

Ripening of Dry Fermented Sausage Without Controlling Temperature and Relative Humidity

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SUMMARY : In view of the hot climate in Egypt, sausage industry, should not only produce the fresh highly perishable sausage preserved by freezing, but also should be directed, at least to some extent, to processing the fermented dry-sausage, which survive much better the storage without cooling facilities. To save electricity and facilitate production process, a fermented sausage was ripened under ambient conditions, without controlling temperature or relative humidity which is done for fermented produced by traditional methods. Two treatments were investigated, i.e. the smoked Dry Fermented sausages and smoked then coated sausage with a layer of pastirma species paste. It seems that ripening was associated with the decrease of moisture, pH, No_2 , No_3 and total No_2 , and the increase of No_3/No_2 ratio, NaCl, colour intensity, lactic acid, acetic and total lactic acid. The changes of acids contents and eating qualities are more important. Such changes were more rapid for coated than the control (uncoated) samples, indicating that coating enhanced the ripening process. Finally, ripening of Dry Fermented (no pigs meat or fat were added) could be easily achieved without controlling temperature or relative humidity.

INTRODUCTION : As for sausage, it is known that fresh sausage is the major, nearly sole type of sausage produced commercially in Egypt. Nevertheless a wide variety of sausages are distributed in markets of foreign countries, particularly the fermented products such as semi-dry and dry sausages (Pederson, 1980). Salami is a more famous dry sausage belonging to fermented types in the foreign countries. Dry sausage, might be of more value from economical view's point. This because fresh sausage is preserved by freezing in Egypt which needs, cooling facilities and electricity consumption. On the other hand, some types of dry sausages could be stored at room temperature. This is of great importance for Egypt which is of relatively hot climate. Unfortunately, all known salami formulas contain pigs fat which is forbidden for Moslems. This needs for research work to develop a salami recipe which depends on using beef. The dried sausages are the "ne plus ultra" of the industry; dry sausage maker is truly an artist (Kramlich *et al.* 1975).

Fermented sausages probably originated in the Mediterranean. The Romans knew that ground meat with added salt, sugar and spices turns into a palatable product with a long shelf-life if prepared and ripened properly. Probably the normal winter climate in the Mediterranean Countries with its moderate temperatures and frequent rainfall is favourable for sausage ripening (Pederson 1980). According to Eakes *et al.* (1975) the country-style hames were produced with and without nitrate and nitrite by dry curing method. Moisture decreased while salt and fat increased over processing time, but treatment effects were similar. Nitrite was depleted after 30 days at 4°C and nitrate gradually decreased with days in storage. Mikhailova *et al.* (1986) reported that raw

Smoked sausage were prepared without starters, or with the addition of various starters (with and without milk protein). Moisture, protein and fat contents, pH, sensory quality were discussed. Sensory quality was little affected by added starters or starter plus milk protein. The microflora of fresh meat, stored aerobically under refrigeration, largely consists of Gram-negative, oxidase positive rods, particularly psychrotrophic pseudomonads (Mc Meekin, 1982). Psychrotrophic enterobacteriaceae are also present, while Gram-positive organisms including lactic acid bacteria usually occur only in small numbers. If the meat is processed into raw sausage mixture, the water activity is reduced to 0.96 - 0.97, and the oxygen present within the mixture is rapidly consumed. Thus, the pseudomonas, which require oxygen and are usually sensitive to salt and nitrite (Mechelmann *et al.*, 1977) are inactivated.

This work was conducted to study the possibility of ripening of dry fermented sausage under uncontrolled conditions, i.e. at ambient temperature and relative humidity of room and acceleration the ripening process by addition of a coat made of pastirma spices.

MATERIALS AND METHODS : This part of study was carried out at Ismailia company for Automatized slaughter (Meatland). Imported frozen beef (Sudfleisch company product, Munsch, F.R.G.) of the shoulder cut (Grade II) was obtained. The meat (of -18°C temperature) was cut by an electrical saw, thawed for 24 hrs at -1°C in a refrigerator and deboned. The formula of dry fermented sausage (from Beef) was composed of the following ingredients :

Lean beef meat	90%
Beef fat tissues	10%
Curing agents (% of the meat + fat weight) :	
Nitrite curing salt (finely powdered 0.4% NaNO_2 + 99.6% NaCl)	2.6%
Lactose	0.7%
Dextrose	0.3%
Ascorbic acid	0.05%
Red paprika	0.20%
Monosodium glutamate	0.10%

Preparation : The meat was cut into pieces about egg-size and frozen at -18°C for 12 hrs. The fat tissues prepared similarly (as the meat), then before cutting the fat was ground through a 3 mm-plate grinder and frozen at -18°C . The first step of beef meat cutting was to comminute frozen meat to particles of about rice-corn size. Then pepper and sugars added and mixed until a homogeneous emulsion was reached. After cutter, the sausage mix was stuffed in artificial casing diameter 80 mm using an automatic sausage stuffer. Control (smoked) sample received an additional seasoning with 0.05% garlic powder and 0.2% paprika per kg sausage mixture. Immediately after stuffing all sausages were dipped in a solution of 20% potassium sorbate and dried at room temperature.

Treatments :

- Control sausage : stuffed samples (after 10% weight loss due to 6 days at 21.9°C and RH 77.8) were smoked 3 times (in three days) for 20 minutes each at 20°C .
- After stuffing sausages were coated with a paste (pastirma spices mixed with water, 130 gm/kg)

of the following composition :

- 30 gm finely ground fennegreek.
- 10 gm finely ground garlic .
- 20 gm paprika .
- 10 gm wheat flour .
- 50 gm water .
- 10 gm salt .

Ripening carried out at ambient (room) temperature and humidity (average 21.9°C, 77.8% RH).
Recipe and processing procedures were according to (Hack *et al.*, 1976).

Analytical methods : The moisture content was determined using methods described by Amtlich Sammlung Von Untersuchungs Verfahren (1980) . Sodium chloride was determined according to the method of Mohr as given by Christen (1976) . Lactic acid was determined according to the method (1972) while for nitrate as well as nitrite, the methods of the Egyptian Standard (1970) were followed . The colour (amount of total curing pigments) was measured using method given by Mohler (1966). Sensory evaluation was carried out by using a descriptive and scoring test . It was a modified five point rating scale (Jellinek, 1981), where outward appearance, colour, consistency as well as taste and odour were evaluated together. Scores multiplied with a factor depending on the importance of the testing characteristic and reached scores summed up; the maximal reachable scores were 50 .

RESULTS AND DISCUSSION :

1. Composition of raw sausage mix :

It could be observed (Table 1) that raw sausage mix had high moisture content (68.54%) and low NaCl (1.88%), pH value was 5.33. Moreover lactic and acetic acids contents were relatively low (5.53 and 0.93 gm/kg respectively). Although in the curing agent (sodium chloride + nitrite) + nitrate (NO_3) was added, the latter compound was found (KNO_3 30.05 ppm) showing that the salt contained nitrate as admixture. Nitrite (NO_2 as NaNO_2) and total nitrite ($\text{NO}_2 + \text{NO}_3$ as NaNO_2) were 92.48 and 112.99 respectively.

2. Chemical and organoleptic changes during ripening :

It could be observed that (Tables 2 & 3) the additional coat seems to absorb some water from sausages which showed more decrease of moisture after two weeks of ripening; this increased the NaCl content in meat. The weight loss indirectly related to the moisture loss, because the water migrated from meat seems to be rapid (at least partially) in the coat. Moreover, the highest pH value was recorded after 21 days for the uncoated sample (control). Therefore, while the smoke components known to be lethal for microorganisms might, retard the activity of natural lactic acid bacterial flora which when acting on carbohydrates during ripening of this fermented sausage produce acids and decrease the pH value. Besides, the coat favoured the action of mentioned bacteria (possibly due to its carbohydrate content). In general coated sausage had higher lactic acid, acetic acid and total acids, when compared with the uncoated sample .

Results given in Tables (2 & 3) show also NO_2 , NO_3 and total NO_2 content in sausages during

ripening for 15, 21 days. At any given time of ripening highest total nitrite was recorded for the control sample lowest for coated sausage prepared with pastirma spices. NO_3 , NO_2 seems to reflect the ripening speed, as it was 0.33, 2.90 and 3.03 for raw mix, control and coated sausage respectively. Also highest NO_2 and NO_3 were found for the control sample indicating more rapid consumption of total nitrite in coated sample. Nevertheless at the end of ripening total nitrite of all sausages was markedly less than the allowance, which is 125 ppm (as given by Egyptian Standards, 1970) and FGR Standards (Leistner, 1981). as it is known, nitrite might be toxic when its level was high in sausages.

For control and coated samples after 21 days of ripening the colour, lactic acid and acetic acid contents were markedly higher while pH and nitrite lower than for the raw mix. at the end of ripening, best organoleptic scores were higher for treatment b, coated with pastirma spices (48.00) followed by control samples (39.00) .

It could be observed (Table 4) that coating with pastirma like spices gave a salami-like sausage of better eating qualities than the control sausages.

Finally, by using additional coat of pastirma spices, it seems that ripening of dry fermented sausage might be accelerate without controlling the temperature and relative humidity. Ripening it was achieved at ambient temperature and relative humidity available in Egypt .

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Table (1) : Analysis of raw sausage mix before stuffing .

Compounds	Values
Moisture content %	68.54
Sodium chloride %	1.88
pH value	5.65
No ₂ ppm as NaNO ₂	92.48
No ₃ ppm as KNO ₃	30.05
Total No ₂ as NaNO ₂	112.99
No ₃ /No ₂	0.33
Lactic acid gm/kg.	5.53
Acetic acid gm/kg.	0.93

Table (2): Changes of dry fermented sausage during natural ripening for 15 days.

Samples	pH Value	Moisture %	No ₂ ppm as NaNO ₂	No ₃ ppm as KNO ₃	Total No ₂ ppm as NaNO ₂	No ₃ /No ₂ ratio	NaCl %	Colour pigment -X	Lactic acid	Acetic acid	Total lactic acid	Losses of weight %
a	5.46	55.08	6.42	18.61	19.12	2.90	4.42	42.44	8.45	4.09	12.54	47.08
b	5.43	51.98	5.41	16.37	16.58	3.03	4.63	48.20	11.05	5.73	16.78	40.98

Treatments :

- (a) Smoked sausage, uncoated .
 (b) Smoked sausage and coated with pastirma spices .

Table (3) : Analysis of dry fermented sausage after 21 days of ripening .

Samples	pH value	Moisture %	No ₂ ppm as NaNO ₂	No ₃ ppm as KNO ₃	Total No ₂ ppm as NaNO ₂	No ₃ /No ₂ ratio	NaCl %	Colour pigments -X	Lactic acid gm/kg	Acetic acid gm/kg	Total lactic acids gm/kg	Losses of weight %	Organoleptic evaluation
a	5.32	30.87	5.31	18.91	18.22	3.56	5.87	46.34	12.20	5.10	17.30	45.00	39.00
b	5.18	34.52	4.11	11.66	12.07	2.84	5.30	66.20	15.38	6.28	21.66	38.40	48.00

Treatments :

- (a) Smoked sausage , uncoated .
 (b) Smoked sausage and coated with pastirma spices .

Table (4) : Description of eating characteristics of dry fermented sausages .

Samples Factors	Coated sausage	Control sausage
Appearance	Outer layer coat, very firm, of homogenous colour and fine grains No mold growth on the coat surface	No mold growth on sausage casing . Appearance normal
Texture	Dry solid, surface of sliced in dry Outer dry ring of each slice not more than 0.5 cm.	Very dry, very solid. Outer dry ring of slices is large and usually more than 0.5 cm
Flavoure	Aroma and taste are excellent, special and very desirable. Flavour is much better than for the control samples .	Flavour normal, relatively characteristic for salami but less desirable than for coated sausage .