QUALITY ATTRIBUTES OF BREAKFAST SAUSAGE AS AFFECTED BY DIFFERENT TYPES OF ANIMAL FATS

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ABSTRACT

Fat is one of the main components of meat sausages, along with muscle tissue and water, therefore, it has a substantial effect on emulsion stability in meat products. It is traditionally produced from pork and lard, but there is insufficient knowledge on the yield and nutritive qualities of breakfast sausage prepared with other animal fats. Investigations were carried out in a completely randomized design to study the effect of different fats on various physical, chemical and sensory properties of breakfast sausage. Three treatments were evaluated to test the effect of different animal fats on sausage production: sausage produced with lard (LS), sausage produced with tallow (TS) and sausage produced with sheep fat (SFS). The results obtained showed the yield from the three fat types when used for production of breakfast sausage were 83.85%, 78.52%, and 76.45% for lard, tallow and sheepfat, respectively. The mean pH value of breakfast sausage were ($P<0.05$) 6.46, 6.25 and 6.51 for LS, TS and SFS, respectively. Water Holding Capacity of LS (84.78%) and TS (84.82%) were similar and significantly ($P<0.05$) higher than SFS (82.69%), Crude protein (31.77 %) and ashes (4.83%) of sausages with lard were higher (LS)while the SFS had (25.47%) and (3.39%) for crude protein and ashes, respectively. The aim of this study was to evaluate the influence of different types of animal fats on the physical, chemical composition and sensory evaluation of breakfast sausages.

Key Words: Physical, Chemical, Sensory evaluation, Breakfast sausages, Animal fats.

INTRODUCTION

Sausage is a food that contains an amount of protein with a widespread consumption. Other than protein, it has a high content of fats. Sausage industries need to select a number of various ingredients in the appropriate amount to manufacture and obtain the desired quality and safe product [Savadkoohi, *et al*., 2014]. Fat is one of the main components of meat sausages, along with muscle tissue and water, therefore, it has a substantial effect on emulsion stability in meat products. Hence, it is important to obtain reliable, practical, technological and scientific information about the type of fat used. Fat in the diets serves not only as nutrient in the human body, but also as source of essential fatty acids and essential components of cell membrane [Pearson, 1987]. Sausages contain fat which is important in the processing, textural, and sensory characteristics of sausage products. It interacts with other components present within a meat system and helps to develop what can be a more consumer acceptable product. There is limited research available, regarding the effects of fat on processing, textural, and sensory characteristics in sausage products. Thus, the objectives of this study were to evaluate the physico-chemical, textural and sensory properties of cooked sausages as affected by tallow, lard and sheep fat.

MATERIALS AND METHODS

Preparation/processing of breakfast sausages

Semitendonisus muscle (6kg) tallow, lard and sheep fat used for this project were purchased from carcass of animals' slaughtered one hour postmortem at Bodija market in Ibadan. The formulation of breakfast sausages and composition of non-meat ingredients are presented in Table 1. The meat was chopped and minced using a 5mm sieve in a tabletop mincer (Breville, Model UTP141, United Kingdom).The minced meat was apportioned into three groups of 2 kg. Group one contained 20% lard as emulsifier (LS) while groups 2 (TS) and 3 (SFS) contained tallow and sheep fat each at 20% inclusion level. Each treatment was replicated four times in a completely randomized design. Slurry of salt (NaCl), sodium nitrite, phosphate and sugar was prepared in the proportion shown in Table 1. All other ingredients were added in equal amounts (g/100g) as shown in Table 1. The minced meat and the other ingredients were mixed thoroughly in a mixer (Oster 8-Speed Blender Model, MG—MB

E103TI -Mexico) for 5 minutes. The thoroughly mixed meat samples were stuffed into natural casing (conditioned pig intestine) of about 2 cm diameter. The stuffed casings were twisted at 10cm intervals to obtain shorter linked units.

Table 1: Sausage formulation of different animal fats types

Ingredients	LS	TS	SFS
Beef	65.00	65.00	65.00
Fat	20.00	20.00	20.00
Soybean flour	4.00	4.00	4.00
Common salt	2.00	2.00	2.00
Sugar	1.00	1.00	1.00
SodiumNitrate	0.01	0.01	0.01
Phosphate	0.30	0.30	0.30
Icewater	3.00	3.00	3.00
Dry spices	2.00	2.00	2.00
Onion	1.31	1.31	1.31
Garlic	0.69	0.69	0.69
Ginger	0.69	0.69	0.69
Total	100	100	100

Determination of physical properties of the product

Cooking loss:

Samples were taken from the prepared sausage for analysis. Sausages from the different treatments were weighed using an electronic scale (Cuisinart KML-K03BV36246-China) before cooking into an internal temperature of 75^{o}C and after cooking.

PRODUCT YIELD (PY)

The cooked and uncooked sausages were weighed, and the product yield was calculated as follows: the weight of the cooked sausage sample divided by the weight of the uncooked sausage sample multiplied by 100 [Yang *et al*., 2007].

WATER HOLDING CAPACITY:

This was determined following a slightly modified method [Suzuki et al., 1991]. The amount of water released from the samples was measure indirectly by measuring the area of the filter paper wetted relative to the area of pressed sample. The water holding capacity (WHC) of the meat was then calculated as follows [Suzuki *et al*., 199]

CHEMICAL ANALYSIS:

Moisture content, crude protein, ether extract and ash of sausage using different animal fats were determined using the analytical methods [AOAC, 2000].

SENSORY EVALUATION

Sensory evaluation was conducted on freshly prepared sausage (day 0). A total of twenty panelists (60% male and 40% female) with age ranging between 22 and 40 years were trained according to the British Standard Institution [BSI, 1993] guidelines to evaluate the product.

STATISTICAL ANALYSIS

All data obtained were subjected to analysis of variance and the means were compared using the Duncan‘s Multiple Range Test (DMRT). The SAS computer soft ware package [SAS, 1991] was used for all statistical analysis.

RESULTS AND DISCUSSION

Cooking Characteristics

Cooking characteristics of breakfast sausage as affected by different animal fats such as product yield, cooking loss, cold shortening and WHC was investigated, and the obtained results are presented in Table 2. The use of different animal fats showed a significant effect ($P<0.05$) on the PY of the

sausages. LS had the highest PY (83.85%) value, while TS and SFS had 78.52% and 76.45%,respectively for PY (Table 2The highest product yield percentage recorded in LS might be due to the fact that LS had the highest water holding capacity and water holding capacity and yield are directly proportional. The cooking loss (10.00%) of beef sausage prepared from lard in this study was lower than the cooking loss of (19.88%) obtained for comparison of textural properties of low-fat chevon, beef, pork and mixed-meat sausages [Gadiyaram and G. Kannan]. Similar results were reported for fermented sausages in which 10 and 20% of the total pork backfat was replaced by olive oil [Bloukas *et al*.,1997]. The inclusion of different types of fat in the processing may change the fatty acids of the meat products [Lima *et al*., 2004]. Cooking loss is an important variable to predict the juiciness and tenderness of the meat and its derivatives, because the dryness of meat affects the sensory characteristics [Guerrero *et al*., 2013]. WHC was influenced (P<0.05) by different animal fats; LS (84.78%) and TS (84.82%) had the highest WHC, and SFS (82.69%) had the lowest; these results showed that different types of fats improve the water holding capacity. WHC of some fibers is related to the type and amount of their polysaccharides; large particles are associated with open structures that improve the properties of hydration and fat absorption capacity.

Table 2: pH, Product yield and physical characteristics of sausage produced using three different fats

Parameter (%)	LS	TS	SFS	SEM
Product Yield	83.85[a]	78.52[b]	76.45[c]	2.23
Cooking Loss	10.10[b]	10.26[b]	12.20[a]	3.36
Cold Shortening	17.74[c]	18.73[b]	19.63[a]	0.69
Water Holdig Capacity	84.78[a]	84.82[a]	82.69[b]	3.36
pH	6..46[b]	6.25[c]	6.51[a]	0.07

[abc]:Means with the same superscript on the same row are not significantly(P> 0.05) different

PROXIMATE COMPOSITION

Table 3 showed the chemical composition values obtained from the three treatments. Results showed that there was a significant difference for moisture content, crude protein, ether extract and ash. The moisture of TS (76.10%) was higher than that of LS (71.47%), and TS (76.33%) had the highest value. Lipids are highly efficient sources of energy and they contain more than twice the energy of carbohydrate and protein [Okazumi *et al*., 2000]. In the present study lipid content varies from 5.20% to 7.27% and shows a significance difference between the three treatments (P<0.05). Highest lipid content was found in LS (7.27%) and the lowest was found in TL (5.20%). High lipid LS have less water and more protein than TL and SFS. There is also concern that low levels of fat will lead to products that is perceived as dry and less tasty. The minimum requirement for an acceptable level of consumer satisfaction for meat products is 3–4% ether–extract on a fresh uncooked basis [Savell and Cross, 1986]. The mean level of protein determined from the sausage was high. However our determinations showed that SFS had a remarkably lowest protein content than LS (31.77%) and TS (28.35%), respectively. The highest crude protein contents of the LS products can be explained by the differences in fat content from the carcasses of different species of farm animals, therefore, its addition to meat products has the advantage of increasing the crude protein contents of the final product. [FAO, 1991] indicated that the most valuable component of meat, from the nutritional and processing points of view is protein, also indicates their biological value, thus meat with higher protein levels are graded higher in terms of quality, than those with lower crude protein levels [Lawrie and Ledward, 2006].

Table 3: Proximate composition of sausage prepared using three different animal fats

Parameters	LS	TS	SFS	SEM
Moisture Content	71.47[c]	76.10[b]	76.33[a]	1.78
Crude Protein	31.77[a]	28.35[b]	25.47[c]	1.59
Ether Extract	7.27[a]	5.60[c]	6.83[b]	0.58
Ash	4.83[a]	4.40[b]	3.39[c]	0.33

[abc]:Means with the same superscript on the same row are not significantly($P > 0.05$) different

SENSORY EVALUATION

Mean scores that the panelists gave for the three treatmens of products are shown in Table 4. Colour, flavour, juiciness, tenderness and overall acceptability were significantly different with respect to different sources of fats, whereas no significant differences in aroma were found among the three treatments. In meat products, fat contributes to the flavour, texture, juiciness, and overall acceptability of lubricity of the product [Mugueza *et al*., 2002]. Juiciness also has an important role in overall quality of meat products [Chambers and Bowers, 1993]. LS sausages obtained the highest score for colour (5.43), flavour (5.83), juiciness (5.63), tenderness (6.13) and overall acceptability (6.38). These results indicate that the higher acceptability of LS sausages may be related only to appearance traits and fat content because differences in fat content improved texture attributes.

Table 4: Sensory evaluation of sausage prepared using three different fats

Parameter (%)	LS	TS	SFS	SEM
Aroma	5.50	5.57	5.71	0.28
Colour	5.43[a]	4.50[c]	4.77[b]	0.22
Flavour	5.83[a]	4.90[b]	4.47[c]	0.29
Juiciness	5.63[a]	5.37[b]	4.83[c]	0.20
Tenderness	6.13[a]	5.10[ab]	4.87[b]	0.25
Overall Aceeptability	6.83[a]	5.03[b]	5.73[ab]	0.31

[abc]:Means with the same superscript on the same row are not significantly($P>0.05$) different

CONCLUSION

This study was conducted to evaluate the effect of various types of animal fats on the physico-chemical and sensory characteristics of the final products. The moisture and fat contents of breakfast sausages varied from 71.47%-76.33% and 5.60-7.26%, respectively, whereas, the protein content ranged from 25.47 to 31.77%. Sensory evaluation results indicated that the most appropriate fat content (%) to have better sensory properties was LS. Further research should be performed to analyze the proportion of lard fat require for the production of breakfast sausages.

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