

Effects of Incorporating Chicken's Gizzards on the Fresh and Stored Sausage

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Abstract The experiments were conducted to study the possibility of using broiler chicken's gizzard and abdominal fat in production of sausage. Five types of sausage with different level of gizzards meat (100%, 75%, 50%, 25%, and 0%) were processed. A taste panel was done for all types of sausage, and the 25% gizzards sausage was stored with the rest of meat and gizzard under freezing (-4°C) for 45 days. Chemical and sensory analyses were done for all samples. There was non-significant difference ($P \leq 0.05$) between 25% gizzards sausage and commercial sausage in the appearance, tenderness, firmness, and overall acceptance. Storage of meat and meat products lead to increases in contents of moisture, ash, and pH, and decreases in contents of fat and protein. It is recommended to use gizzards and abdominal fat in sausage processing after good and quick cleaning with a percentage exceeds 25%.

Keywords Gizzards, Sausage, Appearance, Flavour, Tenderness

1. Introduction

Between 2006 and 2008, per capita consumption of meat increased by 10%. Meat consumption is the highest in developed country, in which the average per capita consumption is 82.9 kg/person per year, while in developing country including Sudan, the per capita consumption average is 31.1 kg/person per year [1].

Today, the world faces the problem of shortage in food supply, which creates the malnutrition problem and its consequences in the developing countries [2].

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 [3].

According to Ministry of Animal Recourses Sudan MAR [4] the production of chicken broilers was increased from 15×10^3 kg to 35×10^3 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.

Gizzards are consumed in several countries especially Asian countries. Gizzards were used in Sudan traditionally in many ways, one of which is to be fried with its own fat or using the abdominal fat of chicken, after addition of some herbs. Another method of cooking is gravy, where gizzards are to be cooked with other giblets of chicken like livers, hearts, neck, abdominal fat of chicken, with onions, garlic, and several types of herbs. Many products were processed from gizzards, for example, in China, fermented sausage, and dried gizzards are produced in Jordan sandwiches were prepared.

Sausages are meat products that are salted and usually seasoned. The name is derived from the Latin term *salsus* meaning salt. From ancient times to the present day sausages mixture has been encased assuming cylindrical form which become traditionally the sausage shape, and in most instances, is one of the characteristics that differentiate sausage form other meat products [5].

In Sudan sausage and burger are normally produced from cow meat with some additives but gizzards are not used in the formulation of them. The main objectives of this study were to assess the effect of using gizzards, palatability of sausage processed from different formulations of gizzards and beef meat and to evaluate keeping quality of sausages.

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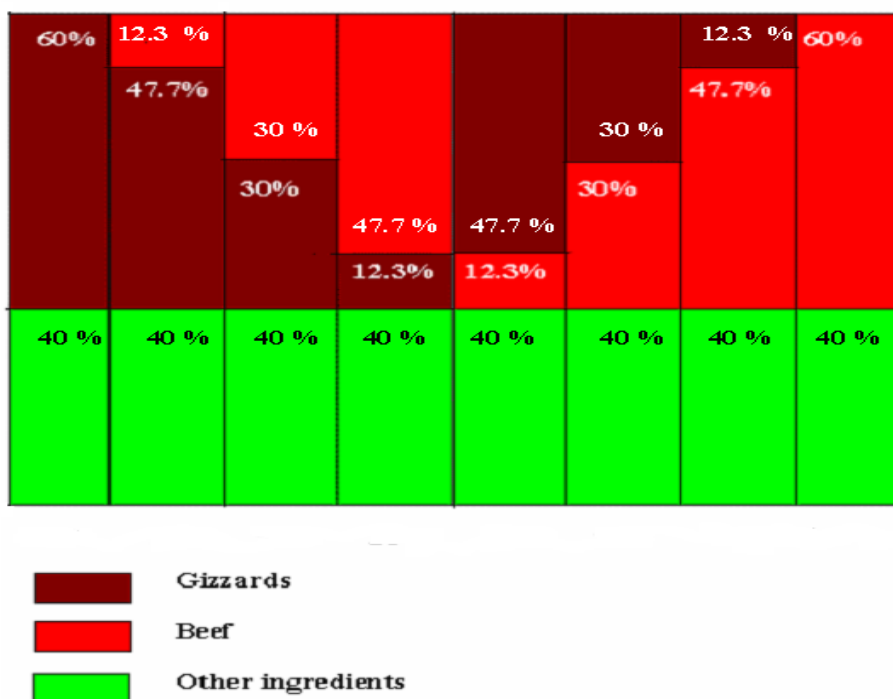


Figure (1). Sausage formulation

2. Materials and Methods

2.1. Materials

Gizzards were collected from slaughtered broiler chickens at Albashair farm, Wad Medani city. Meat from one beef carcass was used for all treatments to minimize variation in meat source. Fat used in the sausage was obtained from the chicken abdominal fat pad. The gizzards, meat of beef, abdominal fat pad of chicken, onion, and garlic, were ground separately to pass through 44 mm sieve using an electric type grinder mill. Chick peas was soaked overnight and then ground to pass through 44 mm sieve using electric grinder. White rice was also soaked overnight, dried and then minced using an electric mincing machine.

2.2. Sausage Processing

The sausages were produced with the main difference being in the composition of meat in the formulation as illustrated in Fig. (1). The minced meat (gizzards, beef) and fat were mixed in a smooth cutter. The mixture was stuffed into prepared sheep intestine casing and formed into fingers of about 5 – 7 cm in length.

2.3. Keeping Quality Assessment

In order to assess the keeping quality of formulated sausage and fresh samples of Gizzard and beef meat, the samples were stored for 45 days at -4°C.

2.4. Proximate Chemical Composition and pH

The proximate composition and pH of sausage samples were determined according to AOAC[6] methods. The pH was determined according to AOAC[7] using a pH meter.

2.5. Sensory Evaluation

The sausages were shallow fried in vegetable oil for 5 – 10 min and served to a panel of seventeen judges, were asked to evaluate the quality in terms of appearance, flavour, tenderness, and over all acceptability. The scale of assessment included 3 grades: Highly acceptable (3 points), Acceptable (2 point), and Unacceptable (1 point).

2.6. Statistical Analysis

Statistical analysis of the data was performed using SPSS (13.0) program. All parameters studied were analyzed by one-way analysis of variance. Means were compared by using LSD test with significance level of 0.05

3. Results and Discussion

3.1. Proximate Composition and pH Value

Meat is a rich source of several essential nutrients. Table (1) shows the proximate composition and pH value for various types of sausages.

Water is added to many products for several reasons. Some products would be dry and unpalatable without adding water. Using water improves tenderness and juiciness and it serves as a processing aid when the product is made. The significantly highest moisture content was found in the beef (77.14±0.52%) followed by gizzard (74.39±1.08%) at ($P \leq 0.05$), while the lowest value was found in 100% gizzard sausage (GS) (59.16±1.77%). However the moisture content of 25% GS (65.30±0.134%) was not significantly different from 100% Gizzard sausage. With respect to raw gizzards moisture, results were relatively lower than that reported by

Pereira *et al.*, [9] who reported a moisture 76.8% for raw gizzards. Fresh sausages had overall moisture percentage of 55.48 [10] Agnihotri and pal [11] mentioned that the **moisture content** of sausage is (66.7%).

Though there was no significant differences ($p < 0.05$) in ash content among the different, the highest value was found in gizzard ($3.07 \pm 2.4\%$). The ash content of raw beef in the present study was higher than that reported by Husein [12] which was 0.99%. The ash content of gizzards was higher than that reported by Maiti and Ahawat [13] who reported a value of 0.94 in raw gizzards.

There were no significant differences ($p \leq 0.05$) in fat content among the different samples in the fat contents. The fat percent of raw gizzards was higher than that reported by Maiti and Ahlmat [13] and Grover *et al.* [14] who reported that the value of fat in the raw gizzard was 2.02% and 2.3%, respectively.

There was no significant difference ($p \leq 0.05$) between the 25% GS, and raw beef, while raw beef was differed significantly from raw Gizzard and 100% GS at $p \geq 0.05$ in protein content. The protein content of raw gizzard in the present study was lower than that reported by Maiti and Ahlmat [13] and Pereira *et al.* [9], who reported that the value of protein in the raw gizzard was 19.86% and 26% respectively. However, Dharmaveer *et al.*, [15] reported 18.36% protein in fresh sausages.

The pH value or acidity of meat is important in relation to the meat microbiology and keeping quality. In live animals the pH value of muscular tissue is about 7.0–7.1. In meat, glycogen is used in anaerobic metabolism which leads to the production of lactic acid that causes decrease in pH to 5.7 which is favorable for keeping the quality of meat (low pH inhibits bacteria growth). Walker and Betts [16] reported that ultimate pH of meat was significant for its resistance to spoilage because most bacteria grow optimally at about pH 7 and not well below pH 4 or above pH 9 [17].

Table (1) shows that the pH of fresh samples, was high in the gizzards (6.87 ± 0.05) followed by beef (5.76 ± 0.07), and the lowest value was found in the gizzards sausage mixture. The gizzards pH was in agreement with that value reported by Sharma *et al.* [8] who reported a pH of 6.60 for raw

gizzards. However, pH of the sausages differed significantly ($P \leq 0.05$) from that of the beef and the gizzards.

Table 1. Proximate composition and pH of fresh samples of meat (beef, gizzards) and sausages (100% gizzard sausage, 25% gizzard sausage)

Parameter	Type of sausage		Type of meat	
	Gizzard	Gizzard	Beef	Gizzard
	Sausage(GS) 100%	Sausage(GS) 25%		
Moisture	59.16 ^c ± 1.78	65.30 ^c ± 1.43	77.14 ^a ± 0.52	74.39 ^b ± 1.08
Ash	1.20 ^a ± 0.25	1.16 ^a ± 0.32	2.2 ^a ± 1.13	3.07 ^a ± 2.40
Fat	5.31 ^a ± 2.04	3.58 ^a ± 0.75	3.02 ^a ± 0.41	3.34 ^a ± 1.36
Protein	13.92 ^b ± 1.54	19.25 ^a ± 0.00	20.24 ^a ± 0.58	14 ^b ± 1.01
pH	4.74 ^b ± 0.17	4.74 ^b ± 0.13	5.76 ^a ± 0.07	6.87 ^a ± 0.05

* For each parameter mean \pm SD in a row followed by different letter differ significantly at 5% level.

3.2. Effect of Storage on Proximate Composition and pH

Table (2) present the proximate composition and pH of fresh and stored samples of meat (beef, gizzards) and sausage (100% GS and 25% GS). The moisture level of 100% GS increased significantly on storage period. This may be attributed to the absorption of moisture by the samples, and/or due to the water produced at the end product from the different constituents as a result of microbial activity.

The ash content of all determined samples were increased significantly at $p \leq 0.05$ during storage for 45 days. This may be attributed to the difference of the dry matter in the fresh and the stored samples, which lead to changes in the chemical contents. The highest value of fat was found in the fresh 100% GS ($5.3\% \pm 2.04$) and the lowest value was found in the stored gizzards ($1.7\% \pm 0.97$). The fat level was decreased during the storage period, this could be attributed to the rancidity and destruction of fats by the microorganisms.

Table 2. Proximate composition and pH of fresh and stored samples of meat (beef, gizzards) and sausage (100% gizzards sausage, 25% gizzard sausage)

Parameter	Fresh samples				Stored samples			
	100% (GS)	25% (GS)	Beef	Gizzard	100% (GS)	25% (GS)	Beef	Gizzard
Moisture	59.16 ^c ± 1.78	65.30 ^{bc} ± 1.43	77.14 ^{ab} ± 0.52	74.38 ^{ab} ± 1.08	74.75 ^{ab} ± 2.73	67.30 ^{bc} ± 0.26	81.13 ^a ± 3.66	76.00 ^{ab} ± 3.06
Ash	1.198 ^b ± 0.25	1.16 ^b ± 0.32	2.99b ± 1.13	3.06 ^b ± 2.40	8.6 ^{ab} ± 3.14	9.34 ^a ± 2.07	4.78 ^{ab} ± 0.77	5.23 ^{ab} ± 2.45
Fat	5.3 ± 2.04	3.58 ± 0.75	3.02 ± 0.41	2.34 ± 1.36	3.40 ± 0.88	3.34 ± 0.00	2.34 ± 0.07	1.71 ± 0.97
Protein	13.42 ^b ± 1.54	19.25 ^a ± 0.00	20.42 ^a ± 0.58	14 ^b ± 1.01	9.9 ^{bc} ± 2.10	7 ^c ± 1.01	8.75 ^c ± 2.67	8.12 ^c ± 0.58
pH	4.74 ^c ± 0.17	4.74 ^c ± 0.13	5.61 ^d ± 0.07	6.87 ^a ± 0.05	6.11 ^{bc} ± 0.08	5.98 ^c ± 0.05	6.29 ^b ± 0.02	7.08 ^a ± 0.02

* For each parameter means in a row followed by different letter differ significantly at 5% level.

The protein content was significantly ($p < 0.05$) decreased during storage and this could be attributed to the destruction of the protein by microorganisms. There was no significant change in pH of Gizzard during storage at $p \leq 0.05$. But the pH of all the other studied samples were increased significantly ($p \leq 0.05$) on storage which could be due to the growth and activity of microorganisms.

3.3. Sensory Evaluation

Results on sensory evaluation of different types of formulated sausage (Table 3) revealed that there was no significant difference ($p \leq 0.05$) in sensory attributes such as appearance, tenderness and overall acceptance among the different types of sausage formulations. Whereas highest mean value for flavour was noted in beef sausage (2.71) and the lowest was recorded for GS 100% and GS 75% (1.94).

Table 3. Sensory evaluation of sausage formulations

Parameters	Treatments				
	100% (GS)	75% (GS)	50% (GS)	25% (GS)	100% Beef Sausage
Appearance	2.12 ^a	2.24 ^a	2.41 ^a	2.59 ^a	2.59 ^a
Tenderness	2.24 ^a	2.29 ^a	2.24 ^a	2.47 ^a	2.59 ^a
Flavour	1.94 ^b	1.94 ^b	2.35 ^a	2.47 ^a	2.71 ^a
Overall acceptance	2.00 ^a	2.12 ^a	2.35 ^a	2.47 ^a	2.47 ^a

* For each parameter means in a row followed by different letter differ significantly at 5% level

4. Conclusions

Gizzards as a low cost alternative source of protein can be incorporated into sausages with a percentage greater than 25% which can produce a product with acceptable quality to the consumers. Further studies were also needed to high light the problem associated with broiler chickens offals especially gizzards, handling, preparation, cooking, and distribution.

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