

# A Study of Sensory Evaluation of Sausages from Beef and Sheep Meat

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**Abstract -** *This study was conducted in the department of meat science and technology, College of Animal Production Science and Technology, Sudan University of Science and Technology to evaluate the sensory evaluation and a panel test of fresh beef sausage and sheep meat sausage. The samples were tasted by 10 semi-trained taste panel as described by Cross et al. (1978). The samples were analyzed in three different brands of these raw cuts in duplicate. The present study showed that there were no significant differences between the species in mean texture (hardness) and only minor differences were seen in color. However, panelists found a texture difference. This work was followed by a sensory experiment to find out if characteristic sheep meat flavors. Panelists found that spiked sheep meat flavors caused an overall significant decrease in mean liking on a 1–6 scale. Beef sausages have been considered harder, more fibrous, and less juicy than sheep sausages. The panelists observed that sheep sausages had greater intensity of flavor and tasted spicier while beef sausages were considered sweeter. Also it was observed that sheep meat sausages received the highest scores in flavor compared to beef sausages. The juiciness of sausages in this study was not significantly ( $P>0.05$ ) different among treatments. Sausages of Sheep meat and beef with bread crumbs fillers were received the same score. There was no significant difference ( $P>0.05$ ) among treatments in texture. So sausages of sheep meat with bread crumbs filler had higher texture scores compared to beef sausages with bread crumbs filler. These results indicated that sheep meat and beef sausages were not significantly different ( $P>0.05$ ) in color of the cooked sausages. Consumers' panel did not show any preference for the different types of sausages. This means that all types of sausages can have market opportunity. Generally it was observed that most of the scores of color, texture, flavor and juiciness were above desirable.*

**Keywords:** *Sensory evaluation, panel test, beef sausage, sheep sausages*

## INTRODUCTION

The Republic of Sudan is a country in northeast Africa, bordered to the east by Ethiopia and Eritrea, to the north by Egypt and Libya, to the west by Chad and the Central African Republic and from the south by the State of Southern Sudan. Increasing population and increased demand per capital together with moderately rapid income growth lead not only to an increased demand for staple foods but also for preferred foods including, particularly, meat and meat products and this will create large food deficits (Bender, 1992). Consumers often tend to evaluate meat quality on the basis of tenderness, juiciness and

flavor of cooked meat. Juiciness and tenderness are influenced by the cut of meat and how long the meat is cooked (grilled or fried). Many of the sausage products that enjoy today were developed originally in Europe. The kind of sausage produced by early European sausage makers was influenced by local customs, availability of spices, seasonings and the climate of the region. Fresh and smoked sausages originated in areas having cool climates while many dry sausages were developed in warm regions. Today, the world faces the problem of shortage food supply, which makes the malnutrition problem and its consequences in the undeveloped countries a major problem (Sheehy et al., 2005). 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. In developing country including Jordan, the per capita consumption average is 31.1 kg/person per year. People in world consume 42.1 kg/person per year (FAO, 2008). Dikeman, (1990); Koohmaraie (1992a); Kerry et al., (2002) and Egena and Ocheme, (2008) reported that meat quality includes tenderness, palatability, flavor, color and juiciness. Meat color is an important parameter in meat quality. It can be measured numerically using a colorimeter or subjectively. Several factors affect meat color such as species/breed, age, sex, cut of meat, surface drying of the meat and surface spoilage. Meat color is largely determined by the content of myoglobin and its derivatives. It is normal for meat to change color depending on the presence or absence of air. For instance, exposed meat changes color due to reactions occurring between myoglobin and oxygen. Tenderness appears to be the most important sensory characteristic of meat and a predominant quality determinant. It can be evaluated by mechanical devices and/or a taste panel. Lawrie, (1991) stated that color, water-holding capacity and odor of meat are detected before and after cooking by the consumer with more prolonged sensation than do juiciness, texture, tenderness, taste and odor. Verbeke and Viaene, (1999) stated that the consumer's decision to purchase beef is guided by the perception of healthiness and a variety of sensory traits including color, tenderness, juiciness, and aroma or flavor. Color is an important criterion of raw or cooked meat and meat products. It reflects the proper composition of the products, particularly in relation of

meat to other compounds, freshness of raw materials, texture, taste and proper conditions of storage (Klak et al., 2001; Alberti et al., 2002). Abril et al., (2001); Faustman and Cassens, (1990) reported that the presence of muscle pigments, myoglobin and haemoglobin is the main limiting factor of the meat colour. Factors affecting meat color include muscle fiber type, ultimate pH, and cooling rate. Adegoke and Falade, (2005) reported that the discoloration is related to the amount of the pigments in meat. Glitsch, (2000) reported that color of meat is an important quality attributes that influences consumer acceptance of meat and meat products. Consumers prefer bright-red fresh meat. Adegoke and Falade, (2005) reported that the presence of muscle pigments myoglobin and hemoglobin is the main limiting factor of the meat color. Moloney, (1999) and Milton, (1990) reported that pre –slaughter stress can lead to dark color of beef. Andersen et al., (1989) reported that the gradual change in surface color from red to brown, often encountered during storage and display of fresh and frozen meat. Abdul -Aleem , (1983) stated that muscle color goes darker when the animal moves along distance. Wilson, (1981) stated that color loss in sausage is caused partly by oxidation of meat pigment myoglobin to met-myoglobin. Water holding capacity is the ability of meat to retain its own or added water during application of external forces such as cutting, heating, grinding, or pressing (Judge et al., 1989) . Generally, young animals tend to produce meat with a higher pH than older animals due to lower levels of glycogen (Kannan, et.al., 2003). Walker and Betts (2000) reported that ultimate pH of meat was significant for its resistance to spoilage because most bacteria grow optimally at about pH 7 and not below pH 4. Dharmaveer et al., (2007) stated that the microbial load increased with increase in pH of the meat product. Of all the attributes of eating quality, the average consumer presently rates texture and tenderness most important (Koohmaraie, 1992a). Mukasa, (1981) defined texture of meat as the sensory manifestation of the structure of the meat and the manner in which the structure reacts to the force applied during biting. Simelaetal., (2003) stated that meat tenderness and flavor are the most important components that determine meat quality. McMillin, (2005) reported that there are two main components of meat tenderness. Juiciness is important to meat texture and palatability. It has two major components; the first is the impression of wetness produced by the release of fluid from the meat during chewing, the second is the more sustained juiciness that apparently results from the stimulating effect of fat on the production of the saliva (Lawrie, 1991 and Moloney, 1999). Lawrie, (1998) stated that juiciness reaches a minimum when the pH level of the meat is about six.

Lawrie, (1991) stated that Juiciness of meat and meat products is affected by the storage conditions and period.

Matlocketal., (1984) stated that the juiciness of sausage is affected by the level of common salt; higher salt content resulted in higher juiciness. Siham, (2008) stated that sausages became juicier with the addition of potato and that, adding of blanched cowpea compared with bread crumbs and potato reduced juiciness. Shahidi, (1994) stated that flavor has a great influence on the sensory quality of meat, consequently on its overall acceptability. Milton, (1990) and Moloney, (1999) reported that the flavor of meat is associated with either moisture or fat contents of meat. Therefore, meat from older animals is more intense in flavor than meat from younger animals. Muchenjeetal., (2009a) reported that flavor depends on the quantity and composition of fat in meat. Lawrie, (1991) stated that flavor is a complex sensation that involves odor, taste, texture, temperature and pH. Angelo etal., (1987) reported that the factors that influence the flavor of meat products include animal feed, processing methods, storage condition and sanitation. Mottram, (2002) stated that meat aroma develops from the interaction of non-volatile precursors, including free amino acids, peptides, reducing sugars, vitamins, nucleotides and unsaturated fatty acids, during cooking. Processing is a mean for extending the product, improving shelf-life and producing an upgraded value added product (Kalalou, etal. 2004). Pearson and Tauber ,(1984) reported that the term sausage is derived from the Latin word „salsas,, meaning salt, or literally refers to chopped or minced meat preserved by salting. Mansour and Ahmed (2000) had used advanced technology to process sausage from camel meat and the products showed similar chemical composition to beef products; however the camel meat products were higher in moisture (73.6%) and ash (4.13%). FAO, (1991) reported that, sausage is meat product in form of especially prepared, ground or chopped meat in which fresh comminuted meat, are modified by various processing methods. Dytteetal., (1981) and Essien, (2003) defined sausages as a comminuted processed meat made from red meat, poultry or a combination of these with water, binders and seasonings. Okerman, (1986) and Jihad et al., (2009) stated that sausages are very common and popular meat products manufactured from lower-value trimmed meat to produce higher value products. Dytteetal., (1981) classified sausage according to the degree of combinations to coarsely comminuted sausage and emulsified sausages. Kerry etal., (2002) reported that fat is an essential component of meat for sensory perception of juiciness, flavor and texture. The water or ice added to the meat mixture provides considerable functional qualities. It chills the meat during the chopping or mixing operations. Essien, (2003) reported that the addition of excessive amounts of water can decrease the quality of sausage, because ice damage fatty tissue which increase fat loss, and lead to uneven salt distribution to the final product. Sausages

Additive contributes to improving and intensifying some properties of meat, protein, water binding and emulsifying capacities. Meat extenders are improving yields and reduce formulation costs (FAO, 1985 and 1991). Also FAO, (1991) reported that the salt is the main flavoring agent used in making sausages and it contributes to basic taste characteristics of the final product. Dennis, (2004) stated that salt enhance the flavor of sausages and aids in preserving them against microbial spoilage. Judge et al., (2001); Kerry et al., (2002) reported that salt is the most common and most important additive of sausage. Sausage Casings are special cylindrical containers used to protect sausage, since sausages are comminuted products they must be placed in some type of forming device to give them shape to hold them together during processing and production. Usually the intestine of sheep and goats are used to produce fresh sausage (FAO, 1991). Botka et al., (2001) stated that beef intestines are used in processing high-quality sausage products (after sorting, calibration and preservation). Quality of sheep meat is directly related to its sensory characteristics, such as tenderness, juiciness, taste, and odor (Rodrigues and others 2009; Rodrigues and Teixeira 2009). Meat from young sheep and goats has special sensory characteristics with good market value in contrast to adult animals, particularly the culled ones that have a very low acceptability and market price. This kind of meat is tougher and normally has an unpleasant taste and odor, and usually is transformed by processes as cured with salts or smoked and dried or also as fresh sausages after grinding, mixing with salt, spices, and other ingredients and casing. In the last years, there have been several studies concerning the incorporation of meat from culled sheep and goats in processed products (Nassu and others 2002; Pellegrini and others 2008).

The objective of this study was to evaluate the sensory attributes of fresh sausages made from beef and sheep meat.

## MATERIALS AND METHODS

This study was conducted at the laboratory of Meat Science and Technology, College of animal Production Science and Technology, Sudan University of Science and Technology. Khartoum / Sudan.

**Meat samples:** A total of 2 kg fresh deboned sheep meat and total of 2 kg fresh deboned beef were obtained from local abattoir in Khartoum State. The muscles samples from male cattle at 2 - 2.5 years old and male sheep from 12 - 13 month old). Each muscle samples (longissimusdorsi) were freed from external visible fat and connective tissue. Samples for sausages processing were stored at 4°C till processing (24 hrs.).

**Sausages Filler:** bread crumbs: It was used dried after ground.

**Sausages preparation:** There are two types of sausages were manufactured according to the type of fillers. All ingredients (shown in Table 1) were added equally to all treatments. The Sausage consist of minced meat to which salt (NaCl), garlic, coriander, black pepper, nutmeg, fat, cold water, were added. The whole mixture was mixed well in a chopper to the dough. The mixture was stuffed in casings using piston stuffer, then linked, labeled and frozen at -18°C to wait the following tests.

Table (1): Ingredients of the sausages recipe:

Ingredient	Percentage (%)
Meat	65.5
Filler	20
Ice water	10
Fat	5
Salt	3
Black pepper	0.3
Coriander	0.3
Nutmeg	0.3
Garlic	0.3

## Sensory evaluation of sausages:

All ingredients are percentage from the formulated products. The samples to be used for sensory evaluation were randomly selected and thawed for 24 hours in 4°C refrigerator before cooking. Ten semi-trained panelists were asked to evaluate the treatment effects on, cooked color, texture, flavor and juiciness of the studded sausage samples. The samples were tasted by 10 semi-trained taste panel as described by Cross et al. (1978).

Sausage samples were separately cooked 7-10 minutes by deep fat frying in vegetable oil then sausages were turned every two minutes to prevent excessive browning. Samples were kept warm in aluminum foil for evaluation test. They were put in coded plates and served warm in special pan to the panelists. From each treatment a sample was randomly placed in a dish divided to under natural light. Every panelist has one dish to test in each session. A six point hedonic scale was used, where six was extremely desirable while one was extremely undesirable (Appendix 1). A taste panel using the Quantitative Descriptive method referred by Meilgaard et al. (2007), and the consumers' preference evaluation using the preference mapping procedure.

## Statistical analysis:

The data collected were subjected to statistical analysis by using complete randomized design used to analyze the results obtained from this study and subjected to ANOVA followed by Least significant difference test (LSD) using the (SPSS, 2008, version ,17).

## RESULTS

The sensory evaluation results of sausages with different types of Meat were shown in Table (2), all the scores given were ranging between 4.5 and 5 and the treatments did not differ significantly ( $P > 0.05$ ) in any of the parameters measured. The result in this study showed that Flavor was not differ significantly ( $P > 0.05$ ) among treatments. Also it was observed that sheep meat sausages received the highest scores in flavor compared to beef sausages. The juiciness of sausages in this study was not significantly ( $P > 0.05$ ) different among treatments. Sausages of Sheep

meat and beef with bread crumbs fillers were received the same score. There was no significant different ( $P > 0.05$ ) among treatments in texture. So sausages of sheep meat with bread crumbs filler had higher texture scores compared to beef sausages with bread crumbs filler. These results indicated that sheep meat and beef sausages were not significantly different ( $P > 0.05$ ) in color of the cooked sausages. However, beef sausages with bread crumbs filler received higher scores than the other sausages. Generally it was observed that most of the scores of color, texture, flavor and juiciness were above desirable (Appendix 1).

Table (2): Mean values of the effect of the type of meat on sensory attributes of sheep meat sausages and beef sausages cooked by oil.

<i>Sausage Samples</i>	<i>Juiciness</i>	<i>Tenderness</i>	<i>Flavor</i>	<i>Color</i>	<i>Overall acceptance</i>
Beef sausages	5	5	4	4.5	5
Sheep meat sausages	4	5	5	4.5	5
Level of significance (L.S.)	N.S.	N.S.	N.S.	N.S.	N.S.

N.S. =No significant different between means

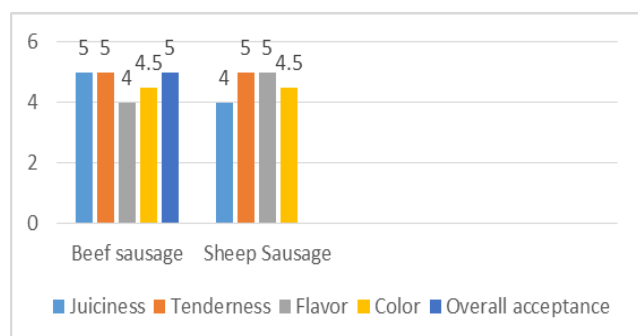


Figure (1). Mean values of the effect of the type of meat on sensory attributes of sheep meat sausages and beef sausages cooked by oil.

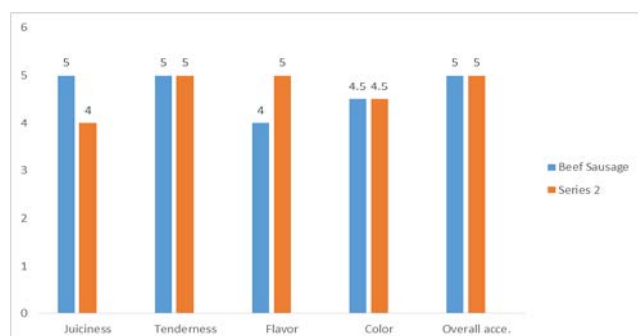


Figure (2). Mean values of the effect of the type of meat on sensory attributes of sheep meat sausages and beef sausages cooked by oil.

## DISCUSSION

The present study showed that the treatments differ significantly ( $P < 0.05$ ) in the sensory parameters measured (tenderness, juiciness, flavor and overall acceptance)

except color and all scores obtained were above moderately desirable. In this study Panelist scores for color were not significant ( $P > 0.05$ ), whereas, significant ( $P < 0.05$ ) different were observed in tenderness. These results being in agreement with the findings of Sen et al., (2004) who reported that beef was tender. Although the differences between the two species were not statistically significant for any of the texture profile parameters. The present result was in line with the findings of Smith et al., (1974) who compared sensory characteristics of goat meat with beef and stated that the goat meat had the same juiciness, but was less tenderness compared to beef. The scores for flavor of sheep meat were lower than beef, which agreed with the statement of Babiker et al., (1990) who reported that the lamb meat was lower in flavor compared to beef. This was also similar to the findings of Schönfeldt et al., (1993a, 1993b); Casey et al., (2003); Sheradin et al., (2003a,b); Webb et al., (2005) who reported the mutton meat has a distinct flavor and aroma compared to beef. Some evidence stated by Nelson et al., (2004) who suggested that goat meat fares favorably in palatability when compared with lamb and beef. In this study the sheep meat sausage and beef sausage were desirable to the panelists. The present result was in line with the findings of Smith et al., (1974) who compared sensory characteristics of with beef and goat meat and reported that the goat meat had less overall satisfaction when compared to beef. Results obtained from this study shown that sausages made from either types of sheep meat or beef is acceptable to the Sudanese palate. This indicates that meat from beef or sheep meat can replace each other in sausages manufacture.

## CONCLUSION

The results in this study showed that the sausages sample were acceptable to Sudanese panelists which processed from sheep meat or beef. Also beef sausages and sheep meat sausages were not significantly ( $P > 0.05$ ) different in juiciness, texture, flavor and color.

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### Appendix (1)

#### Grading Chart for Sausages Samples

Evaluate these samples for color, texture, flavor and juiciness – for each sample, use appropriate scale to show your attitude by checking at the point that best describe the feeling about the sample. If you have any question please ask, thanks for your cooperation.

<i>Sample Code</i>	<i>Color</i>	<i>Flavor</i>	<i>Tenderness</i>	<i>Juiciness</i>	<i>Overall acceptance</i>
A					
B					
C					
D					
E					
F					

Key:

<i>Color</i>		<i>Flavor</i>		<i>Tenderness</i>		<i>Juiciness</i>	
6	Extremely desirable	6	Extremely intense	6	Extremely desirable	6	Extremely juicy
5	Very desirable	5	Very intense	5	Very desirable	5	Very juicy
4	Moderately desirable	4	Moderately intense	4	Moderately desirable	4	Moderately juicy
3	Moderately undesirable	3	Moderately un-intense	3	Moderately un-desirable	3	Moderately un-juicy
2	Very undesirable	2	Very un-intense	2	Very undesirable	2	Very dry
1	Extremely undesirable	1	Extremely un-intense	1	Extremely bland	1	Extremely dry