ISSN 0189-0514
J. Anim. Prod. Res. (2018) 30(1):12-20

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

ASSESSMENT OF QUAIL MEAT NUGGETS PREPARED WITH *OCIMUM GRATISSIMUM* EXTRACT

Olusola, O. O.
Meat Science Laboratory, Animal Science Department, University of Ibadan, Nigeria
Authors email: olusolaolubunmi@yahoo.co.uk

ABSTRACT

Consumers today demand foods with high nutritional value that are free from chemical preservatives. *Ocimum gratissimum* extract (OGE) was used as an antimicrobial agent and natural preservative at graded levels to assess the quality of nuggets made from Japanese quail meat. Batches of nuggets were produced from meat obtained from thirty-six (36) spent quails divided into four treatments (T1-0%, T2-2%, T3-4%, and T4-6%) in a completely randomized design. Carcass characteristics and physico-chemical parameters of fresh quail meat, prior to assigning to treatments were determined. Prepared quail meat nuggets were analysed for pH, proximate composition, cooking loss/yield, microbial and sensory characteristics. Results showed that mean live weight, carcass weight and dressing percentage of quail carcass were 144.00±10.17, 92.83±2.57 and 64.72±3.75, respectively while mean pH, water holding capacity, meat swelling capacity and extract release volume of fresh quail meat were 6.07±0.12, 70.27±5.24, 85.30±6.75 and 32.00±3.46, respectively. There were no significant differences ($p>0.05$) in pH, cooking yield and cooking loss of quail meat nuggets across the treatments. Highest values were however obtained for T4 (6.39), T2 (78.87) and T3 (30.45) in pH, cooking yield and cooking loss, respectively. Proximate composition of quail meat nuggets varied significantly ($p<0.05$) across the treatments with values ranging from 60.45 – 64.05 for moisture, 14.65 – 17.40 for protein and 10.85 – 12.30 for fat. Low microbial load counts were obtained in all treatments with T4 having lowest counts for total plate and coliform while T2 had the lowest count for yeast and mould. Low consumer acceptability scores were however obtained for all treatments. It was concluded that increasing the inclusion rate of OGE up to 6%, gave better quality quail meat nuggets.

Keywords: Quail meat, nuggets, *Ocimum gratissimum*, carcass characteristics, microbial load

INTRODUCTION

Raising quails for meat production is a genuine alternative to other animals raised as sources of animal protein (Fatairone *et al.*, 2005). In recent years, quail meat has been gaining popularity among consumers. Generally, quails are small-to-medium sized birds, belonging to the same biological family as chickens and pheasants (*Phasianidae*) due to their overall similarity in physical characteristics and behavior. They belong to the species *Cortunix coturnix japonica* (Mizutani, 2003).

Meat can be very perishable due to its high moisture and protein contents which can be utilised by spoilage micro-organisms (Zhou *et al.*, 2010). Several preservation methods such as salting, smoking, and drying can be used to provide an unfavourable condition for the growth of these microorganisms. Phyto-preservatives can also be used in extending the shelf life of meat products (Kumar and Tanwar, 2011). In addition, consumers are demanding food/meat products with high nutritional value that are free from chemical preservatives and microbiologically safe (Hathwar *et al.*, 2012)

The use of plant parts, for example leaves, stems, barks etc in the form of powder, extract or essential oils to check growth of many spoilage bacteria and fungi in food have been well documented (Meena and Sethi 1997; Subbulakshmi and Naik 2002; Rajkumar and Berwal 2003).

Ocimum gatissimum is a perennial plant widely distributed in the tropics (Effraim *et al.*, 2003). It is rich in alkaloids, tannins, phytates, flavonoids etc (Ijeh *et al.*, 2004). It has been found to have both antimicrobial and antioxidant properties (Ezekwesili *et al.*, 2004).

Quail nuggets is an example of restructured meat prepared using quail meat as raw material. Restructured meat is one of the meat processing technologies which utilise the relatively small size and irregular shape of meat to be processed, and makes it into a wholesome meat product (Resurreccion, 2004). This study was therefore designed to investigate the utilisation of quail meat as a comminuted meat type for nugget production incorporated with varying levels of *Ocimum gratissimum.*

MATERIALS AND METHODS

Thirty-six (36) spent quail birds were procured from a reputable quail farm in Ibadan, Oyo state, Southwest Nigeria. Birds were slaughtered, dressed, manually de-boned and thereafter packed in freezer bags and stored overnight at 4±1°C. Fresh *Ocimum gratissimum* leaves were harvested from an experimental plot washed with distilled water, drained and ground, thereafter the juice was squeezed to obtain the extract which was immediately used.

Preparation of Quail Nuggets

Meat was cut into small pieces and ground twice in a meat mincer (Breville grinder, model: VTP141, UK) with 5mm plate followed by 3mm plate. Nuggets formulation consisted of quail meat 60%, vegetable oil 6.5%, ice flakes 2.0%, refined wheat flour 14%, skimmed milk powder 2%, whole egg liquid 6%, table salt 1%, sugar 1%, sodium tri-polyphosphate (STPP) 0.5%, condiments 5%, spice mix 1.5% . The *Ocimum gratissimum* extract was included at graded levels 0, 2, 4, and 6% in treatments 1, 2, 3 and 4 respectively substituted with wheat flour to give 100% composition in each treatment. Prepared emulsion was tightly packed in oil coated metallic mold of 3 mm, arranged on the grill, and then grilled for 35 mins. The cooked product was cooled, weighed and removed carefully from the mold. Nuggets were packed aerobically in sterilized zip lock bags and stored at refrigerated temperature (4±1 °C) for analysis after 24 hrs**.**

Proximate Composition

Proximate analysis was carried out using AOAC (2000) models. The quail meat nugget samples were analysed for moisture, crude protein, crude fibre, ash and fat.

pH Determination

1g of sample was weighed and thoroughly homogenised with distilled water (1:10 w/v). The pH of samples was then measured in triplicates by an Electrode probe pH meter (pH meter PHS-3C, by Philips).

Cooking loss

The initial weight of the emulsion was taken (uncooked weight), after cooking, the product (quail nugget) were allowed to cool at room temperature, then weighed.

Cooking loss

$$= \frac{\text{weight before cooking - weight after cooking}}{\text{Weight before cooking}} \times 100$$

Cooking yield

Product yield was determined by weighing the emulsion before and after cooking after been cooled. It was calculated as below:

$$\text{Product yield} = \frac{\text{Product weight}}{\text{weight before cooking}} \times 100$$

Water holding capacity

Water holding capacity was determined by cutting 1g of sample and placed in between two filter papers in two 10.2 ×10.2 cm plexi glass using G-clamp to press for 1min, the pressed meat in filter paper was allowed to air dry. Water holding capacity was calculated as follow:

$$\text{Water holding capacity (\%)} = \frac{\text{Area of meat samples}}{\text{Area of water released}} \times 100$$

Extract Release Volume

This was determined according to the methods described by Jay (1964b). Nugget sample

(20 g) was homogenized with 100 ml distilled water for 2 minutes using a blender (VTLC Mixer/Grinder, India). The homogenate was then poured directly into a funnel lined with Whatman filter paper No 1, folded thrice so as to make eight sections. It was then allowed to seep between the folds and the extract was collected in a 100 ml graduated cylinder for 15 min.

Meat Swelling Capacity

This was carried out with reference from Wierbicky *et al.* (1963). 25 gm of nugget sample was blended (VTLC Mixer/Grinder, India) with 100 ml distilled water for 2 minutes. 35 ml of the homogenate was then taken and centrifuged at 2000 rpm for 15 minutes (Bosch Centrifuge, UK). The volume of the supernatant (S) was then measured using a graduated cylinder. Meat swelling capacity was thereafter determined using the formula below:

$$\%\text{Meat Swelling} = \underline{(35-S-7)} \times 100$$

Microbial examination

This was carried out according to the methods described by APHA (2000) using nutrient agar for total plate counts, McKonkey agar for coliform bacteria count and Potato Dextrose agar for yeast and mould counts.

Sensory Evaluation

A total of twenty (20) semi-trained panelists aged between 20 and 40 years were used to assess three replicate samples of the cooked quail nugget. The samples were evaluated using a 9-point hedonic scale for colour, flavour, aroma, juiciness, ropiness and overall acceptability according to Cross *et al.* (1978). Maximum score of 9 (nine) means extremely high condition while the lowest score of 1 (one) was assigned to the poorest condition (Mahendraker *et al.*, 1988). Equal bite size from the four treatments was coded and served. Each sample was evaluated independently of the other.

Experimental Design and Statistical Analysis

The experiment was designed in a Completely Randomized Design. All data were subjected to analysis of variance using SAS (1999). Duncan Multiple Range Test (DMRT) was employed to reveal the level of significance between treatment means.

RESULTS AND DISCUSSIONS

Table 1: Physico-chemical and carcass characteristics of quail fresh meat used for nugget production

Parameters	Values
Carcass Characteristics	
Live weight (g)	144.00 ±10.17
Bled weight (g)	138.94 ± 9.32
Blood Weight (g)	5.06 ±1.00
Blood (%)	3.50 ± 0.51
De-feathered Weight (g)	134.78 ± 9.27
Feather Weight (g)	3.94 ± 0.19
Eviscerated Weight (g)	110.67±2.59
Carcass Weight (g)	92.83 ± 2.57
Lean Meat (g)	61.67±6.24
Bone Weight (g)	31.17±3.69
Meat:Bone Ratio	2.03 ± 0.48
Dressing %	64.72 ± 3.75
Lean Meat (%)	42.84 ±3 .34
Physico-chemical characteristics	
pH	6.07 ± 0.12
Water Holding Capacity (%)	70.27±5.24
Meat Swelling Capacity (%)	85.30±6.75
Extract Release Volume (%)	32.00±3.46

Table 1 shows the carcass and physico-chemical characteristics of meat from quail birds used in this study. Mean live weight, blood weight percentage and bled weight of Japanese quail birds were 144.00±10.17g, 5.06±1.00 and 138.94± 9.32, respectively. Dressing percentage and carcass weight were 64.72 ± 3.75 and 92.83 ± 2.57, respectively. The values obtained are lower than that of other birds as reported by Akinwunmi *et al.* (2013) for live weight and dressing percentage (66.56%) of chickens and Omojola (2007) for carcass weight of male ducks. These lower values are due to the species differences between the birds. Mean water holding capacity of quail meat was 70.27%, which is slightly higher than that reported by Ishamri *et al.* (2010) for duck meat (65.23%). Mean pH value was 6.07±0.12 as against 7.18 and 5.89 in duck meat and chicken, respectively as compared by Ishamri *et al.* (2010) while mean water holding capacity was 70.27±5.24. Higher meat water holding capacity results in juicier meat products. It will also lead to more nutrients retention in products (Cheng and Sun, 2008).

Meat swelling capacity (MSC) and extract release volume (ERV) of meat are used to ascertain inherent freshness of meat. They are indicative of a good quality meat (Jay, 1964a). The mean value of MSC obtained for quail meat used in this study was high (85.30%) showing high meat quality. It also shows the level of moisture retained in meat protein matrix, as backed up by the high water holding capacity value of the meat obtained. High value (32.00) was also recorded for ERV. This shows a low level of incipient spoilage in quail meat. Meat of good organoleptic and microbial quality will release a large volume of extract whereas meat of poor quality will release small volume or none (Jay, 1964b). From the values obtained for MSC and ERV, it shows that quail meat used in making the nugget was of good quality.

Table 2: Physico-chemical characteristics of quail nuggets prepared with *Ocimum gratissimum* extract

Parameters	Treatment 1	Treatment 2	Treatment 3	Treatment 4	SEM
pH	6.32	6.33	6.31	6.39	0.19
Cooked yield	78.59	78.87	69.55	73.16	2.77
Cooking loss	21.41	21.13	30.45	27.02	2.78

Table 2 shows the physico-chemical characteristics of prepared quail nuggets. There were no significant differences in all parameters presented. pH values ranged from 6.31- 6.39, while cooking yield and loss ranged between 69.55 to 78.87% and 21.13 to 30.45%, respectively. There was slight increase in the pH values of the nuggets when compared to that of the raw meat. The increase in pH can be attributed to the effect of various ingredients that were incorporated into the meat in making it into comminuted quail meat nuggets. Similar trend was reported in buffalo meat nuggets by Thomas *et al.* (2006) and in mutton nuggets by Sangtam *et al.* (2006). They attributed the slight increase in pH to addition of phosphate in the formulation. The high values for cooking yield in all the treatments is indicative of a low cooking loss, as observed in the study. High cooking loss leads to reduced juiciness, tougher meat and loss of profit (Bhattacharya *et al.*, 2007). Quail nuggets in T1 i.e. wheat flour 14% and *Ocimum gratissimum* 0% had the highest value for cooking yield. This could be as a result of its relatively low moisture content when compared to other treatments in this study. Quail nuggets in treatment 4 (wheat flour 8% and *Ocimum gratissimum* 6%) had lowest value for cooking yield as a result of high moisture contents; this is also reflected in the low value for the cooking loss.

Table 3: Proximate composition of quail nuggets prepared with *Ocimum gratissimum* extract

Parameters	Treatment 1	Treatment 2	Treatment 3	Treatment 4	SEM
Moisture	60.45[d]	61.65[c]	62.85[b]	64.05[a]	1.45
Crude Protein	17.40[a]	16.80[a]	16.15[a]	14.65[b]	1.16
Crude Fibre	5.80[a]	5.60[c]	5.30[b]	4.90[d]	0.38
Ash	2.35	2.05	1.75	1.75	0.56
Ether Extract	12.30[a]	11.65[ab]	11.65[ab]	10.85[b]	0.61

[abc] Means on the same row with different superscripts are significantly different (P<0.05). SEM= standard error of mean.

Proximate composition of prepared quail meat nuggets is presented in table 3. Significant ($p<0.05$) differences were observed in all parameters except in ash. Values for moisture content increased ($p<0.05$) from T1 (60.45) to T4 (64.05). This can be as a result of reducing levels of wheat flour used in its formulation. However, values of crude protein (T1-17.40 to T4-14.65) and fat (T1-12.30 to T4-10.85) decreased ($p<0.05$) from T1 to T4. This is because decreasing inclusion rate of wheat flour and increasing inclusion rate of OGE resulted into an increase in the protein and fat contents of the nuggets. This result did not agree with the findings of Santhi and Kalaikannan (2014) when varied levels of oat flour was used in chicken nuggets production.

Table 4: Organoleptic properties of quail nuggets prepared with *Ocimum gratissimum* extract

Parameters	Treatment 1	Treatment 2	Treatment 3	Treatment 4	SEM
Color	3.03	2.70	2.34	2.03	0.17
Flavour	3.93	3.56	3.66	3.69	0.10
Aroma	3.20	2.95	2.86	3.10	0.68
Juiciness	3.63	3.11	2.90	2.76	0.12
Ropiness	3.63	3.52	3.35	3.27	0.15
Overall Acceptability	3.57	3.57	3.30	3.48	0.14

Table 4 shows the organoleptic properties of quail nuggets prepared with *Ocimum gratissimum*. The mean panel rating for parameters measured for all treatments showed generally low insignificant ($p>0.05$) scores. This may be due to the cooking method and colour/typical scent of *Ocimum gratissimum* extract used as the test ingredient which might have a repulsing effect on the panelists. Therefore, quail nuggets with high inclusion of *Ocimum gratissimum* may not be attractive to consumers due to low scores by the panelists obtained in this study.

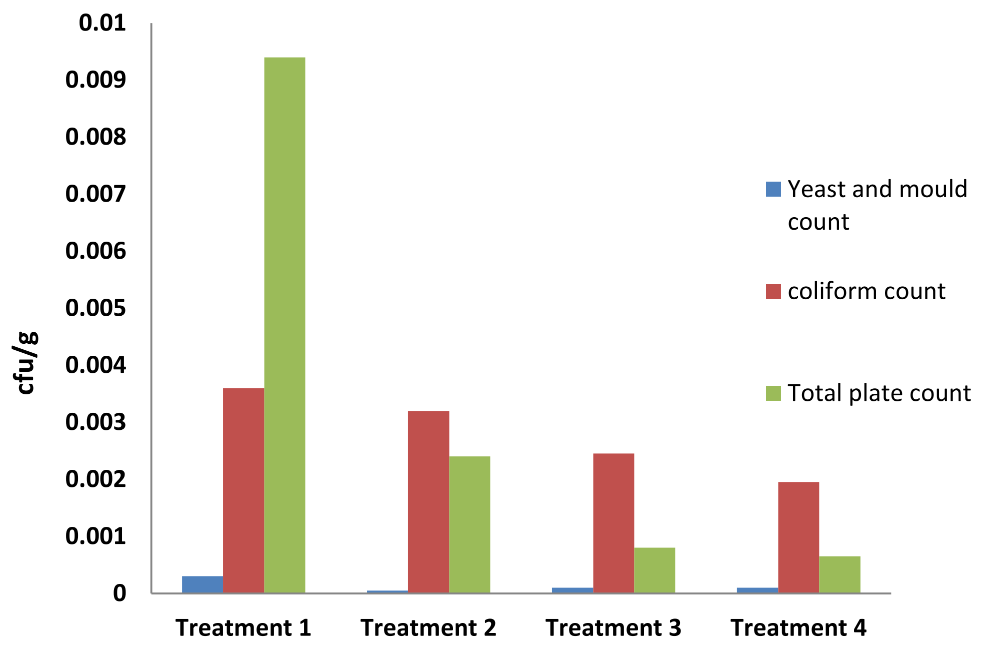

Fig 1: Microbial load counts of quail nuggets prepared with *Ocimum gratissimum* extract

Figure 1 shows the microbial load counts of quail meat nuggets prepared with *Ocimum gratissimum* extract. Least counts were observed for yeast and mould across all treatments while T1 (0% OGE) had the highest total plate count followed by the other treatments. Coliform count load also followed the same trend. It was observed that increasing inclusion rate of OGE resulted in reduced microbial load count. This reduction can be due to the antimicrobial properties of *Ocimum gratissimum* extract (Sharafati-Chaleshtori *et al.*, 2015). This agrees with the result obtained by Kumar and Tanwar (2011) when mustard powder was used as an antimicrobial agent in chicken nuggets.

CONCLUSION AND RECOMMENDATION

It can be concluded that in preparation of quail nugget, *Ocimum gratissimum* extract can be used up to 6% inclusion level with beneficial effect on microbial and physical qualities. However, with low acceptability ratings obtained, further studies can be carried out to determine a level of inclusion that will give a better consumer acceptance.

REFERENCES

A.O.A.C. (2000). Official Methods of Analysis. 17th edition.Washington, D.C: Association of Official Analytical Chemist

Akinwunmi, A. O., A. A. Odunsi, A. B. Omojola, T. O. Akande and T. A. Rafiu (2013). Evaluation of carcass, organ and organoleptic properties of spent layers. *Bolts Journal of Agriculture and Applies Sciences* 9 (1): 3-7

APHA (2000) In: Vandergrant C, Splittstoesser DF (eds) Compendium of methods for the microbiological examination of foods, 4th edn. American Public Health Association, Washington DC, 919–927

Bhattacharya D., M. Sinhamahapatra and S. Biswas (2007). Preparation of sausage from spent duck-an acceptability study. *International Journal of Food Science and Technology*. 42 (1): 24-29

Cross, H. R., Moen, R., and Stanfield, M. (1978). Guidelines for training testing judges for sensory analysis of meat quality. *Food Technology*, 32:48-53.

Effraim K. D, Jacks T. W, Sodipo O. A. (2003). Histopathological studies on the toxicity of Ocimum gratissimum leave extract on some organs of rabbit. *African Journal of Biomedical Research* 6: 21- 5.

Ezekwesili C. N., Obiora K. A., Ugwu O. P. (2004. Evaluation of antidiarrhoeal property of crude aqueous extract of *Ocimum gratissimum* L. (Labiatae) in rats. *Biokemistri* 16:122-31

Faitarone A. B. G., Pavan A. C., Mori C. and Batista L. S. (2005). Economic traits and performance of Italian quails reared at different cage stocking densities. Revista Brasiliere de Ciencia Avicola 7 (1): 19-22

Hathwar S. C., A. K. Rai, V. K. Modi and B. Narayan. (2012). Characteristics and consumer acceptance of healthier meat and meat product formulations—a review. *Journal of Food Science and Technology* 49(6): 653–664

Ijeh I. I., Omodamiro O. D. and Nwanna I. J. (2005). Antimicrobial effects of aqueous and ethanolic fractions of two spices, Ocimum gratissimum and Xylopiaaethiopica. *African Journal of Biotechnology* 4: 953-6.

Ishamri I., Nurul H., Fazilah A. and Noryati I. (2010). Effects of washing on the functional properties of Duck meat. *Malaysia International Journal of Poultry Science* 9(6):556-561

Jay (1964a). Release of aqueous extract by beef homogenates and factors. Food Technology 18: 129-132

Jay (1964b). Beef microbial quality determined by extract release volume (ERV). Food Technology 18: 132-137

Kumar, D. and Tanwar, V. K. (2011). Efects of incorporation of ground mustard on quality attributes of chicken nuggets. *Journal of Food Science and Technology* 48(6): 759-762

Mahendraker N. S, Khabade V. S and Dani N. P. (1988). Studies on the effects of fattening and carcass characteristics and quality of meat from Bannunlamb. *Journal of Food Science Technology* 25: 228- 230.

Meena M. R. and V. Sethi (1997). Role of spices and their essential oils as preservatives and antimicrobial agents—a review. *Indian Food Packer* 51:25–42

Mizutani, M. (2003). The Japanese Quail. Laboatory Animal Research station, Nippon Institute for Biological Science, Kobuchizawa, Yamanashi, Japan. (http://www.angrin.tlri.gov.tw/apec2003/Chapter5JPQuail.pdf): retrieved Dec 15, 2009

Omojola A. B. (2007) Carcass and Organoleptic Characteristics of Duck Meat as Influenced by Breed and Sex. *International Journal of Poultry Science* 6 (5): 329-334

Rajkumar, R. and J. S. Berwal (2003). Inhibitory effect of clove on toxigenic molds. *Journal of Food Science Technology* 40:416–418

Resurreccion A. V. A. (2004). Sensory aspects of consumer choices for meat and meat products. *Meat Science* 66 (1): 11-20

Sangtam H. M., N. Kondaiah and A. S. R. Anjaneyulu (2006). Studies on shelf life of Mutton Nuggets from spent sheep incorporating Chicken Byproducts and Extenders. *Journal of Veterinary Public Health* 4(1)23-29

Santhi D. and Kalaikannan A. (2014). The effect of the addition of oat flour in low-fat chicken nuggets. Journal of Nutrition and Food Sciences 4 (1): 260-264

Sharafati-Chaleshtori, R., Rokni, N., Rafieian-Kopaei, M., Drees, F. and Salehi, E. (2015) Antioxidant and antibacterial activity of basil (Ocimum basilicum L.) essential oil in beef burger. *Journal of Agricultural Science and Technology* 17 (4):817-826.

Statistical Analysis System. (1999). SAS Institute Inc. SAS/STATTM Users Guide, Release 6.0 Ed, Cary, NC, SAS Institute Inc.

Subbulakshmi G. and M. Naik (2002). Nutritive value and technology of spices: current status and future perspectives. *Journal of Food Science Technology* 39:319–344.

Thomas R., A. S. R. Anjaneyulu and N. Kondaiah (2006). Quality and shelf life evaluation of emulsion and restructured buffalo meat nuggets at cold storage. *Meat Science* 72(3): 373-379

Wierbicky, E., Kunkle, L. E., and Deatherage, F. E. (1963). Determination of meat swelling as a method for investigating the water binding capacity of muscle proteins with low water holding force, *Fleischwirtschaft*, 15, 404-409

Zhou G. H., X. L. Xu and Y. Liu. (2010). Preservation technologies for fresh meat-a review. Meat Science 86 (1):119-128