**Defrosting Ground Beef at Room Temperature**

**FSC 125 – Food Microbiology**

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**Abstract**

According to USDA, defrosting ground beef at room temperature is considered safe if it is set in less than 2 hours. This experiment would be done to prove that the statement proposed by the USDA is accurate by testing the microbial count in ground beef from frozen to 4 hours of defrosting at room temperature using dilutions and plate count. The result ranges from 12,000 and 20,000 cfu/gram of ground beef. From the allowable microbial count of 1 x 107 cfu/gram of ground beef, it is considered safe to defrost ground beef in room temperature for more than 2 hours, in this case, up to 4 hours.

**Introduction**

It is very important to know that the food we eat is safe. For this case, food scientists are very concerned about the microbiological fact that microorganisms can live in foods, and pathogens can be one of the microorganisms. Many of uneducated cooks or home cooks do not realize this fact. They assume if the food is cooked then it will be fine, and this is not true at all.

Pathogenic bacteria, such as Escherichia coli O157:H7, Salmonella, Campylobacter jejuni, Listeria monocytogenes, and Staphylococcus aureus are a major concern in ground beef because these pathogens can cause illness. Escherichia coli O157:H7 is the most dangerous one, because it produces toxin that is very harmful to humans (Food Safety: Beef From Farm to Table).

Microorganisms are able to grow exponentially in room temperature, especially when they are in rich environment, such as ground beef. There are many ways that microorganisms can get into this ground beef. One of the important steps is the defrosting step. Even though there are many safer ways that can be done to defrost ground beef or other meats, however defrosting them in room temperature seems to be popular, and this is the most unsafe way to defrost meats.

There are three safe ways to thaw meats: refrigerator thawing, cold water thawing, and microwave thawing. For refrigeration thawing, it needs to be done 1 or 2 days before using or cooking the ground beef, because this type of thawing is very slow. Refreezing ground beef after thawing it in the refrigerator can cause some quality loss (FSIS).

Cold water thawing is faster than refrigeration thawing, but needs more attention, and the beef needs to be cooked right after thawing. The package should not contain any leaks, so the bacteria from the surrounding environment, such as air and water, could not be introduced to the meat. To thaw it, submerge the bag or container in cold water and change the water every 30 minutes (FSIS).

When using microwave thawing, the beef needs to be cooked immediately after thawing, because the meat is in the “Danger Zone” temperature. Cooking without thawing is also safe. This means the beef is still in the frozen state. It is safe to cook, but it will take about 50% longer cooking time (FSIS).

According to the USDA, defrosting meats at room temperature is considered safe if it is set in less than 2 hours (FSIS). Over that time limit, it would be a health threatening for human to consume it. This research was done to prove the statement that is proposed by USDA is accurate by testing the microbial count in ground beef from frozen to 4 hours of defrosting at room temperature using dilutions and plate count. According to “*The Microbiology of Safe Food”*, the suggested microbiological limits for end of shelf-life of ground beef is 1×107 colony forming units per gram of ground beef (Forsythe).

**Methods and material**

Materials:

* 5 Samples of 11 grams of ground beef:
	+ Frozen
	+ 1 hour defrost at room temperature
	+ 2 hours defrost at room temperature
	+ 3 hours defrost at room temperature
	+ 4 hours defrost at room temperature
* 30 dilution blanks of buffered peptone water (99 ml)
* 60 Petrifilm APC
* 40 Petrifilm E. coli / Coliform

Methods:

1. Add 11 grams of ground beef into 99 ml of buffered peptone water. Blend it using Stomacher lab blender.
2. Make 6 buffer dilutions for each beef samples.
3. Withdraw 4 ml and transfer each ml to petrifilms (2 APC and 2 Coliform).
4. Transfer 11 ml to the second dilution bottle (10-2), and then shake.
5. Repeat step 3 and 4 until the 6th dilution bottle (for bottle 10-5 and 10-6, draw 2 mls only for 2 APC Petrifilms, no Coliform needed).
6. Incubate at 37°C for 48 hours.

**Results and Discussion**

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| **APC** | **10-1** | **10-2** | **10-3** | **10-4** | **10-5** | **10-6** |
| Frozen | TMTC | TMTC | 119 | 136 | 16 | 21 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1 hr | TMTC | TMTC | 191 | 175 | 17 | 26 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2 hr | TMTC | TMTC | 180 | 190 | 21 | 22 | 1 | 1 | 2 | 0 | 0 | 0 |
| 3 hr | TMTC | TMTC | 134 | 139 | 17 | 10 | 2 | 0 | 0 | 0 | 0 | 0 |
| 4 hr | TMTC | TMTC | 194 | 205 | 20 | 21 | 5 | 1 | 0 | 0 | 0 | 0 |

* Frozen: 127.5 x 100 = 12750 🡪 1.3 x 104 cfu/gr
* 1 hour: 183 x 100 = 18300 🡪 1.8 x 104 cfu/gr
* 2 hour: 185 x 100 = 18500 🡪 1.9 x 104 cfu/gr
* 3 hour: 136.5 x 100 = 13650 🡪 1.4 x 104 cfu/gr
* 4 hour: 199.5 x 100 = 19950 🡪 2.0 x 104 cfu/gr

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| --- | --- | --- |
| Ground Beef | Variation within Treatment | Percentage |
| Frozen | 0.094281 | 9.43% |
| 1 Hour Defrosting | 0.061824 | 6.18% |
| 2 Hour Defrosting | 0.038222 | 3.82% |
| 3 Hour Defrosting | 0.025901 | 2.59% |
| 4 Hour Defrosting | 0.038988 | 3.90% |
| Standard Deviation of Treatment means | 32.11035 |

The second dilution was used to count the colonies forming units because it was in the range of 30-300. As expected, the frozen ground beef has the least amount of colonies, and the 4 hour defrosting has the most, although they were not too much difference. The percentages of variation for all samples are below 10%, and the standard deviation is about 32.

For the coliform petrifilm, 1 coliform was found in the first dilution of the frozen ground beef, and 3 more coliforms were found in the first dilution of the 4 hours defrosting time. Other than that, all the other petrifilms showed there are no coliform and E. coli.

**Conclusions**

This experiment shows that the ground beef that is defrosted at room temperature is still safe to eat, when it is fully cooked, up to 4 hours of defrosting time. However, there are many safer ways to defrost ground beef rather than thawing it in room temperature, such as refrigeration thawing, cold water thawing, and microwave thawing. This also applies to other meats, like chicken, beef, etc.

# References

Food Safety: Beef From Farm to Table. n.d. 26 March 2012 <http://wiki.medpedia.com/Food\_Safety:\_Beef\_From\_Farm\_to\_Table>.

Forsythe, Stephen J. The Microbiology of Safe Food - Second Edition. New Jersey: Wiley-Blackwell, 2011.

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