

## Influence of best thawing method to reduce microbial load in red meats

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### Summary

The current study was carried out at the college of veterinary medicine, University of Baghdad, for three months. The main objective of this study was to evaluate the effect of different thawing method of frozen minced red meat to reduce its bacterial load. Four thawing methods were used where the tap water at 18 °C for two hours was used in the first method, while the hot water at 40 °C for 1.5 hours was used in the second method and in the third method the frozen minced meat samples were left at room temperature (28 °C) for two hours, where as in the fourth method the frozen meat samples were stored inside the refrigerator at 4 °C for 20 hours. Data revealed that there were significant differences ( $P < 0.05$ ) in the mean values of total aerobic bacterial counts between the tap water, room temperature and the refrigeration thawing methods and were lower than the standard limits recorded by ICOSQ and were ranged between 4.84 to 6.0 log cfu/gm of meat. On the other hand these data revealed that thawing in hot water had non significantly ( $P > 0.05$ ) the highest counts of total aerobic bacterial counts in comparison to the other mentioned three thawing methods and were ranged from (6.04–7.9) log cfu/gm of meat, which were higher than the standard limits recorded by ICOSQC. In conclusion on the basis of this investigation, it is pointed out that thawing of frozen minced red meat inside the refrigerator for overnight was the best and suitable to get meat with stable microbiological quality.

**Keywords:** Meat, Thawing, Microorganism.

### Introduction

The red meat and meat products are highly perishable foods and subjected to spoilage speedily, therefore must be stored in the refrigerator to increase their keeping quality and protect it from any spoilage (1). One of the commonly used storage methods was cooling at 4 °C inside the refrigerator for short time storage (up to three days), but freezing at -18°C was one of the best choice for long time storage (2). Technical thawing for frozen meats is important and necessary because the meat products are not advantageous if still frozen. During thawing the frozen minced red meat are damaged by chemical, physical, and microbiological changes through numerous factors such as long period of thawing, and both the temperature and relative air humidity (3-5). Meat quality changes are happening at thawing for long times because the dripping losses from the muscle fibers were found to have lower in juiciness (6), and then microbial attack started leading to higher microbial load compared with that recorded by the Iraqi tender (7). Various thawing methods were used such as at room temperature, tap water, hot water and inside the refrigerator (8-10). The mean values of logarithmic total bacterial

counts were different between the thawing methods, where by using hot water was 4.59 cfu/gr, and by using tap water was 4.53 cfu/gr while thawing inside the refrigerator for overnight was good to reduce the total microbial count to 4.49 cfu/gr (11). Other researchers concluded that the best thawing method was the refrigerator method, which reduced the mean value to  $2.6 \times 10^5$  cfu /gr (5.415 log cfu/g) compared to the room temperature method with the mean value of  $4.1 \times 10^5$  cfu/gr (5.162 log cfu/g). While (12) reported that thawing in the refrigerator reduced the mean value of bacterial counts to 3.55 log cfu/gr which was more than that in tap water (4.10 log cfu/gr) and room temperature 4.62 log cfu/gr. The main aim of the current study was to evaluate the influence of the best thawing method to reduce of microbial load in the frozen minced red meat.

### Materials and Methods

Fifty six frozen minced red meat samples were collected from different butchers, and supermarkets inside Baghdad city. All meat samples were stored inside the deep freezer at (18-)°C in the laboratory of the department of Veterinary public health, before or until

starting the bacteriological tests of thawing meat: Four methods for frozen meat thawing were used where the tap water was used in the first method while the hot water at 40 °C for 1.5 hour was used in the second method and in the third method the frozen meat samples were left at room temperature (37 °C) for 2 hours were as in the fourth method the frozen meat samples were stored inside the refrigerator (4°C) for 20 hours.

Sample dilution and plating: Ten grams of red minced meat were extracted aseptically and added to 90ml of buffered peptone water (0.1% wt/v) and homogenized for 5 minutes in a stomacher, then 1ml sample was taken and serially tenfold diluted to 10<sup>-6</sup> in a sterile 0.1% buffered peptone water (wt/v) and plated in duplicates by pour plating method using a sterile nutrient agar and then incubated aerobically at 37 °C for 48hours before enumeration. Each experimental condition was conducted for five replications. The data were analyzed by using SAS program (13) and the design used was completely randomized design (CRD). The significance difference (P<0.05) between groups was verified by the Duncan multiple range test.

### Results and Discussion

The means values of logarithmic total aerobic bacterial counts for the frozen minced red meat samples after thawing in both the tap water and the room temperature are shown in (Table, 1). The mean values of total aerobic bacterial counts were ranged from 4.84cfu/g meat to 6.0 log cfu/g meat. Data revealed that there was a significant (P<0.05) difference in the average bacterial counts between the tap water and the room temperature thawing methods. This investigation pointed out that the mean values of total aerobic bacterial counts were lower than the standard limits recorded by ICOSQC (7). The mean values of logarithmic total aerobic bacterial counts in frozen minced red meat samples after thawing inside the refrigerator at 4 °C are shown in (Table, 2). The mean values of total aerobic bacterial counts were ranged from 4.90 to 5.94 log cfu/g of meat. Data revealed that there was a significant differences (P<0.05) in the average bacterial counts between the samples. This investigation pointed out that the mean

values of total aerobic bacterial counts were lower than the standard limits recorded by ICOSQC (7) and similar to the counts that obtained by the tap water and room temperature thawing methods.

**Table, 1: The mean values of total bacterial count in minced meat samples after thawing in tap water and room temperature.**

Number of samples (frequency)	Thawing in tap water (cool) Log Cfug meat	Thawing in room temperature (40°C) Log Cfug meat
1 (4)	5.69 ±0.13 b	5.69 ±0.13 b
2 (4)	6.0 ±0.2 b	5.17 ±0.01 c
3 (4)	5.75 ±0.1 b	5.72 ±0.11 b
4 (4)	5.85 ±0.06 b	5.74 ±0.02 b
5 (4)	5.94 ±0.08 b	5.89 ±0.05 bc
6 (4)	5.95 ±0.12 a	5.07 ±0.03 b
7 (4)	5.65 ±0.06 b	5.78 ±0.05 ab
8 (4)	5.04 ±0.02 b	4.84 ±0.07 c
9 (4)	5.20 ±0.06 c	5.74 ±0.1 b
10 (4)	5.39 ±0.05 b	5.56 ±0.06 b
11 (4)	5.77 ±0.1 c	5.91 ±0.1 a
12 (4)	5.25 ±0.08 c	5.23 ±0.03 c
13 (4)	5.81 ±0.08 b	5.11 ±0.08 c
14 (4)	5.11 ±0.08 c	5.90 ±0.04 a
Significant	P<0.05	P<0.05

The mean values of logarithmic total aerobic bacterial counts in frozen minced red meat samples after thawing in hot water were shown in (Table, 3). The mean values of total aerobic bacterial counts were ranged from 6.04 to 7.9 log cfu/g of meat. Data revealed that there was non-significant differences (P>0.05) in the average bacterial counts between the samples that thawed in hot water, but the mean values of total aerobic bacterial counts were higher than the standard limits ICOSQC (7). Data revealed that the thawing in hot water had significantly (P>0.05) the highest count of total aerobic bacteria in comparison to the other three thawing methods mentioned above (tap water, room temperature and refrigerator). An overall conclusion on the basis of this investigation pointed out that thawing in hot water was not a good method to reduce the bacterial counts in the frozen minced meat (14 and 15). The mean values of total aerobic bacterial counts that mentioned in (Table, 1, 2 and 3) were similar to the results obtained by the other researchers for thawing the frozen

minced red meat (9-12). Thawing of frozen minced red meat inside the refrigerator for 20 hours was the best method although the mean values of total aerobic bacterial counts were similar to both the tap water and the room temperature thawing methods (16-18).

**Table, 2: The mean values of total bacterial count in minced meat samples after thawing at refrigeration temp. 4C°.**

Number of samples (Frequency)	Thawing in refrigerator (40 °C) Log Cfug meat
1 (4)	5.71 ±0.12 b
2 (4)	5.81 ±0.08 b
3 (4)	5.66 ±0.04 b
4 (4)	5.88 ±0.05 b
5 (4)	5.74 ±0.02 c
6 (4)	5.20 ±0.12 b
7 (4)	5.81 ±0.08 ab
8 (4)	4.90 ±0.04 c
9 (4)	5.36 ±0.06 c
10 (4)	5.54 ±0.07 b
11 (4)	5.86 ±0.02 b
12 (4)	5.94 ±0.02 a
13 (4)	5.94 ±0.08 a
14 (4)	5.78 ±0.02 b
Significant	P<0.05

**Table, 3: The mean values of total bacterial count in minced meat samples after thawing in hot water.**

Number of samples (Frequency)	Thawing in hot water (40 °C) Log Cfug meat
1 (4)	6.95 ±0.4
2 (4)	7.91 ±0.05
3 (4)	6.04 ±0.02
4 (4)	6.11 ±0.04
5 (4)	6.57 ±0.07
6 (4)	6.04 ±0.15
7 (4)	6.04 ±0.16
8 (4)	6.04 ±0.02
9 (4)	6.89 ±0.05
10 (4)	6.17 ±0.05
11 (4)	6.44 ±0.02
12 (4)	6.66 ±0.14
13 (4)	6.84 ±0.07
14 (4)	6.57 ±0.07
Significant	N.S.

Thawing the frozen minced red meat using tap water or at room temperature and inside

the refrigerator had significantly differences (P<0.05) lower bacterial counts than that obtained by using the hot water where thawing by using hot water caused an increase in the moisture loss and consequently provided an excellent medium for the microbial growth. Several scientists recorded that thawing of frozen minced red meat inside the refrigerator for overnight was suitable to get meat with stable microbiological quality (14, 19 and 20).

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### تأثير أفضل طريقة لإذابة اللحوم المجمدة في التقليل من الحمل الجرثومي في اللحوم الحمراء

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#### الخلاصة

اجريت الدراسة في كلية الطب البيطري - جامعة بغداد، لمدة ثلاثة أشهر، وذلك لاختيار أفضل طريقة لإذابة اللحوم المجمدة والتي تقلل من العد الجرثومي في اللحوم. وقد استعملت في التجربة أربعة طرائق للإذابة وهي طريقة إذابة اللحوم بالماء البارد من الحنفية ١٨ °م لمدة ساعتان في الطريقة الأولى، وإذابة اللحوم بالماء الحار ٤٠ °م لفترة ١,٥ ساعة في الطريقة الثانية. وإذابة اللحوم بجو الغرفة ٢٨ °م لمدة ساعتان في الطريقة الثالثة. والطريقة الأخيرة إذابة اللحوم في الثلاجة ٤ °م لمدة ٢٠ ساعة. وقد بينت النتائج عدم وجود اختلافات في التأثير ما بين الطرائق الثلاثة لإذابة اللحوم (باستعمال الماء البارد وجو الثلاجة وجو الغرفة) في اعداد الجراثيم الكلية وكانت الأعداد أقل من الحدود المسموح بها حيث تراوحت الأعداد ما بين لوغارتيم ٤,٨٤ - ٦,٠ وحدة تكوين مستعمرة/غم اللحم. اما طريقة الإذابة بالماء الحار فقد كانت غير جيدة من حيث التقليل من أعداد الجراثيم الكلية حيث كانت أعلى من الحدود المسموح بها وأعلى من الطرائق الأخرى وكانت الأعداد تتراوح ما بين لوغارتيم ٦,٤ - ٧,٩٧ وحدة تكوين مستعمرة/غم لحم. نستنتج من ذلك ان طريقة إذابة اللحم عن طريق حفظها في الثلاجة قد أعطت نتائج جيدة من حيث أعداد الجراثيم.

الكلمات المفتاحية: اللحم، إذابة، الجراثيم.