

## **Cooked Ground Beef Color**

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Recent concerns about ground beef causing foodborne illness have resulted in a number of questions related to thoroughly cooking ground beef. USDA's recommendation in 1992 was to cook ground beef until the juices run clear.

After some investigation, USDA subsequently revised their recommendation in 1998 to cook ground beef to an internal temperature of 160°F using a thermometer. They concluded that a thermometer is the only reliable means to ensure the degree of doneness in ground meat. The 1998 USDA revision on cooking recommendations was made because color is not a reliable means of determining doneness, due to premature browning, persistent redness, and consistent pinkness.

### **Premature Browning (PMB)**

The color of fresh meat changes during cooking due to denaturation of the protein myoglobin. Denaturation is the unfolding of the "native" protein into a denatured form. Denaturation does not significantly effect the protein quantity or quality. Sometimes ground beef is susceptible to Premature Browning (PMB). PMB ground beef can form a brown, cooked color at temperatures as low as 135°F. Since some pathogenic bacteria are not killed at this temperature, relying on color alone could potentially lead to some food safety risks.

Researchers at Kansas State University have studied PMB extensively. This research indicates that up to 47% of ground beef may have some degree of PMB.

Their findings also show that the oxidative state of myoglobin (oxy-, deoxy-, or met-myoglobin) effects PMB. Myoglobin is the meat protein responsible for meat color. The predominant states of myoglobin are:

**Oxy-myoglobin:** Red color associated with meat in a retail display.

**Deoxy-myoglobin:** Purple color associated with vacuum packaged meat.

**Met-myoglobin:** Brown color associated with old meat.

If meat is cooked while the myoglobin protein is in the oxy- or met-myoglobin states, PMB is more likely to occur. (see *Farm To Fork*, January 1999, Volume 4, No. 2.)

### **Delayed Browning (Persistent Red)**

On the other extreme, there are some ground beef products which will remain red at temperatures above 160°F. While these products are safe, when cooked to 160°F, they present a quality issue to foodservice establishments and home consumers. Kansas State University researchers have shown that high pH ground beef (6.1 or higher) is likely to be persistently red at 160°F. It is thought that the higher pH protects the myoglobin protein from denaturation during heating. Typically, persistently red ground beef will turn brown after extended cooking.

This can lead to overcooked product, which can be tough and dry.

### **Consistently Pink (CP)**

Occasionally, ground beef can have an irreversible pink color. Regardless of the amount of time or the temperature to which the product is cooked, the product will remain pink. This consistently pink (CP) color is usually caused when the product has been exposed to nitrite or nitrate. Nitrite is a compound used in cured meat products such as corned beef, hams, hot dogs and bacon. Nitrite causes the unique and irreversible formation of nitrosyl-myoglobin which has a pink color. Again, this product is safe to eat, provided it has been thoroughly cooked to a temperature of 160°F.

Nitrite, and/or Nitrate, can be introduced into ground beef in several ways. The most common is from nitrite containing vegetables, especially cabbage. The only solution is to brown the meat prior to adding the vegetables. A second possible source of nitrite is water, which is added during product preparation or cooking. Water can contain low levels of nitrite or nitrate which are acceptable for drinking, but will cause pinking in meat products. *USDA regulations do not allow the addition of water to any product labeled ground beef.* A third source of nitrate can be non-combusted flue gases from gas-fired ovens. These gases, in direct contact with meat, will cause pinking. This is common on the surface of most smoked meat products.

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### **Proper Cooking**

USDA research results and food safety tips are as follows:

The only reliable means for ensuring pathogenic bacteria are destroyed during cooking is to use an instant read thermometer and to cook to an internal temperature of 160°F.

The color of cooked ground beef can be quite variable due to the factors mentioned above.

At 160°F, a safely cooked ground beef patty may be brown, pink or some variation of brown and pink. The color depends on a variety of factors, such as was the product fresh or frozen, and how was the product thawed?

Be sure to wash the thermometer in hot water immediately after testing ground beef and when cooking is completed.

To check the accuracy of a thermometer, fill a large glass with ice chips, add clean tap water and stir well. Immerse the thermometer stem a minimum of two inches into the ice water. The temperature should be 32°F. Most thermometers are adjustable. Check the manufacturer's instructions.

| <b><u>CARGILL Plant Microbiological Information</u></b>   |                              |                         |                               |
|---|------------------------------|-------------------------|-------------------------------|
| <b><u>(Based on data from six plants)</u></b>   |                              |                         |                               |
| <b><u>Product</u></b>   | <b><u>Test Performed</u></b> | <b><u>Frequency</u></b> | <b><u>Average Results</u></b> |
| <b>Ground Beef<br/>(Age is 48 hours or less)</b>  | <b>Aerobic Plate Count</b>   | <b>6 per day</b>        | <b>8600 cfu/g</b>             |
|   | <b>Coliforms</b>             | <b>6 per day</b>        | <b>114 cfu/g</b>              |
|   | <b>Generic E.coli</b>        | <b>6 per day</b>        | <b>40 cfu/g</b>               |
| <b>* Listed are plant level results. Retail level counts will be higher because they have aged more. Coliform and E.coli is done using standard 3M petrifilm. General counts are used to establish control criteria for slaughter-dressing.</b> |                              |                         |                               |

The brown color of meat is not a reliable indicator of doneness. To ensure proper cooking of meat products, consumers should be advised to use thermometers. Thorough cooking is the best prevention for foodborne illness.

For more information on meat color visit the USDA website at [www.fsis.usda.gov.org](http://www.fsis.usda.gov.org) or call the USDA Meat and Poultry hotline at (800) 535-4555. In addition, food safety information is posted on the Canadian Food Inspection Agency website <http://www.inspection.gc.ca/english/toce.shtml>.