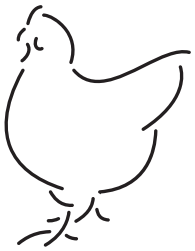
# It Takes a Tough Scientist To Make a Tender (and Juicy) Chicken



Scientists and poultry growers strive to provide the best bird possible in a cost-efficient manner by breeding, disease control, and changing the chickens' diet. But do those actions affect the texture and taste of the meat? What goes into ensuring a product that has consistent characteristics consumers can count on?

ARS food scientist Brenda G. Lyon, with the Quality Assessment Research Unit at the Richard B. Russell Research Center in Athens, Georgia, has researched the characteristics of poultry meat for over 20 years. And, boy, are there a lot of characteristics. We all expect a piece of baked chicken to be moist and tender, but there are many components to those qualities.

Lyon's studies focus on determining how sensory attributes such as size of the bolus (mass of chewed food) or meat fibrousness are related to changes and improvements in the production process. These flavor and texture characteristics give clues to changes in product composition that ultimately influence consumer acceptance. "This information leads to more efficient, economical production methods for the poultry industry and helps processors and product developers provide better, more consistent items to the consumer," Lyon says.

While genetic selection has helped to supply poultry producers with specific birds for their operations, other poultry production and processing practices may alter characteristics of poultry meat.

## The Way We Were

"During my years of research, the biggest change in poultry processing has been the increase in options to consumers—cut-up pieces, deboned breast meat, ready-to-eat products," asserts Lyon. For many years, chickens were sold whole, with the giblet pouch inside. In recent years, producers found that consumers were willing to pay a premium price for the convenience of precut broiler pieces. Consumers also showed preferences for particular portions of the bird, so it is now commonplace to see separate packages containing just thighs, breasts, or drumsticks. Boneless, marinated, seasoned, ready-to-cook chicken parts are now readily available in most supermarkets.

But these modifications come at a price. Lyon and other researchers have found, for instance, that the amount of time the breast muscles remain on the bone after processing affects meat texture. "The timing for acceptable tenderness seems to be 4 to 6 hours postmortem," says Lyon. This aging process allows time for the muscle fibers to go through rigor mortis, the natural biochemical process of converting muscle to meat. But this is an expensive 4 to 6 hours due to the costs of refrigeration and labor.

To accommodate the added step of cutting and deboning the chicken, poultry producers shortened the costly chilling time. But there was a drawback: "Reduced chilling time interfered with rigor mortis, making cooked breast meat tough," says Lyon.

During rigor mortis, unused energy in the form of glycogen causes muscles to contract. Glycogen is stored in muscle fibers for 8 to 24 hours after the bird is killed. As the stored energy dissipates, the muscle relaxes and should then be removed from the bone. However, sensory panels found that meat left on the bone for less than 4 hours was tougher than meat left on the bone longer.

New methods of releasing stored glycogen are being investigated. "Applying

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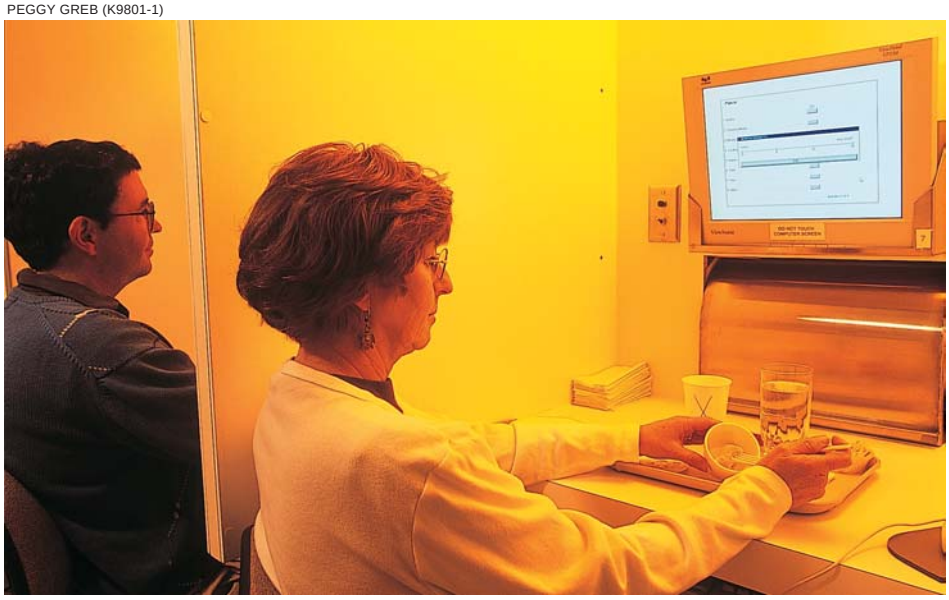

**Sensory panelists Jim Griffin and Judy Davis evaluate chicken texture in separate test booths equipped with special lighting so visual clues won't influence their decisions.**

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**Food technologists Brenda Lyon, left, and Elizabeth Savage discuss fiber orientation of a chicken breast sample. Texture measurements are recorded as a texture analyzer blade shears each meat strip and the results compared to sensory texture data.**

pulsed electrical current—termed electrical stimulation—is being explored as a way to force the muscles to use the stored glycogen more rapidly than traditional aging does," says Lyon. The Poultry Processing and Meat Quality Research Unit, also at the Russell Center, is investigating some of these processing methods.

## The Senses Tell All

Instruments can measure characteristics that are directly related to the physical or chemical components of the product, like how much force it takes to cut through a piece of meat (shear value). However, human subjects are needed to decipher a wide range of factors involved in eating satisfaction, such as juiciness, appearance, aroma, taste, and texture. These are all quality characteristics measured by use of the senses. Sensory and instrumental measurements are used together to draw conclusions and make assumptions about quality.

**In Lyon's lab, sensory evaluations are conducted at workstations equipped with special lights so visual clues do not influence panelists' perception of flavor.**

Sensory evaluation is analysis of product attributes perceived by the human senses of smell, taste, touch, sight, and hearing. Setting up such a sensory panel test is no small feat.

Characteristics such as mouthfeel, springiness, chewiness, compaction of the meat after chewing, and ease of swallowing all play a part in sensory texture profiles. However, it takes training to be able to identify these characteristics and assign intensity values to them. So human panelists are given intensive instruction in flavor and texture profiling. Initial orientation and practice sessions are held to define specific attributes in each stage of evaluation and to monitor panel performance for repeatability, consistency, and discriminating ability.

In Lyon's lab, sensory evaluations are conducted at workstations equipped with special lights so visual clues do not influence panelists' perception of flavor or texture. The air is filtered so outside odors don't intrude on the aroma of the sample. Low-pressure sodium vapor lights mask colors, making everything appear in shades of gray or brown. At each workstation is a computer equipped with a mouse used to mark the attribute scales presented on the computer monitor. Filtered water and unsalted crackers are often given to panelists for mouth cleansing between samples.

Panelists must then complete an evaluation of the samples and mark the line scale for the intensity of each attribute. Intensity values range from 0 to 15. As many as 20 flavor and texture attributes may be developed for a sensory profile. Data analyses usually involve sophisticated statistical analyses.

There are several other types of sensory test formats, depending on the test objective. In difference/discriminative tests, the panelist evaluates a set of samples and determines whether any samples differ from others. If a significant number of panelists detect a difference, then a true difference is assumed to exist. In ranking tests, panelists are asked to rank samples in a specified order, such as most tender to least tender.

Informal sensory testing has been used by humans since we began assessing our environment. Formal sensory testing and analysis have been used by researchers for a much shorter period, but the desire to eat palatable food remains the same.

The ultimate goal of food technology research is to assist producers in bringing to the marketplace a product consumers will purchase—by providing a consistently performing commodity. The sensory techniques and trained panelists help make that happen. "Sensory panels are ultimately the deciding factor in whether a process—and product—is successful," Lyon says.—By **Sharon Durham,** ARS.

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