

Study of Some Quality Attributes of Goat Sausage

Siham Abdelwhab Alamin Mohammed^{1*}

¹ Department of meat science and technology, College of Animal science and technology, Sudan University of science and technology (SUST), Sudan, Khartoum.



(*Corresponding author: Reham Abo Al-Kanj, Email: Sihamlmn666@gmail.com)

Received: 9/05 /2026

Accepted: 2/08 /2026

Abstract

The main objective of this study was to estimate the quality attributes of goat sausage compared to beef sausage. Compared to beef sausages, Goat sausage had higher cooking loss as (23.54 and 22.02 %) respectively. Also Water Holding Capacity in goat sausage register the lower values compared to beef sausages as (1.02 and 2.6) respectively. The result in this study showed that the Lightness (L) values were differ significantly ($P < 0.05$) between the sausages under study. High values of Lightness were recorded by Goat sausages compared to beef sausages as (32.15 and 31.54) respectively. Also Redness (a) values were not differ significantly ($P > 0.05$) between sausages. So, Goat sausage was recorded higher values compared to beef sausage as (11.56 and 11.43) respectively. Similarly, yellowness (b) values were not significant ($P > 0.05$) different. Goat sausages recorded the highest values followed by beef sausages as (8.76, and 8.23) respectively. pH values showed no significant ($P > 0.05$) different between the two types of sausage. pH values were (5.06 and 5.15) for goat sausages and beef sausages respectively.

Keywords: goat sausage, Beef sausage, Cooking Loss, Water holding capacity, color and, pH.

Introduction:

The study of Anaeto, et *al.*, (2010) showed that Goats are very important source of meat, milk and milk products. Also goats are known for other by –products such as hides.

FAO (2017) found that Goats are distributed throughout the world, and the estimation of total population is about one billion head. Devendra (2010) studied that around 98% of the goats are reside in developing countries, also goat meat has long been known by its low fat content and high value of nutrition and high quality that addition with current consumer preferences for lean yet nutrient-rich meats. Numerous studies on sensory evaluations have found goat meat to be relatively palatable and desirable to many consumers. Goat meat is considered a good alternative to red meat due to its rich composition of. Fatty acids, that are more beneficial to the human body compared to the other meats se beef and lamb (Webb, 2008). Furthermore goat meat is a more palatable and acceptable alternative to mutton or lamb meat when compared to sheep and goats in the animal with same ages in comparative studies. The past studies have shown that goat meat tends to be less tender and less juicy compared to sheep meat, this finding attributing to several factors which Were subsequently discussed. One of the most important characteristics of meat products, especially sausages is the loss of moisture during cooking, as this property is linked to the meats ability to retain water. This is ability varies among different types of meat and depending on animal species and the specific muscle tissue used, as noted in a study by Lawrie, (1991). The study of

Kannan, *et. al.* (2001) showed that the loss of liquids that occurs during the cooking process is highest in the meat sample taken from the leg piece, and the loss of liquids is moderate in the meat taken from the shoulder piece and the loss of liquids was found to be lowest in the meat taken from the loin and rib pieces. Also study conducted by Siham (2008) showed that liquid loss during cooking was lower in sausages made from goat meat as (55%) compared to beef sausages (Gadiyaram and Kannan, 2004). As the study conducted by (Trout 1988 and Siham 2008) showed that the water holding capacity of meat and meat products determined the quantity that can be produced for sale and also affects their sensory attributes such as texture, juiciness and flavor. Study of Abubaker *et. al.*, (1986) showed that sausages containing legumes such as chickpeas and fava beans scored highly on tenderness, juiciness and color, while another study found acceptable color and palatability in sausages containing lentils and lupine seeds. Other studies conducted by Smith *et. al.* (1974) and Siham (2008) indicated that goat meat and goat meat products are somewhat similar to beef and beef products.

Materials & Methods

The present Study was conducted in Sudan University of science and technology (SUST) in college of animal production science and technology in the laboratory of meat department and the laboratory of animal production in Khartoum University.

Samples of meat under study:

Ten kilogram of fresh deboned beef and goat meat were obtained from The local Khartoum market in Khartoum state.

Preparation of sausages under study:

Preparation methods of filler:

At the first dry bread (bread crumbs) was ground. Two types of sausages were manufactured ground dry bread as filler. The treatment shambles as shown in (table 1 and figure 1). Sausages consist of minced meat to which garlic, coriander, cinnamon, salt (NaCl), nutmeg, black pepper, fat, ice water, filler and skim milk powder were added (the percent of each Ingredients as shown in table (1). Also the mixture was mixed very well in a chopper machine after adding skimmed milk powder to the dough. The mixture after that was stuffed into sheep casings by using piston stuffer machine then the sausages linked and placed in bags. Also, the bags are labeled and frozen at - 18 C° to wait the experiment tests.

Table (1): Ingredients percent of sausage recipe

Ingredients	%
Cinnamon	0.5
Skimmed milk powder	0.7
Salt	3
Black pepper	0.3
Coriander	0.5
Sugar	0.5
Garlic	0.5
Ice water	10
Fillers	15
meat	60

Quality Attributes Tests:

For this test five samples from the two types of meat were used for each parameter. The samples were free of external visible fat and connective tissue and sub sampled for chemical analysis and

quality parameters. Samples for quality attributes were allowed to oxygenate for 3 hours at 4°C before use.

Cooking loss determination:

cooking loss was determined as that stated by the study of (AMSA, 1995). At the first meat samples were thawed at the temperature of 5°C for 24 hr. after that the samples cut into equal dimensions and weighed. Samples were cooked in plastic bags in a water bath at 80°C for about 90 minutes. Then Samples were cooled in running tap water for 20 minutes. Then the treated samples were dried from fluids and reweighed. Cooking losses were determined by weight difference between raw and cooked sausage. Cooking losses were determined according to (Ziprin, *et al.*, 1981). Cooking loss was determined as the loss in weight during cooking and expressed as a percent of pre-cooking weight.

Cooking loss % =	Weight before cooking – Weight after cooking	X 100
	Weight before cooking	

Water Holding Capacity (WHC):

the water holding capacity was measured according to the methods stated by Jauregui, *et al.*, (1981). In this procedure we take One gram from the minced meat under study. After that each sample was placed on special humidified filter paper which called (Whatman No. 40) in a desiccators over saturated KCl solution) and pressed between two Plexiglas plates for 3 min. at 25 kg load. The meat film area was traced with a ball pen and the filter paper was allowed to dry. Meat and moisture areas were measured with a compensating Plano-meter as stated by the study of (Jauregui, *et al.*, 1981). Then it was calculated as following equation:

Formula:

Water holding capacity =	(Loss water area – meat film area)
	Meat film area

Color Measurement:

it was performed using hunter lab Tri stimulus colorimeter model D 25 M-2 Hunter. Lightness (L), redness (a) and yellowness (b) were recorded on muscle sample (CIE, 1986).

pH determination:

One gram of sample was blended with 9 ml of distilled water in a laboratory blender for 2 min, filtered and then pH of the filtrate was determined by digital pH-meter. The meat samples were packed, labeled and kept frozen in -18 °C (1 g). The procedure at each measurement involved excising of fresh cut surface and sampling it with sterile plate. The area was covered by polyethylene cover to avoid desiccation. Sample weighing approximately 1 gm was homogenized in 10 ml 5mm iodo acetic acid, 150 mm KCl neutralized to pH7.0 by dilute NaOH and HCL. The pH was then read on laboratory pH meter, (adjusted with buffer, pH 7.0) at room temperature.

Statistical analysis:

In this study complete randomized design was used for analyzed the results obtained from this study and after that the data were subjected to ANOVA followed by Least significant difference test (LSD) that by using the Statistical Package for the Social Sciences.

RESULTS

Table (2) shows mean values ($\pm$ SD) of some quality attributes of goat sausages and beef sausages. Goat sausage had higher cooking loss compared to beef sausages as (23.54 and 22.02 %) respectively. Water Holding Capacity in goat sausage recorded the lower values compared to beef sausages as (1.02 and 2.6) respectively. The result showed the Lightness (L) values were significant ($P < 0.05$) between the two types of sausage. Goat sausages recorded high values compared to beef

sausages as (32.15 and 31.54) respectively. Redness (a) values were not significantly ($P>0.05$) different. Goat sausages recorded higher values compared to beef sausage as (11.56 and 11.43) respectively. Similarly, yellowness (b) values were not significant ($P>0.05$) different. Goat sausages recorded the highest values followed by beef sausages as (8.76, and 8.23) respectively. pH values were (5.06 and 5.15) for goat sausages and beef sausages respectively. pH values showed no significant ($P>0.05$) different between the two types of sausage.

Table (2): Mean values ($\pm$ SD) of quality attributes of the beef sausages and goat sausages:

Parameters	Goat sausage	Beef sausage	Significant level
Cooking loss %	23.54 $\pm$ 0.68	22.02 $\pm$ 0.03	*
Water holding capacity (WHC)	1.02 $\pm$ 0.25	2.66 $\pm$ 0.21	*
Lightness (L)	32.15 $\pm$ 1.07	31.54 $\pm$ 0.26	*
Redness (a)	11.56 $\pm$ 0.53	11.43 $\pm$ 0.51	NS
Yellowness (b)	8.76 $\pm$ 0.49	8.23 $\pm$ 0.50	NS
pH	5.06 $\pm$ 0.17	5.15 $\pm$ 0.11	NS

* =significant difference between the two means ($P<0.05$)

N.S. = No significant difference between the two means.

Discussion:

In the present study the result showed that cooking loss was significant ($P<0.05$) among the two types of sausage (goat and beef sausages). Also Goat sausage had higher cooking loss compared to beef sausages as (23.54 and 22.02 %) respectively. Beef sausage in this study had cooking loss percent as (22.02 %) which was similar to that mentioned by Ali, (2012) as (22%). The present result showed that goat sausages were recorded higher cooking loss compared to beef sausage which was disagreed with the findings of Ali, (2012) who reported that goat sausage had lower cooking loss as (16.64%) compared to beef sausage which showed (22.07%). The value of goat cooking loss in this study higher than the findings of Gadiyaram and Kannan, (2004) as (5.52%) and in beef sausage as (19.88%). The difference in cooking loss could be attributed to the denaturation temperature of protein and the difference in chemical properties and types of meat as stated by Dawood, (1995) and Nafiseh, *et al.*, (2010). Also the type of fillers affected significantly ($P<0.01$) on cooking loss %.

Present study showed that Water Holding Capacity (WHC) in goat sausage recorded the lower values compared to beef sausages as (1.02 and 2.66) respectively also results showed there was significant ($P<0.05$) among the two types of sausage studied The goat sausage had WHC of (1.02) which was higher to that reported by Babiker, *et al.*, (1990) as (0.27) and slightly higher value reported of beef sausage as (0.80). The result in this study showed that the Lightness (L) values were significant different ($P<0.05$) between the two types of sausage. Goat sausages recorded high values compared to beef sausages as (32.15 and 31.54) respectively. Redness (a) values were not significantly ($P>0.05$) different. Goat sausages recorded higher values compared to beef sausage as (11.56 and 11.43) respectively. Similarly, yellowness (b) values were not significant ($P>0.05$) different. Goat sausages recorded the highest values followed by beef sausages as (8.76, and 8.23) respectively. The value of lightness in beef sausages in this study was (31.54) which was less than the values reported by Nafiseh, *et al.*, (2010) as (68.6) for beef sausages. Results in this study are comparable to that reported by Babiker *et al.*, (1990) who mentioned that goat meat was darker red in color. The result of redness in this study was slightly more than the value reported by Nafiseh, *et al.*, (2010) who reported that the redness value in beef sausage was (9.2). The result of yellowness value in this study was less than the value reported by Nafiseh, *et al.*, (2010) who reported that

yellowness value in beef sausage as (15.6). pH values were (5.06 and 5.15) for goat sausages and beef sausages respectively. The result of pH in this study was in line with the result reported by (Wensvoort, *et al.*, 2004) who mentioned that the pH in beef sausages was (5.5). Also similar result was reported by Nafiseh, *et al.*, (2010) as (5.6) in beef sausage. In this study goat sausage had slightly similar pH as beef sausage; similar findings was recorded by Dharma veer, *et al.*, (2007) as (6.44) and Abbas, (2009) as (5.61) for goat and beef sausages.

Conclusion:

The results in this study were showed that goat sausages had higher cooking loss compared to beef sausages. Also Water Holding Capacity in goat sausages recorded the lowest values compared to beef sausages. Color evaluation is an essential part of meat research and product development.

References:

- Abbas, M. O., (2009). Effect of adding different levels of citric acid on quality attributes of fresh beef sausage. M. Sc. University of Kentucky.
- Abubaker, T.M., Shekib, El-Iragi, S.M. and Mohamed, M.S. (1986). Upgrading and Utilization of by-products of slaughter houses. 1. Fresh and canned beef usages containing legumes as an Extender in their meal emulsion. Alexandria Science Exchange 7 (3): 319.
- Ali, A.S. (2012). Effect of storage period on quality of chevon and beef sausage. Msc. dissertation Sudan University of Science and technology.
- AMSA (American Medical Student Association) (1995). Research guidelines for cooking, sensory evaluation and instrumental tenderness measurements of fresh meat. American Meat Science Association, 10-11.
- Anaeto, M.; Adeyeye, J.; Chioma, G.; Olarinmoye, A.; Tayo, G 2010. Goat products: Meeting the challenges of human health and nutrition. Agriculture and Biology Journal of North America is an academic journal., 1, 1231–1236.
- Babiker, S.A., El Khider, I.A. & Shafie, S.A., (1990). Chemical composition and quality attributes of goat meat and lamb. Meat Science journal 28, 273-277.
- Commission International Del, Eclairage (CIE) (1986). Calorimetric, 2nd edition. Commission International Del, Eclairage, Vienna.
- Dawood, A.A. (1995). Physical and sensory characteristics of Najdi camel meat. Meat science journal. Vol. 39. Issue (1) p. 59-69.
- Devendra, (2010). Comparative aspects of digestive physiology and
- Dharmaveer, S.; Rajkumar V. and Mukesh, K. P. (2007). Quality and shelf-life of smoked chevon sausage packed under vacuum and stored at $4\pm1^{\circ}\text{C}$. American Journal of food Technology, 2: 238-247.
- FAO (Food and Agriculture Organization) (2017). Gleam. Rome: Food and Agriculture Organization of the United Nations. Available at: https://foodandagricultureorganization.shinyapps.io/GLEAMV3_Public/
- Gadiyaram, K.M. and Kannan G., (2004). Comparison of textural Properties of low-fat chevon, beef, pork, and mixed-meat sausages Agricultural Research Station, Fort Valley State University, Fort Valley, Georgia 31030, USA. South African Journal of Animal Science 2004, 34 (Supplement 1).
- Imazumi (eds.) Ruminant Nutrition and Physiology in Asia. Japan
- Jauregui, C. A., Regenstein, J. N., and Baker, R.C. (1981). A sample centrifugal method for measuring expressible moisture, a water –Binding property of muscle foods. Journal of food science, 46:1271-1273.

- Kannan, G., Kouakou, B, and Gelaye, S. (2001). Color changes reflecting myoglobin and lipid oxidation in chevon cuts during refrigerated display. *Small Rumin. Res.* 42: 67- 75.
- Lawrie, R.A. (1991). *Meat science* 5th ed., Pergamum Press, oxford.UK.
- Nafiseh, S.; Mahdi, K.; Javad, K.; Hooshang, B. & Fatemeh, P. (2010). Camel cocktail sausage and its physicochemical and sensory quality. *International Journal of Food Sciences and Nutrition*, March 2010; 61(2): 226–243.
- nutrition in goats and sheep. pp 45-60 in: C. Devendra and E.
- Siham, A. A., (2008). A comparative Study of Chemical Composition and Eating Quality Attributes of Camel meat and Beef. MSc. College of Veterinary Medicine and Animal Production Sudan University of Science and Technology.
- Smith, G.C.; Pike, M.I. and Carpenter, Z.L., (1974). Comparison of the palatability of goat meat and meat from other animal species. *Journal of Food Science.* 39: 1145-1146.
- Society of Zoo technical Science Ed., Sendai, Japan.
- Trout, G. R. (1988). Techniques for measuring water-binding capacity in muscle foods. *Journal of Meat Science* 23:245.
- Webb, E.C., Bosman, M.J., (2008). Acceptability of chevon from kids, yearling goats and mature does of indigenous South African goats: A case study. *The South African Journal of Animal Science* 38, 247-259.
- Wensvoort, J.; Kyle D.J.; Orskov E.R. and Bourke, D.A. (2004). Biochemical adaptation of camelids during fasting. *The Egyptian Journal of Camel science* 1:71–75.
- Ziprin, Y.A.; Rhee, Z.L.; Carpenter, Hostetler, R.L.; Terrell, R.N. and Rhee, C. (1981). Glandless in cottonseed, peanut and Soya protein ingredients in ground beef patties. Effect on rancidity and other quality factors. *Journal of Food Science* 46: 58-61.

دراسة بعض خصائص جودة نقانق الماعز

سهام عبد الوهاب الأمين محمد¹

¹ قسم علوم وتكنولوجيا اللحوم، كلية علوم وتكنولوجيا الإنتاج الحيواني، جامعة السودان للعلوم والتكنولوجيا (SUST)، السودان، الخرطوم.

(*للمراسلة: د.سهام عبد الوهاب الأمين محمد، البريد الإلكتروني Sihamlmn666@gmail.com)

تاريخ القبول: 2026/08 /2

تاريخ الاستلام: 2026 /05 /9

الملخص

كان الهدف الرئيسي لهذه الدراسة هو تقييم خصائص جودة نقانق الماعز مقارنةً بنقانق اللحم البقري. وقد لوحظ أن نقانق الماعز سجلت نسبة فقدان أعلى أثناء الطهي (23.54% و 22.02% على التوالي) مقارنةً بنقانق اللحم البقري. كما سجلت نقانق الماعز قدرة أقل على الاحتفاظ بالماء مقارنةً بنقانق اللحم البقري (1.02% و 2.6% على التوالي). وأظهرت نتائج هذه الدراسة اختلافًا معنويًا ($P < 0.05$) في قيم درجة السطوع (L) بين نوعي النقانق المدروسة. وسُجلت أعلى قيم درجة السطوع في نقانق الماعز مقارنةً بنقانق اللحم البقري (32.15% و 31.54% على التوالي). في المقابل، لم تكن قيم درجة الاحمرار (a) مختلفة بشكل معنوي ($P > 0.05$) بين نوعي النقانق، حيث سُجلت أعلى قيم في نقانق الماعز مقارنةً بنقانق اللحم البقري (11.56% و 11.43% على التوالي). وبالمثل، لم تكن قيم درجة الاصفرار (b) مختلفة بشكل معنوي ($P > 0.05$). سجلت نقانق الماعز أعلى القيم، تلتها نقانق اللحم البقري بقيم (8.76 و 8.23) على التوالي. لم تُظهر قيم الرقم الهيدروجيني أي فرق معنوي ($P > 0.05$) بين نوعي النقانق. بلغت قيم الرقم الهيدروجيني (5.06) لنقانق الماعز و 5.15 لنقانق اللحم البقري.

الكلمات المفتاحية: نقانق الماعز، نقانق اللحم البقري، فقدان الوزن أثناء الطهي، قدرة الاحتفاظ بالماء، اللون، الرقم الهيدروجيني.