EXCLUSIVE

2009 TECH JOURNAL SERIES

WHOLE MUSCLE TECHNOLOGY 101

A NATIONAL PROVISIONER RESEARCH PROJECT
BY BARBARA YOUNG, EDITOR-IN-CHIEF
LISA WHITE, RESEARCH ASSISTANT

Photo courtesy of the National Turkey Federation

Overview

Quality whole-muscle meat is the prerequisite for successful product-development initiatives. The first step begins with protein material harvested from healthy animals that have been inspected and tested to rule out the presence of chemical residue, antibiotics and other undesirable additives that may end up in finished product.

"Once the carcass passes postmortem inspection, a product sampling plan is executed to test for [such pathogens] as *Listeria*, *E. coli* and *Salmonella*," confirms Josh Herring, Ph.D., assistant professor, Department of Food and Animal Sciences, Alabama A&M University. Other safeguards include solid GMPs (good manufacturing practices) that enable processors to minimize or eliminate problems related to contaminations; BMP (basic metabolic panel) tests as a general screening tool; and cGMPs (current good manufacturing practices) that indicate a company's employment of the latest technologies and systems.

To keep up with technical trends impacting food production, *The National Provisioner* continues its Tech Journal Series that debuted in 2008 with this second research project of 2009 focusing on whole-muscle processing. This year's first report was on poultry processing (visit www.provisioneronline.com to access the full set of tech journals).

Continued on page 38

Glossary: Selection of bovine and porcine muscles

Bovine muscles:

Long digital extensor, digital extensor longus: (derived from the pelvic group) whole-sale section is the round (retail cuts include beef round steak, beef round steak boneless, beef round bottom round roast, beef round bottom round rump roast)

Gluteus Medius: Common name jump, top sirloin, top butt, top sirloin butt (source is pelvic group, whole sale section is loin) action (extends the hip joint, abducts the limb) retail cuts (beef loin porterhouse steak, beef loin top loin steak, beef loin top loin steak boneless)

Latissimus dorsi: Common name large deckle muscle (group is dorsal, whole sale section is chuck, rib) action: adducts arm, rotates it medially, and extends it

Source: Jones, S.J., Guru, A., Singh, V., Carpenter, B., Calkins, C.R., and Johnson, D. 2004. Bovine Myology and Muscle Profiling. Available: http://bovine.unl.edu.

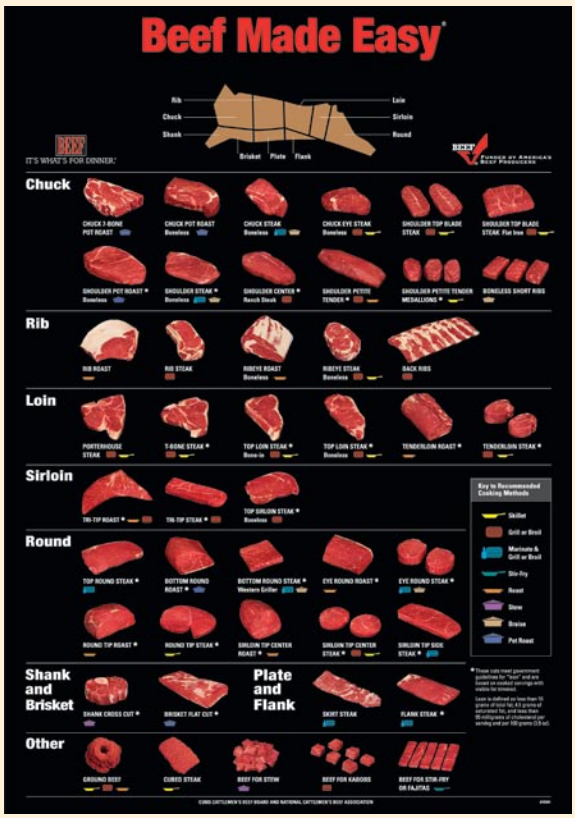

Photo courtesy of the National Cattlemen's Beef Association

Porcine muscles:

Adductor: common name is ham cushion

Biceps femoris: common name is outside ham muscle, group is pelvic

Complexus: shoulder group

Gluteus medius: pelvic group; common name sirloin

Gracilis: pelvic group; common name ham cap muscle

Infraspinatus: thoracic group; common name Flat iron, Book steak, Top Blade

Supraspinatur: thoracic group; common name Mock tender, Chuck tender, Scotch tender, Chuck fillet

Longissimus: dorsal group; common name loin muscle, Canadian back

Source: Jones, S.J., Guru, A., Singh, V., and Jones, T.F. 2006. Porcine Myology. Available: http://porcine.unl.edu.

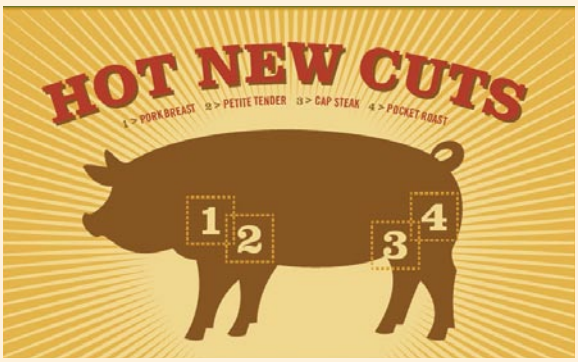

Photo courtesy of the Pork Checkoff

What is whole-muscle meat?

Defining the whole-muscle category is the foundation of this research. Therefore, it was essential to engage members of the scientific community for their input.

Ann Wells, director of scientific and regulatory affairs, North American Meat Processors Association, says that although an official scientific definition of whole-muscle meat is questionable, the category generally is defined as meat cuts from the animal carcass that maintain the muscle characteristics associated with meat on the carcass.

On the other hand, according to Steve Larsen, Ph.D., director, pork safety, National Pork Board, whole muscle is a piece of skeletal muscle that may contain one or more muscle groups.

Josh Herring, Ph.D., assistant professor, Department of Food and Animal Sciences, Alabama A&M University, offers this definition:

"Whole-muscle meat is regarded as an intact, pristine, unadulterated muscle group. It typically is regarded as meat that has not undergone injection (marinated, fillers, binders, extender or otherwise), tenderization (mechanical, physical nor enzymatic), reconstruction or

Continued on page 40

Step up to Supervac and reduce labor costs.

If you currently use two or more double chamber packaging machines, then you need to make the switch to Supervac. Supervac automatic belt chamber machines are designed for single-operator use which can greatly reduce your labor costs. Because Supervac vacuum packaging machines offer significantly shorter evacuation times – one machine can easily handle the production requirements normally handled by two or more machines – the switch is easy. Learn how Reiser and Supervac can help to grow your business – call Reiser at (781) 821-1290.

725 Belleau Street, Canton, MA 02021 • www.reiser.com

REISER

Leading the food industry in processing and packaging solutions.

scored and marinated, from which steaks, chops, cutlets among others may be cut."

Dakota Dunes, S.D.-based Beef Products Inc. (BPI), a leading manufacturer of boneless lean beef, explained:

"Whole muscle products are generally thought to be full primal or sub-primal pieces such as roasts or steaks," explains Ryan Dial, research and development specialist. "However, even within that broad general area, there are many variations, including intact versus non-intact products. Non-intact whole-muscle products would include the same general whole-muscle products, but are no longer considered intact by USDA's Food Safety and Inspection Service because they have been marinated, injected, tenderized by needle, or [had] some other process performed on the product."

Myology

The study of the structure, function and diseases of muscle defines myology. Aspects include primals, muscles, bones, color, composition, tenderness, pH and processing characteristics. This report focuses on beef and pork product myology. Beef sources include research by Dr. Chris Calkins at the University of Nebraska and Dr. Dwain Johnson at the University of Florida. It was funded by The Beef Checkoff. For pork, material was excerpted from *Porcine Myology* by Jones, S.J., Guru, A., Singh, V., and Jones, T.F. 2006 available at http://porcine.unl.edu.

Beef and pork carcasses contain more than 100 different muscles each with varying properties that impact processing characteristics and consumer acceptability, triggering the trend of separating muscles to increase marketing potential.

According to experts, knowledge of the myology of the beef animal and the ability to disseminate that information has become more important in understanding the carcass characteristics of beef.

For one thing, retail meat counters are mostly filled with boneless cuts, confirming the need for knowledge

Continued on page 42

Processor profiles

Meat and poultry processors have contributed to improvements in efficiencies and product-development initiatives that deliver food designed to appeal to consumer palates and lifestyles. They also have improved the overall approach to managing their businesses and marketing their products.

To be sure, the meat and poultry industry has stepped up with a range of products developed from whole-muscle meat. This report provides a glimpse into production programs of Hormel Foods Corp., Beef Products Inc. (BPI), Sam Kane Beef Processors Inc. and Coleman Natural Foods LLC.

Hormel Foods Corp.

Austin, Minn.-based Hormel Foods Corp. is a global marketer of branded meat and poultry food creations developed from whole-muscle material.

With 19,000 companywide employees, 41 U.S, manufacturing facilities and international operations, Hormel, incorporated in 1891, owns a portfolio of venerable brands including Spam, Farmer John, Lloyd's and Jennie-O Turkey Store.

Hormel's new construction project in Dubuque, Iowa, targeting microwave meals, is scheduled to open in November 2009.

Its wholly owned subsidiary, Dan's Prize Inc., in Gainesville, Ga., produces roast beef, corned beef, prime rib, pastrami and other cooked meats for foodservice and deli operations.

Food safety and worker safety are key programs for Hormel. "Hormel Foods understands that ergonomics affects production, yields, quality, efficiencies and the overall effectiveness of all workers," reports Julie Craven, Hormel's vice president of corporate communications. "We implemented an ergonomic program in the late 1980s, years before it was required by law."

Each Hormel location now operates with a safety and ergonomic team working to reduce on-the job stress and strain. "The key ergonomic risk factors include repetition, force, environment and posture," Craven reviews. "Detailed assessments are performed to help guide and substantiate corrective action toward ergonomic improvement."

BPI

BPI, an innovator of lean-meat manufacturing based in Dakota Dunes, S.D., is a major supplier of boneless lean beef for ground-beef applications, producing more than 10 million pounds weekly.

The firm's plants are strategically located throughout the Midwest, close to its raw material suppliers. BPI's processing program does not include slaughter or deboning.

Continued on page 42

Maximize your production & yields

The INNOVATION CENTER in Lenexa, Kansas is a real plant environment, that provides customers the ability to test their products with the latest state of the art equipment.

- Software Solutions
- Frozen Meat Portioning
- Bacon & Deli Slicing
- X-Ray Bone Detection
- Flowlines & Deboning
- Mixing & Grinding
- Loading Solutions
- Weigh Price Labeling
- Fresh Meat Portioning
- Grading & Batching
- Fat Analyzing
- Product Freezing Solutions

Call 888-888-9107 today to schedule your appointment

Marel Food Systems
8145 Flint Street
Lenexa, KS 66214

RETURN ON INNOVATION

www.marelfoodsystems.com

marel
food systems

of the musculature of the beef animal. Moreover, the institutional meat purchaser's specifications, (IMPS) are written in such a way that knowledge of the muscular anatomy of the beef carcass is required to maintain consistency in cutting procedures.

Research has profiled the physical and chemical characteristics of beef muscles to more fully realize their value. Such information aids processors in their development and preparation of new products based on the inherent properties of each muscle

The evolution of a whole-muscle processing industry

Consider the chicken industry, which evolved into its modern state by the mid-1970s with the implementation of nutritional discoveries, disease eradication programs, mechanization and automation technologies and improvements in genetics through traditional breeding. Scientists discovered how DNA worked to control the formation and function of turkey muscle – a tremendous benefit to commercial growers and their processing partners.

Photo courtesy of the National Chicken Council

Specifically, this genetic research led to an increase in breast meat yield.

The beef industry gained marketing momentum in 1926, when USDA introduced beef grading standards allowing packing plants to offer consumers a choice in beef qualities to match their economic capabilities. The introduction of boxed beef in 1967 gave processors the ability to provide conveniently sized cuts to benefit butchers and retailers.

A muscle-profiling study in 2000 found new convenient ways of preparing the 39 muscles from

Continued on page 44

Processor profiles *(Continued from page 40)*

"Production of BPI Certified Tender products is a box-in/box-out program, with raw materials purchased from packers, unpackaged, and then sent through BPI's patented enhancement process," explains Ryan Dial, research and development specialist.

BPI now markets a line of whole-muscle, non-intact "Certified Tender™" products developed using its proprietary injection process.

The company modified its injection equipment to ensure greater precision, consistency, control and finished-product quality. The completely enclosed and automated brine system allows BPI to guard against sources of contamination while also guaranteeing processing consistency.

Sam Kane Beef Processors Inc.

Based in Corpus Christi, Texas, Sam Kane Beef Processors Inc.'s product portfolio includes beef, boxed beef, trim and ground beef.

The company has grown from a small retail company to an operation serving thousands of customers throughout the United States and several foreign countries.

The company's manufacturing program has benefited from the incorporation of the latest technology at its processing plant featuring the newest vacuum packaging equipment and HRI (hotel, restaurant and institution) steak and ground beef systems.

The newly expanded operation's modern slaughter facilities include industrialized robotics, highly efficient fabricating lines, automated carcass storage and retrieval and storage of several million pounds of frozen beef along with a million pounds of fresh boxed beef.

Product quality characteristics begin with the selection of slaughter cattle that meet specific marbling and cutability requirements.

Coleman Natural Foods LLC

A Colorado-based food company, Coleman Natural Foods LLC ranks as a leading U.S. processor, marketer and distributor of fresh and further-prepared natural and organic proteins thanks to a merger involving BC Natural Foods LLC of Golden, Colo., and KDSB Holdings LLC of Gainesville, Ga., in 2006.

The newly formed company operates in 17 locations in six states with nearly 2,300 employees. The company's foodservice division in Gainesville produces cooked, formed and whole-muscle breaded patties, nuggets and filets.

"We have an extremely good incoming raw material inspection process at Plant 1 [whole-muscle operation]," reports Alicia London, foodservice marketing manager, Coleman Natural Foods and Kings Delight Foodservice Division. "That assures that incoming material meets specifications established by our QA department."

NEW

JARVIS NOW HAS ROBOTS FOR THE KILL FLOOR!

NEW

Jarvis offers technologically advanced robots for:

- *Hog head dropping*
- *Brisket opening (hogs)*
- *Aitch bone opening (hogs)*
- *Forequarting (beef)*
- *Hock cutting (beef)*

Model JR-50 Head Dropper Robot with Jarvis' 3HD-1R Head Dropper

Model JR-50 Hock Cutter Robot with Jarvis' 30CL-1R Hock Cutter

JARVIS

View additional equipment information at our website!

JARVIS PRODUCTS CORPORATION
33 Anderson Road, Middletown, CT 06457
Tel: (860) 347-7271
Fax: (860) 347-9905
E-mail: jarvis.products.corp@snet.net
http://www.jarvisproducts.com

the chuck. Further research on undervalued cuts of beef yielded new ways to cut steaks from the chuck to introduce the Flat Iron steak.

Concerning pork, history tells us that explorer Hernando de Soto brought 13 pigs to America that became the breeding stock for its pork industry to the point that most American farmers raised pigs by the 17th century.

The loin muscle in pigs is popular in modern times given that it can be cured for back bacon or Canadian-style bacon. The loin can also be divided for several roast cuts including blade loin roasts, center loin roasts and sirloin roasts.

In December 1991 the University of Wisconsin, working with USDA and the hog producers, published findings concerning the fat content of pork. The results indicated that pork examined in 1990 contained 31 percent less fat, 17 percent fewer calories and 10 percent less cholesterol than its equivalent in the 1983 USDA Nutrient Handbook. Based on National Pork Producers Council estimates, the 1990s' hog, unlike the hog of the 1950s, contained 50 percent less fat. The average hog had 2.86 inches of backfat previously compared to a 1.1-inch average in the 1990s.

Eying the future, Checkoff-funded programs organized by the pork industry, pinpointed several research and development advancements on the horizon including the use of repartitioning agents as feed additives to encourage less fat, leaner meat, and faster growth. Biotechnology was viewed as a tool to advance gene mapping to a point where growth, fat-to-lean ratio, and prolificacy could be better controlled from the laboratory. By 2003, technological advances in genetics had allowed North Carolina to increase efficiency to the extent that it ranked as the second-largest pork producing state.

End products

Simply put, whole-muscle meat is raw material from animals that has not been ground, chopped or cut other than to develop a particular shape. Roasts, steaks, chops, and filet-type products come from whole-

Photo courtesy of the Pork Checkoff

muscle meat.

As an example, Dan Hale, extension meat specialist at Texas A&M University, points to strip steak, which is a whole-muscle product derived from sub-primal beef.

"It goes back to individual muscles," he adds. "There is more than a single definition other than intact muscle removed from species."

As Wells explains, whole-muscle cuts can also be used as the raw material source for a wide variety of high-quality ready-to-eat, heat-and-serve items such a pre-cooked pot roast or pre-cooked fajita strips. Whole-muscle products can also be used as raw materials for high-end deli items, she adds.

The reason that whole-muscle meat is used for such further-processed products is tied to consumer demands. "The typical consumer does not desire whole-muscle portions as they are too large," Herring reports. "They [consumers] want convenience with a proper serving size."

Reduced aging time and acceptable tenderness are primary pursuits of meat and poultry processing programs. The sensory profile of "tenderness" is considered a critical factor in consumer perception concerning taste and mouth-feel qualities. Meat

Continued on page 46

tenderness is tied to such factors as genetics (breed type), muscle type, the quality of tissue, amount of marbling, post-slaughter processing (including conditions before and after rigor-mortis), and various processing techniques.

Researchers have explored the use of many non-thermal post-slaughter technologies for improving tenderness, including application of enzymes, acids, blade tenderization, hydrostatic pressure and hydrodynamic shock-wave treatment.

Other research has focused on the food-safety aspects of non-intact products. Consider the work of BPI, which for years has been on the cutting edge of new processing techniques, sanitation programs and food-safety innovations.

"BPI first became interested in developing technology for the production of whole-muscle, non-intact products following several notable recalls due to *E. coli* O157:H7," reports Mike Hesse, sales director. "We were convinced that technology used to eliminate pathogens concerns in BPI's core production processes could also work on non-intact, whole-muscle products."

Hesse says the firm's research and development efforts, initiated in 2003, led to its BPI Certified Tender™ line. BPI now applies its pH enhancement techniques to whole-muscle cuts of beef, pork and pasture-raised sheep. "Our process brings out the natural characteristics of meat and allows for consistency," Hesse adds. "The process also is considered an intervention for *E. coli* O157:H7 getting up to a 4-log reduction for this pathogen."

FOR MORE INFORMATION, VISIT PROVISIONERONLINE.COM

Photos courtesy of National Cattlemen's Beef Association

weber
The High Tech Company
WEBER INC.
10701 N. Ambassador Drive
Kansas City, Missouri 64153
Phone: (816) 891-0072
Fax: (816) 891-0074
www.weberslicer.com
e-mail:
usasales@weberslicer.com

We proudly support the missions of

AMI NISA NMA fpsa

NEW Issue now online. *Log on to weberslicer.com*

GREATER THROUGHPUT, FASTER LOADING AND NEAR-ZERO GIVE-AWAY...

DISCOVER WHOLE MUSCLE SLICING, WEBER STYLE.

The powerful 604 Slicing System delivers first-pass, on-weight portion rates that exceed 90 percent, as well as loading times of just six to eight seconds.

The compact 604 design requires only 25 sq. ft. of floor space, yet provides 1,600-RPM blade speed and the capacity to produce up to 40 on-weight portions per minute from products up to 30-inches in length.

Weber's superior Vision System assures accurate portioning by instantly measuring the surface area of un-pressed, natural products and automatically adjusting slice thickness between each and every slice. Product waste and the labor cost associated with manual adjustment are eliminated.

Fast, easy cleanup is a given, as the 604 System shares the Weber heritage of hygienic design.

Experience perfect slices and on-weight portions. Arrange a Whole Muscle Slicing demonstration at Weber's North American Technology Center.

Log on today to watch Weber's 604 in action or call for expert assistance with your whole muscle slicing challenges.

weber®
We Add The Value™
1-800-505-8581