



K-STATE
Research and Extension



Fresh Ground Beef Color: A Consumer Guide

Consumers expect fresh ground beef to be bright-red, but at times it may appear brown, mottled red and brown, or even purplish. Color variations can be confusing and may lead to the rejection of acceptable ground beef. Here are answers to frequently asked questions.

Where does meat color come from?

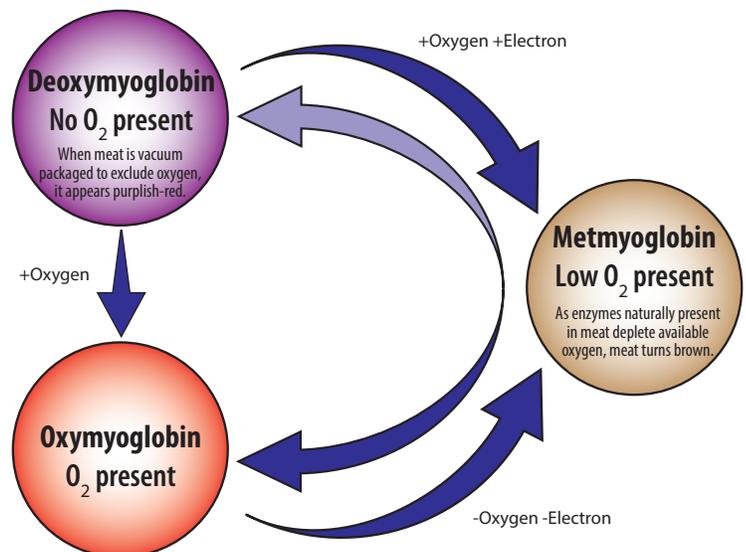
Myoglobin is the pigment responsible for fresh meat color. Through the process shown here, meat color changes continuously, from purplish-red to bright-red, and brown. Because meat color is highly dependent on the amount of oxygen available, as well as storage time and temperature, any combination of these three colors may be present in fresh ground beef.

If my ground beef is brown, does that mean it is unsafe?

Depending on oxygen exposure and time, meat may become brown on the surface while maintaining bright-red, fresh color internally. As long as ground beef smells fresh, it is okay to consume. Check the 'freeze or consume by' date on the package, but if it smells spoiled, discard.

What difference does the package make?

Fresh ground beef is sold in various types of packages. Because oxygen affects meat color, the permeability of package film has a big impact on the color you see. Plastic film overwrap is a common type of packaging for fresh ground beef in grocery stores because it helps to maintain bright-red surface color. This guide follows the color progression of plastic-wrapped ground beef over a 72-hour period, which includes storage time in your refrigerator. It is not meant to show every possible color pattern but to let you know what to expect when you open a package of ground beef at home.



In the presence of oxygen (O₂), meat appears bright-red. As enzymes naturally present in meat deplete available oxygen, it turns brown. When meat is vacuum packaged to exclude oxygen, it appears purplish-red.

Photos show color patterns that appear spontaneously in ground beef over time. Explanations of these color phenomena are provided to help consumers assess ground beef purchases.

Color may vary slightly depending on your computer monitor.

External Color Changes Over Time



Immediately after grinding, the entire ground beef surface appears bright-red. After 4 hours, most surface pigment appears bright-red; areas that have used up available oxygen appear less so. These small patches may appear red or dull-red as meat utilizes oxygen over the first 24 hours. Tan spots may occur under labels as a result of pressure during application and the inability of oxygen to penetrate. Red portions become dull red to tan after 36 hours. By 48 hours, the external surface looks more tan than dull-red. If packages are stacked during home refrigeration, compression may accelerate browning. Between 48 and 72 hours, the ground beef surface becomes mostly tan as oxygen decreases. Regardless of color, always check the odor for freshness.

Internal Color Changes Over Time



Shortly after grinding, meat throughout the package is bright-red from exposure to oxygen. However, internal color is highly variable depending on several factors. Tightly compacted meat contains less oxygen and develops a tannish color sooner than loosely packed ground beef. After 4 to 12 hours of refrigeration, small portions of meat may appear slightly tan as oxygen that is trapped in tiny pockets throughout the interior is depleted. Over the first 24 hours, these small patches grow as oxygen disappears. By 48 hours, internal color contains large tan spots and smaller red or purple patches. Between 48 and 72 hours, purplish portions intensify and the tan color turns purple-red as meat depletes oxygen. When a package of ground beef is opened and meat is broken apart, purplish portions may become bright-red shortly after reexposure to oxygen, while tan spots remain the same. This is normal because of the dynamic nature of color in fresh ground beef.

Lauren Weber, M.S.; Elizabeth Boyle, Ph. D., professor and meats specialist; Melvin Hunt, Ph.D., professor; and Aaron Tapian, M.S.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Publications from Kansas State University are available at www.ksre.edu. They are reviewed and revised annually to reflect current research and practice. Date shown is that of publication or last revision. Contents may be freely reproduced for educational purposes. All other rights reserved. In each case, credit Lauren Weber, et al., *Fresh Ground Beef Color: A Consumer Guide*, Kansas State University, August 2015.