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INFLUENCE OF COOKING METHODS AND TEMPERATURE ON PRODUCTS YIELD OF SAUSAGE

Nwamo, A. C [1]., Oshibanjo D. O[2]., Oyinlola O.O[3], Adomeh, E.E[4], Garba, I[5], Agu C. G[6]., Adesope A.I[7]Satkyes A. K[2] and Chuhwak M.M.[2]

[1]Poultry Division, National Veterinary Research Institute, Vom, Plateau state.
[2]Department of Animal Production, Faculty of Agriculture, University of Jos, Plateau State.
[3]Department of Animal Health and Production, Oyo State College of Agriculture and Technology, Igboora, Oyo state
[4]Department of Animal Science, Faculty of Agriculture, A.A.U., Ekpoma
[5]Livestock Investigation Division, National Veterinary Research Institute, Vom, Plateau state.
[6]Bacteria Vaccine Division, National Veterinary Research Institute, Vom, Plateau state.
[7]Department of Animal Science, Faculty of Agriculture, University of Ibadan, Oyo State
Corresponding Author: akuchi.nwamo@yahoo.com
08035739034.

ABSTRACT

This study seeks to investigate the effect of cooking methods and temperature on products yield of sausage. Sausage (g/100g: beef 65.0, lard 20.0, sodium chloride (SC) 2.0, others 13.0) was prepared and allotted in a completed randomized design using three cooking methods (CM): boiling, grilling and frying each at cooking temperatures (CT) of 80, 90 and 100ºC until an internal temperature of 72ºC was reached. Samples from each treatment were subjected product yield. Data were analyzed using descriptive statistic and ANOVA at $\alpha_{0.05.}$

Breakfast sausage grilled was significantly higher ($P<0.05$) in product yield followed by boiling with least product yield in frying cooking method. Among the grilling methods, breakfast sausage grilled at 80 ^{0}C was observed to be statistically higher in product yield (88.71%) than 90 ^{0}C and 100 ^{0}C (86.71 and 81.81% respectively). From the results obtained, sausage should be grilled at 80^{0}C due to higher product yield.

Key word: Product yield, duration of days, sausage, cooking methods and temperature

INTRODUCTION

Cooking methods and temperatures have important role in keeping nutrients. Methods for preparation and cooking of foods cause some changes in structures of food components (Ackurt, 1991). Thermal processing makes meat palatable and it imparts desirable attributes for consumers in terms of physical and sensory characteristics. As a result of thermal processing, connective tissues in meat will have a tenderizing effect while toughening effect is due to hardening of myofibrillar proteins (Laakkonen, 1973). Thermal processing of meat and meat products include open cooking, pressure cooking, fat frying, grilling, microwave, smoking etc. Shallow frying, sautéing, stir frying and deep-fat frying in vegetable oil or melted animal fats are the common methods of frying.

Meats can be consumed fresh, cured, dried or otherwise processed. Ham and sausage are the most popular processed meat products (Brown, 2004). Sausages are made from chopped or comminuted lean meat and fat mixed with salt, spices and other ingredients, and then filled into a casing made of animal intestine or cellulose. Sausages are very common and popular processed products manufactured from lower-value trimmed meat to produce a higher- value product. Sausages can be classified based on country of origin or based on types of spices added (FAO, 2007); one of which is breakfast sausage under fresh sausage type. This seeks to investigate the effect of cooking methods and temperature on products yield of sausage.

MATERIALS AND METHODS

Experiment site

The experiment was undertaken at the Animal Products and Processing Laboratory of the Department of Animal Production, Faculty of Agriculture, University of Jos, Plateau State

Meat Source and sausage preparation

Semi-membranous muscle from mature bull was used. The meat was cleaned; connective tissue and fat were trimmed out of the meat so as to make it lean meat. The meat was kept in the refrigerator before sausage preparation at 4 ±1˚C, so as to keep the microbial load low, and for safety. Meat and fat were run separately through an automated meat mincer, the meat through 6mm plate and the fat through 4mm plate. Then the rest of the meat and the other ingredients as showed in Table 1, 2 and 3 were thoroughly mixed reground through a 4mm plate. The prepared sausage was stuffed into presoaked natural casing (pig intestine) that was presoaked in brine using an automated stuffer.

Cooking methods

Sausages were subjected to three cooking methods which were grilling, frying, boiling at three cooking temperature; 80, 90, and 100 ^{0}C. Internal temperature of 72 ^{0}C was reached to get the exact cooking time.

Table 1: Sausage composition

Ingredient	Composition %
Beef	65.00
Lard	20.00
Binder	3.50
Curing salt *	2.00
Sugar	1.00
Phosphate	0.30
Ice water	4.00
Dry spices **	2.00
Green spices ***	2.20
Total	100.00

* Sodium chloride and Sodium nitrite
** Table 2
*** Table 3
Source: Oshibanjo, (2017)

Table 2: Composition of dry spices for breakfast sausage

Spice	Inclusion level %
Black pepper	20.00
Nutmeg	7.00
Calabash nutmeg	3.00
Red pepper	20.00
Monosodium glutamate	15.00
Thyme	20.00
Curry powder	10.00
Total	100.00

Source: Oshibanjo, (2017)

Table 3: Composition of green spices for breakfast sausage

Spices	inclusion level %
Onion (*Allium cepa*)	60
Ginger (*Zingiber officinale)*	20
Garlic (*Allium sativum*)	20
Total	100

Source: Oshibanjo (2017)

Product Yield

Product yield of sausage is the yield of the final product which is done by weighing the sausage after making it. Product yield was calculated using the following formula:

$$\text{Yield} = \frac{\text{Weight of product}}{\text{Initial weight of sample}} \times 100$$

RESULTS

Sausage grilled was significantly higher ($P<0.05$) in product yield followed by boiling with least product yield in frying cooking method. Among the grilling methods, breakfast sausage grilled at 80 ^{0}C was observed to be statistically higher in product yield (88.71%) than 90 ^{0}C and 100 ^{0}C (86.71 and 81.81% respectively).

Table 1: Product yield of breakfast sausage cooked at different temperature

PARAMETERS (%)	TEMPERATURE (^{o}C)	GRILLING	FRYING	BOILING	SEM
Product yield	80	88.71^{ax}	57.69^{bz}	72.38^{cy}	3.11
	90	86.79^{bx}	57.06^{cz}	80.10^{by}	4.73
	100	81.81^{cx}	63.26^{az}	80.93^{ay}	3.02
	SEM	1.49	0.99	1.36	

$^{xyz...}$Means on the same column with different superscripts are significantly different ($p<0.05$)

$^{abc...}$Means on the same row with different superscripts are significantly different ($p<0.05$)

DISCUSSION

Cooking process shows a significant difference in product yields ($P < 0.05$) as shown in Table 1. Grilled sausage was significantly higher in product yield compared to other cooking methods, followed by boiling with least product yield in frying cooking method. Among, the grilling method, grilling at 80^{0}C was observed to be statistically higher (88.71%) than 90 and 100^{0}C (86.71% and 81.81% respectively). Temperature and sample size are generally accepted to be key factors connected with weight loss. Bengtsson *et al*. (1976) observed that as internal temperature increased, as cooking yields decreased. Also, result showed that cooking yields decreased with increasing endpoint temperatures due to moisture loss (e.g., evaporation, moisture drip) or fat gains/losses during cooking (Oshibanjo, 2017). Offer and Knight (1988) reported that cooking involves heat and mass transfer by diffusion of water through the meat and evaporation from the meat surface, and through physical expulsion caused by constriction of muscle bundles. The authors hypothesized that meat surface dehydration led to the development of crust formation in grilling and microwave heating with less pronounced loss of liquids, as was previously suggested by other authors (Vittadini, *al et.,* 2005).

CONCLUSION

Sausage can be grilled at 80^{0}C due to higher product yield.

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CHEMICAL PROFILE OF LIQUID SMOKE GENERATED FROM *PARKIA BIGLABOSA VITELLERIA PARADOXA AND EUCALYPTUS GLOBULUS* WOOD USING GC-MS ANALYSIS

***[1]Yaqoob, R., [2]Abdu S. B., [3]Jibir M., [1]Shehu, F. N., [1]Muhammad H., and [1]Talabi A.E.**

[1]Department of Livestock and Fisheries, National Agricultural Extension and Research Liaison Service, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

[2] Department of Animal Science Ahmadu Bello University Zaria, Kaduna State, Nigeria.

[1]Department of Animal Science, Usman Danfodio University, Sokoto

***Corresponding Author- Email:** ummnusaybah29@gmail.com**; Phone no: +234 7033587008.**

ABSTRACT

This research was conducted to compare the chemical profile of liquid smoke generated from *Parkia biglabosa*, *Vitelleria paradoxa* and *Eucalyptus globulus* using GCMS Analysis. The results of the liquid smoke analysis as indicated by Gas Chromatography and Mass Spectrometry (GCMS) identified a total of 22, 18, and 15 chemical compounds in Liquid smoke parkia (LSP), Liquid smoke sheabutter (LSS) and Liquid smoke eucalyptus (LSE), respectively. The major components found across the liquid smokes produced included 2,4-Di-tert-butylphenol; 2,6 dimethoxy phenols; 3,5-dimethoxy-4-hydroxytoluene; 5-tert-butylpyrogallol and 2-Propanone, 1-(4-hydroxy-3-methoxyphenyl).

Key words: Liquid Smoke, GC-MS analysis chemical profile, Chemical compounds, woods.

INTRODUCTION

The antimicrobial, colour and flavour properties of wood smoke are due to the presence of phenolic, carbonylic and acidic compounds naturally present in wood (Holley and Patel, 2005). The preservative action of the smoking process for foods depends upon elements such as processing temperature and partial dehydration. The conventional smoking process has been continuously substituted by the use of smoke flavourings like liquid smoke (Guillen and Ibargoitia, 1998). According to the International Organization of the Flavour Industry (IOFI), liquid smoke is a complex mixtures of components of smoke obtained by heating untreated wood to pyrolysis by a limited and controlled amount of air, dry distillation or superheated steam, then collecting the wood smoke in an aqueous collection system (IOFI, 2012).

Liquid smoke extracts has the capability to flavour and impart characteristic smoke colour to food products (Gary, 1992). Liquid smoke is known to possess antioxidant properties, and serve as natural alternatives to conventional antimicrobials (VanLoo *et al.*, 2012). It has been demonstrated in previous studies that liquid smoke preparation are effective against various types of spoilage microorganisms (Yaqoob,2022; Milly *et al*., 2005). It exhibits antimicrobial activity against *Listeria, Escherichia coli, Staphylococcus aureus,* and *Staphylicocal enterotoxins* which are the main contaminants of meat products (Lingbeck *et al*., 2014). The antimicrobial properties, colour and flavour of wood smoke are due to the presence of phenolic and carbonylic compounds naturally present in wood (Holley and Patel, 2005).

The carbonization of many different types of wood can be used to produce various wood vinegars including Eucalyptus, oak, bamboo, mangrove, coconut shell, and apple trees. (Yang *et al.*, 2016). The chemical composition of liquid smoke depends primarily on the wood type (soft or hard) and moisture