

Organoleptic Evaluation of Irradiated Mutton Steaks and Sausage

H.A. EL-MANSY*, I.M. HASSAN**, A.G. EL-WARRAKI**, M.F. HUSSEIN**

* Faculty of Agriculture (Moshtohor), Zagazig University, Moshtohor, Egypt.

** Faculty of Agriculture, Ain-Shams University, Cairo Egypt.

In the field of irradiation preservation of meat, one of the most important points to be tackled is the loss of quality after long storage period. So, the organoleptic changes were studied in the irradiated mutton meat (200, 300 and 500 K rad), steaks and sausage, cold stored at $2^{\circ}\text{C} + 1^{\circ}\text{C}$. The statistical analysis for the organoleptic evaluation of 8 panels was found to be interest. After 15 days of storage the unirradiated samples failed significantly and became inedible, while the irradiated steaks and sausage remained edible. After 25, 35 and 45 days the irradiated samples with 200, 300 and 500 K rad respectively failed significantly and the samples were judged to be unacceptable.

INTRODUCTION

Preservation of food by irradiation is one of the truly peaceful uses of atomic energy. During the past 20 years, the possibility of using atomic radiation for this purpose has arisen great interest in many countries. Research of unprecedented magnitude of food irradiation has been conducted, with respect both to the technology of the process and to the wholesomeness of irradiated food for human consumption. As a result, it has been demonstrated that a number of applications of ionizing for the preservation or processing of food are already technically feasible, and that food so treated under specified conditions can safely be used as food for man.

By applying the radiation process, the storage life of some food stuffs may be extended considerably at both room temperature and under refrigeration, especially when it is properly packaged. The method is, therefore, well adapted to the present trend toward the distribution of packaged food stuffs and mechanization in the food industry.

Many investigators studied the effect of irradiation and cold storage on protein, postmortem lipid, water holding capacity and plasticity of meat and fish (Miyachi *et al.*, 1966; Soloviev, 1966; Krilova and Liskovskaia, 1968; Kamal *et al.*, 1970; Kosaric *et al.*, 1973 and Uchiyama and Uchiyama, 1979). In the present work, organoleptic properties of irradiated mutton steaks and sausages were evaluated.

MATERIALS AND METHODS

Materials;

This study has been carried out on mutton leg meat of about 20-24 months old. Sixteen mutton legs were obtained from the market at El-Azhar District in Cairo, 6 hours post slaughtering. The bones were removed and meat were cut into steaks about 70 gms each and of equal thickness of about 5 cm. The boneless mutton meat were divided into two groups, the first was simply packed as steaks and the second was solded to sausage after being minced.

Sausage processing:

Sausage was made by mincing a part of boneless mutton legs using an electric meat mincer having pores of about 4 mm in diameter. Additives usually used for mutton sausage in Egypt, i.e. salt and spices, were added to the minced meat in the following percentages: 1.5 % sodium chloride grade, table salt and 0.5 % powdered spice mix composed of: 40.7 % coriandum, 16.1 % chilli pepper, 12.9 % cinnamon, 9.7 % black pepper, 5.6 % cloves, 4.2 % cubeb, 2.4 % nutmeg, 2.4 % camfun, 2.4 % ginger, 1.6 % sesame seeds, 1.2 % curcuma and 0.8 % cardamon.

Sodium chloride and spices were mixed thoroughly with minced meat, the mixture was put in a filling machine for packing. The packing materials were natural mutton casings which were cleaned up and washed thoroughly various times and the outer fat tissues were removed. The sausage mixture was stuffed into the natural mutton casings and the sausage was arranged into pairs. One sausage was about 10 cm long x 1.5 cm diameter.

Packing and refrigeration:

A. The mutton steaks were packed in polyethylene bags of about 22 cm long x 16 cm wide, and the thickness was about 0.03 mm, 4 steaks of about 250 gms were packed in each polyethylene bag.

B. The simple sausages were packed in similar polyethylene bags mentioned before, 4 pairs in every polyethylene bag.

These bags of both mutton steaks and sausage were sealed by a hot iron bar, then put to cool in the refrigerator for 3 hrs at 2°C .

Irradiation process:

The packed meat and sausage were transported to the Middle Eastern Regional Radio Isotope Center for Arab Countries at Dokki "Giza" where the radiation treatments were applied 12 hrs after slaughtering, using a "NORATOM NORCONTROL" Cobalt 60 Gamma Cell Indoor Facility. Gamma irradiation was carried out at dose rate of 100 rad / sec. The applied radiation were at exposure levels of 0, 200, 300 and 500 K rad.

Cold storage:

All mutton steaks and sausage samples were stored in a refrigerator at $2^{\circ}\text{C} \pm 1^{\circ}\text{C}$, and the samples were periodically, at zero time and every 5 days period, drawn for organoleptic examinations.

The odor, Juiceness, color, overall quality and flavor after blanching were the main parameters considered herein for meat and sausage as the organoleptic properties. In order to evaluate the quality after cooking, mutton steaks samples untreated and treated with the tested levels of radiation, boiled in 1.5 % sodium chloride solution for 10 minutes and judged organoleptically. The sausage samples were treated similarly with one exception that the boiling was carried out in tap water. The composed complete incpmplete block design was applied as explained by Cornell and Schreckengost (1975). The panelists were asked to use numerical values from 1 to 10 to evaluate their acceptance to the tested treatments. The obtained data were subjected to analysis of variance and LSD values were calculated.

RESULTS AND DISCUSSION

Table(1) shows the average scores of the organoleptic properties of the mutton steaks and sausages unirradiated and irradiated with doses of 200, 300 and 500 Krad.

From this table it could be concluded that after 1 day of storage at 2°C there were significant differences between 0, 200, 300 and 500 Krad treated mutton samples. Sausage samples did not show significant differences between the irradiation treatments, while the untreated samples showed significant difference compared with the irradiated samples.

After 5 days storage under the conditions in this prevailing experiment there were no significant differences between the unirradiated and the irradiated samples. This means that some changes detected in the irradiated samples after the first day of storage disappeared after 5 days of storage and the untreated and irradiated samples could not be differentiated.

After 15 days of storage the central samples were significantly inedible, while the treated samples withstood this storage period and even after 20 days without significant differences due to the radiation level used, while after 25 days of storage, the samples which were treated by the 200 Krad level were significantly inedible.

After 30 days of storage there are no significant differences between the samples of mutton steaks or sausage irradiated with 300 Krad and with 500 Krad, while at the 35th day of storage under the same conditions, the 300 Krad were significantly unaccepted organoleptically in the mutton steaks samples. Although the LSD for the overall quality of the sausage samples treated with 300 and 500 Krad after 35 days of storage was 2.2 as seen from table (1), but the 300 Krad treated samples were considered unsuitable for human consumption when compared with 500 Krad treated ones.

After 40 days of storage the 500 Krad treated samples were still acceptable organoleptically with average scores of 5.2 and 5.4 for overall quality of sausage and mutton steaks respectively.

This means that to prolong the storage period of mutton steaks and sausage to about 40 days, applying radiation dose of 500 Krad revealed suitable in combination with the storage at 2°C , while the unirradiated could not withstand more than 10 days under the same storage conditions. The irradiation dose of 300 Krad was suitable for extending the storage period of mutton steaks, and sausage to a period of not more than 30 days. On the otherhand the irradiation dose of 200 Krad extended the storage period to about 20 days at the cold storage conditions ascribed herein.

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Table 1: Average scores of organoleptic properties of mutton steaks and sausage irradiated with different doses of gamma rays and stored at 2°C.

Storage period (days)	Organoleptic properties	Radiation level (K.rad) of mutton steaks					Radiation level (K.rad) of mutton sausage				
		0	200	300	500	L.S.D.	0	200	300	500	L.S.D.
1	Odor	9.3	8.9	7.6	7.3	0.7	8.7	7.9	6.8	6.9	2.7
	Juiciness	8.9	8.6	7.3	7.7	0.7	8.9	8.1	8.2	7.2	0.8
	Color	9.1	8.4	6.5	5.9	1.1	8.9	7.6	7.8	7.0	0.9
	Over all quality	8.9	8.6	6.8	6.8	0.9	9.1	7.9	8.0	7.9	0.8
	Flavor after blanching	8.3	8.4	6.3	6.8	0.7	8.6	7.4	7.7	7.5	0.6
5	Odor	8.2	7.8	8.3	8.1	0.8	8.3	8.2	8.4	8.4	0.6
	Juiciness	7.6	8.0	7.6	8.0	1.0	8.2	8.0	7.8	8.3	0.5
	Color	7.3	7.7	7.9	7.6	1.0	8.3	7.5	8.0	7.6	0.8
	Over all quality	7.3	7.7	8.1	7.6	0.8	8.1	7.7	8.2	8.0	0.7
	Flavor after blanching	8.0	8.3	7.8	7.6	0.7	8.1	7.8	7.9	7.9	0.7
10	Odor	7.8	7.9	7.6	7.6	0.6	6.1	7.6	7.9	7.8	0.8
	Juiciness	7.1	7.6	7.1	6.9	0.8	6.9	7.8	7.5	7.6	0.5
	Color	7.0	7.6	7.1	6.6	1.0	6.3	7.7	7.6	6.6	0.6
	Over all quality	7.5	7.6	7.4	6.8	0.8	6.4	7.6	7.8	7.9	0.8
	Flavor after blanching	7.6	7.6	7.4	6.8	0.8	6.8	7.8	7.6	7.9	0.7
15	Odor	4.1	7.0	7.2	6.9	0.9	2.7	7.4	7.4	7.4	1.2
	Juiciness	4.5	7.4	7.4	6.0	0.7	5.3	7.3	7.4	7.4	1.2
	Color	4.1	7.1	7.2	6.4	0.9	3.8	6.9	7.0	6.4	1.2
	Over all quality	3.8	7.9	8.1	6.9	0.9	4.0	7.5	7.3	7.4	1.8
	Flavor after blanching	6.1	6.6	6.4	5.5	1.1	5.1	7.4	7.3	7.2	1.6
20	Odor	7.8	7.1	7.6	0.6		7.6	7.6	6.8	0.8	
	Juiciness	6.5	6.5	5.9	1.4		7.6	7.1	6.6	1.0	
	Color	6.4	6.5	6.2	1.0		7.0	7.1	6.2	0.9	
	Over all quality	6.4	7.2	6.6	0.7		6.9	7.0	6.7	0.7	
	Flavor after blanching	7.8	7.1	7.6	0.6		7.4	7.0	5.9	1.5	

Table 1: (Continued)

Storage Period (days)	Organoleptic Properties	Radiation level (K.rad) of mutton steaks					Radiation level (K.rad) of mutton sausage				
		0	200	300	500	L.S.D.	0	200	300	500	L.S.D.
25	Odor	3.8	7.1	6.7	2.0		4.3	6.3	6.3	2.1	
	Juiciness	3.8	7.7	7.1	1.4		4.4	6.3	5.9	0.8	
	Color	3.3	7.7	7.0	1.7		4.4	6.1	5.7	0.6	
	Over all quality	2.3	7.7	7.0	1.6		4.4	6.7	6.1	1.7	
	Flavor after blanching	3.8	7.1	6.7	2.0		3.8	5.4	6.4	0.8	
30	Odor		5.0	6.1	0.8		6.4	5.1	1.0		
	Juiciness		4.8	6.8	0.8		5.6	5.3	0.5		
	Color		4.9	5.9	0.8		5.8	5.6	0.9		
	Over all quality		4.8	6.4	1.2		5.7	5.6	0.9		
	Flavor after blanching		5.0	6.1	0.8		5.9	6.1	0.4		
35	Odor		3.4	6.0	1.1		2.7	4.8	2.5		
	Juiciness		2.0	5.6	2.4		3.3	5.9	2.7		
	Color		1.8	5.3	1.4		2.9	4.4	1.5		
	Over all quality		2.4	5.9	1.2		3.7	5.7	2.2		
	Flavor after blanching		3.7	6.0	1.0		2.5	5.4	3.0		
40	Odor			3.0				2.2			
	Juiciness			5.2				4.5			
	Color			3.8				3.6			
	Over all quality			3.2				5.2			
	Flavor after blanching			4.8				3.7			