

## EFFECT OF FREEZING AND MINCING TECHNIQUE ON MICROBIAL LOAD OF MINCED MEAT

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### Abstract

This experiment was carried out to explain the variation between the use of either fresh or frozen meat cuts in manufacturing minced meat; this besides the role of mincer and the hygienic condition of handler's as well as the temperature under which the raw material and product was handled.

The achieved results indicated that the minced meat manufactured from fresh meat has low microbial load as compared with that produced from frozen one. However, mincing at butchers shops may expose the meat to many sources of contamination than that minced at home (Self made mincing). The handling of raw meat either fresh or frozen in butchers shops exposed the produced minced meat to high numbers of either spoilage or food poisoning microorganisms. The sources of contamination of produced minced meat were discussed.

### INTRODUCTION

The minced meat as a food article is widespread in different pictures, and reaches to consumers from different sources as well as in meat products. Use of beef carcasses in mincing before freezing could have several advantages as well as more safe to consumers. Consequently, different standard specifications and regulations have been imposed in advanced countries to control the production and handling of minced meat (Carl 1975, Elliott and Michener 1961, Foster *et al.* 1977, ICMSF 1978, Pivnick *et al.* 1976 and Roberts *et al.* 1980). The degree of initial contami-

nation differs practically in every case and is naturally most pronounced if the handling and preservation of the meat is not hygienic. The microbiological quality of market minced pastes was discussed (Darwish *et al.* 1986, Duttschaever *et al.* 1973 and 1977, Elmossalami and Roushdy 1973, Goepfert 1976, ICMSF 1978, Roberts *et al.* 1990 and Roushdy *et al.* 1979). In this concern, Enswiler and Kotula (1979) stated that bacterial counts in ground beef from hot-boned beef were either significantly lower or not significantly different from bacterial counts in ground beef from cold-boned carcasses. The behaviour of food-borne pathogens in experimentally inoculated ground beef packed in a cold room at 2°C were studied (Goepfert and Kim 1975).

The present study was undertaken to evaluate the microbiol load of minced meat produced from fresh and frozen meat in butchers shops and home.

## MATERIALS AND METHODS

### Sampling:

Ten raw red meat samples (each sample 1000 grams) were collected from freshly slaughtered cattle from different butchers shops at Giza City. Each sample was divided into two equal parts where the first part was frozen at -5°C for 10 days, while the second was divided into two equal parts as soon as possible. The first part was minced in a butcher's shop, and the other was self minced at home. The frozen part was divided into two parts and minced as previously mentioned in fresh one.

### Preparation of samples:

Ten grams of each sample were homogenized in 90ml of 0.1% peptone water using an electric blender under sterile conditions. Ten-fold serial dilutions upto  $10^{-6}$  were prepared from the original dilution (ICMSF 1978).

### Bacteriological examination:

1. Aerobic plate count (APC): The drop plate method recommended by ICMSF (1978) was used. Inoculated plates were incubated for 3 days at 25°C for enumeration of

mesophilic count and for 10 days at 0°C for enumeration of psychrophilic count .

2. Enterobacteriaceae count : The technique recommended by ICMSF ( 1978) was applied by using Violet REd Bile Glucose Agar ( VRBG agar) . Inoculated plates were incubated at 37°C for 24h. Representative colonies were isolated and tested for Gram reaction. The isolates were identified biochemically according to the technique recommended by Finegold and Martin ( 1982).
3. Staphyloocci count : Plates of Baird Parker's Agar were inoculated and incubated at 37°C for 24h. Suspected colonies were subjected to Gram reaction. Isolates were typed according to the technique recommended by ICMSF (1978).
4. Isolation of Salmonellae : The procedure included using buffered peptone water pre - enrichment (24h at 37°C), selective enrichment in modified Rappaport Vassalidis broth (24h at 37°C) followed by streaking on xylose - lactose-desoxycholate agar (24h at 37°C). Suspected colony was identified biochemically and serologically according to Finegold and Martin ( 1982) and Kauffmann (1974).
5. Isolation of *Yersinia enterocolitica* : Ten grams of mince were added to 90ml Rappaport Vassalidis broth , and then incubated at 25°C for 48 h. A loopful of enriched broth was streaked on surface of *Yersinia* selective base with supplement, and then incubated at 22°C for 24h. Suspected colonies were identified biochemically by the method of Bercovier and Mollaret ( 1984).

## RESULTS AND DISCUSSION

From the results achieved in Table 1, it can be concluded that the average aerobic plate counts per gram at 25°C and 0°C in self made minced fresh meat at home were  $8 \times 10^4$  and  $6 \times 10^2$  organisms, respectively, while such counts were increased to  $10^6$  and  $10^3$  organisms per gram if the meat was minced at butcher's shop . After freezing of fresh meat, such counts were increased in produced minced meat, reaching  $6 \times 10^5$  at 25°C and  $8 \times 10^3$  at 0°C in self made mincing, while, reaching its maximum  $5 \times 10^6$  at 25°C and  $2 \times 10^4$  at 0°C organisms per gram in mincing at butcher's shop. The aerobic plate counts of examined samples, either fresh or frozen did not exceed the standard for APC set by Carl (1975) , Pivnick *et*





*al.* (1976). and International Commission on Microbiological Specification for Foods (1986). Higher figures of Psychrotrophic count were reported by Duttschaever *et al.* (1973) and Goepfert and Kim (1975).

The average counts of Enterobacteriaceae were  $10^3$  and  $2 \times 10^4$  organisms per gram minced meat either self made minced or minced at butcher's shop, while such counts were increased in frozen meat to  $4 \times 10^4$  and  $8 \times 10^4$  organisms per gram, respectively. High figures of Enterobacteriaceae count were obtained than those recorded by Mercuri and Cox (1979) and Roberts *et al.* (1980).

Staphylococci counts of fresh raw meat minced either at home or in butcher's shop were  $4 \times 10^2$  and  $10^3$  organisms per gram, while in frozen samples they were  $10^3$  and  $8 \times 10^3$  organisms per gram, respectively. Such counts were higher than those reported by Surkiewicz *et al.* (1975) and Pivnick *et al.* (1976), while high figures were recorded by Sorkari and Anozie (1990).

From Table 2, none of examined self made minced meat freshly prepared exceeded  $10^6$  organisms/gram, while in butcher's shop mincing, the frequency reached 20%. After freezing, 50% and 80% of samples minced either at home or in butcher's shop exceeded  $10^6$  organisms per gram respectively.

Table 2. Frequency distribution of examined samples according to their APC/gram.

	Fresh minced meat				Frozen minced meat			
	Self minced meat		Butcher's shops		Self minced meat		Butcher's shops	
	No.	%	No.	%	No.	%	No.	%
$> 10^2$	10	100						
$> 10^3$	6	60	10	100				
$> 10^4$	4	40	9	90	10	100		
$> 10^5$	1	10	5	50	7	70	10	100
$> 10^6$			3	30	5	50	8	80
$> 10^7$			2	20			4	40

The minced meat is usually exposed for sale in bulk in butcher's shops or in a small amount minced at home as well as exposed for sale ready packed (frozen). The condition of meat either fresh or frozen used in mincing is partly reflecting the bacteriological status of minced meat produced. The problem may arise if the meat was minced under unhygienic conditions and stored under inadequate temperature or cooked in insufficient temperature before consumption.

Generally, it seems that deep tissue from animals slaughtered under normal hygienic conditions is usually sterile (Gills 1979). Thereby, the bacterial load in meat generally results from growth of bacteria on the surface of meat only. However, during mincing, bacterial contamination present on the surface of meat is distributed throughout the entire product, and an ideal condition for their multiplication may be created.

Therefore, the bacterial flora present in ground meat is dependent upon the microbial quality of meat used for mincing and on sanitary conditions during preparation. This agrees with the view reported by Rogers and Mc. Cleskey (1957), Duttschaeffer *et al.* (1972) and Ghoshal (1992).

High bacterial counts of meat minced in butchers shops as compared to self made minced meat at home may be attributed to excessive unhygienic handling of meat before and after mincing. In this respect, Guthrie (1988) stated that skin of humans is an excellent site for the growth of bacteria. As well, secretions on the skin and body provide the necessary nutrients and temperature for growth of bacteria. Moreover, utensils and equipment used in mincing at butchers shops, as well as the used mincer machine may increase the additional bacteria.

The bacterial counts in minced meat produced from fresh meat were lower than those produced from frozen meat. This may be attributed to the effect of temperature during which frozen meat was handled and transported to butcher's shops for mincing. In addition, the extraction of meat juice is a good medium for bacterial multiplication. It could be concluded that minced meat prepared from fresh meat has low bacterial count and good keeping quality as compared with minced meat produced from frozen meat. Also, mincing in butchers shops increases the bacterial content of prepared minced meat.



Table 3 indicates the isolated microorganisms from minced meat prepared from either fresh or frozen at home as follows: *Escherichia coli*, *Citrobacter freundii*, *Klebsiella pneumoniae* and *Proteus vulgaris*. In butcher mincing of fresh meat the samples were contaminated with *Yersinia enterocolitica* and *Staphylococcus aureus*. During mincing of frozen meat at butcher's shop, it was noticed that the isolated microorganisms recorded the highest frequency in examined samples in addition to isolation of *Proteus mirabilis*.

The presence of *Staphylococci aureus* in minced meat prepared at butcher's shop may be attributed to the excessive hand contact with meat which occurs in traditional markets in butcher's shops, as well as during mincing. Such view has been reported by Sorkari and Anozie (1990).

Increasing in frequency of *Escherichia coli* during butcher's mincing may be attributed to the survival of the organism on finger-tips for various periods of time. In this respect, Pether and Gilbert (1971) isolated *Escherichia* from the finger-tips of 13 out of 110 butchers at a meat factory soon after they had left the meat line.

Table 3. Incidence of isolated microorganisms.

Isolates	Fresh minced meat				Frozen minced meat			
	Self minced meat		Butcher's shops		Self minced meat		Butcher's shops	
	No.	%	No.	%	No.	%	No.	%
<i>Escherichia coli</i>	2	20	4	40	2	20	5	50
<i>Citrobacter freundii</i>	1	10	2	20	1	10	3	30
<i>Klebsiella pneumoniae</i>	1	10	2	20	2	20	2	20
<i>Proteus vulgaris</i>	1	10	1	10	1	10	4	40
<i>Proteus mirabilis</i>	-	-	-	-	-	-	2	20
<i>Staphylococcus aureus</i>	-	-	2	20	-	-	4	40
<i>Yersinia enterocolitica</i>	-	-	1	10	-	-	1	10

Therefore, it could be concluded that, the mincing technique in butcher's shop increased the contamination rate of produced minced meat with spoiling and food poisoning microorganisms. Any minced meat to be used for preparation of meat products ( sausage, beef burger.. etc.) should be used quickly after mincing.

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## تأثير التجميد وطريقه الفرغ علي الحمل الميكروبي للحم المفري

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تناولت التجربه الاختلاف الناتج من استخدام كل من اللحوم الطازجة او المجمده في تصنيع اللحم المفري . وهذا بالاضافه الي دور آله الفرغ والحاله الصحيه لمتناولي تلك اللحوم والحرارة التي يتناول فيها اللحم قبل وبعد تصنيعها.

أظهرت النتائج أن الحمل الميكروبي اقل في اللحم المفري المصنوع من اللحوم الطازجة عن تلك المصنوعه من اللحم المجمدة.

تتعرض اللحوم المفرومه في محلات الجزارة الي مصادر كثيره من التلوث عن اللحوم المفرومه في المنزل، ذلك أن تناول اللحوم طازجة أو مجمدة في محال الجزاره يعرض اللحم المفروم المنتج الي اعداد عاليه من الميكروبات المسببه للتسمم الغذائي او الفساد. هذا وقد ذكرت مصادر التلوث التي يتعرض لها اللحم المفروم المنتج.