

# **Chapter one**

## **Introduction**

Meat and meat products are considered as an excellent source of high quality animal protein, vitamins especially vitamin B and certain minerals, especially iron (Gracey , 1986). Meat in diet is an important source of protein which is not only of high biological value but for its amino acid contents (shahidi, 1989).

Meat consumed by human for variety reasons including taste, nutrient, Prestige, tradition and availability (Rogowski, 1980). Meat consumption in developing countries has been continuously increasing from a modest average annual per capita consumption of 10 kg in the 1960s to 26 Kg in 2000 and will reach 37 kg around the year 2030 according to. F A O projection (Gunter and peter, 2007).

Sausage is defined to preserving meat by stuffing salted, chopped meat flavors with spices into animal casing dated back thousands of years, to the ancient Greeks romans and earlier (AFDO, 1999). It is difficult to define sausage in single definition due to the variety of different type.

There are six types of sausage: fresh sausage, uncooked smoked sausage, cooked smoked sausage and cooked sausage dry and semi-dry (judge et al., 1990; Boyle, 1994; Tronsky et al; 2011).

**The objectives of this study are:-**

1-To determine the shrinkage percentage in different source of beef sausage.

2-To determine the shrinkage percentage of different beef sausage at specific cooking temperature (70°C).

3- To determine the cooking loss percentage of different beef sausage at specific cooking time (100 minute).

## Chapter Two

### Literature Review

#### 2.1: meat:

Meat is defined as those animal tissues, which are suitable for use as food, all processed or manufactured products, which might be prepared from those tissues, are included in the definition (Judge et al 1990). Lawrie (1991) defined meat as the flesh of animal used as food and it is often widened to include as well as musculature organs such as liver and kidney, brain and other edible tissues .FSANZ (2002) and Williams (2007) defined meat as the whole or part of the carcass of cattle, camel, goat, sheep, poultry, rabbit, hare and deer slaughtered .Gunter and peter (2007) defined meat as “the muscle tissue of slaughter animals.

There are several reports available which declare that the ultimate internal temperature has major effect on the rheological and technological properties of meat. Cross and stanfeld, (1978); Barbera and Tassone, (2006).

## **2.2: cooking loss percentage:**

The cooking loss percentage defined the water lost during cooking of meat expressed as percentage wafaa (2014). Mahassin (2008) reported that age of animal and wholesale cuts had a significant influence on cooking loss percentage and shear and force values.

Cooking loss percentage increased as the salt level in the formulation decreased, in addition, the cooking loss also increased with use of lower quality meat. It's possible to reduce cooking loss by using binder Sofos, (2008). The loss in sausage after cooking maybe affected by several factors such as manufacturing sausage by incorrect recipe , Temperatures at commination, cooking system and cooking time, water holding capacity, moisture , fat retention and the type of ingredient used in their formulation Nurul et al,(2010), Gadiyaram and Kannan (2004) reported the cooking loss percentage in beef sausage as 19.88%. In another study Ali (2012) found the cooking loss percentage of beef sausage as 22.07%. Mahssin (2008) reported the cooking loss percentage of beef sausage 18.04%. Mousab (2009) found the cooking loss percentage in beef sausage as 10.1%.

Cooking loss is one of the most important properties of emulsion type sausage products and it is related to water holding capacity.

There are variation in water holding capacity among different type of meat from different animals and muscles. Higher holding capacity of meat products and is often unique characteristic of particular product ranging from coarse commented, to finely commented, to from an emulsion F A O, (1991).

### **2.3: Water holding capacity ;( W H C):**

It's the ability of meat to hold it is own or added water during the application of any force Hamm, (1986) Babiker et al. (1990).

The water holding capacity of meat attribute of obvious important. This is particularly so in comminute meat such as sausage, where the structure of tissue has been destroyed and is longer, able to prevent the aggress of fluid released from the protein Lawrie, (1991).The water-holding capacity of meat is affected by several factors, such as species, age and muscular function. Muscles with high content of intramuscular fat tend to have high W H C Saffle and bratzler, (1959).

## **Chapter three**

### **Materials and method**

#### **3.1: Location:**

The experiment was conducted from January to July 2018 in the laboratory of meat Science and Technology College of Animal production Sudan University of Science and Technology.

#### **3.2: materials:**

The materials used are:-

- 1- Water bath at 70°C.
- 2- Thermometer.
- 3- Poly ethylene bags.
- 4- Sensitive balance.
- 5- Paper tissues.
- 6- Beef sausage.

### 3.3: method:

36 samples of beef sausage was randomly collected from different manufacturing sources, the samples were weighed by the sensitive balance (W1). Then the samples were put in a poly ethylene bags and cooked at 70C for 100 minute in water bath. after cooking the sample were taken out of the poly ethylene bags and then dried by paper tissues, then samples were weighed (w2). The cooking loss percentage was determined by subtracting the weight before cooking (w1) from the weight after cooking (w2) and divided by w1 as follows :-

$$\text{The cooking loss percentage:} = \frac{W1 - W2}{W1} \times 100$$

W1 = weight of the sample before cooking.

W2= weight of the sample after cooking.

### **3.4: statistical analysis:**

The data presented as mean  $\pm$  standard deviation was subjected to one way analysis of variance (ANOVA) ( $P < 0.05$ ) to assess whether cooking loss percentage varied significantly between sample. All statistical calculations were performed with SPSS 17 Gomez and Gomez (1984).



## Chapter four

### Results

The mean values  $\pm$  standard deviation of cooking loss percentage of different sausage sources are presented in tables (1-5).

The result obtained showed highly significant different at ( $p < 0.01$ ) in cooking loss percentage between different sausage sources.

Table I: Show the Cooking loss Percentage of Beef Sausage (source I) for three successive days.

Cooking days	Cooking loss Percentage
First day	19.87 <sup>c</sup> $\pm$ 0.81
Second day	22.20 <sup>a</sup> $\pm$ 0.72
Third day	20.4 <sup>b</sup> $\pm$ 1.28
Sig	**

a, b, c: - means within the same column followed by different superscripts are significantly ( $p < 0.01$ ) different.

As shows in table I the result of cooking loss percentage of source I in first day was 19.87 $\pm$ .81%, second day was 22.20 $\pm$ .72% and third day was 20.4 $\pm$ 1.28%.

Table II: Show the Cooking loss Percentage of Beef Sausage (source II) for three successive days.

Cooking days	Cooking loss Percentage
First day	18.00 <sup>c</sup> ± 1.00
Second day	21.00 <sup>b</sup> ± 1.00
Third day	22.67 <sup>a</sup> ± 1.53
Sig	**

a, b, c: - means within the same column followed by different superscripts are significantly ( $p < 0.01$ ) different.

From table II the result of cooking loss percentage of source II in first day was 18.00±.00%, second day was 21.00±1.00% and third day was 22.67±1.53%.

Table III: Show the Cooking loss Percentage of Beef Sausage (source III) for three successive days.

Cooking days	Cooking loss Percentage
First day	18.60 <sup>c</sup> ± 1.05
Second day	21.40 <sup>b</sup> ± 0.80
Third day	24.13 <sup>a</sup> ± 0.81
Sig	**

a, b, c: - means within the same column followed by different Superscripts are significantly ( $p < 0.01$ ) different.

From table III the result of cooking loss percentage of source III in first day was 18.60±1.05%, second day was 21.40±0.80% and third day was 24.13±0.81%.

Table IV: Show the Cooking loss Percentage of Beef Sausage (source IV) for successive three days.

Cooking days	Cooking loss Percentage
First day	41.00 <sup>a</sup> ± 1.00
Second day	36.17 <sup>c</sup> ± 1.26
Third day	39.00 <sup>b</sup> ± 1.00
Sig	**

a, b, c: - means within the same column followed by different superscripts are significantly ( $p < 0.01$ ) different.

As shows in table IV the result of cooking loss percentage of source IV in first day was 41.00±1.00%, second day was 36.17±1.26% and third day was 39.00±1.00%.

Table V: Show the average Cooking loss Percentage of Beef Sausage from different Sources for three successive days.

Cooking days	Cooking loss Percentage in Different Beef Sausage Sources			
	Source I	Source II	Source III	Source IV
First day	19.87 <sup>b</sup> ±0.81	18.00 <sup>d</sup> ±1.00	18.60 <sup>c</sup> ±1.05	41.00 <sup>a</sup> ±1.00
Second day	22.20 <sup>b</sup> ±0.72	21.00 <sup>d</sup> ±1.00	21.40 <sup>c</sup> ±0.80	36.17 <sup>a</sup> ±1.26
Third day	20.4 <sup>d</sup> ± 1.28	22.67 <sup>c</sup> ±1.53	24.13 <sup>b</sup> ±0.81	39.00 <sup>a</sup> ±1.00
Sig	**			

a, b, c, d : - means within the same row followed by different superscripts are significantly ( $p < 0.01$ ) different.

Note: source I, source II, source III are processing factories  
Source IV is butchers shop.

## Chapter five

### Discussion

The results of cooking loss percentage of beef sausage from different sources will be discussed in this chapter.

The results presented in table I show the cooking loss percentage in source I in the first day as  $19.87 \pm 0.81\%$ . This result was similar to that reported by Gadiyaram and Kannan (2004) as 19.88% and differs from that reported by Ali (2012) as 22.07%, Mahassin as 18.04% but higher than Mousab (2009) as 10.1%. In the second day, the cooking loss percentage was  $22.20 \pm 0.72\%$ , which was in line with that reported by Ali (2012) as 22.07% and higher than that reported by Gadiyaram and Kannan (2004) as 19.88%, Mahassin (2008) as 18.04% and Mousab (2009) as 10.1%. In the third day, the cooking loss percentage was  $20.4 \pm 1.28\%$ , which was similar to that reported by Gadiyaram and Kannan (2004) as 19.88%, Ali (2012) as 22.07%, Mahassin (2008) as 18.04% but higher than Mousab (2009) as 10.1%.

The result of cooking loss percentage of source II, which is presented in table II in the first day, was  $18.00 \pm 1.00\%$ , which was similar to that reported by Mahassin (2008) as 18.04% and Gadiyaram and Kannan (2004) as

19.88% , Ali (2012) as 22.07% but higher than Mousab (2009) as 10.1% whereas in second day it was  $21.00\pm 1.00$  which was nearly similar to that reported by Gaidyaram and Kannan (2004) as 19.88% , Ali (2012) as 22.07% , Mahassin (2008) as 18.04% but higher than Mousab (2009) as 10.1% in third day the cooking loss percentage was  $22.67\pm 1.53\%$  while was similar to that reported by Ali (2012) as 22.07% and higher tow that reported by Gadiyaram and Kannan (2004) as 19.88% , Mahassin (2008) as 18.04% and Mousab (2009) as 10.1%.

The result presented in table III show the cooking loss percentage of source III at first day was  $18.60\pm 1.05\%$  while was in line with that reported by Mahassin (2008) as 18.04% and to that reported by Gadiyaram and Kannan (2004) as 19.88% , Ali (2012) as 22.07% and whereas in second day was  $21.40\pm .80\%$  while was high than that reported by Gadiyaram and Kannan (2004) as 19.88% and Mahassin (2008) as 18.04%, but similar to Ali (2012) as 22.07%. In third day the cooking loss percentage was  $24.13\pm .81$  while was higher that reported by Gadiyaram and Kannan (2004) as 18.88%, Ali (2012) as 22.07%, Mahassin (2008) as 18.04% and Mousab (2009) as 10.1%.

The result presented in table IV show the cooking loss percentage in source IV. In first day the cooking loss percentage was  $41.00\pm 1.00\%$  was higher to that reported by Gadiyaram and Kannan (2004) as 19.88%,

Ali (2012) as 22.07% , Mahassin (2008) as 18.04% and Mousab (2009) as 10.1% whereas in second day was  $36.17 \pm 1.26\%$  was also higher to that reported by Gadiyaram and Kannan (2004) as 19.88% , Ali (2012) as 22.07% , Mahassin (2008) as 18.04% and Mousab (2009) as 10.1% the cooking loss percentage in third day was  $39.00 \pm 1.00\%$  was higher to that reported by Gadiyaram and Kannan (2004) as 19.88% , Ali (2012) as 22.07% , Mahassin (2008) as 18.04% and Mousab (2009) as 10.1%.



## **Conclusion and Recommendation**

### **Conclusion**

This results were concluded that the cooking loss percentage of the sample collected from the processing factories were very satisfactory while samples collected from butcher was too high.

### **Recommendation**

Studies should be continued regarding the cooking loss percentage of beef sausage from different sources.

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