

Importance of Animal Products

Lesson 1: Importance of Animal Products

Animal agriculture takes many forms throughout the United States and worldwide; however, the majority of large animal agriculture is for the purpose of producing high quality meat, poultry, dairy products, and eggs. The animal processing industry is a constantly changing, consumer-driven industry that provides billions of dollars and numerous jobs for the economy.

Animal Processing Industry

The animal processing industry has evolved into a large, corporate, automated industry, which utilizes the entire animal in some manner. The origin of the animal processing industry can be traced back to the time when small, privately-owned processing plants processed a few animals each day. Today, the majority of animals are processed in large state-of-the-art facilities that handle thousands of animals per day. Furthermore, many of the newer processing plants have their own rendering facilities, which turn inedible parts into byproducts, such as blood meal, bone meal, and feather meal.

Several key legislative acts have helped bring consistency and safety to the animal processing industry. The Meat Inspection Act of 1906 was the beginning of federal meat inspection by the United States Department of Agriculture (USDA). The Meat Inspection Act of 1906 was prompted by consumer concerns about the wholesomeness of meat products and the sanitary conditions of processing plants. In 1921, the Packers and Stockyards Act was passed to prevent unfair business dealings by packing and stockyard companies. One benefit of this act was the initiation of scale testing in sale barns and packing facilities. Scales are tested to ensure accuracy of weighed animals and products. Next in 1967, the Wholesome Meat Act was passed, which made state inspection similar to federal meat inspection. The Wholesome Meat Act has been revised several times. Presently, meat, poultry, and egg inspections are implemented by the USDA's Food Safety and Inspection Service. Inspection ensures wholesomeness, safety, and accurate labeling of meat, poultry, and egg products.

Career Opportunities

There are thousands of jobs and careers related to animal processing. These include livestock buyers, federal inspectors, USDA meat graders, quality control supervisors, and butchers.

Livestock buyers purchase animals for the processing company. Livestock buyers must be skilled in animal evaluation and meat grading in order to determine a fair market value for the livestock that they are purchasing.

Federal inspectors carry out the rules and regulations set by the USDA in order to ensure the safety of our food supply. Inspectors check the sanitary conditions of the processing plants and also inspect the health and wholesomeness of the animals, dairy products, and eggs being processed.

USDA meat graders assign meat grades for quality and cutability (yield grades) of meat carcasses. Unlike federal inspections, federal grading is not required. However, the grades that are assigned determine the value of the food product. Yield grades predict the amount of boneless closely trimmed retail cuts from the carcass, while quality grades predict the tenderness, taste, and juiciness of the meat.

Quality control supervisors manage employees and ensure that quality work is being done to provide a high-quality finished product.

Butchers cut carcasses into retail and wholesale cuts. They also process live animals into carcasses.

Economic Impact

The economic impact of the U.S. animal processing industry is quite extensive with billions of dollars worth of meat, dairy, and egg products sold each year alone. More than 358 billion dollars worth of products are sold a year. In addition, animal byproducts contribute to the profits of the processor. A byproduct is any product produced in addition to the primary product. In the animal processing industry, byproducts can be edible (heart or brains) or inedible (such as skin, hair, and bones). With the expanded use of inedible

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byproducts, the economic impact is quite high. Many inedible byproducts are used in animal feeds and pet foods. A majority of animal processors' profits are derived from the sale of inedible byproducts, which include leather from cattle hides, feather meal from chicken/turkey feathers, blood meal, fish meal, and bone meal. These byproducts are used by other industries and operations, such as pharmaceuticals, clothing, and animal feeds.

Processing Affects Value of Product

Many different businesses are involved in the animal processing industry. Some processors purchase the raw animal product (animal, milk, or eggs) from the producer and process it into wholesale products. Other processors purchase the raw product and do all the processing needed to make the edible products available at the retail level. Still many other processors not only process the edible products but process the byproducts as well. As discussed earlier, byproducts can be edible or inedible. The more processing that the processor does to the raw product, the more the business is able to receive for the end products, edible or inedible.

The amount of processing the raw product (e.g., beef cattle) receives affects the cost of the end product (e.g., ground beef, chili with beef). The more processing steps involved, the higher the cost of the end product. Value-added products, such as microwave ready and ready-to-eat products, have gone through many processing steps on the way to the consumer. Consumers are willing to pay more because less time will be required for them to prepare these products to eat. For example, it would take a significant amount of time to make beef chili if the consumer had to start from the raw product (beef animal) and process it into hamburger and then process (cook) the hamburger to be put in the chili and then process (cook) the chili.

Summary

Animal processing has evolved into a large multi-billion dollar industry under the regulation of the USDA. Many careers are directly involved in the processing of animals. The sale of value-added products and byproducts help the animal processing industry remain profitable.

Credits

Martin, Phillip. *Food Science and Technology*. University of Missouri-Columbia: Instructional Materials Laboratory, 1994.

United States Department of Agriculture. National Agricultural Statistics Service. *Ag Statistics 95-96*. Washington, DC.

Lesson 2: Beef

Beef carcasses are inspected and then quality and yield graded while in the processing plant. After grading, the carcass is split into wholesale, or primal, cuts which are sold to retail stores. At the retail level, the wholesale cuts are cut into the smaller retail cuts to be purchased by the consumer.

When officially graded, beef carcasses may consist of a quality grade only, a yield grade only, or a combination of the quality grade and the yield grade. Bull carcasses can only receive a yield grade. The United States Department of Agriculture (USDA) graders use photographs and other objective aids to correctly interpret and apply the standards.

Quality Grading

Beef carcasses are graded for quality to provide an indicator of the palatability of the lean. Palatability refers to tenderness, juiciness, and flavor of the meat. Beef carcasses are divided into two sections: 1) steers, heifers, and cows and 2) bullocks. Steer and heifer are eligible for Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner quality grades. Cow is eligible for the same designations except for Prime. Bullock is only available for Prime, Choice, Select, Standard, and Utility quality grades.

To determine the grade, the carcass must be split down the back into two sides and one or both sides must be partially separated into a hindquarter and a forequarter. The hindquarter and forequarter separation is made at the 12th thoracic vertebra. The separation must be done cleanly so that the grader can accurately evaluate the lean and the maturity.

The quality of the beef is determined by evaluating the quality of the lean in relation to carcass evidences of maturity. The maturity of the carcass is determined by evaluating the size, shape, and ossification of the bones and cartilages and the color and texture of the lean flesh. Lean characteristics of marbling and firmness are observed in the cut surface of the rib eye between the 12th and 13th thoracic vertebrae.

Maturity - To facilitate the application of the principles, the standards recognize five different maturity groups.

The five maturity groups are identified as A, B, C, D, and E in order of increasing maturity (see Figure 2.1). The youngest and most common maturity is A, which refers to animals 30 months of age or younger. The A and B maturity groups are for young animals only. Maturity groups C through E are older animals.

In the youngest beef carcasses, the cartilages on the ends of the chine bones show no ossification. Cartilage is evident on all of the vertebrae of the spinal column, and the sacral vertebrae show distinct separation. In addition, the split vertebrae usually are soft and porous and very red in color. The rib bones have only a slight tendency toward flatness. In progressively more mature carcasses, ossification changes become evident first in the bones and cartilages of the sacral vertebrae, then in the lumbar vertebrae, and still later in the thoracic vertebrae. In beef very advanced in maturity, all the split vertebrae will be devoid of red color, be very hard and flinty, and the cartilages on the ends of all the vertebrae will be entirely ossified. Likewise, with advancing maturity, the rib bones will become progressively wider and flatter until the ribs are very wide and flat.

In the youngest beef carcasses, the lean flesh will be very fine in texture and light grayish red in color. In progressively more mature carcasses, the texture of the lean will become progressively coarser and the color of the lean will become progressively darker red. In very mature beef, the lean flesh will be very coarse in texture and very dark red in color. In determining the maturity of a carcass in which the skeletal evidences of maturity are different from those indicated by the color and texture of the lean, slightly more emphasis is placed on the characteristics of the bones and cartilages than on the characteristics of the lean. For bullock carcasses that have darker colors of lean than specified in the standards, additional consideration is given to the carcass characteristics.

Marbling and firmness - Marbling, which is intramuscular fat, is evaluated between the 12th and 13th ribs. When you look at the rib eye muscle, the marbling appears as white flecks of fat dispersed between the muscle fibers. The degrees of marbling referenced in the specifications are: slightly abundant, moderate, modest, small, slight, traces, and practically devoid. In carcass evaluation programs and other purposes, three

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additional degrees are recognized: very abundant, abundant, and moderately abundant. There are color photos that graders can use to help evaluate marbling consistently. The rating for the firmness of the muscle ranges from firm to very soft and watery. The standards spell out exactly what type of firmness is required for each quality grade. The amount of firmness varies within the grade when more than one maturity level is included in the grade. For example, within the Choice Grade, the lean of an A maturity carcass can be slightly soft, but the lean of a B maturity carcass must be slightly firm.

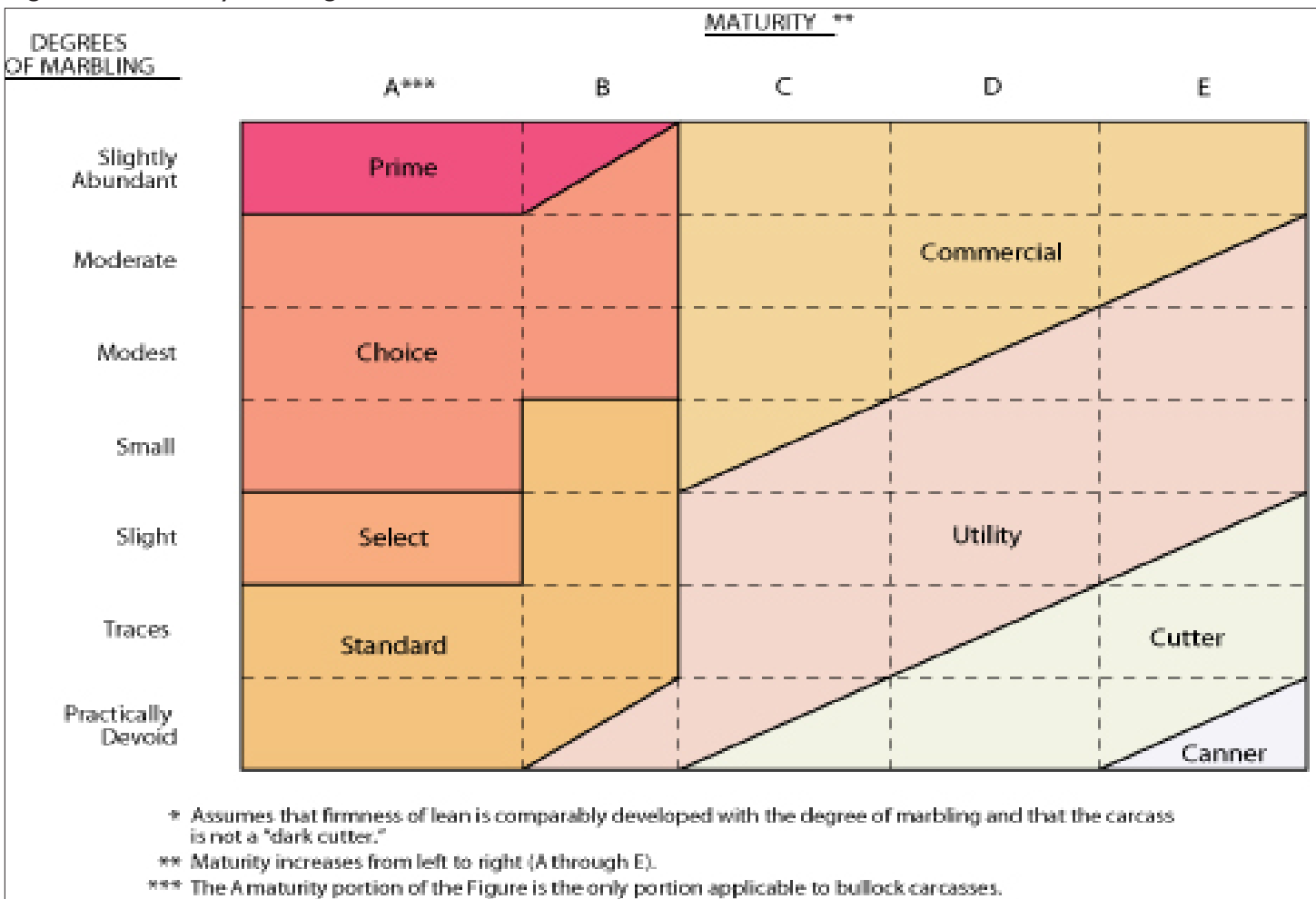
The relationship between marbling, maturity, and quality grade is shown in Figure 2.1. This figure assumes that the firmness of lean is comparably developed with the degree of marbling and that the carcass is not a “dark cutter,” which is the result of reduced sugar content of the lean at the time slaughter. The limits of these five maturity groups are specified in the grade descriptions for steer, heifer, and cow carcasses.

After the maturity and marbling are estimated, the grader locates the estimates in the chart in Figure 2.1 and the quality grade is determined. For example, if the carcass has a maturity of A and a small degree of marbling, the carcass has a quality grade of Choice.

Yield Grades

The yield grade refers to the amount of saleable meat obtained from the carcass as boneless, trimmed retail cuts from the round, sirloin, short loin, rib, and square-cut chuck. Yield grades are a numerical value from 1 through 5 with 1 being leaner and more muscular than 5. A yield grade of 1 indicates the highest percentage of saleable meat and 5 indicates the lowest percentage of saleable meat. The factors that influence yield grades are external fat thickness, the amount of fat from the kidney, pelvic, and heart areas, the area of the rib eye muscle, and the carcass weight.

Figure 2.1 - Quality Grading*

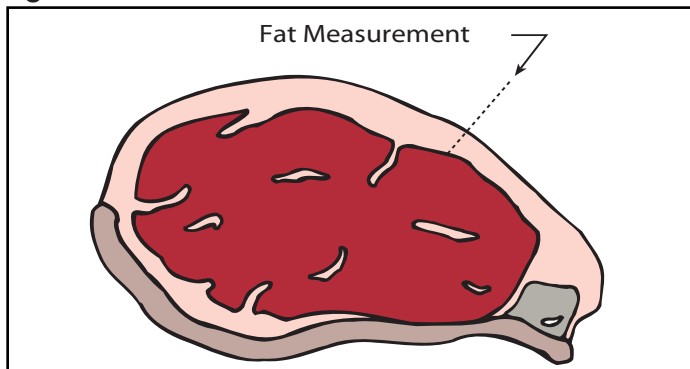


The yield grade is determined using the following equation: Yield grade = 2.50 + (2.50 x adjusted fat thickness, inches) + (0.20 x percent kidney, pelvic, and heart fat) + (0.0038 x hot carcass weight, pounds) - (0.32 x area rib eye, square inches). The grade is expressed as a whole number. If the calculations result in a whole number and a fraction of a number, the fraction is dropped. It is important to note that the number is NOT rounded. If the calculations result in 3.7, the final grade would be 3, not rounded to 4.

External fat thickness - The amount of fat covering the rib eye gives a good approximation of the total carcass fat. However, the measurement may be adjusted if unusual amounts of fat are found on other parts of the carcass, especially in the brisket, plate, flank, cod or udder, inside round, rump, and hips. The amount is measured in tenths of an inch. The external fat is measured $\frac{3}{4}$ of the length of the rib eye from the chine bone (see Figure 2.2).

Kidney, pelvic, and heart fat - This includes the kidney and surrounding area fat, the lumbar and pelvic fat

Figure 2.2 Location of External Fat Measurement



in the loin and round, and the heart fat in the chuck and brisket areas. The fat in the kidney, pelvic, and heart areas is evaluated subjectively and expressed as a percent of the carcass weight. The higher the percentage of fat, the less retail cuts are available.

Rib eye area - The actual rib eye area is measured at the 12th rib using a grid or other device approved by the Agricultural Marketing Service of the USDA. The grid measures the muscle area in square inches. An increase in the area of rib eye increases the percent of retail cuts. A change of 1 square inch in area of rib eye changes the yield grade by approximately 30 percent of a yield grade.

Hot carcass weight - The hot carcass weight is the weight of the carcass before it is chilled. If only the chilled carcass weight is known, that amount can be multiplied by 102 to give an estimate of the hot carcass weight. Hot carcass weight is used instead of chilled carcass weight because as the carcass cools, water is lost to dehydration, reducing the weight of the carcass. As carcass weight increases, the percent of retail cuts decreases. A change of 100 pounds in hot carcass weight changes the yield grade by approximately 30 percent of a yield grade. For example: A beef carcass has the following measurements: adjusted fat thickness = .7 inches; kidney, pelvic, and heart fat = 4.5%; hot carcass weight = 625 pounds; rib eye area = 10.6 square inches.

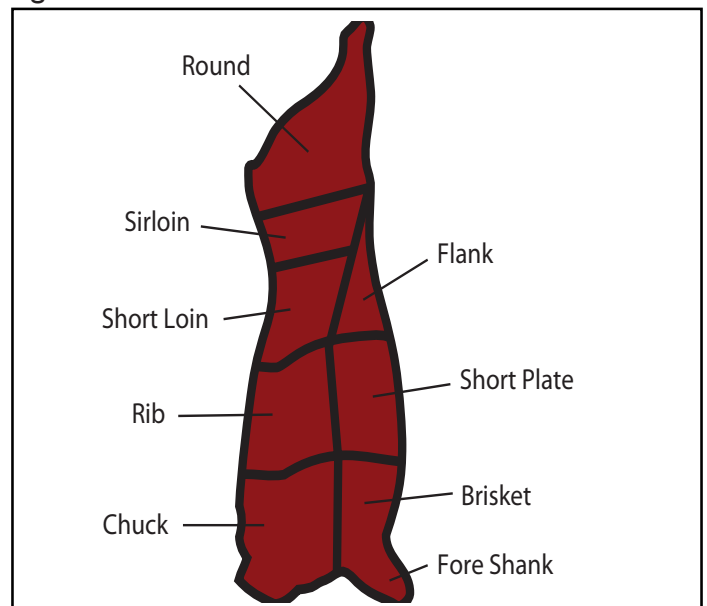
Formula: Yield grade = 2.50 + (2.50 x adjusted fat thickness, inches) + (0.20 x percent kidney, pelvic, and heart fat) + (0.0038 x hot carcass weight, pounds) - (0.32 x area rib eye, square inches)

$$\begin{aligned} \text{Yield grade} &= 2.50 + (2.50 \times .7) + (0.20 \times 4.5) + (0.0038 \times 625) - (0.32 \times 10.6) \\ \text{Yield grade} &= 2.50 + 1.75 + .9 + 2.375 - 3.392 \\ \text{Yield grade} &= 4.133 = \text{Final yield grade of 4} \end{aligned}$$

Wholesale Cuts

The wholesale cuts of beef are the chuck, rib, short loin, sirloin, round, flank, short plate, brisket, and fore shank (see Figure 2.3).

Figure 2.3 - Wholesale Cuts of Beef



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Retail Cuts

Wholesale cuts are cut into various retail cuts. Some retail cuts, such as ground beef and stew meat, are made from several different wholesale cuts. Steaks and roasts are the primary types of retail cuts. Steaks are generally under 1 inch thick, and roasts are usually over 1 ½ inches thick. The following is a list of the most common retail cuts from each wholesale cut.

Chuck

- Arm pot roast
- Blade pot roast
- Boneless shoulder pot roast
- Boneless top blade steak
- Chuck eye roast
- Cross rib pot roast
- Flanken-style ribs
- Mock tender
- Short ribs
- Seven bone roast
- Under blade pot roast

Rib

- Rib roast large end
- Rib roast small end
- Rib steak
- Rib eye steak
- Rib eye roast
- Back ribs

Short loin

- Boneless top loin steak
- Porterhouse steak
- T-bone steak
- Tenderloin steak and roast

Sirloin

- Sirloin steak, round bone
- Sirloin steak, flat bone
- Top sirloin steak

Round

- Bottom round roast
- Boneless rump roast
- Eye round roast
- Round steak
- Tip roast, cap off
- Tip steak
- Top round steak and roast
- Flank and Short Plate
- Flank steak

Flank steak rolls

Skirt steak

Fore Shank and Brisket

Brisket whole

Brisket flat half

Corned brisket, point half

Shank cross cuts

Other cuts - These cuts come from more than one wholesale cut.

Beef for stew

Cubes for kabobs

Cubed steak

Ground beef

Variety meats - These retail cuts are not from any wholesale cut, but they are other edible parts of beef cattle.

Heart

Tongue

Liver

Kidney

Tripe

Brains

Sweetbreads

Summary

Beef carcasses are graded for both yield and quality. Quality grades refer to how the meat will taste, while yield grades refer to how much saleable meat is available from a carcass. Wholesale cuts are divided into retail cuts, which are purchased by consumers.

Credits

Boggs, Donald L., and Robert A. Merkel. *Live Animal Carcass Evaluation and Selection Manual*. 4th ed. Dubuque: Kindall/Hunt Publishing Company, 1993.

Meat Evaluation Handbook. Chicago: National Livestock and Meat Board, 1988.

United States Department of Agriculture, Agricultural Marketing Service, Livestock and Seed Division. *United States Standard for Grades of Carcass Beef*. United States Department of Agriculture (Effective January 31, 1997).

Lesson 3: Pork

Pork carcasses are graded and purchased on a yield basis. Continuing work is being done to accurately evaluate the quality of pork carcasses.

Pork Quality Characteristics

Pork quality is concerned with evaluating characteristics that make the edible product nutritious and wholesome after processing and storage. The pork product should be suitable for processing, be attractive to consumers, and be appetizing and palatable (flavorful) after cooking. Quality characteristics have been defined so that there is consistency from processor to processor. The evaluation characteristics are muscle color, muscle firmness/wetness condition, marbling (intramuscular fat), and other tissue conditions. They are primarily evaluated in the loin muscle viewed between the 10th and 11th thoracic vertebrae.

Muscle color - The most desirable color for muscle is reddish pink. Muscle color is important because consumers do not want to buy meat that is too pale or too dark. Very light muscle tends to shrink and turn gray in retail display cases, which results in dry-tasting products after cooking. Since consumers often assume that very dark meat is from older animals, they are less likely to buy it.

Muscle color varies from one part of the carcass to another but is usually the same color across a muscle group. Processors use color pictures to help them consistently evaluate the color of the muscle. There are five color scores: 1 = pale pinkish gray, 2 = grayish pink, 3 = reddish pink, 4 = purplish red, and 5 = dark purplish red. Carcasses scoring a 1 or 5 should be eliminated from consideration for retail cuts.

Muscle firmness/wetness condition - The firmness or wetness of the muscle is evaluated and given a score ranging from 1 to 5. A score of 1 indicates a very soft and very watery condition. It is usually associated

with a pale pinkish gray muscle color. Also, it shrinks excessively during processing and lacks juiciness after cooking. A score of 2 indicates a soft and watery muscle that is not as severe as in score 1. Score 3 indicates a slightly firm and moist muscle condition. Score 4 indicates a firm and moderately dry muscle condition. A rigid, closed structure with no visible surface fluids is scored a 5. It is often associated with a purplish red or darker muscle color. Carcasses receiving a score of 1 or 2 should be eliminated from consideration for retail cuts.

Marbling - Marbling is the intramuscular fat, which is the visible fat within the boundaries of the muscle. Some marbling is considered desirable because it provides for a juicy and flavorful cooked product. There are 5 marbling scores: 1 = devoid to practically devoid, 2 = traces to slight, 3 = small to modest, 4 = moderate to slightly abundant, and 5 = moderately abundant or greater. Palatability would be decreased because lack of fat causes meat to be dry and less flavorful. Excessive fat (moderately abundant or greater) does not make the meat proportionally more flavorful but does add too many calories. Carcasses scoring 5 should be eliminated from consideration for retail cuts. Carcasses scoring a 1 should be eliminated from consideration for retail cuts because this score indicates that the meat would not be palatable.

Other tissue conditions - If either of the following conditions are present, the carcass is eliminated from consideration: steatosis and soft, oily fat. Steatosis is fatty infiltration in muscle tissue, indicating a problem such as muscle atrophy. Soft, oily fat is often slightly brown, is unattractive in the display case, and is more likely to turn rancid during processing and storage.

Saleable Product Determination

Although there are USDA standards for grades of pork carcasses, every packer has established its own system for grading. As pork carcasses are moved through the processing plant, cutability measurements are

Figure 3.1 - Percent Muscle Formula

$$\frac{88.307 - (.036 \times HCW) - (18.574 \times 10th\ rib\ backfat) + (3.734 \times LMA) \times 100}{170} = \% \text{ muscle}$$

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Figure 3.2 - Sample Calculation of Percent Muscle

If a hog carcass has a HCW of 180 pounds, 1 inch backfat at the 10th rib, and 5 square inches LMA, the percent muscle is calculated as follows.

$$\frac{88.307 - (.036 \times 180) - (18.574 \times 1) + (3.734 \times 5)}{170} \times 100 = \% \text{ muscle}$$

$$\frac{88.307 - 6.48 - 18.574 + 18.67}{170} \times 100 = \% \text{ muscle}$$

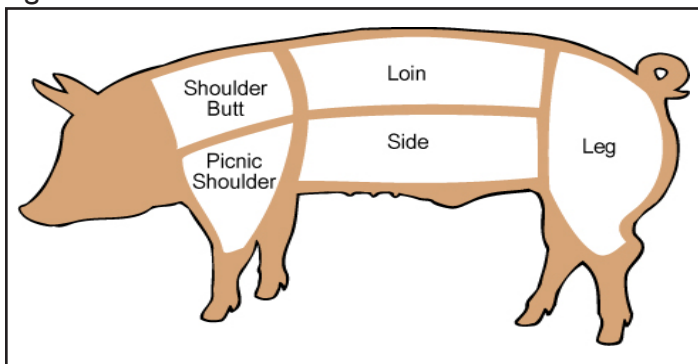
$$\frac{81.923}{170} \times 100 = \% \text{ muscle}$$

$$= 48.19 \text{ or } 48\% \text{ muscle}$$

Because the percent muscle is below 50%, the producer's selling price will most likely be docked for this pork carcass.

taken on the carcass to assign a percentage of muscle with 5 percent fat. Cutability refers to the amount of leanness and muscle or red meat an animal has. This measurement is referred to as the percent muscle or percent lean of a carcass. Currently, 50 percent muscle is considered average by the industry. Carcasses over 50 percent muscle are often given a premium, which is added to their purchase price. Carcasses under 50 percent muscle are usually docked, which means the producer is paid less for the carcasses. In order to calculate percent muscle, the hot carcass weight (HCW), the average backfat thickness at the 10th rib, and loin muscle area at the 10th rib are needed. Most processing plants use loin depth to estimate loin muscle area (LMA). After these measurements are taken, they are put into a formula to derive the percent muscle, which is adjusted to a 170 pound hot carcass weight (see Figure 3.1 and Figure 3.2).

Figure 3.3 - Wholesale Cuts of Pork



Wholesale Cuts

After the carcass is measured for percent muscle, the carcass is cut into wholesale cuts and shipped to retail stores. The wholesale cuts of pork are the shoulder, loin, leg, side, and picnic shoulder (see Figure 3.3).

Retail Cuts

After the wholesale cuts arrive at the retail level, they are fabricated or cut into retail cuts. Pork cuts can be either fresh or cured, which enhances their flavor and taste. The following is a list of the retail cuts of pork.

Leg

- Bone-in fresh ham
- Smoked ham
- Fresh boneless ham roast
- Leg cutlets

Loin

- Sirloin chop
- Rib chop
- Boneless rib end chop
- Boneless center loin chop,
- Butterfly chop
- Center rib roast
- Bone-in sirloin roast
- Boneless center loin roast
- Boneless rib end roast

- Loin (continued)
 - Loin chop
 - Boneless sirloin roast
 - Tenderloin
 - Canadian-style bacon
 - Country-style ribs
 - Back ribs
 - Shoulder butt
 - Bone-in blade roast,
 - Boneless blade roast
 - Ground pork
 - Sausage
 - Blade steak
 - Picnic shoulder
 - Smoked picnic
 - Arm picnic roast
 - Smoked hock
 - Side
 - Slab bacon
 - Sliced bacon
 - Spareribs
- Variety meats - These retail cuts are not from any wholesale cuts, but they are other edible products from the hog.
- Tongue
 - Heart
 - Sweet breads
 - Brains
 - Liver
 - Kidney

Credits

Boggs, Donald L., and Robert A. Merkel. *Live Animal Carcass Evaluation and Selection Manual*. 4th ed. Dubuque: Kindall/Hunt Publishing Company, 1993.

Meat Evaluation Handbook. Chicago: National Livestock and Meat Board, 1988.

Procedures to Evaluate Market Hogs. 3rd ed. Des Moines: National Pork Producers Council, 1991.

Purchasing Pork: A Consumer Guide to Identifying Retail Pork Cuts (poster). National Pork Producers Council in Cooperation with the National Pork Board, 1997.

Summary

The quality of pork carcasses is determined by evaluating muscle color, muscle firmness/wetness, marbling, and other tissue conditions. Pork carcasses are evaluated for cutability by calculating the percent muscle of a carcass. Hot carcass weight (HCW), average backfat thickness at the 10th rib, and loin muscle area at the 10th rib (LMA) are used to calculate the percentage of muscle on a carcass. Wholesale cuts are divided into retail cuts. Pork can be either fresh or cured.

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Lesson 4: Lamb and Mutton

Ovine (sheep species) carcasses are both quality and yield graded. After being graded, the carcasses are cut into wholesale cuts and then into retail cuts. Ovine carcasses usually weigh between 50 and 80 pounds.

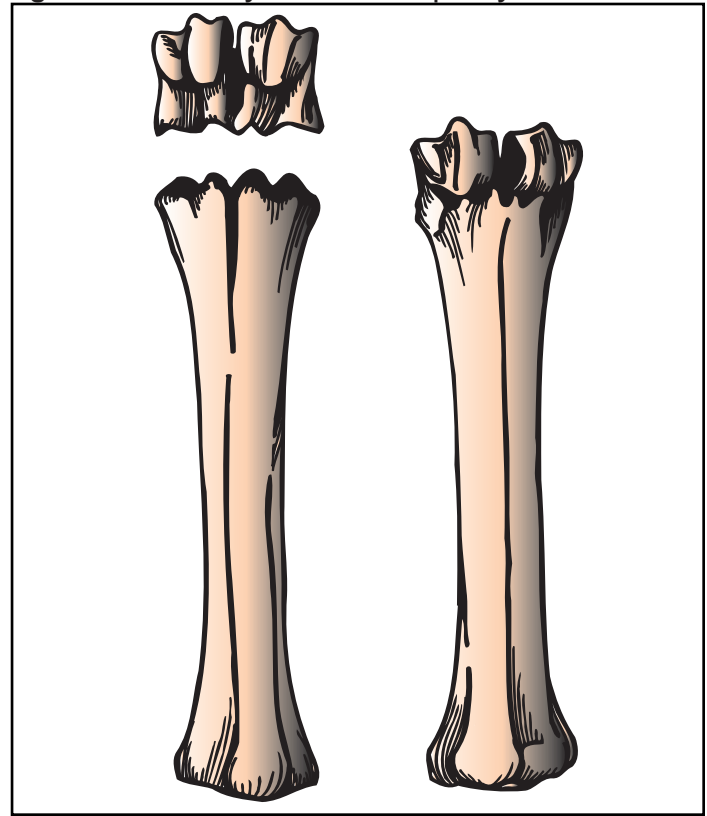
Quality Grading

The maturity (age) of the animal is the single most important factor in determining the quality grade. There are three maturity classes: lamb, yearling mutton, and mutton. For grading purposes, the USDA has divided the lamb class into young lamb and older lamb (see Figure 4.2). Each maturity class has its own standards. In order to determine the quality grade of the carcass within each class, the fat streakings inside the flank area must be evaluated, plus a minimum degree of lean and fat firmness must be present.

Descriptions or definitions for the classes of typical ovine carcasses help in determining the maturity of the carcass. Maturity is determined by evaluating the carcass for break joints or spool joints on the front shanks, the size and flatness of the rib bones, and the color and texture of the lean. In the dressing of ovine carcasses, both front cannon bones (trotters) are usually left attached. There are some cases when one or both trotters may be removed. Trotters will end in perfect break joints, imperfect break joints, or spool joints. Figure 4.1 shows break joints and spool joints. A carcass with perfect break joints on both trotters will be classed as lamb or yearling mutton based on other evidences of maturity. A carcass with spool joints on both trotters will be classed as yearling mutton or mutton based on other evidences of maturity. If the carcass has one break joint and either a spool joint or a missing joint on the other trotter, it can be classed as lamb if other maturity characteristics of lamb are present.

Lamb carcasses must have a break joint on one of the front shanks. Their ribs are flatter and narrower than yearling mutton or mutton. The rib bones become wider as the lamb ages. In young lamb carcasses, the lean in the flank area is slightly dark pink, and for older lamb it is light red. In all lamb carcasses, the lean is fine-textured.

Figure 4.1 - Break Joints versus Spool Joints



Yearling mutton carcasses may have either spool or break joints on their front shanks. They have wider and flatter rib bones. The lean is slightly dark red and slightly coarse in texture.

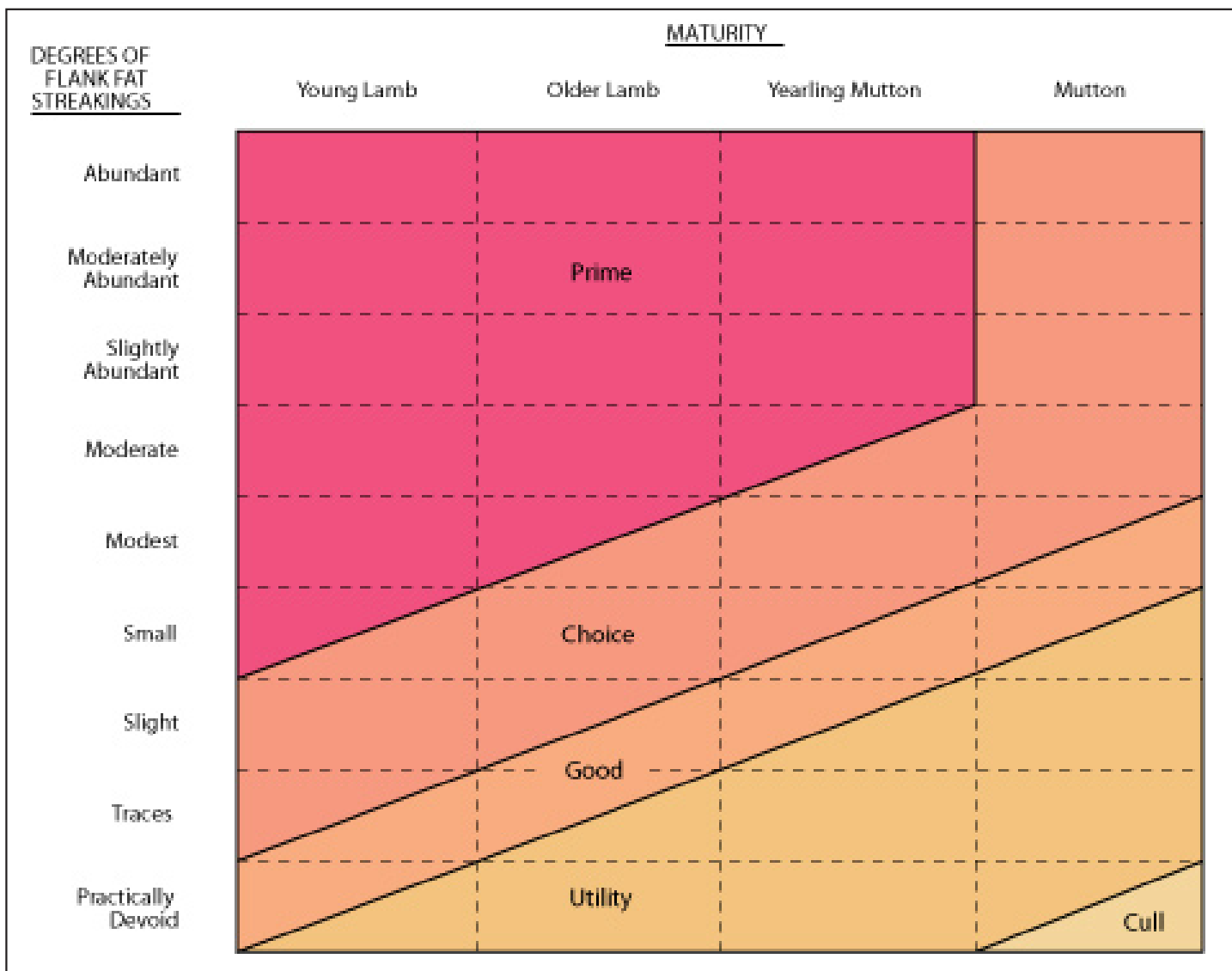
Mutton carcasses have only spool joints on their front shanks. Rib bones are wide and flat. The lean is dark red and coarse-textured.

The other determining factor of lamb quality grades is the amount of flank streaking. Flank streaking is the amount of fat streaks within and upon the inside flank of the carcass. The greater the degree of flank streaking, the more palatable the carcass will be. There are ten degrees of flank streaking: abundant, moderately abundant, slightly abundant, moderate, modest, small, slight, traces, practically devoid, and devoid.

After maturity and amount of flank streaking are determined, the quality grade is determined using the chart in Figure 4.2. The quality grades are prime, choice, good, utility, and cull. Notice that prime can be only lamb or yearling mutton and that cull can only be mutton. The chart is similar to the quality grade chart for beef. First, the grader locates the maturity

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Figure 4.2 - Quality Grades of Ovine Carcasses



of the carcass on the chart and then locates the flank streaking degree. The point where the two meet determines the quality grade. For example, an older lamb with a small amount of flank streaking would be choice. Almost all lamb carcasses reach the choice grade.

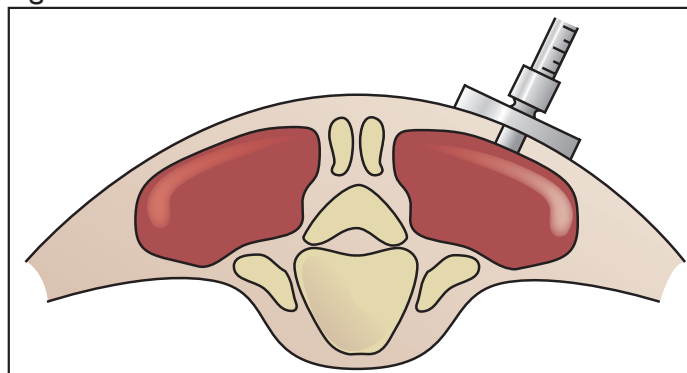
Yield Grading

Ovine yield grades provide estimates of the amount of semi-boneless or boneless closely trimmed (.10 in fat or less) major retail cuts from the carcass. Ovine yield grades are based on the amount of external fat present. For carcasses with normal fat distribution, the external fat is measured over the center of the ribeye muscle. This measurement is taken perpendicular to the outside surface between the 12th and 13th ribs

(see Figure 4.3). An approved measuring device must be used.

If the carcass has unusual fat distribution, the grader adjusts the ribeye fat measurement upward or

Figure 4.3 - Location of External Fat



downward depending on the fat distribution over the rump, outside the shoulders, breast, flank, cod, or udder. An adjustment of .05 inch is common with some adjustments being greater. The grader may take an additional measurement (body wall thickness) to help determine the adjustment. As the amount of external fat increases, the percent of retail cuts decreases. An accurate adjusted fat measurement is important because for every .05 inch in change, the yield grade changes one-half yield grade. The formula that is used to determine the yield grade is $.4 + (10 \times \text{adjusted fat thickness in inches})$.

Example:

During the evaluation of an ovine carcass, the grader determines that the external backfat is not evenly distributed. The external backfat is adjusted to .15.

$$.4 + (10 \times .15) = \text{yield grade}$$

$$.4 + (1.5) = \text{yield grade}$$

$$1.9 = \text{yield grade}$$

A yield grade of 1.9 means the carcass is at the bottom end of a yield grade of 1. There is not much of a difference between a yield grade of 1.9 and a 2.0, so accuracy is important. The 1.9 is considered a yield grade 1 and the 2 a yield grade 2.

Ovine carcass yield grades range from 1 to 5 with a yield grade of 1 being leaner than a yield grade of 5. Figure 4.4 lists adjusted fat thickness ranges for each of the five yield grades.

Figure 4.4 - Yield Grades with Adjusted Fat Thickness Ranges

Yield Grade 1 - 0.00 to 0.15 inch
Yield Grade 2 - 0.16 to 0.25 inch
Yield Grade 3 - 0.26 to 0.35 inch
Yield Grade 4 - 0.36 to 0.45 inch
Yield Grade 5 - 0.46 and greater

Wholesale Cuts of Lamb

The wholesale cuts of lamb and mutton are the leg, loin, rib/rack, shoulder, and foreshank/breast (see Figure 4.5).

Retail Cuts

Wholesale cuts are cut into various retail cuts. The following is a list of the retail cuts from each wholesale cut.

Leg

- French style leg
- American style leg
- Leg steak
- Lamb leg (sirloin half)
- Sirloin chops

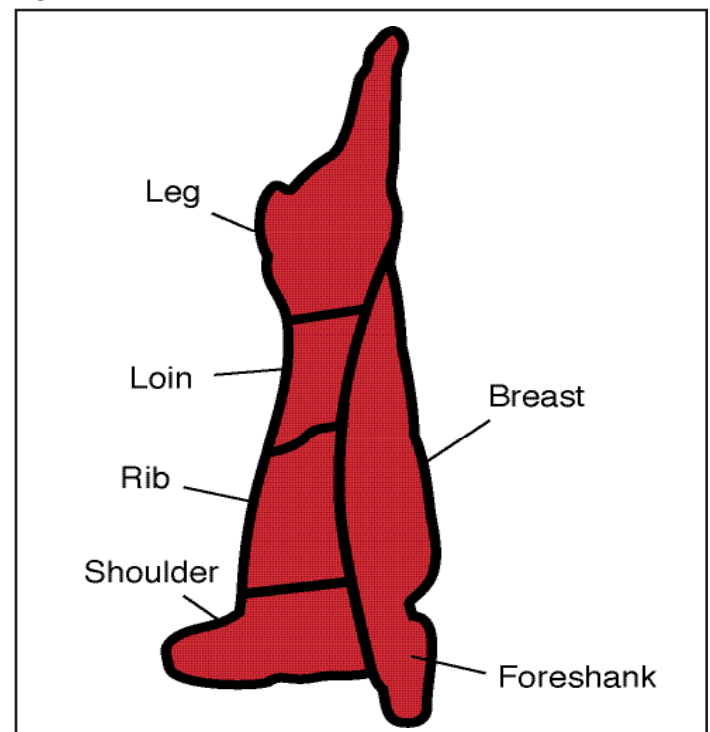
Loin

- Loin roast
- Loin chops
- Double loin chops

Rib/Rack

- Rib roast,
- Rib chops
- Rack of lamb

Figure 4.5 - Wholesale Cuts of Lamb



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Shoulder

- Square cut shoulder
- Rolled shoulder
- Arm chop
- Blade chop
- Arm roast
- Blade roast

Foreshank/breast

- Breast
- Riblets
- Fore shank

Variety meats

- Patties
- Liver
- Kidney
- Heart

Summary

Ovine carcasses are graded for both quality and yield. Quality grading provides an estimate of the potential eating quality of the meat by evaluating maturity and flank streaking. Yield grades predict the amount of semi-boneless and boneless closely trimmed retail cuts from the ovine carcass. Carcasses are then sold as wholesale and retail cuts.

Credits

Boggs, Donald L., and Robert A. Merkel. *Live Animal Carcass Evaluation and Selection Manual*. 4th ed. Dubuque: Kindall/Hunt Publishing Company, 1993.

Meat Evaluation Handbook. Chicago: National Livestock and Meat Board, 1988.

United States Department of Agriculture. Agricultural Marketing Service. Livestock and Seed Division. United States Standards for Grades of Lamb, Yearling Mutton, and Mutton Carcasses. (Effective July 6, 1992.)

Lesson 5: Poultry Products

Even though the poultry industry is a national, ever-growing industry, much of the poultry is produced in the southern Midwest and the Southeast United States. Missouri is a major contributor to poultry and egg production.

Poultry Parts

The common chicken or broiler carcass is cut into several edible parts.

Half - Entire half of a chicken

Breast quarter with or without wing - Similar to the breast with ribs, but it also contains the back

Breast with or without ribs - Breast portion of the bird without any vertebrae, which may or may not have the wing attached

Boneless, skinless breast - Entire chicken breast or one half of the breast without skin or bones, sometimes referred to as the butterfly

Breast tenderloin - Boneless, skinless piece of breast meat

Wishbone - Breast portion containing the wishbone

Leg quarter - Drumstick, thigh, and back portion

Leg - Drumstick and thigh

Drumstick - Portion of the leg of a chicken below the knee joint

Thigh - Thigh of a chicken

Wing - Wing of a chicken

Drumette - Largest portion of the wing

Back - Backbone of a chicken

Liver, gizzard, heart and neck

Poultry Grading

All ready-to-cook poultry must be officially inspected to ensure that it is free from visible signs of disease before it can be quality graded. Ready-to-cook poultry can be graded by USDA graders, but grading is not required. If ready-to-cook poultry is graded by the official U.S. standards and grades, it assures consistency of quality from coast-to-coast and overseas. The standards and grades form a uniform yardstick or measure that describes the commercial quality of various products so their value, usage, and price can be determined.

Chickens, turkeys, ducks, geese, guineas, and pigeons are the classes of poultry covered by the "USDA Standards for Quality of Ready-to-Cook Poultry." The USDA has established standards for A, B, and C quality grades of poultry carcasses, parts, and individual units of poultry food products. The standards define and measure quality in terms of meat yield (fleshing), fat covering, and freedom from defects such as cuts and tears in the skin, broken bones, and discolorations on the meat and skin. The total area of the defects, their location, and number of defects are all considered in determining the grade. The final quality rating (A, B, or C) is based on the factor with the lowest rating. Carcasses, parts, or poultry food products found to be unsound, unwholesome, or otherwise unfit for human food in whole or in part, shall not be given any of the quality designations.

Ready-to-cook poultry is graded based on the following factors: conformation, fleshing, fat covering, defeathering, exposed flesh, discolorations, broken and disjointed bones, missing parts, and freezing defects. A detailed explanation of the factors for each grade is provided in the *Regulations Governing the Voluntary Grading of Poultry Products and Rabbit Products and U.S. Classes, Standards, and Grades (7 CFR Part 70)*. The "Summary of Specifications for Standards of Quality for Individual Carcasses and Parts" from the USDA regulations for each grade are shown in Figures 5.1, 5.2, and 5.3. The tables are not all inclusive. Refer to the regulations for more details.

Conformation is evaluated by judging the shape and appearance of the part or carcass. To what extent are there deformities, such as a dented, curved or crooked breast, a crooked back, or misshapen legs or wings?

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Figure 5.1 - Ready-to-Cook Poultry - A Quality

Ready-to-Cook Poultry - A Quality

Effective March 6, 1995

Summary of Specifications for Standards of Quality for Individual Carcasses and Parts

(Not All Inclusive) (Minimum Requirements and Maximum Defects Permitted)

		A Quality				
Conformation: Breastbone Back Legs and Wings		Normal Slight curve or dent Slight curve Normal				
Fleshing:		Well fleshed, considering kind and class				
Fat Covering:		Well developed layer -- especially between heavy feather tracts				
Defeathering: Protruding pinfeathers, Diminutive feathers, and Hairs		Free				
Exposed Flesh:¹ Weight Range		Carcass		Large Carcass Parts² (halves, front and rear halves)		Other Parts²
Minimum	Maximum	Breast and Legs	Elsewhere	Breast and Legs	Elsewhere	
None	2 lbs.	1/4 in.	1 in.	1/4 in.	1/2 in.	1/4 in.
Over 2 lbs.	6 lbs.	1/4 in.	1 1/2 in.	1/4 in.	3/4 in.	1/4 in.
Over 6 lbs.	16 lbs.	1/2 in.	2 in.	1/2 in.	1 in.	1/2 in.
Over 16 lbs.	None	1/2 in.	3 in.	1/2 in.	1 1/2 in.	1/2 in.
Discolorations: Carcass		Lightly Shaded			Moderately Shaded³	
		Breast and Legs	Elsewhere on carcass		Hock of leg	Elsewhere on carcass
None	2 lbs.	3/4 in.	1 1/4 in.		1/4 in.	5/8 in.
Over 2 lbs.	6 lbs.	1 in.	2 in.		1/2 in.	1 in.
Over 6 lbs.	16 lbs.	1 1/2 in.	2 1/2 in.		3/4 in.	1 1/4 in.
Over 16 lbs.	None	2 in.	3 in.		1 in.	1 1/2 in.
Discolorations: Large Carcass Parts (halves, front and rear halves)		Lightly Shaded			Moderately Shaded³	
		Breast and Legs	Elsewhere		Hock of leg	Elsewhere
None	2 lbs.	1/2 in.	1 in.		1/4 in.	1/2 in.
Over 2 lbs.	6 lbs.	3/4 in.	1 1/2 in.		3/8 in.	3/4 in.
Over 6 lbs.	16 lbs.	1 in.	2 in.		1/2 in.	1 in.
Over 16 lbs.	None	1 1/4 in.	2 1/2 in.		5/8 in.	1 1/4 in.
Discolorations: Other Parts		Lightly Shaded			Moderately Shaded³	
None	2 lbs.	1/2 in.			1/4 in.	
Over 2 lbs.	6 lbs.	3/4 in.			3/8 in.	
Over 6 lbs.	16 lbs.	1 in.			1/2 in.	
Over 16 lbs.	None	1 1/4 in.			5/8 in.	
Disjointed and Broken Bones:		Carcass--1 disjointed and no broken bones Parts--Thighs with back portion, legs, or leg quarters may have femur disjointed from the hip joint. Other parts--none.				
Missing Parts:		Wing tips and tail. In ducks and geese, the parts of the wing beyond the second joint may be removed if removed at the joint and both wings are so treated. Tail may be removed at base.				
Freezing Defects:		Slight darkening on back and drumstick. Overall bright appearance. Occasional pock marks due to drying. Occasional small areas of clear, pinkish, or reddish colored ice.				

¹Maximum aggregate area of all exposed flesh. In addition, the carcass or part may have cuts or tears that do not expand or significantly expose flesh, provided the aggregate length of all such cuts does not exceed a length tolerance equal to the permitted dimensions listed above.

²For all parts, trimming of skin along the edge is allowed, provided at least 75 percent of the normal skin cover associated with the part remains attached, and the remaining skin uniformly covers the outer surface and does not detract from the appearance of part.

³Moderately shaded discolorations and discolorations due to flesh bruising are free of clots and limited to areas other than the breast and legs except for the area adjacent to the hock.

Credit: United States Department of Agriculture, Agricultural Marketing Services, Poultry Division, Regulations Governing the Voluntary Grading of Poultry Products and Rabbit Products and U.S. Classes, Standards, and Grades (7 CFR Part 70). Washington, DC. Effective March 6, 1995.

Figure 5.2 - Ready-to-Cook Poultry - B Quality

Ready-to-Cook Poultry - B Quality

Effective March 6, 1995

Summary of Specifications for Standards of Quality for Individual Carcasses and Parts

(Not All Inclusive) (Minimum Requirements and Maximum Defects Permitted)

		B Quality	
Conformation: Breastbone Back Legs and Wings		Moderate deformities Moderately dented, curved, or crooked Moderately crooked Moderately misshapen	
Fleshing:		Moderately fleshed, considering kind and class	
Fat Covering:		Sufficient fat layer -- especially on breast and legs	
Defeathering: Protruding pinfeathers, Diminutive feathers, and Hairs		Few scattered	
Exposed flesh: Weight Range		Carcass	Parts
Minimum	Maximum		
None Over 2 lbs. Over 6 lbs. Over 16 lbs.	2 lbs. 6 lbs. 16 lbs. None	No part on the carcass (wings, legs, entire back, or entire breast) has more than 1/3 of the flesh exposed	No more than 1/3 of flesh normally covered by skin exposed
Discolorations:¹ Carcass		Carcass Lightly or Moderately Shaded Discolorations	
		Breast and Legs	Elsewhere on Carcass
None Over 2 lbs. Over 6 lbs. Over 16 lbs.	2 lbs. 6 lbs. 16 lbs. None	1 1/4 in. 2 in. 2 1/2 in. 3 in.	2 1/4 in. 3 in. 4 in. 5 in.
Discolorations:¹ Large Carcass Parts (halves, front and rear halves)		Large Carcass Parts	
		Breast and Legs	Elsewhere
None Over 2 lbs. Over 6 lbs. Over 16 lbs.	2 lbs. 6 lbs. 16 lbs. None	1 in. 1 1/2 in. 2 in. 2 1/2 in.	1 1/4 in. 1 3/4 in. 2 1/2 in. 3 in.
Discolorations:¹ Other Parts		Other Parts Lightly or Moderately Shaded Discolorations	
		Breasts, Legs, and Parts	
None Over 2 lbs. Over 6 lbs. Over 16 lbs.	2 lbs. 6 lbs. 16 lbs. None	3/4 in. 1 in. 1 1/2 in. 1 3/4 in.	
Disjointed and Broken Bones:		Carcass--2 disjointed and no broken bones, or 1 disjointed and 1 nonprotruding broken bone Parts--may be disjointed, no broken bones; wing beyond second joint may be removed at a joint	
Missing Parts:		Wing tips, 2nd wing joint and tail.	
Trimming:		Carcass	Parts
		Slight trimming of the carcass is permitted provided the meat yield of any part on the carcass is not appreciably affected. The back may be trimmed in an area not wider than the base of the tail to the area halfway between the base of the tail and the hip joints.	A moderate amount of meat may be trimmed around the edge of a part to remove defects.
Freezing Defects:		May lack brightness. Few pockmarks due to drying. Moderate areas showing a layer of clear, pinkish, or reddish colored ice.	
¹ Discolorations due to flesh bruising shall be free of clots and may not exceed one-half the total aggregate area of permitted discoloration.			

Credit: United States Department of Agriculture, Agricultural Marketing Services, Poultry Division. *Regulations Governing the Voluntary Grading of Poultry Products and Rabbit Products and U.S. Classes, Standards, and Grades* (7 CFR Part 70). Washington, DC. Effective March 6, 1995.

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Figure 5.3 - Ready-to-Cook Poultry - C Quality

Ready-to-Cook Poultry - C Quality

Effective March 6, 1995

Summary of Specifications for Standards of Quality for Individual Carcasses and Parts
(Not All Inclusive) (Minimum Requirements and Maximum Defects Permitted)

		C Quality	
Conformation: Breastbone Back Legs and Wings		Abnormal Seriously curved or crooked Seriously crooked Misshapen	
Fleshing:		Poorly fleshed	
Fat Covering:		Lacking in fat covering over all parts of carcass	
Defeathering: Protruding pinfeathers, Diminutive feathers, and Hairs		Scattering	
Exposed Flesh: Weight Range		Carcass	Parts
Minimum	Maximum		
None Over 2 lbs. Over 6 lbs. Over 16 lbs.	2 lbs. 6 lbs. 16 lbs. None	No limit	
Discolorations: Carcass		Carcass	
		Breast and Legs	Elsewhere on Carcass
None Over 2 lbs. Over 6 lbs. Over 16 lbs.	2 lbs. 6 lbs. 16 lbs. None	No limit on size, number of areas, or intensity of discolorations and flesh bruises if such areas do not render any part of the carcass unfit for food.	
Disjointed and Broken Bones:		No limit	
Missing Parts:		Wing tips, wings, and tails Backs shall include all meat and skin from the pelvic bones, except that the meat contained in the ilium (oyster) may be removed. The vertebral ribs and scapula with meat and skin and the backbone located anterior (forward) of the ilia bones may also be removed (front half of back).	
Trimming:		Carcass	Parts
		Trimming of the breast and legs is permitted, but not to the extent that the normal meat yield is materially affected. The back may be trimmed in an area not wider than the base of the tail to the area between the hip joints.	
Freezing Defects:		Numerous pockmarks and large dried areas	

Credit: United States Department of Agriculture. Agricultural Marketing Services. Poultry Division. *Regulations Governing the Voluntary Grading of Poultry Products and Rabbit Products and U.S. Classes, Standards, and Grades* (7 CFR Part 70). Washington, DC. Effective March 6, 1995.

Fleshing is evaluated by judging the amount of flesh covering the carcass or part. The appropriate amount of flesh is dependent on the kind of poultry you are evaluating.

For fat covering, the grader is evaluating how well the fat is distributed over the carcass or part.

For defeathering, the grader is evaluating the presence of and number of protruding pinfeathers, small (diminutive) feathers, and hairs.

The grader evaluates the amount of exposed flesh (exposed meat) that is the result of cuts, tears, and missing skin. For each grade, the total area (aggregate area) of exposed meat must not equal more than the equivalent area of a circle as indicated by the diameters listed in the tables. Diameters vary depending on the size of the carcass and the part.

Discolorations indicate the amount of bruising of the skin and flesh of poultry with skin and the flesh of skinless poultry. The amount of light to moderate discolorations allowable for the grade are listed in the tables. The total area (aggregate area) of discolorations must not equal more than the equivalent area of a circle as indicated by the diameters listed in the tables.

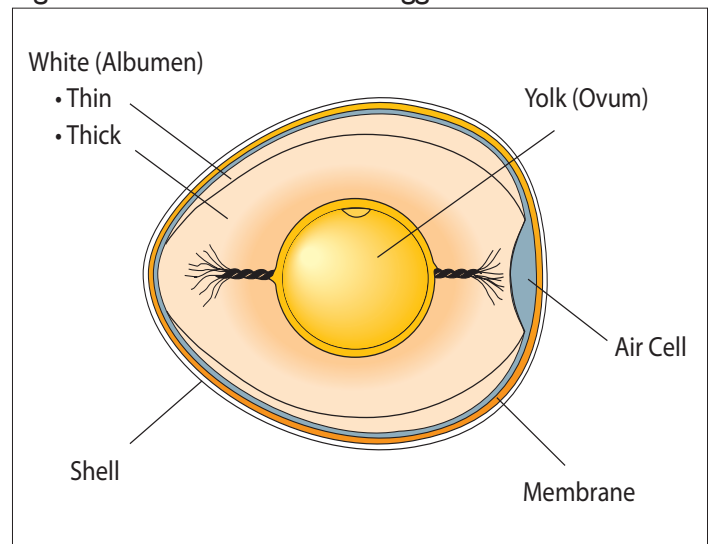
For the disjointed and broken bones and missing parts categories, the grader is evaluating the carcass or part for disjointed bones, broken bones, and missing parts. The criteria for each grade indicates what is the maximum number of defects allowed. For all grades, the wing tips may be removed at the joint, and the tail may be removed at the base. Grades B and C criteria also include the amount of trimming allowed.

Freezing defects indicate the amount of allowable damage from handling or from freezing the packaged poultry, parts, or poultry food products.

Egg Grading

Just like ready-to-cook poultry products, quality grading is not required for individual shell eggs. The “*United States Standards for Quality of Individual Shell Eggs*” provide a consistent way to grade the quality of whole eggs from chickens. It does not apply to eggs

Figure 5.4 - Main Parts of an Egg



from any other type of poultry or to eggs out of the shell. Only a summary of the standards is provided (See Figure 5.5). Refer to the regulations for more details.

The standards spell out the specifications for four quality factors: shell, air cell, white, and yolk. Figure 5.4 shows the main parts of an egg. The interior egg specifications (air cell, white, and yolk) are based on the apparent condition of the interior contents of the egg as it is twirled before a candling light. For candling, the egg should be held between your thumb and first two fingers with the large end up. Turn your hand and wrist quickly in an 180° arc, causing the inside of the egg to whirl. Quickly stop the turning motion and place the side of the egg next to the candling light with the large end up. If not candled this way, the air cell will not be visible. The movement, outline, and shape of the air cell, white, and yolk are evaluated.

An egg is considered inedible if it has any type of rot, is moldy or musty, contains a blood ring or an embryo chick, or is adulterated (altered). An egg that is inedible, cooked, frozen, contaminated, or contains bloody whites, large blood spots, large unsightly meat spots, or other foreign material is considered a “loss.” Eggs that are a loss are not eligible for a quality grade. Most eggs qualify for AA, A, or B qualities. For eggs with dirty or broken shells, the standards of quality provide two additional qualities: dirty and check. Dirty indicates that the unbroken shell has adhering dirt, prominent stains or moderate stains covering more

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Figure 5.5 - Quality Standards for Individual Shell

SUMMARY OF U.S. STANDARDS FOR QUALITY OF INDIVIDUAL SHELL EGGS Specifications for Each Quality Factor			
Quality Factor	AA Quality	A Quality	B Quality
Shell	Clean. Unbroken. Practically normal.	Clean. Unbroken. Practically normal.	Clean to slightly stained.* Unbroken. Abnormal.
Air Cell	1/8 inch or less in depth. Unlimited movement and free or bubbly.	3/16 inch or less in depth. Unlimited movement and free or bubbly.	Over 3/16 inch in depth. Unlimited movement and free or bubbly.
White	Clear. Firm.	Clear. Reasonably firm.	Weak and watery. Small blood and meat spots present.**
Yolk	Outline slightly defined. Practically free from defects.	Outline fairly well defined. Practically free from defects.	Outline plainly visible. Enlarged and flattened. Clearly visible germ development but not blood. Other serious defects.
For eggs with dirty or broken shells, the standards of quality provide two additional qualities. They are:			
Dirty		Check	
Unbroken. Adhering dirt or foreign material, prominent stains, moderate stained areas in excess of B quality.		Broken or cracked shell but membranes intact, not leaking.***	
* Moderately stained areas permitted (1/32 of surface if localized, or 1/16 if scattered). ** If they are small (aggregating not more than 1/8 inch in diameter). ***Leaker has broken or cracked membranes, and contents leaking or free to leak.			

Credit: United States Department of Agriculture. Agricultural Marketing Services. Poultry Division. *Regulations Governing the Grading of Shell Eggs* (7 CFR Part 56) Effective May 1, 1997, and *United States Standards, Grades, and Weight Classes for Shell Eggs* (AMS 56) Effective April 6, 1995. Washington, DC.

than 1/32 of the shell surface if localized, or 1/16 of the shell surface if scattered. Check indicates that an egg has a broken shell or crack, but the shell membranes are intact and do not leak.

The shell is evaluated for its cleanliness, shape, texture, and thickness. A shell is considered clean if it is free from foreign material and stains that are readily visible. It may have small specks, stains, or cage marks if they do not detract from the generally clean appearance of the egg. Practically normal indicates that the shell is basically the usual shape and is sound and free from thin spots. Ridges and rough areas that do not

significantly affect the shape and strength of the shell are permitted. Abnormal indicates that the shell is somewhat unusual or decidedly misshapen or faulty in soundness or strength or that its air cell moves freely toward the uppermost point in the egg as the egg is slowly rotated. A bubbly air cell indicates that the air cell has ruptured resulting in one or more small separate air bubbles.

The white is evaluated for its clarity, firmness, thickness, and presence of blood spots or meats. Clear indicates that the white is free from discolorations or from any foreign bodies floating in it. Firm indicates that

the white is sufficiently thick to prevent the yolk outline from being more than slightly defined when the egg is twirled. Reasonably firm indicates that the white is somewhat less thick than a firm white, which is indicated by the yolk outline being fairly well defined when the egg is twirled. The weak and watery statement indicates that the white is weak, thin, and generally lacking in thickness, which is indicated by the ability of the yolk to come close to the shell when the egg is twirled. Blood spots and meats spots indicate the presence of blood spots or meat spots not more than 1/8 inch in diameter. If they are larger or showing blood in the white, the egg is classified as a loss. An egg with a bloody white has blood diffused through the white and is considered a loss. Eggs with blood spots that show a slight diffusion into the white around the localized spot are not to be classed as bloody whites.

There are eight descriptive terms used when evaluating the yolk.

Outline slightly defined - A yolk outline that is not distinct and appears to blend with the surrounding white as the egg is twirled.

Outline fairly well defined - Indicates that the yolk outline is visible but not clearly outlined when the egg is twirled.

Outline plainly visible - The yolk is clearly visible as a dark shadow when the egg is twirled.

Enlarged and flattened - The yolk membranes and tissues have weakened and/or moisture has been absorbed from the white to such an extent that the yolk appears definitely enlarged and flat.

Practically free from defects - Indicates that the yolk shows no germ development, but there may be slight defects on the yolk's surface.

Serious defects - Indicates that the yolk shows well developed spots or areas and other serious defects that do not render the egg inedible.

Clearly visible germ development - Indicates the development of the germ spot on the yolk of a fertile egg to the point where it is plainly visible as a definite circular area or spot with no blood in evidence.

Blood due to germ development - Indicates that blood lines or a blood ring is present due to germ development. The egg is classified as inedible.

The USDA Marketing Service has summarized the specifications for each quality factor (see Figure 5.5).

Summary

Poultry carcasses are often cut into various parts before sale to consumers. Both carcasses and parts can be graded by the USDA, although grading is not required. When shell eggs are federally graded, the shell, air cell, white, and yolk are evaluated for quality.

Credits

Ermis, Larry. *Poultry Science Manual for National FFA Career Development Events*. College Station, TX: Instructional Materials Service, 1995.

USDA. Agricultural Marketing Service. *Regulations Governing the Grading of Shell Eggs (7 CFR Part 56)* Effective May 1, 1997, and *United States Standards, Grades, and Weight Classes for Shell Eggs (AMS 56)*, Effective April 6, 1995. Washington, DC.

USDA. Agricultural Marketing Service. *Regulations Governing the Voluntary Grading of Poultry Products and Rabbit Products and U.S. Classes, Standards, and Grades (7 CFR Part 70)*. Washington, DC. Effective March 6, 1995.

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Introduction to Animal Products

Lesson 6: Dairy Products

Along with beef, pork, lamb, and poultry, dairy products are a major agricultural food commodity in the United States. Raw milk is inspected and processed into fluid milk and other dairy products, such as yogurt, ice cream, and various types of cheeses.

Milk Grades and Products

Raw milk can be one of two grades: grade A milk or manufacturing-grade milk. Grade A milk is for drinking and is called fluid milk. Other dairy foods may be made from grade A milk. Grade A milk comes from grade A dairies that are required to meet more strict sanitation standards than manufacturing grade dairies. All milk is tested periodically for bacteria count, somatic cell count, and antibiotics. Somatic cells are mostly white blood cells that the cow produces to fight infections. When the somatic cell count of milk is elevated, the cow is experiencing health problems in one or more of the four mammary glands. Grade A milk commands a higher price paid to producers than does manufacturing grade milk.

Manufacturing grade milk may be used only for manufactured dairy products, such as butter, dry milk products, cheeses (except cottage in some markets), and frozen desserts (in most markets).

Milk Processing

Fluid milk is collected from the farm in a large insulated stainless steel “bulk” tank on a truck and is taken directly to a processing plant. At the processing plant, the milk is pasteurized and homogenized. Vitamin D must be added to all fluid milk, while vitamin A must be added to milk containing less than 3.25% milk fat, the legal minimum for any product that is labeled “milk.” Below this limit, descriptors must be placed in front of the word milk. For example, milk containing 2% milk fat is called “reduced fat milk.” Milk that provides less than 3 grams of fat per 8-ounce serving is known as “lowfat milk,” and when 8 ounces contain less than 0.5 grams of fat, it is called “nonfat milk” or “skim milk.”

Pasteurization involves heating milk above 161°F for over 15 seconds to kill bacteria and other disease-causing microorganisms.

Homogenization prevents the milk from separating into cream and skim milk during storage. The hot milk is pumped through a fine orifice (opening) under high pressure. This breaks down the milk fat globules, so they will be too small to separate from the skim milk.

Milk Defects Resulting in Off Flavors

Milk is naturally a slightly sweet, rather bland-tasting liquid; however, various factors sometimes create off flavors in milk. Off flavors resulting from milk defects are a major consumer concern. These off flavors, if not detected before reaching the consumer, lower the consumer appeal for milk and milk products. Some milk defects that result in off flavors of milk can make the milk unsaleable. Off flavors can be associated with the following.

Bitter - Bitterness usually results from the spoilage of milk by bacteria that grow at refrigerator temperatures. These psychrotrophic bacteria degrade milk proteins causing bitterness. A bitter taste makes the milk unsaleable.

Feed - One of the most common milk defects occurs when the feed flavor passes through the cow's bloodstream to the mammary glands, producing an off flavor in milk. Offending feeds and plants include silage, ryegrass, ragweed, and wild onions. These will cause the milk to taste similar to the smell of the feed the cow has consumed. Off flavor caused by feed does not affect the milk's saleability, but it reduces the flavor appeal.

Flat/watery - A flat or watery taste results when milk is diluted with water or when milk is very low in fat content. It does not affect the milk's saleability, but it reduces the flavor appeal and it is illegal to add water to milk.

Foreign - A foreign taste is present in milk that has come in contact with cleaners or sanitizers in inadequately drained equipment. This makes the milk unsaleable.

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Malty - A malty taste results from milk that has been spoiled by an unusual type of bacteria. Infrequently, bromegrass pastures produce malty flavored milk. A malty taste will probably result in the milk being unsaleable depending on the cause of the malty flavor.

Oxidized - This “wet cardboard” or “metallic” taste results from milk being exposed to sunlight, copper, or iron. Milk that has been oxidized is usually not saleable.

Rancid - Rancid is also known as lipolyzed. A rancid flavor results from milk that has been allowed to become too warm and was not properly stored and/or cooled. Churning milk fat removes the protective fat globule membrane, allowing milk’s natural lipase to split the fatty acids from the glycerol “backbone” of the milk fat. Rancid milk has a foul odor and taste resembling the smell of sweaty socks or blue cheese. Rancid milk is not saleable.

Salty - Salty milk originates from cows with mastitis, which is an infection in the mammary system. With today’s production practices, there are very few incidences of mastitis. Salty milk is saleable because the pasteurization process kills the bacteria that are present in the mastitis. However, the flavor may not be desired among consumers.

Sour - This acidic flavor is caused by the production of lactic acid by bacterial fermentation of milk’s sugar, lactose. Sour milk is almost always caused by leaving the milk out at too high a temperature. Sour milk is not saleable.

Cheese Identification

Approximately 400 varieties of cheese are available for consumption. Cheeses differ in appearance, color, flavor, and texture. Most are made from cow’s milk. When a cheese is typically made from milk of another species, it is noted in the discussion.

Blue - Blue cheese is a semisoft, mold-ripened cheese. It has a white interior with strips of blue *Penicillium* mold running through the cheese. Blue cheese exhibits a peppery taste and a pungent aroma. In France this general class of cheeses is known as Fromage Bleu.

Many countries have their own name(s) for blue cheeses, for example Gorgonzola in Italy and Stilton in Great Britain. Roquefort cheese looks like blue cheese but is made from ewe’s milk in a specific region of France.

Brick - Brick cheese is semisoft, mild to medium-strong in flavor, smooth and waxy in texture, yellow in color, and has small openings throughout. Traditionally, Brick cheese is surface-ripened, but some markets require a delicate flavor that is achieved without the surface microflora.

Brie/Camembert - Brie/Camembert cheese is a very soft cheese variety with a thin crust that contains microorganisms that aid in ripening the cheese. It has a mild to pungent flavor.

Cheddar - Cheddar cheese is the most popular cheese in the United States. The intensity of the yellow color depends on how much coloring is added. Mild Cheddar is aged for a shorter period of time than medium and sharp Cheddar. Cheddar cheese has a nut-like flavor and has a firm but smooth texture. Openings that may exist in it are irregular in shape, unless undesirable bacteria produce gas that forms round holes or until undesirable yeasts form slits.

Colby - Colby is a yellow cheese that is softer than Cheddar and has many small irregular openings. Because it is aged only 1 to 3 months, it has a mild and slightly sour flavor.

Cottage - Unripened curd is made from skim milk. Cream, salt, and stabilizer are added to make the creamed form of this soft product, which contains 4% milk fat and 20% total solids. It is also made in reduced fat, lowfat, and nonfat varieties. The curds are cut into cubes that range in size from 0.2 to 0.5 inches.

Cream - Soft, white, buttery, smooth, spreadable cheese made by concentrating acidified cream. It is served fresh without ripening. The flavor is nut-like and slightly sour.

Gouda/Edam - Gouda and Edam cheeses originated in Holland. They are similar to Cheddar in taste. Gouda and Edam are less sour because they are made with a

high concentration of the coagulating enzyme, rennin or chymosin. These cheeses are traditionally covered with wax coatings and are formed in ball or wheel shapes. Gouda and Edam contain round openings throughout, which are caused by gas from friendly ripening bacteria that produce a nutty flavor.

Monterey Jack - This white to light yellow (no color added) cheese has many small holes. It is similar to Colby but softer.

Mozzarella - This white, very stringy, or plastic, cheese is used primarily on pizzas. After curd is produced similar to Cheddar cheese, the pressed curd is submerged in hot water and stretched. This removes much of the acid and causes the proteins to form polymers that provide the stretchy consistency of the melted cheese. This also makes the flavor somewhat bland. Salt is added by soaking the formed loaves of curd in cold salt brine.

Munster (Muenster) - This semi-soft, yellow to white cheese originated in Germany. It is similar to brick cheese but has less of a surface layer of microorganisms and undergoes less ripening. It contains numerous small irregularly shaped openings and has a mild to mellow butternut flavor.

Pasteurized Process American - This is a yellow to white group of cheeses that can be made from several varieties of natural cheese including Cheddar, Colby, stirred curd, and washed curd. Both fresh, or green, curds and ripened cheeses are shredded and ground together and melted in a cooker. To this mixture emulsifier salts are added and mixed. The hot molten cheese is pressed onto cooling belts to make slices or into wrappers to make loaves. The process adds some cooked flavor, the emulsifier salts provide saltiness, and the cheeses provide characteristic flavors blended to maintain consistency from batch to batch. The cheese is usually free of holes provided air bubbles are eliminated, and it stores exceptionally well because enzymes and bacteria are inactivated by the process.

Provolone - This yellow to white colored, hard Italian cheese typically is highly aromatic, has a spicy flavor, and may have a smokey and/or salty taste. Being of the Pasta Filata (plastic curd) family, it has been stretched

under hot water and has a stringy consistency similar to mozzarella cheese when warmed. Typically, provolone cheeses are formed into pear shapes and encased with twine or rope.

Swiss - Swiss cheese is hard, yellow to white in color, and filled with large openings (gas holes) produced by the ripening bacteria that impart the sweet, nut-like flavor.

Summary

Milk is graded differently from other raw animal products. Whereas, each egg, broiler, pig, and steer is examined for quality and safety, milk is graded based on inspections of farms and processing facilities and by periodic testing of milk. All fluid milk comes from grade A dairies. Milk is pasteurized and homogenized, and vitamins are added at the dairy plant. Dairy producers and processors must be careful not to contaminate milk with foreign material or to allow off flavors to develop. Various cheeses can be identified by using taste, sight, and smell.

Credits

Martin, Phillip. *Food Science and Technology*. University of Missouri-Columbia: Instructional Materials

Introduction to Animal Products
