Understanding Cattle Production, Beef Quality and the Supply Chain

Examination and certification available online at www.qsmbeefandlamb.co.uk
Course Introduction

Welcome to the AHDB Beef and Lamb Education Programme. “Understanding Cattle, Beef Quality and the Supply Chain”.

This course is aimed at anybody working with beef, from the beef buyer to the chef and anybody in between. It will try to explain the difference between the different types of breeds and their characteristics, the different stages in the animal’s life from calf, heifer, cow, bull or steer, matters that affects eating quality, the supply chain involved and what the consumer is ultimately looking for.

Dick van Leeuwen

To pass the exam for this course, you are expected to know the information within this publication.

Note: The information from this course is very important as it is the basis on which you can build any further meat knowledge.
So spend your time well. It will help you in your future career working with meat.
Introduction

Traditionally, British people have always enjoyed eating meat. The farmer, in rearing animals for meat production, aims, through good breeding and careful husbandry to produce high-quality meat which satisfies the needs of the consumer. Today’s trend is towards a preference for leaner meat.

We think of meat as being made up of lean, fat, bone and connective tissue which we often call gristle. The lean is muscle tissue, itself made up of water, protein, vitamins, minerals and intra muscular fat (marbling). The fat is either external or deposited between the muscles, or inside the body cavity. The bone is the skeletal tissue, while the gristle is the connective tissue made up mainly of two proteins – collagen, with some elastin.

Today’s beef industry in Great Britain relies on integrating the skills of the scientist and geneticist, farmer, wholesaler and butcher, to provide the quality of meat that the consumer expects, at an acceptable price.
Ever-Changing Consumer Demands

Retail and foodservice beef cuts are consistently changing to keep up with the ever-changing consumer and their eating habits. With less time spent in home kitchens, the growth of eating out and ready meals, sous vide cooking in the food manufacturing sector, retailers and chefs are constantly looking for new ideas to add value. The carcase of beef might have changed shape and become much leaner over the last 100 years. However, the muscles within the carcase are still the same. Therefore, there is a need for continuous new product development and new cutting methods to satisfy consumer and trade demand.
Breeding
Livestock producers use two approaches to breeding:

**Pure breeding:** Where pure-bred animals of the same breed are mated, as in pedigree herds.

**Cross breeding:** Where pure or cross-bred animals of different breeds are mated in order to combine good qualities found in each breed or cross. This helps productivity.

Beef Cattle

Beef production is part of a continuous cycle. Dairy cows, which are kept primarily for the production of milk, have to produce a calf first. Some female calves are kept for replacements in the dairy herd. The other calves will be predominantly used for meat, although some beef cross females may be kept for breeding in a suckler herd.

The production of meat and milk is, therefore, part of the cycle. Just over 50% of our meat comes from the dairy herd, with the rest from the suckler herds. Meat production is the main aim of suckler herds where cows are not milked, but directly rear the calves by suckling. The breeder chooses both males and females for the qualities affecting productive efficiency.

By careful selection, generation after generation, the breeder seeks to improve those qualities. For milk, animals are primarily selected to produce maximum yields. For meat, the breeder looks for high growth rates, good feed efficiency, and the sort of carcase composition the butcher will require. Beef bulls and dairy cows are, therefore, cross-bred to combine the good qualities of both. The bulls can be from British breeds – Hereford, Aberdeen Angus or Devon – or from continental breeds like Charolais, Limousin and Simmental. When the large continental breeds are mated with smaller British breeds, the farmer has to be careful that the calf produced is not too big for the mother to deliver successfully.

Beef cattle are cross-bred to produce animals with well-developed loin and hind quarters, as the most valuable meat comes from these parts. Most dairy farmers sell their surplus and cross-bred calves to rearers, who, in turn, look after them until they are big enough to be sold to feeders as “store” cattle. The feeders then keep them until they are ready for sale.
Beef from the Dairy Herd

After giving birth to a calf, which it carries for nine months, a cow will produce milk for about 10 months. Generally, the farmer will mate a good milker to a good pedigree dairy bull of the same breed, usually by artificial insemination, and the heifer produced will be reared to replace older cows in the dairy herd. Only a small proportion of bull calves will be kept for breeding. Most will be reared for beef, often entire (bull) but sometimes after castration (steer). About two-thirds of a dairy farmer’s herd will be bred in this way to have sufficient numbers of replacements. The rest of the herd, usually including the heifers, will be mated with a beef bull. Since the milking capacity of the heifers is unknown, they are usually mated with bulls of beef breeds. In this way, the farmer produces a cross-bred calf intended for beef. The small, compact Aberdeen Angus or Hereford bull will produce a smaller calf than a larger Charolais, Simmental or Limousin bull. This is important in helping to reduce the incidence of difficult calvings in heifers due to the size of the calf. The breed of bull used has no effect on the milk production of the heifer or cow to which it is mated. About 70% of dairy heifers and 30% of dairy cows are mated with beef bulls. Most dairy-bred calves not required for rearing for beef on the farm are sold by dairy farmers after about a week.

At the end of their productive life, dairy cows will be slaughtered as cull cows, either straight from the dairy herd or following a period of intensive finishing. This is, typically, after three lactations, although some cows can remain productive for five or more. Most dairy-bred cull cows will be six years of age or less at slaughter.
Usage of Cow Meat

Because cow meat is generally less tender than prime beef, it is more suited for longer and slower cooking methods, such as pot roasting. Cow beef is also used for mince, burgers and diced products. In addition, some of the primal cuts are sought after for export markets due to the various cooking methods, usage and palates found in different countries. For example, the rib eye steak from prime beef is often grilled or fried but, if cut from cow beef, it is used for braising steaks in some European countries.

These examples show the difference between cow beef and prime beef

Beef from the Suckler Herd

After giving birth, the calf will stay with the beef cow for around 7 to 10 months before it is weaned and transferred for finishing. During this time the cow and calf will normally be grazing outside. In winter months when conditions worsen, the animals may be brought into cattle yards.

Suckler cows are, typically, beef breeds and cross-breeds which produce calves for meat production. They generally produce a carcase with better conformation (or shape) than a dairy cow and generally have a higher level of fat cover. They will produce one calf per year and, at the end of their productive life, suckler cows will be finished and slaughtered as cull cows. On average, suckler cows will be older than dairy cows at slaughter. Approximately 10% of cows are slaughtered at 12 years or older and these will, typically, be suckler cows.
# Different names used to describe different types of animals

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Beef</strong></td>
<td>The meat of all cattle, other than from the young calf which is referred to as veal.</td>
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<tr>
<td><strong>Bovine</strong></td>
<td>The Latin term pertaining to/characteristic of, the ox or cattle.</td>
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<tr>
<td><strong>Fatstock</strong></td>
<td>Animals that have been purposely reared and finished for meat production, in direct contrast to breeding stock.</td>
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<tr>
<td><strong>Beef Cattle</strong></td>
<td>Animals reared solely for the purpose of beef production.</td>
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<tr>
<td><strong>Grass Silage Beef</strong></td>
<td>Beef produced from cattle (often bulls of dairy breeds) fed indoors on a diet of silage and cereals ready for slaughter at 13 to 17 months of age.</td>
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<tr>
<td><strong>Heifer</strong></td>
<td>Young female bovine that has not produced a calf. However, in the farming community, animals are often referred to as heifers following the production of their first calf until calving for a second time.</td>
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<tr>
<td><strong>Ox</strong></td>
<td>Any bovine animal (plural, oxen), although the term is most generally used when referring to mature steers used for draught purposes.</td>
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<tr>
<td><strong>Steer</strong></td>
<td>Castrated bovine animal sometimes referred to as a bullock.</td>
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<tr>
<td><strong>Stirk</strong></td>
<td>A weaned heifer or steer up to the age of 12 months.</td>
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<tr>
<td><strong>Suckler</strong></td>
<td>A young animal that is drawing milk from its dam, ie suckler calf. May also be used to refer to a suckler cow.</td>
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<tr>
<td><strong>Suckler cow</strong></td>
<td>A cow that is nursing a calf. The milk produced during lactation is used solely to feed a calf (single suckling) or several calves (multiple suckling). These animals are normally beef breeds, or females resulting from beef bulls crossed onto dairy cows, producing calves for meat production. The meat from these animals (cull cow) following slaughter at the end of their productive lives tends to be tough due to the amount of connective tissue present.</td>
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<tr>
<td><strong>Veal</strong></td>
<td>The meat from calves slaughtered before 8 months of age.</td>
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<tr>
<td><strong>Clean Cattle</strong></td>
<td>Heifers, young bulls or steers, distinct from cull cows or mature bulls. Also known as prime cattle.</td>
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<tr>
<td><strong>Cow</strong></td>
<td>A female bovine animal which has produced a calf. Prior to producing their second calf, these animals are sometimes referred to as heifers.</td>
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<tr>
<td><strong>Dairy Beef</strong></td>
<td>Beef produced as a by-product of the dairy industry from calves of dairy cattle. The calves produced from dairy cattle which are predominantly Holstein/Friesian crosses, tend to produce lean carcasses with poor conformation in comparison to beef breeds. Bull calves from the dairy herd are the predominant type used for cereal beef production systems, due to their ability to produce good feed efficiency on such systems. The crossing of dairy Holstein/Friesian cows with a beef breed bull can improve the conformation of their offspring.</td>
</tr>
<tr>
<td><strong>Dairy Cattle</strong></td>
<td>Cattle of a breed specifically bred and kept for milk production. In the UK, the Holstein and Friesian breeds are the most widely used dairy cattle.</td>
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<tr>
<td><strong>Cereal Beef</strong></td>
<td>Young cattle ready for slaughter around 12 months of age, commonly referred to as “barley beef”. These cattle are fed mainly a cereal diet (eg cereals plus a protein supplement) and housed indoors throughout their lives. The cattle used for cereal beef production tend to be male calves surplus from the dairy herd.</td>
</tr>
<tr>
<td><strong>18 month beef</strong></td>
<td>Production system for beef from animals slaughtered at 16 to 20 months of age. Animals will usually be housed and fed grass silage during winter months but will have grazed for the remaining months. Animals born in the spring will have a period at grass followed by a housed period through the winter and then be finished off grass. Conversely, animals born in the autumn will be housed at first and then have the summer at grass before being finished off silage indoors in the following winter.</td>
</tr>
<tr>
<td><strong>Bull</strong></td>
<td>Uncastrated male cattle, often referred to as an entire.</td>
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<tr>
<td><strong>Young Bull</strong></td>
<td>As above, used in intensive beef production.</td>
</tr>
<tr>
<td><strong>Steer/Bullock</strong></td>
<td>Castrated male bovine.</td>
</tr>
<tr>
<td><strong>Calf</strong></td>
<td>Young cattle from birth to weaning. A female calf is referred to as a heifer calf and a male calf, a bull calf. The meat obtained from calves is termed veal.</td>
</tr>
<tr>
<td><strong>Bobby Calf</strong></td>
<td>A calf slaughtered at only a few days of age, a by-product of the dairy industry.</td>
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Sale of the Animals

Transport

When the animals are ready for sale, they are transported from the farm to the abattoir or auction market. It is important for the production of good quality meat that the animals are handled quietly and are not stressed or bruised during transit. Stress may produce dark cutting beef. Animals should not be mixed with “strangers” to avoid fighting. Bulls should not be mixed less than one week before slaughter. The method of loading animals into or out of vehicles is very important. All stock finds it easier to walk uphill rather than down and prefer to move from dark to light. The careful use of lighting can help to move animals without the use of force. To prevent bruising and skin damage in transit, there should be no sharp projections, narrow gates, and side or floor gaps to trap legs or slippery surfaces. Transport should be well ventilated and draught free.

Liveweight sales

There are auction markets in operation in Great Britain, which vary in size and specialisation. Days are set aside for selling finished stock or for the sale of breeding and “store” stock. Finished animals are taken to market by the farmer and sold by weight to abattoirs, wholesalers, multiple retailers, butchers, dealers and export buyers. The farmer pays a commission for the sale of their animals. Cattle are sold singularly and are weighed on entry to the auction ring, where the liveweight can be seen by everyone. They are then sold by price per kilogram. This method of selling is openly competitive.

Deadweight sales

Great Britain has abattoirs of various sizes, which provide slaughter facilities for butchers, wholesalers and processors. The abattoir or meat plant is part of the business of wholesale buying and selling of meat. The farmer sells their livestock direct to the abattoir and is paid on weight and specification of carcase produced. Payment terms and prices are quoted in advance. An advantage to the retailers is that they are able to select their own carcase requirement at the abattoir.
Beef carcase classification

This describes the carcase in a manner which is meaningful to farmers and wholesalers, indicating the degree of fatness and muscle shape.

Carcases are classified by assessment of conformation (five classes: E, U, R, O and P) and fat cover (five classes: 1, 2, 3, 4 and 5). In order to give an E classification, the carcase must have excellent conformation. P is the poorest conformation class. For fat cover, 1 is the leanest and 5 the fattest.

<table>
<thead>
<tr>
<th>Conformation Class</th>
<th>Fat class</th>
<th>increasing fatness</th>
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</thead>
<tbody>
<tr>
<td>E</td>
<td>1</td>
<td>5L</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5H</td>
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<td></td>
<td>5L</td>
<td>5H</td>
</tr>
</tbody>
</table>

Fat is determined by visual assessment of external fat cover. There are five main classes. Class 4 and 5 are subdivided into L (leaner) and H (fatter).
The Carcase and its Composition

The value of the beef animal depends on how much can be sold by the butcher and for what price. The quantity of meat that can be sold is called saleable meat yield, and is made up by lean, fat and some bone-in cuts, for example, Fore Rib on the bone. The fat is trimmed to a suitable level by the butcher. Different cuts from the beef carcase will fetch a range of prices, the price per kilo usually being related to tenderness, the amount of lean meat in the cut, what the meat can be used for, how popular the cut is or where in the carcase it comes from. Tender hindquarter cuts, such as sirloin and rump steaks, will fetch a higher price than tougher forequarter cuts such as brisket and neck.

In selecting cattle, the amount of saleable meat in the carcase and the proportion of the carcase that will yield higher priced cuts, are of prime importance. These factors can be influenced by breed, sex, the diet and feeding regime of the cattle. Young bulls are, on average, leaner and heifers fatter than steers. This will influence the meat yield of the carcases because of the amount of fat that has to be trimmed off to make the meat acceptable to the consumer. The diet, be it grass or cereals such as barley, and the feeding regime, whether the animals are taken to slaughter weight in 12, 18 or 24 months, will also affect the yields of the carcase.

Examples of classification – These images show a range of fat levels for all carcases of the same (O+) conformation
Quality

What is Quality?

• Quality is different things to different people.
• Quality is a set of attributes or variables resulting in that product’s acceptability or rejection by the customer.
• Two distinct areas – carcase quality and meat quality. Eating quality is a key attribute of meat quality.

Factors Affecting Beef Quality

• Variables which exist in the animal – age, sex, breed, feed.
• Variables in the conversion of that animal (muscle) into meat.
• Variables in handling and storage – time, temperature, humidity taints/odours, contamination.

Meat quality traits can be influenced by production methods on farm and a wide range of factors beyond the farm gate:

• Where supply can be guaranteed and there is a marketing advantage, use of a single breed can be advantageous. This can also improve consistency and, for pure-bred Aberdeen Angus and Hereford, may give an eating quality advantage. This is only likely to be perceived by the consumer if strict adherence to optimum post-slaughter handling is observed.
• Selection for tenderness is possible but it is difficult to measure the phenotype. Gene markers could help but it is important that they are validated in the population of interest.
• Quality prime beef can come from steers, heifers and young bulls. Young bulls, however, produce less tender meat than steers at the same age so an upper age limit of 15 months is recommended, together with additional post-mortem maturation of bull meat.
• Young bulls from the suckler herd produce more tender beef. This may also apply to steers and heifers but this has not been shown.
• An upper age limit of 30 months for steers and heifers and 15 months for bulls protects against the toughening effect of animal maturity.
• Overall, it seems that the best advice is to finish animals as young as possible within a given production system. In general, this approach will also minimise cost of production and environmental impact.
• Aim to maximise growth rate within the production system and avoid variation in growth rate within a group of cattle.
• Avoid imposing nutritional challenge on the pregnant cow during mid-gestation.
• Ensure adequate antioxidant provision for cattle to optimise colour and flavour stability in beef. In non-forage rations, supplement with vitamin E at 1000IU per head for 100 days pre-slaughter.
• Limit feed withdrawal pre-slaughter to avoid dark cutting (DFD meat).
Meat quality traits can be influenced by production methods on farm and a wide range of factors beyond the farm gate:

- In specific supply chains, it may be possible to minimise dietary variation to generate a more consistent beef flavour.
- Careful consideration should be given to potential flavour issues before introducing novel feed ingredients.
- Handle cattle considerately to avoid DFD and toughness issues.
- Avoid mixing unfamiliar groups of animals.
- Move young bulls to the slaughter point direct from the transport vehicle where possible.
- Apply electrical stunning with care – monitoring pH/temperature relationship post-slaughter to avoid hot-shortening.
- Aim for a minimum fat class of 3 as a precaution against poor eating quality.
- Hip suspend (or aitch bone hang) for optimal eating quality of loin and hindquarter cuts.
- In the absence of electrical stimulation, avoid rapid chilling.
- Careful use of electrical stimulation can enhance beef quality where hip suspension is not being used.
- Mature beef in the bag or on the bone to enhance tenderness.
- Use ‘dry aging’ only where there is a specific value added market for the product.
- Avoid high oxygen packaging wherever possible, as this may contribute to toughening over extended storage times.
- Monitor pH/temperature post-slaughter and adjust stimulation/chilling rates to ensure pH 6 is reached at a muscle temperature below 35°C and above 12°C.
- Monitor ultimate pH and review the handling and process if it is outside the normal range (5.5-5.8)
What is DFD (dark, firm and dry muscle) meat?

This is a muscle condition defect seen in beef carcases, (particularly in young bulls, cull cows and veal) when it is termed dark cutting beef. The condition is rarely seen in sheep carcases. In muscles that develop DFD, increased circulatory levels of adrenaline cause the muscle glycogen to be depleted prior to slaughter. This results in less substrate available for post-mortem glycolysis. In turn this restricts the amount of lactic acid formed in the muscle post-mortem and thus the ultimate pH of the muscle will be higher than normal.

An indication of the occurrence of DFD in a carcase is an ultimate pH of above 6.0. In addition to the apparent abnormal colour found in DFD meat, it has also reduced keeping qualities and is prone to microbial (bacterial) spoilage. Both of these traits are because of its higher pH. Fluid retention is very high in DFD meat. Poor pre-slaughter handling (prolonged stress) and prolonged periods of fasting prior to slaughter are predisposing factors for the development of DFD.

What happens with DFD (dark, firm and dry) meat?

- Chronic stress prior to slaughter.
- Muscle energy levels are rapidly depleted.
- Deficiency of lactic acid in muscle.
- Higher pH results in excessive water holding capacity of the proteins.
- Fluid is retained in muscle proteins.
- Muscle cut surface and meat appear dark, firm and dry.
- Keeping quality is reduced significantly.
- The meat is not necessarily tougher than non-DFD meat.
What is Cold Shortening in beef?

This occurs when muscles are cooled rapidly after slaughter, while still in a pre-rigor condition. This causes the sarcomeres (the contractile units of myofibrils) within the muscle to shorten, which results in a very appreciable reduction in the tenderness of meat. The basic underlying cause of cold shortening appears to be related to a premature, cold-induced, rise in calcium within the muscle cell. This increase in calcium availability occurs at a time when the muscle may still contain appreciable energy reserves capable of fuelling the contraction of the muscle. The muscle will then go into rigor in a contracted state, leading to the toughness. Several methods have been developed to overcome the problem of cold shortening. These include considerate chilling, electrical stimulation to accelerate the development of rigor-mortis of the carcase and pelvic suspension, to place the muscles under tension and prevent them from shortening.

Faster chilling and, hence, cold shortening has been demonstrated to occur to a greater prevalence in extremely lean carcases. Thus it has been suggested that subcutaneous fat (backfat) may assist in insulating the muscles from rapid chilling. The muscle fibre type has been shown to be an important determinant of susceptibility to cold shortening. With those muscles or species containing predominantly white fibres showing more resistance to cold shortening than those with predominantly red fibres. This is largely because white muscle fibres enter rigor-mortis more rapidly than red muscle fibres.

What happens during Cold Shortening?

- Meat cooled to below 15°C before rigor.
- Rigor is accompanied by muscle contraction.
- Actin and myosin lock together irreversibly.
- Muscle fibres shrink and meat becomes tough.
- External muscles are most affected.

How Does Electrical Stimulation Work?

- Carcases are subjected to electrical stimulation immediately after slaughter.
- Post-slaughter energy levels in the muscle are depleted rapidly.
- Rigor mortis sets in before the muscle reaches 15°C.
- The subsequent rapid cooling cannot change the shape of the muscle fibres.
- Cold shortening has been avoided.

Cold Shortening in beef

What is Electrical Stimulation in beef?

Electrical stimulation is the application of an electric current to the carcase post-slaughter, to enable faster chilling of the carcase.*

This appears to be achieved due to the depletion of ATP (muscle energy) and hence a faster lowering of pH, hastening the onset of rigor mortis in the carcase. It can be used to overcome the problem of cold shortening.

In addition, it has been found to improve the tenderness of meat and can be used to reduce or even replace expensive ageing of meat. An improvement in muscle colour has also been demonstrated.

Where other electrical inputs are used during the slaughter and dressing, caution must be taken to ensure pH doesn’t fall too quickly to bring about heat shortening – a toughening effect caused by pH falling below 6 at too high temperatures (above 35°C).

*There are two types of electrical stimulation commonly used: low voltage (LVES) and high voltage (HVES). LVES is used immediately post-slaughter (exsanguination) whereas HVES is used post-scales, prior to chill.
**Lean Meat (Muscle) Composition**

- Consists of fibre bundles containing meat juices and protein.
- Fibre bundles are held together by connective tissue (gristle).
- Long thick fibres with a lot of connective tissue make less tender meat.
- In gentle, moist heat, connective tissue converts to gelatine and enhances tenderness.
- Muscle fibres do not increase in number but get thicker as the animal gets older.
- Species, breed, sex and age will all affect the texture of the muscle.

![Diagram of Muscle Structure](image)

**The Structure of the lean meat (muscle) is made up of**

- **Water**: 75%
- **Protein**: 18%
- **Carbohydrates, inorganic salts and traces of vitamins**: 4%
- **Fat**: 3%
Maturation – Dry Ageing/Wet Ageing

For many years, ageing/maturation of meat has been used to enhance meat eating quality, tenderness and also flavour. Provided meat is stored in the right conditions, tenderisation can occur. It is important to get the ageing time, temperature and overall storage conditions correct. Ageing for too long can result in off-flavours developing. Primal cuts which are used for mince, burgers, braising and stewing cuts generally don’t need maturing and are, therefore, often processed as soon as possible to increase shelf life. Often, ultraviolet light is used to slow down microbial spoilage.

Dry Ageing

The objective is to enhance depth of flavour and tenderness. Dry ageing is achieved by hanging beef quarters (mainly hind quarters) or placing meat primal cuts on racks without any packaging in a controlled refrigerated environment. The temperature is very important (generally between 0 to 4°C). If stored at freezing temperatures (-2 to -3°C), the ageing process will cease. It is also important to control the relative humidity (± 80%). If it is too high, spoilage bacteria can grow and result in off-odours and possible off-flavours. A certain amount of air flow around the meat is also needed to avoid spoilage, but too much air flow can increase weight loss and drying out of the meat unnecessarily. Often, ultraviolet light is used to slow down microbial spoilage.

Dry ageing is an expensive process due to the weight which is lost during the ageing period. Meat can become dark and discoloured on the outside and, therefore more trimming is needed. If procedures are not followed correctly, rancidity of fat and mould growth can become a serious issue. Dry-aged beef is seen a “premium” product and commands a premium price.

Wet Ageing

The objective is to improve the tenderness of meat. Wet-aged beef has, typically, been aged in vacuum-sealed plastic bags packed in boxes. It is popular with abattoirs, wholesalers and retailers as it is less expensive than the dry age method. It takes up less fridge space, provides less weight loss during the process and requires less trimming than the dry age method. However, during wet ageing, the plastic does not allow the meat to breathe, so the meat ages in contact with its own fluid, which can create an intense sour note if the meat is aged too long. Temperature abuse can increase drip loss in the bag which also has a negative effect on flavour and meat yield. The flavour is different from that of dry-aged beef and wet-aged beef commands a lower price than dry-aged beef.
The colour of meat

The colour of meat mainly comes from the presence of myoglobin. The colour we see is determined by how much is present and its chemical state. Consumers generally prefer bright red meat, in which oxymyoglobin predominates, and discriminate against browned meat (with high metmyoglobin concentrations).

Meat discolouration

When meat is wrapped in an oxygen-permeable film, or packed in an atmosphere with increased oxygen levels, bright red oxymyoglobin forms at the meat surface. A metmyoglobin layer forms at lower levels where the oxygen concentration is low, while myoglobin predominates at the meat centre where there is no oxygen. With time, the metmyoglobin layer thickens towards the meat surface, giving the typical brown appearance associated with discoloured meat.

In vacuum-packed meat, where oxygen has been excluded, the pigment exists mostly as myoglobin.

Examples of meat colour

Thick Flank – Freshly cut
Thick Flank – Vac packed
Thick Flank – Removed from vac pack after 1 hour
Colour shelf life

With time, all muscles will discolour as brown metmyoglobin appears at the surface. The rate at which they do so is highly variable. Redder muscles are less stable. Colour stability differences are especially apparent in cuts of meat comprising different muscles, in which case the effective colour shelf life will be determined by the least stable muscle.

Comparison of discolouration

The comparison below shows the discolouration between freshly cut sirloin steak and a sirloin steak removed from vac-packaging over a 3-day period.
Seam Butchery

This cutting method is based on the continental style of butchery which involves removing muscles by following the natural seams. In contrast, traditional British butchery uses the bone structure of the carcase to define joints and cuts so that they generally contain more than one muscle. Some traditional cuts and joints contain more than one muscle with a different level of tenderness between them and this can lead to poor and inconsistent eating quality. The advantage of seam cutting is that individual muscles can be cooked by the most appropriate method. Seam cutting also allows for a higher degree of fat trimming and the removal of gristle and connective tissue. In some traditional cuts the grain of the muscle runs in different directions but by using the seam cutting method muscles can be cut across the grain which improves eating quality.

Seam cutting example of the heel muscle

1. Position of the Heel muscle.
2. Heel muscle.
3. Remove the Pencil muscle by following the natural seams.
4. Pencil muscle (flexor superficialis).
5. The remaining muscle (gastrocnemius) can be...
6. ...separated into 3 parts by following...
7. ...the natural seams between them.
8. A. very tender – frying quality
    B. less tender – braising quality
Other useful resources

Meat Purchasing Guide

Beef Yield Guide

To order copies or download these materials, call the scheme hotline 0845 491 8787 or visit www.qsmbeefandlamb.co.uk