The Science of Grilling Burgers

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From fast food drive-throughs to backyard barbecues, a hamburger is the iconic American food. Whether you're simply topping it with ketchup or dolling it up with fancy fixings, the key to a successful burger lies in proper handling and cooking. That's because the simple act of grinding meat profoundly changes the way it cooks, which makes grilling a hamburger a bit trickier than grilling a steak. Here, we'll discuss the relationship between ground meat and high heat, and how to marry the two for the tastiest burger around.

Recipe Collection: Best Burgers on the Block

How do you keep a burger juicy?

There are three keys to a juicy burger. Meat, which is a cross-section of muscle, is composed of protein and fat. The protein parts are full of moisture (lean beef is about 60 percent water). Grinding meat pulverizes the muscle fibers, which allows the moisture inside to run out. When

the absorptive pad in the bottom of a package of commercially ground beef is soaked, it's because it's saturated with juice that had been in the meat.

If you want a juicy hamburger, it helps to restore some of that lost moisture. The easiest way is to add water or some other liquid to the burger mixture. We've found that 2 to 3 tablespoons of ice-cold water mixed into a pound of ground beef greatly increases the juiciness of grilled burgers.

How you handle your burgers is the second key. As burgers cook, the protein in the meat contracts, forcing out moisture. To maintain juiciness, handle burgers as little as possible during grilling. Every turn or prod forces out more juice, which is why you should never press a cooking burger with the back of a spatula in an attempt to speed up the grilling time. It doesn't make heat transfer into the meat any faster, but it does increase moisture loss by wringing the meat fibers as if they were a saturated sponge.

Finally, fat content also contributes to the perception of moisture in burgers, not because the burger has more juice, but because we do; the presence of fat in the mouth triggers saliva flow. That's why ground beef with a fat content of less than 10 percent is unpalatably dry when cooked, beef with 10 to 15 percent fat content tastes lean and juicy, meat with a 15 to 20 percent fat content tastes rich and beefy, and burgers with more than 20 percent fat have very full flavor but a fatty mouth-feel.

How hot should the grill be?

Raging hot, but not for the entire cooking time. The intense heat of a grill creates a deeply browned crust, one of the hallmarks of a great burger. Surface browning begins to occur around 250°F, when the meat's sugar and protein react with each other, forming an unstable structure, which then breaks down into hundreds of flavorful compounds that make the meat taste more savory, caramelized, and delicious. (These browning reactions are known as Maillard reactions, named after Louis-Camille Maillard, the French chemist who discovered them.) The higher the heat, the more intense the browning reactions, and the more complex the flavor.

But if left over high heat for too long, a burger's crust can go from browned to burnt. To prevent this, set up your grill with both high-heat and low-heat zones. Start by grilling burgers over the high-heat zone to create deep surface browning, and then move them to the low-heat zone to finish cooking, a strategy known as indirect grilling. Also, be sure to preheat the grill for at least 15 minutes, brush the grate clean, and lubricate it with an oil-soaked paper towel just before adding the burgers. (Contrary to popular belief, a grill grate caked with carbonized residue doesn't make grilled food taste better—it only slows down the heat transfer, inhibiting deep grill marks and surface browning on your burgers.)

How do I know when a burger is done?

There are lots of visual cues, but a thermometer is the most reliable gauge of doneness. As meat heats, its protein becomes drier, less translucent, browner, and firmer. The meat also

shrinks, partially from moisture loss but also because fat melts and drips away, and the protein fibers become smaller as they firm up. The hotter and more cooked the meat gets, the more these physical changes manifest themselves. A rare burger (120°F to 125°F) will be running with juice, bright red in the center, and fairly soft to the touch. The same burger at well done (160°F or hotter) will be smaller, drier, brown throughout, and very tough. To take a burger's internal temperature, insert an instant-read thermometer through its side to ensure that the thermometer's probe has enough contact with the interior to register accurately.

What about food safety?

Although you might like your burgers rare, there are safety factors to consider. All of the harmful bacteria on a solid piece of meat are on its surface. During grinding, the surface and interior are mixed together, causing any bacteria to become dispersed throughout the batch. This is why it is not advisable to eat any ground meat product that is not cooked to at least 145°F (harmful bacteria are destroyed at 140°F). The United States Department of Agriculture recommends 160°F to ensure that all areas of the food have reached a temperature of 140°F or higher, but we've found that at that temperature all of the moisture is gone as well. We prefer to stop cooking beef burgers when they reach 150°F (medium well). At this temperature, the meat will be slightly pink in the center and still relatively juicy.

Choosing Ground Beef for the Best-Tasting Burgers

The most important factor influencing the flavor and texture of ground beef is what part of the animal the meat comes from. Meat is muscle, and as it's exercised, its fibers expand, making the muscle larger, redder, and more flavorful. Also, the muscle's connective tissue thickens, which makes the meat tough.

Since grinding negates toughness, the best ground beef comes from the more exercised and flavorful part of the steer. The cuts most commonly ground into hamburger are chuck, bottom round, and sirloin. Chuck is the most flavorful because it's from the well-exercised shoulder of the animal. Ground sirloin is less flavorful than chuck, but its meat has the smoothest mouth-feel because it is the least exercised. Bottom round falls in the middle; it's more flavorful than sirloin and smoother in texture than chuck.

We like chuck for burgers not only because it has the deepest flavor but also because it's a less desirable cut to sell for roasts or steaks, so it usually costs less than either ground round or sirloin. When we grind meat at home, we like to experiment by adding other tough cuts like short rib, which provides more rich flavor, and brisket, which lends a satisfying chewy texture, to our ground chuck, bottom round, or sirloin. As for fat content, we think a ratio of 15 to 20 percent fat to 80 to 85 percent lean offers the best combination of flavor and mouth-feel.

Shape Matters

When it comes to forming burgers, it's often said that packing the ground meat too much leads to a tougher result. We don't believe that's true. A firmly packed burger may be denser, but that's not necessarily a bad thing.

The shape of the burger, however, does matter. During cooking, the meat at the edges shrinks first, causing the center to bulge, which can give you a burger that looks more like a meatball than a patty. Pressing a slight dimple into the center of each burger before cooking prevents—or at least lessens—the bulge.