Effects of Incorporating Chicken’s Gizzards on chemical characteristics of beef sausages

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Abstract: This study was conducted to investigate the effect of incorporation of chicken gizzards in beef sausage product on chemical characteristics of sausage. Three formulations of sausage with (25%, 50%, 0%) chicken gizzard were done. The proximate analysis revealed that, the protein and fat content were not significantly different (P>0.05), however the dry matter, moisture and ash content were significantly different (P<0.05).

Keywords: Chicken gizzard, Sausage, Proximate analysis.

I. Introduction

Sudan has largest population of animals in Africa and among Arabic countries. Recently Ministry of Animal Resources, Fisheries and Ranges (MARFR, 2010) estimated animal population to be around 104 million heads. Although Sudan is rich in animal resources, it confronts many problems which lead to continuous increase, in animal and meat prices. These include poor natural pastures, high cost of feed ingredients and processed feed, diseases, inefficient management of stocks and high transportation costs.

According to Ministry of Animal Resources Sudan (MAR, 2008) the production of chicken broilers was increased from 15x103 kg to 35x103 kg in 2007, and the consumption of poultry meat had been increased from 0.8 kg per capita per year in 2000 to one kg per capita per year in 2007, and according to the Sudan quarter century comprehensive national strategy it will increased from 1 kg per capita per year to 5.5 kg per capita per year in 2012.

Throughout the world, consumption of poultry meat continues to rise in both developed and developing countries. In 1999, global production of broiler chickens reached 40 billion for the first time and, by 2020, poultry is predicted to become the overall meat of choice (Bilgili, 2002).

It is estimated that during slaughtering of birds, about 10 to 13% live poultry weight is wasted in the form of skin, gizzard, heart and other by-products (Sharma, 1999). The nutritive value of these edible by-products in respect of protein and fat is as good as lean meat. It is more advisable to incorporate chicken giblets (Heart and gizzard) in the preparation of processed meat products if the consumer is looking for low calorie diet having high protein and polysaturated fatty acids. Effective utilization of these by-products for production of value added meat products is one way to realize maximum returns from poultry sector (Subhashkumar, 2009).

With the growing poultry production and processing activities, there would be an increased availability of the edible byproducts. Gizzard is one of the principal edible byproducts of poultry processing which is being marketed as variety meats along with dressed chicken. It forms nearly 3% of dressed chicken (Charonpong and Chen, 1980) and as such it is less preferred by the consumer due to its peculiar flavor and texture. Gizzard contains approximately 20% proteins (Kondaiah and Panda, 1987; Rao et al., 1994) and has potential for using in cost effective, convenient ready to eat chicken products. Studies on development of fried chicken gizzard and its storage stability has been reported (Pangas et al., 1998). Further, utilization of this byproduct would increase the profitability of broiler industry.

Most sausages are made from only skeletal muscles that are taken off the bones. A few varieties of sausage can also be made with variety of meats, such as liver or tongue (Food Safety and Inspection Service / United States Department of Agriculture FSIS/USDA, 1995). Meat quality, especially in relation to its bacteriological load, is of special importance in the production of fresh sausages. Beef sausage is also manufactured from cheaper cuts of forequarters such as clod (Savic, 1985). For desirable color, meat from older animals which contains more myoglobin is preferred (Toldra, 2002). Increasing costs of conventional animal protein foods have encouraged researchers to study alternative protein sources, particularly chicken gizzards that are commonly used in direct consumption without processing.
The objectives of this study are to study the effect of addition of chicken gizzards in beef sausage on chemical properties of sausages product, and to access a new type of meat product in meat industry.

II. Materials and methods

The experiment of the study was conducted at the laboratory of Meat Science and Technology Faculty of Animal Production Science and Technology, Sudan University of Science and Technology.

Meat and gizzards preparation

Fresh deboned beef meat was obtained from the local market, and was ground through 0.25 in. plate of an electrical meat grinder. The whole bulk of mixed meat was thoroughly hand mixed to give a homogeneous sample. Then, it was divided into three patches (One batch for each treatment). Fresh Chicken Gizzards were obtained from Khartoum meat market, washed, cleaned and ground through 0.25 inch plate of an electrical meat grinder, then the bulk was divided into two batches to obtain, one treatment contained (0.25 kg) Chicken Gizzard and the other treatment contained (0.5 kg) Chicken Gizzard While the third treatment was formulated without chicken gizzard (control), (three replications were prepared for each treatment).

<table>
<thead>
<tr>
<th>Table 1: Ingredients based on total mixed base</th>
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Preparation of sausage

Three patches of sausage formulation were made, 0% chicken gizzard(control), 25% chicken gizzard and 50% chicken gizzard. Each patch was chopped separately, after formulation using the ingredients in table (1). The chopper was started after the minced meat was introduced. Salt and half of the recommended ice water were added together and uniformly dispersed. Then, the binder and seasoning were added together, with the remainder of the recommended ice water. The entire mass for each batch was chopped about 5 minutes. The batter for each patch was then stuffed into natural casings and linked at length about7cm. The sausages were packed in polyethylene bags and stored in freezer waiting chemical tests.

Proximate analysis

Three sausage samples were taken random from each treatment and then approximately 50 grams portions were taken from different places and mixed well to assure a representative sample for proximate analysis, and were sent to the Central Laboratory for Veterinary Research Department of Biochemistry Soba for the Proximate chemical analysis, moisture, crude protein (CP), ether extract (EE) and ash of the sausage samples were determined according to Association of Official Analytical Chemists (AOAC 1995) methods.

Statistical analysis

Statistical analysis was performed on all data of the various experiments using SPSS and was subjected to analysis of variance (ANOVA). Least significant difference (LSD) was used for mean separation (Gomez & Gomez, 1984).

IV. Results and discussion

Mean values of the effect of different substitution levels of chicken gizzard for beef on chemical composition as shown in table (2) Figure (1). The were no significant differences (P>0.05) among the treatments in percentage of crude protein and fat, while there were significant differences (P ≤ 0.05) ( P≤0.01) among the treatments in percentage of ash dry matter, and moisture.

Crude protein and fat content were not significantly different, however there were decrease in protein and fat with increase of chicken gizzard percentage, that sausage sample (C) which was incorporated with 50% chicken gizzard recorded (19.34%) protein and (3.12%) fat, while the sausage sample (B) which was incorporated with 25% chicken gizzards, recorded (19.19%) protein and (3.02%) fat compared to sample (A) the control (100% beef) which had the lowest score (18.86%) protein and (2.93%) fat. These findings were in agreement with that observed by Reddy and Vijayalakshmi(1998) who reported a gradual increase in the protein and fat content with increased incorporation of heart and gizzard in sausage formulation. Similar trend was observed by Raut, et al (2015), who revealed that, protein and fat content were increased gradually with increased incorporation of heart and gizzard. Also Mohamed Elkhatim, et al (2013) reported that, there were no significant differences (p≤0.05) in fat content among the different samples in their study of the effect of incorporation of chick gizzard on the fresh and stored sausage. On the other hand, Sudheer, et al (2011) mentioned that, the protein increased significantly, whereas, the fat content decreased significantly (p < 0.05) as the level of incorporation of gizzards increased which was may be due to the low fat content in the raw gizzard.
Table (2) and Figure (1) indicated that, there were significant differences (p≤ 0.05) in dry matter content among the treatments, where the sample (A) has the highest percentage in dry matter (22.50%) compared to the sausages sample (C) (19.33%) and sausages sample (B) which has the lowest percentage (19.17%). As for ash content table (2) and Figure (1) showed that, the treatments were significantly different (p≤ 0.05), so the sample (A) as (2%) had higher percentage followed by sausages sample (C) (1.67%) and sausages sample (B) which recorded (1.33%). Similar trend was observed by Sudheer, et al (2011), who found the ash content significantly as the level of incorporation of gizzards increased. In contrast to the findings of the study, Mohamed Elkhatim, et al (2013) were reported no significant differences (p>0.05) in ash content among the different treatments however there was increase in ash content with increased chicken gizzard percentage as in the present study.

The results of moisture content as shown in table (2) and Figure (1) indicated that, there were significant differences (P≤0.01) among the treatments, the sausages sample (B) incorporated with 25% chicken gizzard contained the highest moisture content which recorded (81.17%), followed by that sausages sample (C) incorporated with 50% chicken gizzard which reached (80.67%) and sample (A) which recorded (77.50%). Reddy and Vijayalakshmi (1998) also reported gradual reduction in moisture content of sausages made with incorporation of skin, gizzard and heart which agree with Mohamed Elkhatim, et al (2013) who observed decrease in moisture content with increased percentage of chicken gizzard incorporated in sausage. Similar trend was reported with Raute, et al (2015) who incorporated heart and gizzard in chicken pickle.

**Table 2: Mean values and their standard deviation (SD) for Dry Matter, Crude protein, Fat Content, and Moisture content of various treatments**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Significant level</th>
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<tbody>
<tr>
<td>Dry matter</td>
<td>22.50±2.17a</td>
<td>19.17±0.75b</td>
<td>19.33±1.51b</td>
<td>**</td>
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<tr>
<td>Crude protein</td>
<td>18.86±0.89</td>
<td>19.19±0.72</td>
<td>19.34±0.63</td>
<td>NS</td>
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<tr>
<td>Fat</td>
<td>2.93±0.18</td>
<td>3.02±0.08</td>
<td>3.12±0.18</td>
<td>NS</td>
</tr>
<tr>
<td>Ash</td>
<td>2±0a</td>
<td>1.33±0.52b</td>
<td>1.67±0.52a</td>
<td>*</td>
</tr>
<tr>
<td>Moisture</td>
<td>77.50±2.17b</td>
<td>81.17±0.75a</td>
<td>80.67±1.51a</td>
<td>**</td>
</tr>
</tbody>
</table>

N=6

a, b, c: Mean having different super scripts differ significantly (p<0.05)
*: significant at (p< 0.05)
**: significant at (P≤0.01)
NS: Not significant

Different letters with in the same raw means significant different at P≤0.05
A: Control (100% beef ). B: (25% chicken gizzards + 75% beef).
C: (50% chicken gizzards + 50% beef).

**Figure 1: Mean values and their standard deviation (SD) for Dry Matter, Crude protein, Fat Content, and Moisture content of various treatments**

A: Control (100% beef). B: (25% chicken gizzards + 75% beef).
C: (50% chicken gizzards + 50% beef).
DM: Dry Matter. CP: Crude Protein. MOIS: Moisture

**IV. Conclusions**

The study has concluded that, chicken gizzard sausages are nearly similar, in proximate analysis, as beef sausage.
V. Recommendations

This study has recommended to encouragement of the researchers to investigate other chicken meat alternatives for beef in meat processing, and explore more about chicken gizzard and other chicken by-products such as liver and heart.

Acknowledgements

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References