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Meat Quality of Japanese Quail (*Coutonix Coutonix Japanica)* Fed Graded Levels of Fermented Mango Kernel Meal

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Abstract— *This study is aimed at evaluating the effect of replacing maize with Fermented Mango Kernel Seed Meal(FMKSM) on meat quality of Japanese Quails . A total of two hundred and twenty five (225) one week old unsexed Japanese quails purchased from National Research Institute Vom, Plateau State, Nigeria were used in a six weeks study. The quails were equally allotted in to five treatment group of 45 birds per treatments. The control diet which contains 0% FMSKM and four other experimental diet in which maize was replaced with FMSKM at 10% , 15%, 20% and 25% levels of inclusion thus; 5 treatments respectively. At the end of the experiments, cooking loss, drip loss, Colour and pH were analyzed. From the results, cooking loss, drip loss, Colour and pH showed no significant differences (p>0.05) across treatments. Only water holding capacity at 25% inclusion of FMSKM showed a significant difference (p<0.05) . The result showed that the ater holding capacity remained constant through treatment 1-4 (100%),it then decreased at treatment 5. It was concluded that 20% inclusion of FMSKM is recommended in the feeding of meat type Japanese quail without having any effect on these meat quality parameters.*

Keywords— ***Japanese Quail, Coutonix Coutonix Japanica, Mango Kernel Meal.***

I. INTRODUCTION

Quail rearing for meat and egg production is becoming an economically viable activity in some places of the world and has increasingly developed. From the technical and economic viewpoints, quail rearing is attractive due to their rapid growth and early onset of lay, high reproduction rates, and low feed intake (Murakami & Ariki, 1998; Albino & Barreto, 2003).

Physical properties and eating quality of meat are affected by cooking temperature and time. During cooking, the distinctive meat proteins are denatured and this reasons structural changes in the meat textural profile. These resulted in destruction of cell membranes, shrinkage of meat fibres, the aggregation and gel formation of myofibrillar and sarcoplasmic proteins, and shrinkage and solubilization of the connective tissue Tornberg E. (2005). Heat treatment can result to undesirable meat quality changes, such as nutritive value loss because of lipid oxidation and changes in a few segments of the protein fraction (Sa-adchom *et al*., 2011).

The most important poultry meat quality attributes are appearance and texture because they most influence consumers' initial selection and ultimate satisfaction with products. Moreover, one of the major contributing components of appearance is color (Fletcher *et al*., 2000). The author, taking into account the results of much research, concluded that the major factors affecting poultry meat color were heme pigment content of meat and also preslaughter, postslaughter, and slaughter factors. The best way to determine the texture of cooked meat is through the sensory analysis of experienced panelists, which is an expensive and demanding method. Warner-Bratzler (WB) shear test for toughness of cooked meat is the most widely used and primary method (Cavitt *et al*., 2005; Lee *et al*., 2008).

Meat quality is significantly affected by preslaughter factors. Atmospheric conditions in the pre-slaughter period, and especially those causing an additional stress for animals can be important. Seasonal changes in temperature can affect the level of glycogen in muscles after slaughter and the ultimate pH, and consequently the quality of meat. An increase in glycolysis results from excessive excitement, starving and stress caused by ambient temperature, which in turn leads to high post-mortem pH values and consequently meat colour is influenced (Kreikemeier *et al*., 1998; Abril *et al*., 2001; Honkavaara *et al*., 2003). The problem of seasonal changes in meat quality caused by temperature stress was studied by many authors (Fabiansson *et al*., 1984; Jones and Tong, 1989; Mitlöhner *et al*., 2002; Kadim *et al*., 2004).

Quail production for meat is becoming a viable activity in some places in the world therefore this study is done to ascertain the quality of quail meat fed graded level of fermented mango kernel meal.

Objectives of study

To determine the effect of graded levels of fermented mango seed kernel on the meat quality of Japanese quail.

Justification

This study is done to improve the meat quality of Japanese quail using grade levels of fermented mango seed kernel since the protein content of the fermented mango seed kernel is more than that in maize.

Objectives

The study is done to reduce the production cost in poultry farming and yet achieve a good meat quality since the energy and protein level of fermented mango kernel seed can be compared to that maize.

II. MATERIALS AND METHOD

Physical Parameters Measured

Physical analysis of the meat quality was done using 3 birds randomly picked from each treatment (1-5) to measure and study some qualities of their meat using the following parameters;

- Colour
- Ph
- Water holding capacity
- Driploss
- Cooking loss

PROCEDURES

1. Colour

A chunk of lean meat was cut from the slaughtered birds of the various treatments with knife and brought close to the CIE LAB colour chat. The reading wastakenbase on the similarity of the colour of the meat to that on the CIELAB colour chat following the model of the commission Iternationionale d'Eclairge L*a*b* system was used, where L* is the lightness of the meat, a* the redness and b* the yellowness (Swatland, 1985; Monnin, 1998). This was done at slaughter (0 hour), 4 hours, and 24 hours.

2. pH measurement

After slaughter, breast fillets were directly measured using pH meter with 0.01 precision (Sentro, model 1001).

3. **Water holding capacity**

Water holding capacity was evaluated using a method adopted from Hamm (1960), based on meat water loss when pressure is applied on the muscle. Meat cubes weighing 2g were cut and laid between two filter papers circles. The weight of 10kg was placed on it for 5minutes and afterwards, it was re-weighed. Water holding capacity was calculated as initial weight minus final weight and expressed as percentage. Statistically

(Initial weight - final weight)/1 x 100

4. Drip Loss

To determine the drip loss, breast fillet samples of 10g was remove from the carcass of the various treatments and stored in plastic trays covered with water proof foil paper and refrigerated for 24hours. After this period, exudates were discarded and the samples were weighed following the procedures of Northcut *et al*., (1994) and Dirik *et al*., (1996). Drip loss was calculated as initial weight minus final weight and expressed as percentage. Statistically;

(Initial weight - final weight)/1 X 100

5. Cooking loss

Samples were weighed and put in plastic bags and cooked in boiling water of about 82 - 85^{o}C for 10minutes and allowed to cool on absorbent paper at room temperature. Samples were re-weighed following the procedures of Honikel, (1989). Cooking loss was calculated as;

Initial weight - final weight.

III. RESULTS AND DISCUSSION

Table.1: Colour Measurement of Japanese Quail Meat fed Graded Levels of Fermented Mango Seed Kernel meal

TREATMENTS	0 Hour (at slaughter)	4 Hours	24 Hours
T1	+b*	+b*	+b*
T2	+a*	+a*	+a*
T3	+b*	+b*	+b*
T4	+b*	+b*	+b*
T5	+b	+b*	+b*

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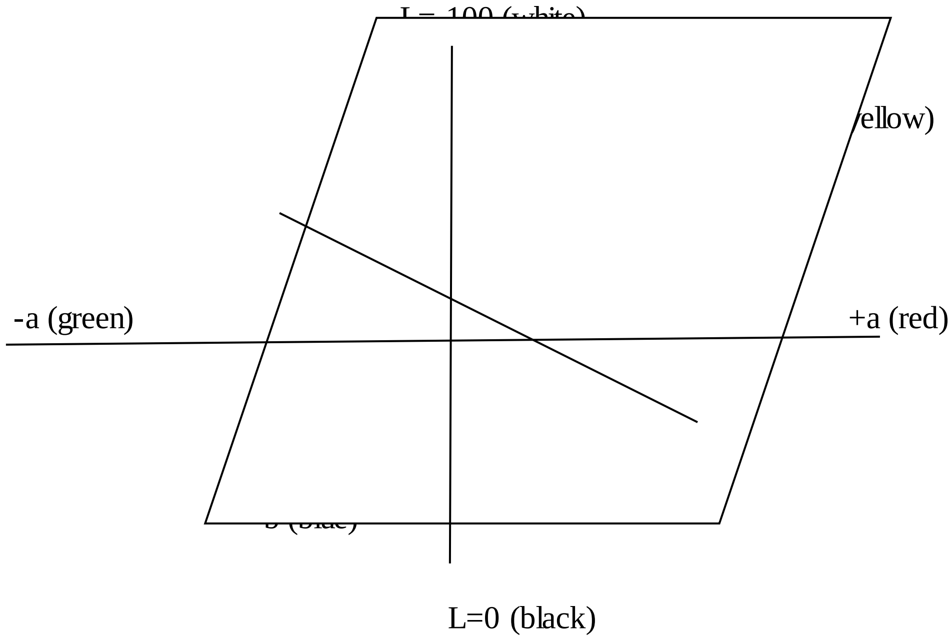

Diagram 1: Colour scale for determining meat colour

The colour of muscles was determined on post slaughter 0, 4, 24, on each muscle. The determination was done on the longitudinal out surface of each muscle. The CIELAB colour system was used considering l^*, a^*, and b^* calorimetric coordinates as follows:

1. **L^* a value 100 corresponded to absolute white value – Absolute black**
2. **a^*a^+ corresponded to red spectrum.**
   a^- corresponded to green spectrum.
3. **b^*- b^+ corresponded o yellow spectrum.**
   b^-Corresponded to blue spectrum.

Table 1 shows the result of evaluated meat parameter including lightness (L^*), redness (a^*) and yellowness (b^*). For treatment 1, 3, 4 and 5, the colour ($+b^*$) was constant through 0 hour, 4 hours and 24 hours. Whereas, treatment 2 shows a different shade of colour ($+a^*$) from the other treatments through the time of slaughter (0 hour), 4 hours and 24 hours.

Table.2: pH measurement of Japanese quail Meat fed graded levels of Mango Seed Kernel

Parameters (HOUR)	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	SEM
24 hour (At Slaughter)	3.10	3.07	2.67	2.87	2.65	0.10
0 Hours	4.87	4.93	4.17	4.17	4.67	0.22
4 Hours	3.50	4.00	4.37	4.77	4.00	0.33

Table 2 shows the pH measurement for the various treatments from the time of slaughter, 4 hours and 24 hours. pH at 0 hour ranges from 2.65 to 3.10 with the highest in treatment 5. At 4 hours of slaughter the pH ranges from 4.67 – 4.87 while those in 24 hours ranges from 3.50 to 4.77 with the highest in treatment 4.

Table.3: Effect of feeding graded levels of fermented mango kernel seed on water holding capacity (WHC) and cooking loss of Japanese quail meat.

PARAMETERS	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	SEM
WHC	100	100	100	100	66.67	6.67
Cooking Loss	6.00	6.00	4.67	7.00	7.00	0.78
Drip Loss	33.33	66.67	100.00	66.67	100.00	18.17

Trt = treatment, WHC = water holding capacity

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IV. DISCUSSION

From this study, the meat colour of all the treatment (1-5) remained unchanged even during the process of transformation of muscle into meat. At slaughter, treatment 1,3,4 and 5 showed a yellowish colour (+b*) this might be as a result of the environmental temperature when the study was carried out (at midday). It is known that detoriation sets in faster at higher temperatures than at lower temperatures which increases the pH therefore altering the colour from reddish (+a*) to yellowish (+b*). This result is within the range observed by Owens *et al.*(2000), Woelfel*et al.*(2002), Woelfel and Sams (2001), Barbut (1998), and Vimini (1996), whom observed 2 to 50% yellowish colour in chicken breast fillets, depending on environmental conditions. Treatment 2 shows redness,this may be due to the 5% inclusion of the Fermented Mango Seed Kernel in the fed of the birds. However, the incidence observed in this present experiment is lower than that found by Lara (2003), who evaluate PSE percentage in the meat of broilers submitted to heat stress before slaughter and obtained incidences of 35.30% in non-stressed and 37.08% in heat-stressed birds.Some authors reported a significant effect of environmental temperature on meat colour (Owens *et al.*, 2000; Guarnieri*et al.*, 2002).

A pH of 4.93 at slaughter was observed and falls between the range of 5-5.9 recorded by several researchers Oguz*et al.*(2009); Gevrekci*et al.*(2009). Some authors (Genchev *et al.*, (2008)(2010) reported the value of 6.17 and 6.00 at slaughter which is higher than the 4.87 reported in this study. The difference might be due to different sanitary measures during slaughter which might increase the microbial load leading to a higher pH. The lower pH might indicate a higher microbial load in the meat samples after 4 hours of slaughter. It is an established fact that at room temperature, microbial load multiply as the keeping time is been lengthened which leads to a higher pH. So also karakaya *et al.* (2005) reported the pH of 5.59 at slaughter which is not far from the value obtained in this study. In a study carried out by Singh and Verma 1995, they recorded the pH of 5.8 to 5.9 at slaughter and a rapid decrease 2 hours after slaughter due to high microbial load at room temperature.

The water holding capacity as presented in Table 3, showed no significant difference (P>0.05) across the treatments. This stands to reason that quail meat has high water holding capacity regardless of it been fed the normal ration in treatment 1 which is the control nor been fed the experimental diet. From this study, it was observed that the water holding capacity remain constant (100%) in treatment 1-4 and decreased in treatment 5 (25% inclusion of experiment diet). This implies that the inclusion of fermented mango kernel up to 25% may affect the water holding capacity of the meat. Bower *et al.*, (2014) in his study gave a range of 74 – 92% which falls between the range of 66.67 – 100% obtained in this study. A lower value to that obtained in this study was recorded by Woelfel *et al.*, (2002) who found 47% of pale fillets out of a total of 3,554 fillets evaluated in commercial processing plant that could be potentially classified as PSE, and presented low water holding capacity. In line with this study, Garcia *et al.*, (2010) recorded and average value of 64.79 in the water holding capacity of normal fillets of chicken meat. This study is also consistent with the studyof Weeranantanaphan *et al.*, (2009) who stated that water holding capacity cannot be predicted in fresh meat to the same degree of accuracy as the chemical composition of the meat.

The cooking loss was observed to have increase at treatment 4 (20% inclusion of test ingredient) and treatment 5 (25% inclusion of test ingredient). This study achieve a similar cooking loss value (14.6%) in broiler chicken reported by Le Bihn-Duval *et al.*, (2008). Similarly, Garcial *et al.*, (2010) recorded 19.45 cooking loss value in chicken meat in a commercial processing plant. Dogan *et al.*, (2013), reported a cooking loss of 24% which is higher than that obtained from this study, the disparity can be attributed to difference in time, temperature, ultimate pH and the type of muscle cooked.

Drip loss in this experiment shows no significant difference (P>0.05) across the treatment, it increases across the treatments having its least value in treatment 1 which is the control. Treatment 3 and 5 having 15% and 25% inclusion of the experimental ingredient shows a higher drip loss of 100%, this may imply that 15% and 25% inclusion of fermented mango kernel seed is not advisable. This is consistent with the study of Kauffman *et al.*, (1992) who reported that an unacceptably high moisture loss from fresh product as purge or drip has been estimated to occur in as much as 50% of the pork produced. In contrary to this study, Garcia *et al.*, (2010) observed a little drip loss of 1.37 in chicken meat in a commercial processing plant.

V. CONCLUSION

The result obtained in this study shows that up to 20% fermented mango seed kernel can be included in the diet of quail birds without deleterious effect on their cooking loss, drip loss, colour and pH which are important factors in measuring meat quality.

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