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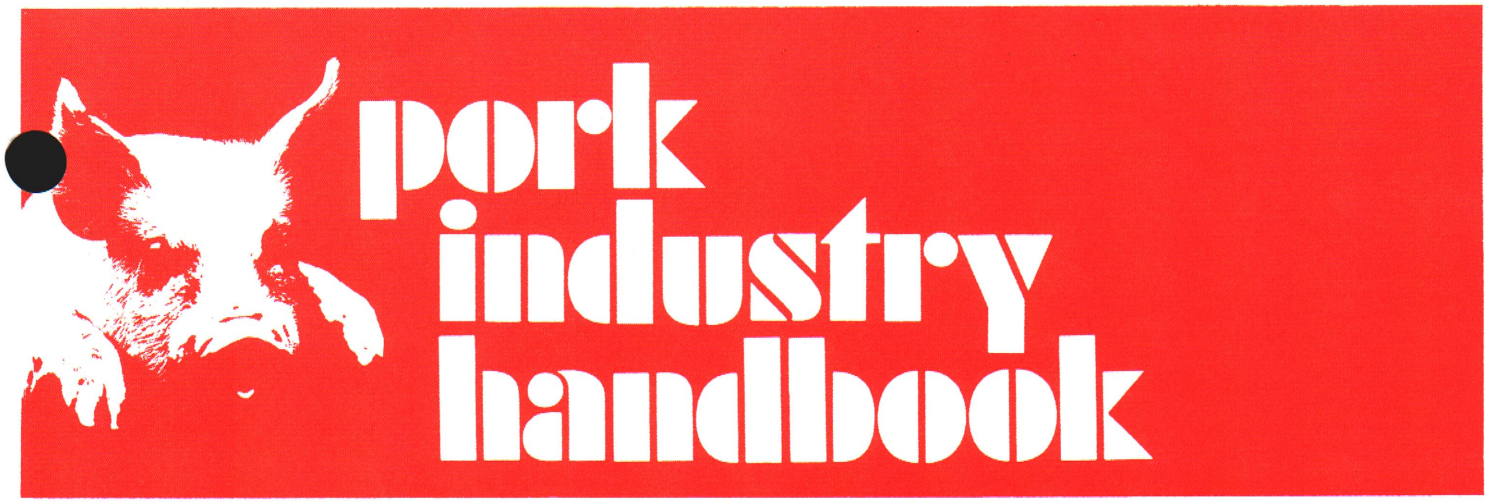

Cooperative Extension Service • Michigan State University

Carcass Evaluation

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Introduction

Carcass evaluation is an important part of determining success in pork production. Following reproduction, feeding, and marketing of the hog, the final step is its transformation to food for humans. Through these processes, pork producers can effectively evaluate their progress in selection and management. In addition to measuring efficiency in terms of producing large, healthy litters that gain rapidly on minimum feed, producers should also be concerned about how much lean, edible pork is produced and how desirable it is for processing and consumption. This fact sheet describes compositional and qualitative characteristics associated with pork carcass desirability and identifies procedures that can be standardized and applied to measure these characteristics throughout the pork industry.

Transforming the Hog to Pork

Identification. Marked with approved edible ink, each hog should be tattooed at two locations on each side. If hogs are skinned rather than dehaired, tags can be clipped to both ears. After bleeding and before the head is removed, the tags are removed, placed in a plastic bag, and securely pinned to the foreshank.

Inspection. The person in charge of inspection at the slaughter plant should record information concerning any specific abnormalities that are observed during antemortem and postmortem inspection. Even though carcasses might pass inspection, abnormalities such as jowl abscesses, arthritis, or cryptorchidism might exist. Producers should be informed if such conditions prevail in their herds. It is recommended that such carcasses not be evaluated.

Hot carcass weight, belly dimension, and trimming losses. The hot carcass weight should be written on the carcass with an edible ink marker, or if time and space do not permit this, weight may be recorded sequentially on a weigh sheet. One advantage of writing on the carcass is that fewer are lost in the coolers. If chilled weights are recorded, convert to a hot weight basis by dividing by .985 because most carcasses shrink about 1.5% during drying and chilling. For skinned carcasses, adjust to a skin-on basis by dividing the hot weight by 0.94 (the skin accounts for about 6% of the hot carcass weight), or by another more appropriate value that might be provided by the plant management.

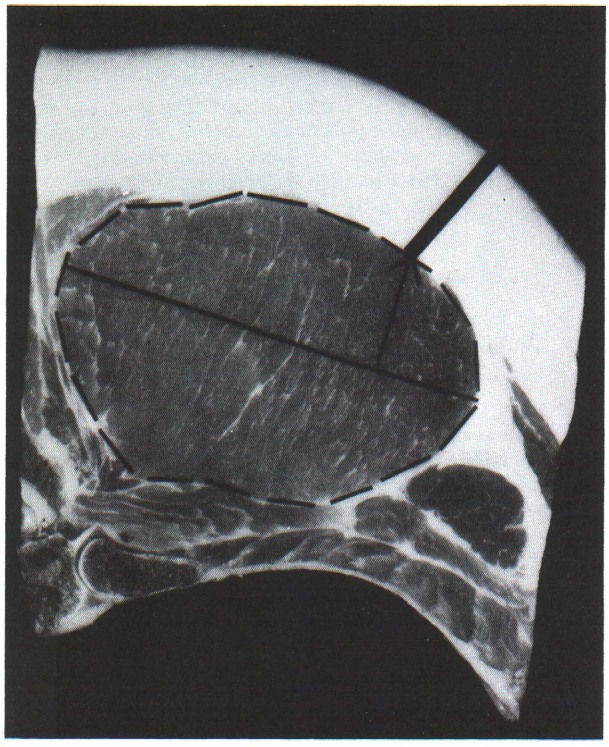

Figure 1. Loin muscle area and fat depth at 10th rib location.

If jowls are removed or if muscle, fat, or bone have been removed from locations where measurements need to be taken, or if excessive (greater than 5% of hot carcass weight) muscle, fat, and/or bone have been removed because of bruises or localized infections, the carcass should not be evaluated. If the trim loss is less than 5%, the amount missing should be estimated and added to the hot carcass weight.

A minimum carcass weight of 150 lb. is recommended for evaluation. However, if thin bellies are a concern at this weight, then the minimum carcass weight requirement should be increased. To date, there is no reliable objective definition of a belly that is too thin; such descriptions have not been standardized, and there is no clearly interpreted and practical method for identifying this. Most carcasses weighing 150 lb. or more will be free of the thin-belly problem. Once bellies meet minimal dimensions for subsequent processing, the major concern is desirable composition and quality.

Ribbing the carcass. To measure composition and quality characteristics, the vertebra of the untrimmed carcass is first cut with a saw perpendicular to the long axis of the loin between the 10th and 11th ribs. Start adjacent to the 11th rib and at the 11th-12th thoracic vertebrae junction to permit a square cut across the loin muscle without cutting into the 10th rib. After the vertebra is sawed, use a knife and extend the cut no more than 1 in. beyond the outer side of the loin muscle surface. Extending the cut farther will damage the belly. Ribbing should be done only on properly chilled carcasses (at least 6 hours or more after slaughter is recommended), and it should be completed at least 30 minutes prior to visual examination to allow for full expression of the quality characteristics.

Composition Characteristics

Composition refers to the proportionate amount of lean (or muscle) that a carcass contains. Degree of fatness and extent of muscling (reflecting variations in muscle-bone ratio) are the two important factors associated with composition. It is desirable to have as much muscle and as little fat, bone, and skin as biologically possible without jeopardizing quality and live production factors. When comparing carcasses or measuring production efficiency, it would be ideal to determine the proportion of muscle by physical dissection and chemical analysis. However, these procedures are not practical under most circumstances. Simpler, though less accurate, methods are used to estimate composition. The following indicators are recommended:

- **Hot carcass weight (adjusted for missing parts).**
- **Fat depth (including skin) over the loin at the 10th rib.** Visually divide the longest axis of the loin muscle surface into quarters. Measure the fat depth opposite a point that is ¾ the distance along the long axis closest to the belly. The measurement is taken in tenths of inches from the edge of the loin muscle to the outer edge of and perpendicular to the skin (see Figure 1). For skinned carcasses, add 0.1 in. to the measurement. For greater accuracy, both sides of the carcass should be ribbed, measured, and averaged and reported to the nearest .05 in. There is no minimum fat thickness that can be recommended because there is little or no information to support a minimal acceptable fatness level. As long as selection against fatness does not result in muscle quality deficiencies, inadequacies in belly characteristics, or reduced live production efficiency, producers must continually attempt to reduce fatness.
- **Loin muscle area (LMA).** This measurement is taken in square inches by using a clear plastic grid (Grid AS-235e, Iowa State University, Ames). Loin muscle area is determined by measuring the cross-sectional area, which is illustrated in Figure 1. The area can also be measured by tracing the outer perimeter of the loin muscle on acetate paper and using a compensating polar planimeter to measure the area on the tracing paper. For more accuracy, both sides of the carcass should be ribbed and measured and the values averaged and reported to the nearest 0.1 square in.
- **Carcass muscling score** (see Figure 2).
- **Combining hot carcass weight, fat depth, and loin muscle area or muscling score to estimate pounds or percentage of lean pork (containing 10% fat).** The first two equations can be used to estimate pounds of lean pork when carcass weight is to be adjusted to 160 pounds because of live weight and age differences that should be minimized in comparing carcasses in a carcass contest.

Equation 1.

Pounds of lean pork = 81.4
(containing 10% fat)
+ (hot carcass weight, lb. x .06)
+ (loin muscle area, in.^{2} x 2.0)
- (10th rib fat depth, in. x 14.9)

If the carcass cannot be ribbed, then the following equation should be used:

Equation 2.

Pounds of lean pork = 82.8
(containing 10% fat)
+ (hot carcass weight, lb. x .047)
+ (carcass muscling score x 3.6)
- (last rib fat thickness x 14.0)
+ 3.6 (if sex = gilt)

To determine percentage of lean pork in the carcass, always divide pounds of lean pork by 160 and multiply by 100 for equations 1 and 2. When circumstances dictate that weight should not be held constant (i.e., when carcasses are evaluated for current worth), then one of the next two equations should be used:

Equation 3.

Pounds of lean pork = 10.5
(containing 10% fat)
+ (hot carcass weight, lb. x 0.5)
+ (loin muscle area, in.^{2} x 2.0)
- (10th rib fat depth, in. x 14.9)

or

Equation 4.

Pounds of lean pork = 12.4
(containing 10% fat)
+ (hot carcass weight, lb. x 0.5)
+ (carcass muscling score x 3.6)
- (last rib fat thickness, in. x 14.0)
+ 3.6 (if sex = gilt)

To determine percentage of lean pork in the carcass, divide pounds of lean pork by *actual* hot carcass weight and multiply by 100 for equations 3 and 4.

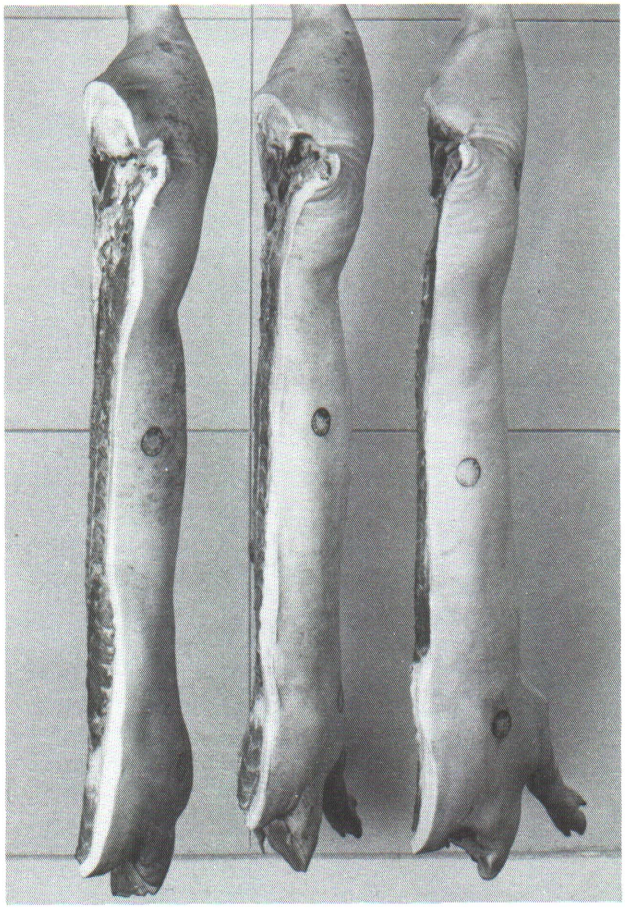

Figure 2. Muscling scores: left, 3 = thick; center, 2 = intermediate; and right, 1 = thin.

Qualitative Characteristics

Desirable fresh pork quality is defined as a combination of traits that provides for an edible product that loses a minimum of water and nutrients, is wholesome after processing and storage, is attractive in appearance, and is appetizing, nutritious, and palatable after cooking. Nutritive value is basic to pork quality; the primary merit of pork as a food is its nutrient content. Pork muscle contains the essential amino acids in biologically available form; the water-soluble vitamins, especially thiamin; some minerals, notably iron; and high-energy lipids, including the essential fatty acids.

Wholesomeness refers to cleanliness and the freedom from undesirable microorganisms, which is influenced by the health of the live hog and by proper sanitation during slaughtering, handling, and storage of pork. Together, nutritive value and wholesomeness satisfy the minimum requirements for pork to be used as food.

Suitability for processing relates to pork which sustains minimal shrinkage because the muscle is not watery. Attractiveness of pork is an aesthetic factor that is determined by its color, structural appearance, and its convenience (size of cut, amount of bone, etc.) for use as food. Palatability characteristics include flavor (taste and aroma), tenderness, texture, and juiciness. The following quality traits are related to shrinkage, appearance, and palatability and are useful predictors of pork quality.

Muscle color. Pork muscle should be grayish pink. Individual muscles are usually uniform in color, but muscle groups in close proximity to each other often display considerable variability in color (such as in the ham). Darker color may result from increased quantities of color pigments, greater presiaughter physical activity, less surface oxygen, surface dehydration, or minimal production of lactic acid during carcass chilling. A pale color may be the result of a rapid conversion of muscle glycogen to lactic acid immediately after slaughter.

Muscles that are too pale or too dark are objectionable in appearance in retail trade. Abnormally pale muscles quickly turn gray in the retail display case and often incur considerable shrinkage, resulting in economic losses during processing, and in dry-tasting products after cooking. Dark muscles will have a shorter shelf life because they are less acidic and therefore support bacterial growth, and are considered by some consumers to originate from older animals (generally not a correct assumption). The three color scores (1 = pale, 2 = grayish pink, and 3 = dark), shown in *Procedures to Evaluate Market Hog Performance,** represent normal variation of pork color. Carcasses having either of the two extreme color scores should not be evaluated.

Muscle firmness—wateriness condition. If the loin is soft and watery, displaying obvious fluid accumulations on its surface and exhibiting a loose, coarse texture, the carcass should be eliminated from evaluation. This condition is related to the pale color, and such a product often sustains excessive shrinkage during processing and is dry when eaten. For visual scores, see National Pork Producers Council (NPPC) *Procedures to Evaluate Market Hog Performance.*

Intramuscular fat. Marbling is the visible fat within the boundaries of the muscle. Slight to small amounts as shown in *Procedures to Evaluate Market Hog Performance* are desirable to provide a juicy and flavorful cooked product. Pork with traces or less marbling may be less flavorful and less juicy than desired. However, at the other extreme, abundant marbling does not make pork proportionately more palatable but does supply more calories (thus diluting other nutrients) making these pork products objectionable to most consumers. Carcasses possessing abundant quantities of marbling should not be evaluated.

Abnormalities. Pork fat should be firm and white. Soft, oily, and slightly brownish colored fat is objectionable because it is not attractive when displayed at the market place and is more susceptible to rancidity during processing and storage.

Other abnormalities affecting the acceptability of pork muscle include fatty infiltration and blood splashing. Such conditions are rare, but if present, the carcass should not be evaluated.

Combining Composition and Quality Traits Of the Carcass with Live Production Traits

If carcasses are to be ranked on the basis of overall merit, then each carcass should (a) be free of all abnormalities; (b) meet minimum standards for muscle quality, that is, grayish pink in color, less than abundant amounts of marbling, and free of the soft, watery, coarse-textured properties; and (c) meet minimum requirements for hot carcass weight (150 lb.), loin muscle area, carcass length, and maximum requirements for fat depth at 10th rib as described in Table 1. Carcasses meeting these criteria can then be ranked on percentage muscle as calculated by using one of the four equations, preferably (equation 1 or

* National Pork Producers Council, 1983. *Procedures to Evaluate Market Hog Performance.* P.O. Box 10383, Des Moines, IA 50306.

3) using hot carcass weight, loin muscle area, and fat depth at the 10th rib.

Carcass excellence in itself is desirable but is not the ultimate answer to successful pork production. Factors indicative of carcass quality and composition should be combined with live visual traits and production records as described in *Procedures to Evaluate Market Hog Performance.* Pounds of acceptable quality lean pork gain per day on test or per day of age† should be implemented to measure more realistically overall progress in pork production, rather than simply evaluating carcasses on the basis of their muscle percentage.

Pounds of acceptable quality lean pork (containing 10% fat) gain per day on test

= 0.9

- (.0044 x initial live wt. on test, lb.)
- (.007 x days on test)
- (.15 x fat depth at 10th rib, in.)
+ (.018 x LMA, in.^{2})
+ (.0047 x hot carcass wt., lb.)

† From Grisdale, B., L.L. Christian, H.R. Cross, D.J. Meisinger, M.F. Rothschild, and R.G. Kauffman, 1984. "Revised Approaches to Estimate Lean of Pork Carcasses of Known Age or Days on Test." *Journal of Animal Science* 58:335.

Table 1. Minimum and maximum requirements for loin muscle area, carcass length, and fat depth at the 10th rib according to carcass weight.

	Hot carcass weight, lb.		
	<165	165-180	>180
Minimum loin muscle area at 10th rib, in.^{2}	4.50	4.75	5.00
Minimum carcass length, in.	30.0	30.5	31.0
Maximum fat depth at 10th rib, in.	1.2	1.3	1.4

NOTE

The equations included in this publication were developed from a study by Grisdale, et al. (1984). The study included 185 carcasses that varied in fat depth at the 10th rib (0.5-1.9 in.), muscling (thin to thick), loin muscle area (3.7-7.5 in.^{2}) and weight (139-236 lb.). The carcasses originated from hogs of known history that represented four body types and that were fed to four live weights (200, 230, 260, and 290 lb.).

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