school fees. There has been a significant shift in the consumer preference for guinea fowl meat due to its peculiar taste.

Meat from guinea fowl has high levels of crude protein, lower in fat and cholesterol compared with chicken (Koney, 1993). Guinea fowl rearing is however plagued by high cost of feed, bringing about a high production cost of Guinea fowls in Ghana. Maize, which constitutes the main energy source, is inadequate in supply and expensive when available. This necessitates a study into locally available, less expensive and nutritionally adequate substitutes for maize in poultry feeding. One of such ingredients with potential for use is mango seed kernel.

Mango (*Mangifera indica*) is a tree crop which is well adapted to all ecological zones of Ghana, and the trees are found in almost every part of the country. Mango kernel, a by-product of mango pulp is reported to be a good source of starch (Saadanry *et al*., 1980). In India, mango kernel is used to prepare porridge for human consumption (Saadanry *et al*., 1980; Opeke, 1982), but in Ghana it is regarded as waste, thus contributing to environmental pollution.

There are few reports on the use of mango kernel in livestock feeding, but levels of inclusion in poultry diets has been low because of the presence of tannins which have been reported to reduce chick growth (Jansman *et al*., 1995; Teguia, 1995). Teguia (1995) reported that body weight gains and feed consumption of broilers were adversely affected when 20% of dietary maize was substituted with raw mango kernel meal. However, boiling has been reported by several researchers to be an effective method of reducing the levels of tannin in feed ingredients (Gyabaah, 2011). Mbajunwa (1995) reported a reduction of tannins up to 52% when African oil bean was boiled in water. This study was therefore aimed at determining the effects of feeding graded levels of boiled mango kernel meal to guinea fowls on the carcass and sensory characteristics of the birds.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Poultry Section of the Department of Animal Science, University for Development Studies, Nyankpala Campus, Tamale.

Processing of mango kernel meal for use

Mango seeds were collected during the month of May (peak mango season in the study area). The seeds were opened up with a knife to obtain the fresh kernels which were chopped into smaller units and boiled in fresh water at 100^{o}C for 30 minutes. The boiled product was then spread on a clean concrete floor and sun-dried for 72 hours. The dried mango kernel was milled using a conventional grinding mill, packaged in polythene bags and stored at room temperature for later use.

Experimental diets and birds

Four dietary treatments were formulated and fed to birds from five weeks old till maturity (16 weeks). T1 was the control diet with 0% BMKM. In treatments 2, 3 and 4, BMKM was used to replace dietary maize at 10%, 15% and 20% respectively. A total of forty-eight (48) indigenous guinea fowls (16 weeks old) with sex ratio of 1:1 were selected with twelve birds each randomly selected from each of the four treatment groups.

Slaughtering of birds

Each bird was weighed (live weight) with an electronic scale (Sartorius, CP 245S) after a 24-hour feed withdrawal, and tagged to differentiate them. The birds were then stuck with a sharp knife to cut the jugular veins and were allowed to bleed for approximately 60 seconds, after which they were scalded in warm water (60°C). The feathers were plucked manually and head and shanks removed. An incision was then made around the vent to remove the viscera. The hot carcass weight was then taken.

Carcass yield and sectioning

The viscera were separated into intestines, gizzard, liver and spleen. The dressed carcass was chilled for 24 hours and cold weight taken. Primal cuttings were made from the chilled carcass and weighed. The breast and thigh muscles were used for sensory evaluations.

Carcass and Sensory Evaluations

Measurement of carcass characteristics

The carcass was chilled and weighed to get the chilled carcass weight. Dressing percentages were obtained as follows;

$$\textit{Hot carcass} = \frac{eviscerated\ weight}{live\ weight} \times 100$$

The cold dressing percentage was calculated by:

$$\textit{Cold carcass} = \frac{weight\ after\ chilling}{live\ weight} \times 100$$

Sensory evaluation of carcass

A total of fifteen (15) panelists aged between 18-25 years were randomly selected and trained according to the British Standard Institution guidelines to evaluate the products (BSI, 1993). Sensory evaluation was carried out on days 1 and 7 of product storage (-18°C). The breast muscles were thawed and grilled to a core temperature of 70°C in an electric oven (Turbofan, Blue seal, UK). The products were sliced into uniform sizes (about $2cm^3$) and wrapped with coded aluminum foils and presented to the panelists. Each panelist was provided with water and pieces of bread to serve as neutralizers between the products.

A five-point category scale was used to evaluate the sensory characteristics of the products as follows: Colour: Very pale red (1), Pale red (2), Intermediate (3), Dark red (4), very dark red (5); Off-odour: Very weak (1), weak (2), intermediate (3), strong (4), very strong (5); Juiciness: Very dry (1), dry (2), intermediate (3), juicy (4), very juicy (5); Tenderness: Very tough (1), tough (2), intermediate (3), tender (4), very tender (5); Guinea fowl flavour: Very weak (1), weak (2), moderate (3), strong (4), very strong (5) ; Flavour-liking: Dislike very much (1), Dislike (2), intermediate (3), Like (4), Like very much (5).

Data analysis

The data obtained was analyzed using the General Linear Model (GLM) of Analysis of Variance (ANOVA) of Minitab statistical package (Minitab, 2007). Where significant differences were found, means were separated using Tukey Pair-Wise comparison, at 5% level of significance

RESULTS AND DISCUSSION

Dressing percentage and primal cuts of the birds

The dressing percentage and primal cuts of the birds are presented in Table 1.There were no significant (P> 0.05) differences in the dressing percentages and primal cuts of the birds.

Hot dressing percentage indicates the carcass yield, while cold dressing percentage indicates the ability of the carcass to retain moisture during chilling.

Table 1: Dressing percentage and primal cuts of the birds

Parameter (%)	T1	T2	T3	T4	SED	Sig
Hot dressing	79.19	78.09	77.74	79.54	1.88	NS
Cold dressing	70.35	69.69	68.29	70.48	2.09	NS
Drumstick	36.73	32.98	30.60	33.06	4.03	NS
Wings	49.37	43.39	42.12	44.56	4.97	NS
Breast	140.1	124.7	131.0	123.5	14.33	NS
Thigh	47.11	44.31	39.62	42.78	6.65	NS

SED= Standard Error of Difference; Sig.=significance; ns = not significant (P>0.05)

The primal cuts are the most marketable parts of poultry, and therefore higher weights of primal cuts are desirable for high profitability. Teye *et al.* (2011) reported significantly lower ($P < 0.05$) dressing percentage and primal cuts of birds fed raw false yam seed meal (RFYSM). This observation was assigned to the anti-nutritional factors in the false yam seed meal that hindered growth and development of the birds. The anti-nutritional factors in the feed might have made the feed unpalatable and poorly digestible and consequent difficulty in proper utilization by animals (Okine *et al.,* 2009). Gyabaah (2011) however, used boiled false yam seed meal to feed broiler chicken and reported no significant differences ($P>0.05$) in the dressing percentages. The results from this study confirm the assertion that boiling is an efficient means of minimizing anti-nutritional factors in feed materials. Jourdain (1980); Oluyemi and Roberts (1988) reported that protein utilization in feed is important in muscle deposition, but this is hindered by anti-nutritional factors in feed. Therefore, the insignificant differences in the carcass yield and primal cuts indicate that dietary nutrient utilization was not affected by the inclusion of BMKM to Guinea fowl diets.

There was no significant ($P>0.05$) difference in the contents of the intestine and gizzard. This indicates that the rate at which the feed passes through the gastro- intestinal tract is similar among the birds on the different diets. This might have resulted in the insignificant differences in the carcass yield of the birds.

Sensory evaluation of the meat

The sensory characteristics of the meat are indicated in Table 2. There was no significant ($P>0.05$) difference in the colour, off-odour, juiciness, flavour and flavour-liking of the guinea fowl breast muscles. These sensory parameters are the most important qualities consumers look out for when buying meat.

Table 2: Sensory characteristics of the meat

Parameter	T1	T2	T3	T4	SED	Sig
Colour	2.27	2.33	2.33	2.40	0.54	NS
Off-odour	1.80	1.60	2.07	1.87	0.85	NS
Juiciness	3.07	3.00	2.87	3.20	0.87	NS
Tenderness	3.27	3.60	3.87	3.53	0.64	NS
Flavour	3.53	3.87	3.73	3.47	0.98	NS
Flavour-liking	3.73	4.07	4.00	3.47	0.75	NS

SED= Standard Error of Difference; Sig.=significance; NS = not significant (P>0.05)

Colour and general appearance of meat are important criteria consumers look out for when making buying decisions (Feiner, 2006). Colour is an important factor used by most consumers to determine freshness of meat and meat products (Van Oeckel *et al*., 1999). This implies that a product with an unusual colour will not be accepted by consumers. The similar

colour appearance of the meats indicates that the use of BMKM had no effect on the appearance of the meat.

According to McWilliams (1997), pleasant odour of a product invites people, while a strong irritating odour discourages consumer patronage. A product with an odour that differs from the known will deter consumers from patronizing such products.

Juiciness of meat is directly related to inter and intra-muscular lipids and moisture content of the meat (Cross *et al*., 1986). Juiciness of a product is very important to a consumer and since there was no significant difference between treatments, it can be said that the experimental diet had no adverse effect on the meat. Guinea fowl meat has a characteristic aroma, which is cherished by most consumers in Ghana. The result from this study indicates that the experimental diet had adverse effect on the aroma of the meat. Flavour is the outcome of combining the senses of smell; taste and mouth feel by a consumer, and is determined subjectively by taste panellists. Sulphur compounds like hydrogen sulphide provides the meat flavour of meats (Bell and Weaver, 2002). Therefore any meat product which does not have the taste of its source is said to be contaminated and will likely be rejected by consumers. From the results, there was no significant difference in the flavour-liking of the products, meaning consumers will not hesitate buying such products.

Costs of acquiring maize and Boiled Mango Kernel Meal

The costs of acquiring 100kg each of maize and boiled mango kernel meal are shown in Table 3. The cost of acquiring 100kg of BMKM was GH ¢60.00 ($20.00) whiles that of 100kg maize was GH¢150.00 ($50.00). It can be realised that using BMKM in place of dietary maize was cheaper, although there were no significant differences in the carcass parameters. The adoption of BMKM in Guinea fowl production will reduce production cost and boost profitability of Guinea fowl production. The use of BMKM in place of maize will also minimize competition between livestock and humans over maize, which is now very expensive due to inadequate supply of the commodity.

Table 3: Costs of acquiring 100kg maize and BMKM

Ingredient	Cost of acquiring 100kg (GH¢)	Cost of processing (GH¢)	Total Cost (GH¢)
Maize	140.00	10.00	150.00
Mango kernel	10.00	50.00*	60.00

* Cost includes boiling, drying, milling and transportation

CONCLUSION AND RECOMMENDATION

The use of boiled mango kernel meal up to 20% inclusion in Guinea fowl diets has no adverse effects on the carcass and sensory characteristics of the meat. However, the use of BMKM in place of maize in guinea fowl diets reduces production costs. It is recommended that further studies should be conducted to determine the effects of feeding boiled mango kernel meal to guinea fowls, on the haematological characteristics and nutritional composition of the birds.

REFERENCE

Bell, D.E. and W.D. Weaver. 2002. Feeding Commercial Egg-type Layers in Commercial Chicken Meat and Egg Production. Academic Publishers, the Netherlands. pp: 287–328.

British Standard Institution (B.S.I). 1993. Assessors for sensory analysis: Guide to selection, training and monitoring of selected assessors. London, United Kingdom. 31p.

Cross, H.R., P.R. Quland, and S.C. Seldeman. 1986. Muscles as Food. Ed. P.P.J. Bechtel Academic Press F.L.P. pp: 45-52.

Dei, H.K. and N. Karbo. 2004. Improving Smallholder Guinea Fowl Production in

Ghana: A Training Manual. University for Development Studies, Tamale and Animal Research Institute (CSIR), Nyankpala Station Tamale. p: 27.

Feiner, G. 2006. Colour in fresh meat and in cured meat products. In Meat products handbook: Practical science and technology. Cambridge, England: Woodhead Publishing Limited. pp: 142–156.

Gyabaah, H.K. 2011. The impact of boiled false yam (*Icacina oliviformis*) seed meal on the carcass characteristics and the sensory qualities of broiler chicken. Dissertation submitted to the Department of Animal Science, University for Development Studies. pp: 21-26.

Jansman, A.J.M., M.W.A. Verstegen, J. Huisman, and J.W.O. Van den Berg. 1995. Effects of hulls of faba beans (*Vicia faba* L.) with a low or high content of condensed tannins on the apparent ileal and faecal digestibility of nutrients and the excretion of endogenous protein in ileal digesta and faeces of pigs. *J. Anim. Sci*. 73: 118-127.

Jourdain, R. 1980. Aviculture en Milieu Tropical, imprime par Beaudoin S.A. 77120.

Koney, E.B.M. 1993. Poultry Health and Production. Advent Press. Accra, Ghana. p: 185.

Mbajunwa, O.K. 1995. Effect of processing on some antinutritive and toxic components of the African oil bean seed (*Pentaclethra macrophylla Benth*). *Journal of Food Science and Agriculture* 68: 153-158.

McWilliams, M. 1997. Food experimental prospectus, 3rd edition. Prentice-Hall, INC, Upper Saddle River, New Jersey 07458. p: 45.

Minitab. 2007. Minitab Statistical Software, release 15 for Windows 95/98/2000 and Windows NT. Minitab Inc, USA.

Okine, C.A., G.A. Teye, and H.K. Dei. 2009. Effects of Processed *Mucuna pruriens* beans on carcass characteristics of broiler chicken. *Proceedings of the Ghana Association of Animal Production (GSAP)*, 16th Biennial Conference. pp: 145-147.

Oluyemi, J.A. and F.A. Roberts. 1988. Poultry Production in Warm Wet Climates. McMillan Education Limited, London. 197p.

Opeke, L.K. 1982. Tropical Tree Crops. Spectrum books, Ibadan, Nigeria. p: 327.

Saadanry, R.M.A., Y.H. Roda, and F.M. Saadany. 1980. Studies on starch extraction from Mango seed (*Mangifera indica*) as a new source of starch. *Starch/Starke.* 32: 113- 116.

Teguia, A. 1995. Substituting mango kernels (*Mangifera indica L*.) for maize in broiler diets. *Animal Feed Science Technology.* 56: 155-158.

Van Oeckel, M.J., N. Warrmant, and L.V. Bookque. 1999. Measurement and prediction of Poultry colour. *Meat Science.* 52: 347-354.

Teye, G.A., M. Coffie, and M. Teye. 2011. Effects of Raw False Yam (*Icacina Oliviformis*) Seed Meal in Broiler Rations, on Carcass Yield and Eating Qualities of the Meat. *J. Anim. Sci. Adv*. 1(2): 79-84.