Influence of Drum Kiln Models on Meat Quality Evaluation of Smoked Chicken Thighs

E. E. Adomeh[1*]

[1]*Department of Animal Science, Faculty of Agriculture, Ambrose Alli University, Ekpoma, Edo State, Nigeria.*

Author's contribution

The sole author EEA designed, analyzed, interpreted and prepared the manuscript.

Original Research Article

ABSTRACT

The experiment was carried out at the Livestock unit of the Teaching and Research Farm Ambrose Alli University, Ekpoma, Edo State, Nigeria to investigate Influence Of Drum Kiln Models On Meat Quality Evaluation Of Smoked Chicken Thighs. Four different Kiln models viz; perforated clay pot (T_1), drum with upper lid cutoff (T_2), drum with both lids sealed (T_3) and semi-spherical drum (T_4) were used for the experiment and each Kiln models was replicated four times, making a total of sixteen Kiln models. Five chicken thighs each were randomly selected and arranged to each of the Kiln models (T_1, T_2, T_3 and T_4) with three replicates each, thus making a total of eighty chickens thighs in a complete randomized design (CRD). Proximate composition and sensory evaluation were carried out and Data generated were subjected to a one-way Analysis of Variance and means were separated using the Duncan multiple range test. Result on the proximate parameters assayed revealed a significant ($P<0.05$) variation among the treatments with highest moisture in T_2 (drum with both lid sealed) while crude protein, crude fibre, ether extract and crude ash were highest in T_4 (semi spherical drum kiln). However, Nitrogen Free Extract was highest in T_2. For sensory evaluation, highest significant ($P<0.05$) value was only recorded in general acceptability while other parameters assayed were not significantly ($P>0.05$) influenced. From the overall result obtained from the study, it is therefore concluded that processing chicken meat with semi spherical drum kiln gave a better quality chicken meat product.

Corresponding author: E-mail: evaadomeh@gmail.com;

1. INTRODUCTION

The importance of protein in human diet cannot be overemphasized because its components are crucial to the well being of every human and livestock. The major means of getting the animal protein apart from the plant protein is from livestocks inform of meat, milk, egg and other by-products. Livestock plays an important role in Nigerian agriculture, accounting for 9.88% of the agricultural Gross Domestic Product [1]. Despite these enormous resources, a wide gap exists between domestic demand and supply. It has been reported that the daily animal protein per capita intake in Nigeria is about 8 g which is far below the required 35 g protein intake requirement of animal origin out of the 70g daily recommended total protein intake [2]. This inadequate protein intake in Nigeria is as a result of livestock production not keeping pace with human population growth rate of 3.2% [3].

Smoking is one of the oldest of food preservation methods. Probably having risen shortly after the development of cooking with fire, the practice attained higher levels of sophistication in several cultures, notably the smoking of fish in Scandinavia and North America and the production of smoked hams in Europe and the United States. Interest in smoking meat, which had declined during the mid 20th century owing to the popularity of chemical preservatives, was revived late in the century by the so called natural of health food movement [4]. Smoking of food or meat is a technique in which the food is exposed directly to wood smoke in combination with heat which may be generated by a variety of methods. The smoke – heat drying of meats as a technology has gone through several developmental phases although the technology largely used in Africa still remains primitive simple and required improvement. When meat is smoked, roasted, barbecued, or grilled; Polycylic Aromatic Hydrocarbons (PAHs) are formed as a result of incomplete combustion or thermal decomposition of the organic materials [5]. Pyrolysis of the fats in the meat/fish generates Polyclic Aromatic Hydrocarbons (PAHs) that become deposited on the meat. PAH production by cooking over charcoal (barbecued, grilled) is a function of both the fat content of the meat and the proximity of the food to the heat source [6].

Traditional smoking techniques involve treating of pre-salted, whole, or filleted meat with wood smoke in which smoke from incomplete wood burning comes into direct contact with the product. It is likely that smoked meat products are a natural development of even older drying process, where the smoke from fires used for warmth, flavored meat and other food stuff, hung up to dry in the same enclosed shelter. Smoking as a processing method of meat product is hampered majorly by the reduction in the quality of the finished product as a result of over smoking, uneven burning, and bitter taste which in the long run reduce the cost of the meat product [7]. This study is therefore aimed at evaluating the effect of drum kiln model on the proximate composition and sensory evaluation of smoked chicken thighs.

2. MATERIALS AND METHODS

2.1 Location of the Experiment

The experiment was carried out at the Livestock unit of the Teaching and Research Farm Ambrose Alli University, Ekpoma Nigeria. The Farm lies between lat $6.44°N$ and long $6.8°E$ in Esan West Local Government Area of Edo State, Nigeria. Ekpoma is within the South- South geo-political zone of Nigeria.

2.2 Experimental Kilns and Design

Four different Kiln models viz; perforated clay pot (T_1), drum with upper lid cutoff (T_2), drum with both lids sealed (T_3) and semi-spherical drum (T_4) were used for the experiment and each Kiln models was replicated four times, making a total of sixteen Kiln models. Five chicken thighs each were randomly selected and arranged to each of the Kiln models (T_1, T_2, T_3 and T_4) with the replicates each, thus making a total of eighty chickens thighs in a complete randomized design (CRD).

2.3 Preparation of Chicken Thighs and Materials Used

Materials used for the experiment are as follows: Meat, Smoking Kiln (Drums), Fire wood, Water, Sodium Chloride (Common Salt), Napkin, Charcoal, Ruler, Scale, Basin, Ceramic Plates and Native Pots. The purchased chickens' thighs in cartons were thawed, washed and trimmed off of fats before dry curing with salt. The salt was rubbed manually to give uniform blend to the

thighs and it was allowed to cure before smoking in the different kilns with hard wood and charcoal.

2.4 Proximate Analysis

After smoking the chicken thighs, the dried products were analyzed for proximate composition according to the procedure of [8]

2.5 Sensory Evaluation

Twelve selected and semi trained tasters among the academic and non academic staff of the Faculty of Agriculture, Ambrose Alli University, Ekpoma, were used for the sensory assessment. A nine point hedonic scale (1= dislike extremely to 9=liked extremely) as described by [9] was used for the sensory evaluation.

2.6 Statistical Analysis

Data generated were subjected to a one-way Analysis of Variance (ANOVA) and means were separated using the Duncan multiple range test [10].

3. RESULTS AND DISCUSSION

Table 1 shows the proximate composition of the differently processed chicken meat and results indicate that all parameters analyzed were significantly ($P<0.05$) affected by the processing methods. Percentage moisture was significantly ($P<0.05$) higher in T2 (33.00± 0.41) followed by T_1 (32.00±0.71) and T3 (32.00± 0.71) while the least numerical value of (31.00± 0.41) was recorded in T_4. Least moisture content that was obtained in chicken thighs processed with semi-spherical drum (T_4) is a pointer to the fact that there was an effective evaporation which in the long run enhance the keeping quality of the chicken meat. Thus, the possibility of chicken meat processed with semi spherical drum to be safe or low in muscle spoilage can be effectively achieved by using semi spherical drum method of processing chicken meat. This is in conformity with the report of [11] who reported that moisture content is one of the factors that increased muscles spoilage in fresh meat.

Percentage Crude Protein (CP) was significantly ($P<0.05$) highest (49.89± 0.01) in T_4, followed by the similar value of (49.38± 0.01) recorded in T1, and (49.21± 0.02) obtained in T_3 then lowest crude protein value of (48.25± 0.02) was recorded in T_2. The results obtained indicated that crude protein increased with different processing methods which are in agreement with the studies of earlier research [11-14] which states that smoking/drying increase crude protein, remove lipid and ash content of fish and meat products. From this study, protein contents increase with decrease in moisture content [13]. It was also observed by [14] that wood smoke contains pyroligenous acid which may have an added preservatives effect on smoked dried meat.

Percentage ether extract (EE) was also significantly ($P<0.05$) influenced by the various processing methods with the highest value of (7.11± 0.01) obtained in T_4, followed by T_1 (6.96± 0.01) and T_3 (6.96± 0.01) and least value of (6.75± 0.10) was recorded in T_2. Ether extract (fat) generally indicate a continuous increase in the different processing methods. This agrees with [15]. The result in Table showed that the crude lipids of the different treatments were affected by temperature or heat source. The reduction in ether extract of the smoked chicken thigh could be attributed to possible loss of fat during the experiment which is supported by the finding of [12]. As a result of the high temperature, the fats melted and dripped into the fire. This could have significantly reduced the fat content of the finished products [16].

Percentage crude fibre was significantly ($P<0.05$) higher in T_4 with mean value of (7.24± 0.02), followed by treatment T_3 with mean value (6.11± 0.14), (5.13± 0.06) in T_2 and lowest (4.30± 0.02) in T_1. The highest value obtained in the chicken thighs smoked with semi spherical drum could be adduced to the reduction in the moisture content that increases its dryness which in the long run influenced the fibre content of the finished product. This also agrees with the findings of [15].

Percentage ash was significantly ($P<0.05$) higher in T_4 with mean values (2.00± 0.01), followed by (1.83± 0.02) in T3 and lowest (1.72± 0.01) in T_1 similar to the mean value of (1.78±0.02) obtained in T_2. There was an increased in the ash content of the differently processed smoked chicken thigh as the processing methods vary. This result is in conformity with the earlier study of [11], which stated that the ash content varied with different factors. The higher values of ash content in Treatment Four (2.00) may be due to the presence of smoke, which implied a steady increase in the values during the drying period. It could also be due to the NaCl (Salt) applied during processing.

Table 1. Proximate composition of chicken meat as affected by processing methods

Parameters (%)	T_1	T_2	T_3	T_4
Moisture	32.00± 0.71[b]	33.00± 0.41[a]	32.00± 0.71[b]	31.00± 0.41[C]
Crude protein	49.38± 0.01[a]	48.25± 0.02[c]	49.21± 0.02[b]	49.89± 0.01[a]
Ether extract	6.96± 0.01[b]	6.75± 0.10[c]	6.96± 0.01[b]	7.11± 0.01 [a]
Crude fibre	4.30± 0.02[c]	5.13± 0.06[bc]	6.11± 0.14[b]	7.24± 0.02 [a]
Crude Ash	1.72± 0.01 [c]	1.78± 0.02[c]	1.83± 0.02[b]	2.00± 0.01 [a]
NFE	5.64± 0.01[a]	5.09± 0.11[b]	3.89± 0.04[c]	2.58± 0.02[c]

abc: Means in the same row with different superscripts differ (P<0.05) significantly
SEM: Standard Error of Mean

Percentage NFE was also significantly (P<0.05) influenced by the various processing methods with highest mean value (5.64± 0.01) obtained in T1, followed by T_2 with mean value (5.09± 0.11), followed by similar mean values (3.89± 0.04) and (2.58± 0.02) recorded in T_2 and T_3 respectively. There was a reduction in the NFE value as the processing methods vary and this could be as a result of the heat variation that affects the protein content of the chicken meat.

4. SENSORY EVALUATION OF CHICKEN MEAT

Result in Table 1 shows the sensory evaluation parameters of the smoked dried chicken thighs such appearance, tenderness, juiciness and flavor did not show any significant (P>0.05) differences in all the treatment groups however, general acceptability revealed that treatment 4 was significantly highest (8.63±0.08) followed by treatment 3 (8.31±0.19), treatment 2 (7.81±0.31) and least in treatment 1 (7.71±0.29). The colour or appearance of the smoked chicken thigh was of the same standard. Generally, colour or appearance as a yardstick that consumers used in accepting or rejecting a product under examination. Hence this is crucial in quality evaluation. Result of this study is in agreement with the findings of [17], who stated that colour serves as an important sensory attribute which is correlated with changes in aroma and flavour.

Tenderness, juiciness and flavour are good quality of assessment in sensory evaluation. The differently processed chicken thighs were not significantly different in all the treatment examined (P>0.05). Odour is an important quality parameter, as poor odour will discourage people from accepting food product. The taste, juiciness, tenderness was the same in all the treatment examined from the observation of the panelists. This is in consonance with the report of [17].

From the assessment, the best smoking method appeared to be treatment Four (T_4), followed by (T_2), (T_3), and lowest in (T_1). Treatment Four (T_4) happens to have the highest value in appearance, tenderness and flavour with very good acceptability and quality attributes. The general acceptability of the smoked chicken thigh was high because the temperature used for smoking or processing were not excessively high and was constantly controlled. This made most of the nutritive and physical qualities to be retained at the end of smoking, giving rise to products that were very delicious and attractive. These results of sensory evaluation are in line with the findings of [18,19,20] who had observed various changes in sensory evaluation of broiler meat in reaction to thawing and re-freezing before processing. However, the best overall acceptability score was obtained from the chicken smoked with charcoal in semi spherical drum.

Table 2. Sensory Evaluation of Chicken Meat as Affected by Processing Methods

Parameter	Treatments			
	T_1	T_2	T_3	T_4
Appearance	8.25± 0.21	8.25± 0.12	8.54± 0.15	8.52± 0.16
Tenderness	7.89± 0.23	8.02± 0.31	8.19± 0.23	8.42± 0.16
Juiciness	8.02± 0.21	8.46± 0.25	8.19± 0.15	8.13± 0.15
Flavor	7.92± 0.25	8.42± 0.17	8.27± 0.19	8.42± 0.30
Gen. acceptability	7.71± 0.29[b]	7.81± 0.31[b]	8.31± 0.19[ab]	8.63± 0.08[a]

abc: Means in the same row with different superscripts differ (P<0.05) significantly
SEM±: Standard Error of Mean

5. CONCLUSION

From the overall result obtained from the study, it is therefore concluded that processing chicken meat with semi spherical drum kiln gave a better quality chicken meat product.

CONSENT

As per international standard or university standard, written participants' consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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