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Physiochemical and Sensorial Properties of Burgers Produced from Nubian Goat Meat and Beef

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Abstract

Purpose: This study was aimed to evaluate sausage processed from different levels of goat meat replacement beef meat.

Methodology: Beef top side cut and goat leg were purchased from local market and used according to A (Beef 50 % ,goat meat 50 %) , B(beef 25 % , goat meat 75 %) , C (goat meat 100 %) and D (Beef 100 %) as control group, and to compare the goat meat sausages with the most common commercial sausages made with beef.

Findings: The chemically, crude protein percentage was significantly different ($p<0.05$) in sausage treatments where higher in beef sausage, ash, and fat were also different increased with beef meat among sausage treatments, on the other hand moisture content increased with goat meat. Ultimate pH and cooking loss % of sausage treatments were significantly different ($p <0.05$). Total viable bacterial counts of sausage treatments were determined. Sensory attributes, including color, flavor, juiciness, tenderness, and overall acceptability among the different types of sausages prepared were no significantly differences ($p > 0.05$)

Unique contribution to theory, practice and policy: Goat meat mainly from animals out of quality brands with low commercial value can be valorized when processed, giving the opportunity to increase its consumption and acceptability. In this study goat meat incorporated to the sausage ingredients with beef fat to evaluated the quality and flavor of sausage replacing beef meat. Sudanese Nubian goat meat useful for use in meat processing products with good characteristics and more acceptable for the final products. More researches for use goat meat in other meat products.

Keywords: *Goat meat, beef, sausage, physiochemical, sensory*.

1.0 INTRODUCTION:

Tendencies towards healthier ways of living among the global population have changed and are still changing several aspects of the food industry, leading producers to reformulate their products and offer more healthy alternatives Agregán *et al*., (2019) Consumer perceptions towards healthier meat products are now mainly associated with how meat is produced and processed as well as its physicochemical composition and nutritional and sensory quality Teixeira *et al* (2017), Teixeira and Rodrigues (2021). In recent years, several strategies for producing healthier meat products have been developed. Some of them go through reducing fat content Leite *et al.* (2015) , Teixeira *et al* (2020) using different fat sources Teixeira *et al* (2019) Das (2009).

1.1 Statement of the Problem

Meat from goats has been gaining acceptance over the past few years around the world (Devendra, 1990) especially as it is leaner than beef and mutton. Few studies have been carried out to investigate the quality of goat meat but some indicate that it is comparable in quality and nutritive value to beef and chicken (Johnson *et al.,* 1995; Mahgoub *et al.*, 2002).

1.3 Objectives of the Study

This study was conducted to evaluate sausage processed from different levels of goat meat replacement beef meat

2.0 LITERATURE REVIEW

In Korea, goat production has been mostly for milk production whereas the Korean native black goat (KNBG) has been used for meat production. Also, most of the KNBGs are castrated then slaughtered in the autumn. However, KNBG meat production is limited due to odor and off-flavor of the meat. Typical in Arab and Africa, or Sudan for Sudanese Nubian goat. Consumers in the western world do not favor goat meat (Tech, 1992). Goat meat composition and quality are influenced by genotype (Tshabalala *et al*., 2003), age (Todaro *et al*., 2002), sex (Todaro *et al*., 2004), diet, and production methods (Marinova *et al*., 2001). These factors influence the volatile composition of goat meat, which affects the characteristics that are easily perceived by smell and which consumers associate with goat meat (Webb *et al*., 2005). Recently, it was reported that hybridization of goat affected its meat nutritive value and quality (Ding *et al*., 2010). Also, sunflower cake feed supplementation significantly improved goat meat quality (Xazela *et al*., 2012). The overall composition of the carcass was greatly influenced by age, sex, feed, body weight, growth, physiological conditions and physical activity (Owen *et al*., 1978). These factors also influenced the volatile composition of goat meat, hence, the smell associated with it (Webb *et al*., 2005). Branched chain fatty acids in meats of different sheep and goat breeds have been related to flavor (Ha & Lindsay, 1990).

When mutton, goat meat, and spent fowl meat are used with substantial amounts of nonmeat ingredients in certain food processes, the undesirable characteristics of these meats may not be

reflected in the final products because of the inherent nature of processes involved, or they may be overcome through ingredient interactions during processing, (Rhee *et al*., 1999). In this study goat meat incorporated to the sausage ingredients with beef fat to evaluated the quality and flavor of sausage replacing beef meat.

3.0 MATERIAL AND METHODS:

3.1. Experiment

Carcass of goat purchased from local market and deboning, sausage processing by mixes beef topside to goat meat as flowing: A (Beef 50 % ,goat meat 50 %) , B(beef 25 % , goat meat 75 %) , C (goat meat 100 %) and D (Beef 100 %) as control group. Fat of formula from beef 10%, sausage products were stuffed in animal intestine.

3.1.1 Chemical composition

Sausage products samples were ground to a homogenous mass in a grinder, and then used for chemical analyses. Chemical composition of the sausage samples was measured according to standard methods of AOAC (1990).

Crude protein was determined using a Foss Tecator Kjeltec 2300 Nitrogen/Protein Analyzer. Fat was determined by Soxhlet extraction of the dry sample, using petroleum ether. Ash content was determined by ashing samples in a muffle furnace at 500 °C for 24 h.

3.1.2 Meat quality attributes:

Sausage products were prepared for colour sensing and covered by polythene sheets. The ultimate pH of products samples determined by sing pH meter. The pH meter was calibrated with buffers 4 and 7. Duplicate samples, each of approximately 0.5 gm of two products, were placed on a humidified filter paper (Whatman No. 4 in a desiccator over saturated KCl solution) and pressed between two plexiglass for 1 min at 25 Kg/cm2. Meat and moisture areas were measured using a compensating planometer. The result was expressed as ratio (Grau and Hamm, 1953). Water Holding Capacity (WHC) = [Loose water area-meat film area] ÷ meat film area. Cooking loss determined as Babiker (1981) by using thermostatically controlled water bath 90^{o}C for 90 min, samples were weighed before and after cooking.

3.1.3 Microbial analysis:

One gram of products (sausage) was homogenized in nine ml of sterile distilled water for 1-5 min. ten fold dilutions of homogenate were prepared in normal saline.

3.1.3.1 Enumeration of total aerobic mesophilic bacteria:

Plating was performed into plate count agar (PCA, OXOID CM 325) from the prepared dilutions by spread plate method. Colonies formed after 48 h incubation at 30^{o}C of aerobic conditions were counted according to (Swanson *et al*., 1992).

3.2 Statistical analysis:

The data collected from the different treatments was subjected to analysis of variance and whenever appropriate the mean separation procedure of Duncan was employed (Steel and Torrie, 1980). The SAS program (SAS, 2002), was used to perform the general linear model (GLM) analysis.

4.0 RESULTS AND DISCUSSION:

The chemical composition for sausage of goat meat were significantly ($p<0.05$), presented in table (1) A higher protein percent mean for beef sausage the control, and the second mean value for sausage which processing by 50% of beef, and then group B 25% of beef, and a lower one in protein group C processed from 100% goat meat, that indicates the protein percentage relative to amount of beef meat in sausage, on the other hand, fat content % for sausage increased by increasing beef meat proportion in processing formula also ash content %. Hogg *et al.*, (1992) reported that goat meat contained little fat and therefore relatively higher proportions of protein and minerals. The relatively high protein content and the low percentage fat found in goats compared to sheep lead to a favourable ratio of protein and fat which conforms to contemporary nutrient requirements of humans (Riedel according to Raljic *et al*., 1995) and consumer preferences (Hadjipanayiotou and Koumas, 1994) agreement with (Rhee *et al*, 1999) in percentages level for protein and fat. Moisture content increasing by goat meat increased in formula, a higher one for group C (100% goat meat), B (75% goat meat), A (50% goat meat), and D (control 0 goat meat), moisture content means value 60%, 58%, 55.3%, and 53% respectively. Rhee *et al*, 1999 also reported that chicken and goat meat had more moisture than other meats Moreover, chicken and goat meat were much lower in fat content others.

Table (1):

Chemical composition of sausage treatments:

Items	A	B	C	D
Protein	19.8 ± 0.28^{b}	19.6 ± 0.05^{b}	19.2 ± 0.14^{c}	21.2 ± 0.14^{a}
Fat	7.4 ± 0.05^{a}	6.7 ± 0.11^{b}	6.3 ± 0.05^{b}	7.9 ± 0.03^{a}
Moisture	55.3 ± 0.3^{b}	58 ± 0.6^{b}	60 ± 0.3^{a}	53 ± 0.3^{c}
Ash	1.53 ± 0.03^{a}	1.26 ± 0.03^{b}	1.16 ± 0.03^{b}	1.86 ± 0.03^{a}

^{ab}Means ± SD with different superscripts in the same row are significantly different ($P \leq 0.05$).

.A (Beef 50 % ,goat meat 50 %) , B(beef 25 % , goat meat 75 %) , C (goat meat 100 %) and D (Beef 100 %)

Table 2):

Ultimate pH, cooking loss% and total bacterial count of sausage treatments:

Item	A	B	C	D
PH	5.9 ± 0.01^{b}	6.0 ± 0.03^{b}	6.1 ± 0.05^{ab}	5.7 ± 0.03^{bc}
Cooking loss	18 ± 0.6^{b}	22 ± 0.6^{a}	22 ± 0.3^{a}	17 ± 0.6^{b}
T . Count	5.6 ±	6.2 ±	6 ±	6.3±

^{ab}Means ± SD with different superscripts in the same row are significantly different (P≤ 0.05).

.A (Beef 50 % ,goat meat 50 %) , B(beef 25 % , goat meat 75 %) , C (goat meat 100 %) and D (Beef 100 %)

Sausage pH values were significantly different among sausage treatments which indicate that the pH value decrease in sausage by increased beef meat, whereas sausage made from goat meat 100% a higher one (6.1) in pH and a lower one in control group which processed from beef (5.7). Although, the pH effect in other meat quality attributes, but it's not clear in cooking loss%, which obtained 22% as a higher values for sausage made of goat meat (100 and 75 %) whereas sausage beef had low cooking loss%, that its may be refer to protein type and proportion in beef beside moisture% in goat meat Gamaleldin *et al*., 2019 Nagaraj *et al*. 2005 suggested that the changes in the rates of myofibrillar protein fragmentation may clarify the changes in the rate of postmortem tenderization of meat.

The total bacterial count cfu/gm were significantly ($p<0.05$). The bacterial growth higher number in beef and lower in sausage which made from 50% incorporation. The bacterial growth effect by various factors, ultimate pH, equipment, skinning, cutting, and all things may be in touch to meat and meat products. Contamination could happen during production, processing or distribution. The excellent microbiological quality of Mortadella and meat products were due to the quality of raw materials used, in combination with good production practices in preparing the products. Guerra. *et al*, 2011, Rawaa *et al*., 2020

Sensory attributes of sausage groups there were no significantly different in coulor, falvour, juiciness, tenderness, and overall acceptability. The panelist prefer coulor of sausage made from beef and even tenderness, on other hand prefer flavor of sausage made 100% from goat meat. Sausage juiciness in all groups 5.5 except sausage made from goat meat 100% lower in juicy. The panelist grade sausage in overall acceptability the control firstly, sausage made by goat meat 100% and 50% second, finally sausage made 75% goat meat and 25% beef. Tshabalala *et al.*, 2003 mentioned Acceptability of ground beef patties has been correlated with fat content showed that for ground beef patties, flavor intensity was affected by the fat content. Differences in fat content

were minor at high levels of fat but more pronounced at lower levels. The differences in flavor intensity between goat and beef patties can be explained by the differences in fat content between beef and goat meat. Meat composition is considered a significant indicator of meat functionality; protein and fats are essential constituents reflecting the quality value of meat, whereas moisture content plays a central role in eating and keeping qualities of camel meat

Table 3

Means and standard error of sensory evaluation of sausage treatment .

Sample code	Colour	Flavour	Juiciness	Tenderness	Overall acceptability
A	5.7± 0.14 ^{ab}	5.8± 0.14 ^{ab}	5.5± 0.28 ^{ab}	6.03 ± 0.26 ^{ab}	6.03 ± 0.26 ^{ab}
B	5.8 ± 0.49 ^{ab}	5.5± 0.28 ^{ab}	5.5± 0.28 ^{ab}	5.8 ± 0.11 ^{ab}	5.8 ± 0.11 ^{ab}
C	5.7 ± 0.14 ^{ab}	6.1± 0.05 ^{ab}	5.2± 0.20 ^{ab}	6.03± 0.03 ^{ab}	6.03 ± 0.03 ^{ab}
D	6 ± 0.01 ^{ab}	5.8± 0.11 ^{ab}	5.5 ± 0.28 ^{ab}	6.16 ± 0.60 ^{ab}	6.16 ± 0.16 ^{ab}

^{ab}Means ± SD with similar superscripts in the same row are not significantly different (P> 0.05).

.A (Beef 50 % ,goat meat 50 %) , B(beef 25 % , goat meat 75 %) , C (goat meat 100 %) and D (Beef 100 %)

Conclusion

The study it was concluded the Sudanese Nubian goat meat obtained good results in processing sausage products by mixing with beef and developed characteristic especially in microbial growth, and giving the opportunity to increase its consumption and acceptability. However, goat meat had good characteristics where used in processing products like fresh sausage especially whereas, incorporated and mixes with beef meat.

Recommendation:

Sudanese Nubian goat meat useful for use in meat processing products with good characteristics and more acceptable for the final products.

More researches for use goat meat in another meat products.

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