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# Understanding Pork Carcass Contest Information

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This NebGuide explains how to interpret data from pork carcass contests.

## Introduction

Pork carcass contests provide youth and their families with information to enhance the educational experience of a 4-H swine project. Carcass contests help create an awareness of current swine carcass qualities that are considered desirable by the pork industry and by consumers. Carcass contests identify those carcasses that excel in meat yield, or percent lean. In today's industry, percent lean and carcass weight determine carcass value. Ideally, market animals that excel in live animal characteristics also will excel in carcass traits. However, live animal characteristics, such as structural soundness, and production traits, such as feed efficiency, are not considered in ranking pork carcass contests. Thus, animals that excel in carcass contests may or may not be the most desirable animals overall. Selection, breeding, nutrition and management practices can affect both carcass and live animal characteristics. Practices that result in high performing live animals that produce superior carcasses can only be identified when carcass information is available and properly interpreted.

## Percent Lean

Most pork carcass contests are ranked on percent lean or percent muscle. "Percent lean" and "percent muscle" are used interchangeably and refer to the amount of muscle as compared to the amount of fat and bone in the carcass. Carcasses should have as much muscle and as little fat and bone as possible, without jeopardizing meat quality and live production factors.

Information needed to calculate percent lean can be gathered on the actual carcasses or by using ultrasound on live animals. While the data from actual carcasses is most accurate and preferred, this information can be difficult to gather, due to operating procedures in most modern meat packing facilities. Thus, many youth carcass contests use ultrasound measurements for backfat and loin muscle area. Carcass weight also is needed to calculate percent lean. The actual carcass weight may be obtained from the packing facility, or it may be calculated from the live weight, using a standard dressing percentage.

Dressing percent is the percentage of live weight that becomes carcass weight. Carcass weight is calculated by the following formula: Live weight x Dressing Percent = Carcass Weight. For example, using a 270 lb. hog and dressing percent of 74%, the calculated carcass weight is 200 lbs.

When using ultrasound data, four factors are used to calculate percent lean. These factors are (1) sex of the pig; (2) $10^{th}$ rib fat depth, in inches; (3) $10^{th}$ rib loin muscle area (LMA) , in square inches; and (4) warm carcass weight, in pounds. Each one of these factors alone is related to the amount of lean that a carcass will produce, but to get the most accurate estimate of the amount of lean, all factors must be considered. When combined into the formulas below, they provide an accurate estimate of the pounds and/or percentage of fat free lean (FFL) on the carcass. Fat-free lean is simply an estimation of total lean meat on a pork carcass. All exterior fat trim and bone have been removed. The only fat included in the fat free lean estimate is intramuscular fat or marbling, which is fat within the muscle.

**Formula 1:** 5.777 + (1.006 × sex of pig (barrow = 1, gilt = 2)) - (18.838 × $10^{th}$ rib fat depth) + (4.357 × $10^{th}$ rib LMA) + (.401 × warm carcass weight) = Pounds of fat free lean

**Formula 2:** Pounds of fat free lean ÷ warm carcass weight × 100 = % FFL or percent lean

**Sex of the pig** is included in the formula because carcasses from gilts generally produce a greater amount of lean than carcasses from barrows of equal weight.

**Tenth rib fat thickness** is measured over the loin muscle, at a point three-quarters of the way from the backbone to the outer edge of the loin muscle. **Loin muscle area** is also measured at the $10^{th}$ rib. The location of the $10^{th}$ rib on a live hog is shown in *Figure 1*. A cross-section of the loin muscle, indicating the location for fat measurement and the loin muscle area, is shown in *Figure 2*.

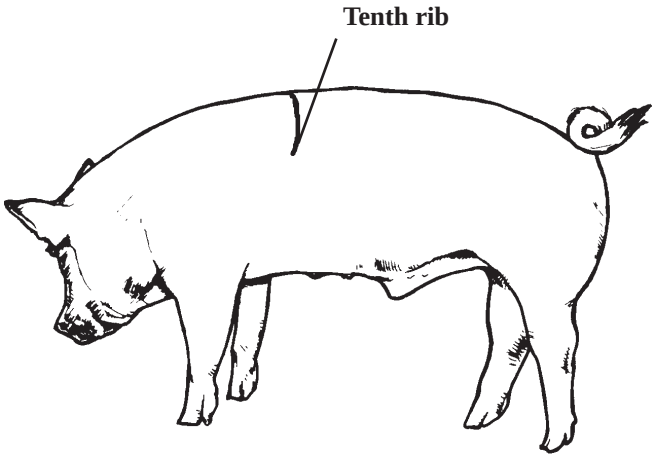


**Figure 1. Live hog — 10th rib indicated.**

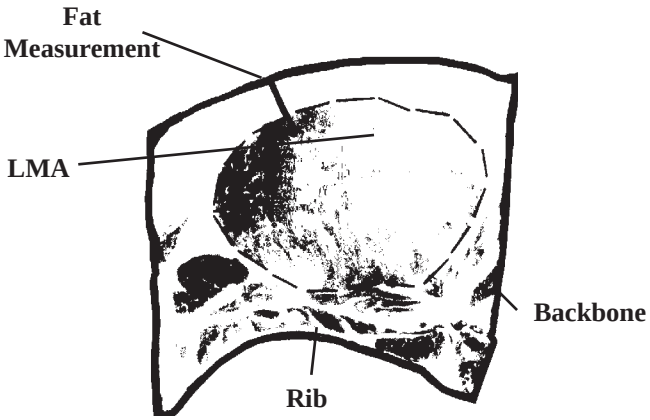


**Figure 2. Loin eye cross-section, indicating fat measurement location and loineye area.**

The average fat thickness for all pork carcasses is slightly over 1.00 inch; however, pigs shown in youth shows are typically leaner. For example, the 2000 Ak-Sar-Ben Youth Livestock Exposition Pork Carcass Contest had 465 entries, with an average 10th rib fat thickness of .52 inches. Most pork carcasses have between .2 and 1.2 inches of fat at the 10th rib. Between these ranges, less fat is desirable and will increase the percent lean.

The average LMA (also called loin eye area, or LEA) for all pork carcasses is approximately 6.25 square inches. However, as with fat thickness, pigs from youth shows are often above average, with larger LMA's. Again using the 2000 Ak-Sar-Ben Contest as an example, the average LMA was 8.02 square inches. Most pork carcasses have LMA's between 4.5 and 9.0 square inches. Within these ranges, a larger LMA is desirable and will increase the percent lean.

The **warm carcass weight** is the weight of the dressed carcass, taken immediately after harvest, before it has been chilled. Hogs that weigh 240 to 280 pounds live typically will have carcasses that weigh 170 to 215 pounds. An average dressing percent, or the percent of live weight that becomes carcass, for show pigs is approximately 74%. In other words, a pig that has a live weight of 250 pounds would produce a carcass that weighs about 185 pounds (250 × .74).

Once the pounds of fat free lean have been calculated, it is easy to put this on a percentage basis. Simply divide the pounds of fat free lean by the carcass weight (Formula 2). This allows for a more objective comparison of carcasses of different weights. If carcass shows were ranked on pounds of lean, rather than percentage of lean, heavier carcasses would nearly always have an advantage.

It is important to note that there are different formulas available to calculate percent lean, based on how the fat, LMA and weight data were collected. The formula used to calculate percent lean from ultrasound data varies slightly from the formula used when actual carcass data is available, and the formula used when actual carcass weight is available is different than the formula used when carcass weight is calculated from live weight. For more detailed explanations, consult "Pork Composition and Quality Assessment Procedures," available from the National Pork Producers Council and the American Meat Science Association.

### Example Contest Data and Interpretation

Carcass contests will vary in specific rules, but many have minimum and maximum weights for both live animals and carcasses, and minimums for muscling. This example will use rules from the 2001 Nebraska State Fair 4-H Premium Book to evaluate a set of data. These rules include:

A. Minimum Carcass Weight: All carcasses weighing less than 160 lbs. will be disqualified. (Disqualified carcasses will receive a white ribbon ranking).
B. Maximum Carcass Weight: All carcasses weighing more than 220 lbs. will be disqualified.
C. Live Weight Requirements For Blue & Purple Awards: To be eligible for blue or purple ribbons, carcasses must be from barrows or gilts with live weights of 230 to 290 lbs.
D. Minimum Loin-eye Area: All carcasses not having a loin-eye area of at least 4.50 square inches will be disqualified.

Using these criteria, nine example carcasses are ranked as follows:

| *Rank/Ribbon* | *Live Weight* | *Sex* | *Carcass Wt* | *Backfat* | *LMA* | *% Lean* |
|---|---|---|---|---|---|---|
| Purple 1 | 249 | B | 193 | 0.40 | 9.95 | 62.17 |
| Purple 2 | 237 | G | 186 | 0.38 | 7.65 | 58.36 |
| Blue 1 | 262 | G | 209 | 0.60 | 8.39 | 55.91 |
| Blue 2 | 258 | B | 204 | 0.62 | 7.75 | 54.25 |
| Red 1 | **209** | G | 166 | 0.38 | 7.81 | 60.98 |
| Red 2 | 217 | B | 162 | 0.65 | 4.96 | 50.07 |
| White 1 | 225 | G | **158** | 0.56 | 5.89 | 54.59 |
| White 2 | **293** | G | **227** | 0.58 | 8.15 | 54.36 |
| White 3 | 267 | B | 204 | 1.00 | 6.9 | 48.93 |

The first four entries in this contest are ranked strictly on percent lean, using the formulas found earlier in this paper. A larger LMA may compensate for slightly higher fat thickness, and reduced fat will compensate for a less muscle (smaller LMA). Divisions between purple and blue ribbons are designated at a certain percent lean, based on the range of percent leans in the carcass contest. In this example, all carcasses above 56% lean that met eligibility requirements received a purple ribbon, and carcasses with 53.0 to 55.99% lean received a blue ribbon. The highest ranked red ribbon carcass had nearly 61% lean, but failed to qualify for a blue or purple ribbon because of the light live weight (Rule "C"). However, its percent lean ranks it at the top of the other red ribbon carcasses. The range in percent lean for red ribbon carcasses not outside the acceptable live weight range was 50.0% to 52.99%. The first white ribbon carcass is in the white ribbon group because it was underweight and did not meet Rule "A". Similarly, the second white ribbon carcass was overweight and did not meet Rule "B". Even if this carcass had not been overweight, it would have qualified for only a red ribbon, as the live weight also was heavier than the maximum live weight (Rule "C"). Again, for the first two white ribbon carcasses, the percent leans would have qualified them for a higher ranking, but they were disqualified and placed in the white ribbon group due to carcass weight. The third white ribbon carcass is there simply due to percent lean. Although on a nationwide basis this would be a fairly average carcass, it was far below the average of carcasses in this youth show. In this example, any carcass with less than 50% lean was placed in the white ribbon group.

## Meat Quality

Pork carcass contests based on live pig ultrasound data do not include an evaluation of pork meat quality. However, carcass contests based on actual carcass data often include evaluations of meat quality. Collection of actual carcass data and meat quality factors is not currently feasible in many packing plants. However, changes in the meat industry soon may allow for meat quality measurements in the packing plant. Accordingly, packers will adjust prices for carcasses based on the estimated meat quality, and more carcass shows may include a measurement of meat quality. Since the genetics that produce the highest percentages of lean also often lead to poorer meat quality, it is an item of concern for many show pig producers. Therefore, it is important to have an understanding of factors that affect meat quality.

Four measurements of loin muscle quality have been identified as key traits. These include color, ultimate pH, water holding capacity (WHC) and intramuscular fat.

Loin muscle color is often visually scored using a six-point scale, with (1) indicating a very light, pale pinkish gray color and (6) indicating a very dark purplish red muscle color. Neither very pale or very dark is desirable, consumers generally prefer a medium reddish-pink colored meat. Thus, color scores of (1) and (6) are unacceptable.

Ultimate pH is a measure of the acidity of the muscle. A higher number indicates less acidity. Meat with a higher pH has less drip loss and a darker color. It is firmer and more tender than meat with a lower pH. The range in pH is not very wide. The lowest pH values are usually around 5.3, the highest values around 6.0. A pH below 5.7 is considered less desirable. A measurement of pH may be quite adaptable to modern meat packing facilities.

Water holding capacity is the ability of the meat to retain its moisture during cutting, grinding and cooking. Meat with low water holding capacity will lose much of its moisture before and during cooking. This results in unattractive meat packages that display excess fluid, as well as excess cooking loss and dry meat. A true evaluation of water holding capacity is usually done with laboratory procedures, but a visual assessment of firmness and wetness can serve as an indicator of water holding capacity. A three-point scale is used for assessing wetness, with (1) indicating "exudative," (2) "moist," and (3) "dry," Exudative means that excess fluid has pooled on the cut surface, thus a wetness score of (1) is not acceptable. Firmness is also assessed with a three-point scale, with (1) indicating "soft," (2) "firm," and (3) "very firm." Soft meat surfaces are visibly soft and may appear mushy, thus a firmness score of (1) is not acceptable.

Carcasses that have color, wetness, and firmness scores of (1), or unacceptable, are referred to as PSE pork, or pale, soft and exudative. This low quality pork is much less desirable to consumers. If procedures are developed that allow for meat quality measurements in packing plants, PSE carcasses are most likely to receive negative price adjustments.

Intramuscular fat is the amount of fat found within the muscle. Laboratory tests can be done to determine he actual percentage of intramuscular fat, but it is also highly related to visual scores for marbling. Marbling can be scored on a scale of one to ten, with (1) indicating an extremely low level of marbling and (10) indicating a very high level of marbling. A marbling score of (2) is considered the minimum to produce pork loins that are acceptable to consumers for juiciness and eating quality. Scores of (6) or greater are also less desirable, due to the increased fat content and calories associated with these marbling levels.


**Summary**

Carcass contest information can be used to plan for and improve future projects. Fat thickness and loin muscle area information can be used to adjust diets to reach the optimum level of finish for pigs at time of harvest. Loin muscle area information can be used to plan for breeding programs that improve muscle characteristics. Appropriate use of carcass contest information can help with the process of selecting animals that excel in both live animal and carcass characteristics.



**This publication has been peer reviewed.**





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