

QUALITY BY NAME



QUALITY BY NATURE

**A Study into Red Meat Eating Quality
in the Scottish Meat Sector**

QUALITY MEAT SCOTLAND SUMMARY REPORT 2023

NOT ALL MEAT IS CREATED EQUAL.
BORN, REARED & PROCESSED IN SCOTLAND,
SCOTCH IS MEAT WITH INTEGRITY.





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QUALITY BY NAME & NATURE

Scottish red meat – Scotch Beef, Scotch Lamb and Specially Selected Pork – has a fantastic reputation, with consumers world-wide recognising its provenance and quality. It is an important profit driver for Scotland too, with the economic output for Scotch Beef, Scotch Lamb and Specially Selected Pork being £849m, £299m and £139m respectively. But with consumers globally becoming more demanding, and seeking consistent, reliable eating quality, there is an opportunity for Scotland's red meat sector to discuss and develop a collaborative approach to this.

While figures suggest the ability to use the Scotch Beef PGI status has helped deliver an additional £30–40 per animal over the last 10 years, evidence from other countries indicates that a well-implemented eating quality management system can further boost returns, in some cases considerably. In these international markets, consumer studies have highlighted a willingness to pay more for eating quality which is guaranteed, there is clearly an opportunity.

The overall aim of this project, commissioned by QMS and independently produced over an 18-month period by Birnie Consultancy, has been to identify practical methods which can be employed within the Scottish red meat sector to improve and guarantee eating quality, and which can be used to deliver competitive advantage both in the UK and export markets. Given the nature of the pork sector, and the greater variability in beef and lamb, this report concentrates on the opportunity for these two products. This summary document highlights some of the key areas, and a more detailed 80-page document, which adds considerable depth and context, is freely available on the QMS website – www.qmscotland.co.uk

The proposals in this report on meat eating quality, and the wider 80-page project document, provide much to consider and are sure to generate discussion. But the opportunity to secure consumer sales and loyalty through more consistent eating quality is one which should be looked at closely. We are keen to gauge reaction from all parts of the beef and lamb supply chain, so please come to talk to us at shows and events, and you can also email your thoughts to info@qmscotland.co.uk – we look forward to hearing from you.



THE AUTHORS

Birnie Consultancy is a specialist consultancy working with primary and secondary food processors, farmers, supermarkets, levy bodies, research institutions and governments across the UK and Europe.

It is involved in commercial and research projects, writing and implementing strategies, delivering in-depth technical analysis and reporting, managing farmer groups and delivering knowledge exchange. It aims to help clients build their capabilities, productivity, profitability and competitiveness, as well as adding customer value and building their sustainability efforts.

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THE MARKET

Beef and lamb production are highly important to the Scottish agricultural industry with beef, sheep and dairy accounting for about 50% of the total agricultural output. A range of production systems is used in Scotland to produce beef and lamb, creating significant challenges around consistency of management, monitoring of performance, transfer of knowledge or new practice, and, importantly, the management and measurement of eating quality. Scotland has a strong reputation for its beef and lamb products and is internationally recognised. Protection and development of the brand is crucially important.

Market demand is changing, and it is important that these changes are accounted for to ensure that markets are retained and opened up, and that demand for red meat from Scotland remains strong. Consumers tend to respond positively to meat products which demonstrate much higher eating quality and/or environmental benefits.

The most significant factors are: 1) The demand for increased product quality and consistency; 2) The increasing need for demonstration of environmental sustainability; and 3) The need for an increased volume of food production with a genuinely reduced impact on the environment.

Payment for meat in Scotland is currently carried out using the EUROP framework. This payment system is unrelated to eating quality, and only incentivises yield. Historically, there have been considerable challenges to developing a consumer-based grading scheme with a reluctance for active cooperation between countries and industry sectors within each country. It is important that Scotland retains its USP with regard to eating quality, but this needs to be driven through measurement and the application of good practice.





MEAT EATING QUALITY AND THE CONSUMER

There is an increasing demand from consumers for beef products which are more consistent and have guaranteed eating quality. It is known that if a consumer has a negative eating experience they will drop out of the category (or at least avoid purchase of the same product) for up to 12 weeks.

Consumer perception of meat and meat products is a critical issue for the red meat industry because it directly impacts profitability. Quality cues such as tenderness and flavour are of immense importance to consumers at point of consumption, but consumers find it difficult to decipher the quality of fresh meat at the point of purchase, finding it complex, and difficult to define. The multifactorial nature of meat quality, and the varied expectations of different consumers make it difficult to fully understand and predict specific consumer acceptability of a meat product.

Nevertheless, there is an increasing demand from consumers for beef products which are more consistent and have guaranteed eating quality. It is known that if a consumer has a negative eating experience they will drop out of the category (or at least avoid purchase of the same product) for up to 12 weeks.

Retailers have informed us that the demand for high eating quality is increasing and will continue to do so. This is particularly the case for beef, less so for lamb, and, in general, eating quality is not considered to be quite as important for pork by many retail organisations. There is general acceptance that, in the future, individuals will eat a lower amount of red meat, and as a result they will expect that the red meat they do eat will be of a higher eating quality. In other words; red meat is expected to become even more of a luxury than it currently is, and that when it is consumed, it needs to meet quality expectations. There is also general acceptance that global demand for red meat will continue to increase, which is likely to outstrip supply. This will continue to drive the price of red meat upwards, contributing to a lower volume of meat to be eaten per person, but a higher expectation around eating quality as a result of the higher price paid. All retailers were extremely supportive of the general concept of creating a meat eating quality improvement and measurement system in Scotland.

Red meat processors identified four main factors which are of primary concern: The need to ensure ongoing supply of beef and lamb; the price of beef and lamb to the consumer, and the resulting impact on sales volumes; carbon and environmental impact of beef, lamb and pork; and eating quality of beef in particular, but also for lamb and pork. Processors recognise that there is a genuine challenge around development of eating quality, acknowledging that variability in quality carries significant economic cost through product returns and, more significantly, putting consumers off of purchasing meat on the basis of previously poor experience.





MEAT EATING QUALITY AND THE CONSUMER

Consumers base their purchase choices on quality cues and learnt experience, and it is essential that the meat industry (producers, processors and retailers) strives to enhance these cues and experiences in existing and new products. The industry must utilise the best scientific knowledge and technology to deliver this.

A range of factors impacts the way in which the industry and consumers perceive red meat eating quality. These factors include:

- **Conformation:** A consumer's perception of quality is influenced by the appearance of the meat and meat with low fat (intramuscular and rind/subcutaneous) is often preferred.
- **Hygiene:** The hygiene of the meat does impact the perception of quality by the consumer. High microbial loads, besides being unsafe, increases the speed at which meat becomes rancid. Meat which turns rancid quickly is rightly judged to be of lower quality than normal meat. Even meat which is only partially rancid (or 'on-the-turn') will produce unusual and unpleasant flavours, negatively impacting the eating quality of the meat.
- **Nutritional content:** The proportion of lean tissue to fat impacts the overall nutritional content and has an effect both on the perception of the meat (too much fat is seen as negative) and the actual eating quality. Under blind taste testing conditions increased intramuscular fat up to about 7.3% is associated with improved liking of the meat
- **Sustainability:** Good provenance can positively impact the overall perception of product quality, at purchase and at consumption.
- **Ethics:** Ethical attributes associated with a meat product can, in the same way as a provenance story, influence a consumer to perceive meat as being of higher quality. In general the ethical attributes include the need for farm assurance, the need to demonstrate high animal welfare and the growing need to demonstrate high climate and biodiversity performance.
- **Appearance:** The appearance of meat is one of the only criteria the consumer can base their purchase on, and therefore highly important. The palatability (tenderness, texture, juiciness and flavour/odour) of a product is the criteria that a repeat purchase is based on, including, meat colour, fat content, quantity of exudate, packaging type and appearance of the meat.
- **Post-purchase:** Tenderness, juiciness and flavour are all important and have a significant impact on repeat purchasing of meat products.





HOW TO IMPROVE EATING QUALITY

Many of the changes which could be made to improve eating quality could also substantially benefit environmental performance and these 'win-win' changes are critically important.

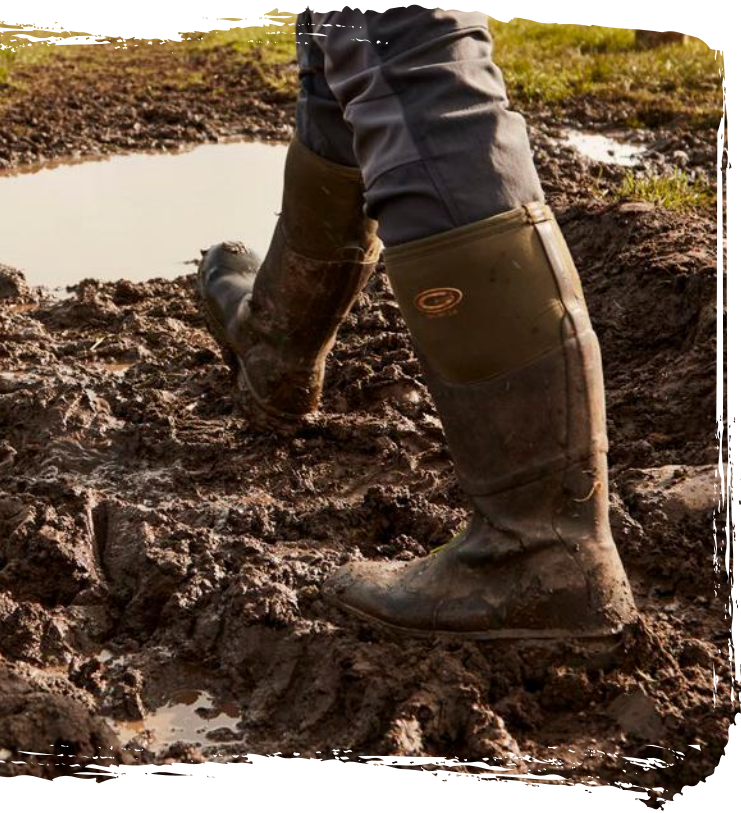
Within the UK beef supply chain, variability in meat quality is high. In Scotland this variability is partly a result of the diversity of our landscape and production systems, and this can have an impact on both our customers and consumers. Large degrees of variability in age of slaughter, carcass weight and fat classification can produce an inconsistent product, which can often result in a differing eating experience.

Many of the changes which could be made to improve eating quality could also substantially benefit environmental performance and these 'win-win' changes are critically important. One of the outputs of this report is a menu of options to improve and/or guarantee eating quality which can be implemented on-farm and then confirmed by farm assurance and customer satisfaction surveys.





ON-FARM



There is less impact of the sex of a lamb on overall eating quality provided that entire male lambs are slaughtered before six months of age.

Ensuring consistently high meat quality starts on the farm. Meat quality can be influenced by many different factors on the farm and understanding these offers the opportunity to improve the eating quality and consistency of the end product. These factors include:

Genetics: The genetics of the animal are a key determinant of eating quality because they significantly influence a range of key components. Genetics interact with the animal's environment to impact phenotype (although the relationship is not yet fully understood). Genetics impact: Carcass muscle structure; type of muscle fibres; speed of growth of the animal; temperament of the animal; fat content of the carcass; intramuscular fat content; and muscle calpain content, as most evidence points to the calpains as the main cell proteins involved in post-mortem tenderisation.

Sex: In general, it is accepted in the literature that for cattle, heifers tend to be more tender than steers, which are more tender than bulls. There is a strong management/sex interaction, and it is known that good eating quality can be obtained, even for bulls, provided that the management is appropriate to the animal.

There is less impact of the sex of a lamb on overall eating quality provided that entire male lambs are slaughtered before six months of age. Flavour taint can emerge for entire male pigs above a certain age. However, this can be managed through putting a weight limit on entire male pigs at around 105kg live weight.

Diet: Consistency of flavour is important to the consumer when purchasing beef. Fat is crucial for flavour as a minimum level of 30mg/kg (3%) is required to achieve acceptable eating quality for beef. Tenderness of beef is even more important than flavour.

Fatty acid composition is heavily influenced by diet and has a significant influence on juiciness and flavour. A diet with a high proportion of grass and forage will have a substantially different flavour to beef from animals which have been fed on cereals. Consumer preferences differ, with some preferring grass-fed flavours and others preferring concentrate-fed flavours. In general, lamb flavour is more heavily influenced by diet than beef or pork, but the demand for grass-fed beef is also growing.

Age: Collagen's 'building blocks' – fibrils and fibres – are arranged in intramuscular tissue during the development of muscle. The collagen becomes progressively tougher, more rigid and less easily denatured or broken over time, leading to increased toughness as the animals age. This is more pronounced in entire male animals (Bailey, 1985). Bonny et al. (2016) investigated the age of the animal and its impact on eating quality. They found no relationship for animals that are less than three years old. However, anecdotal evidence around the effect of age is strong, and it is another control factor which should be considered.



ON-FARM

The quantity of intramuscular fat or the degree of marbling is affected by many factors, namely, animal breed, carcass fat level, slaughter weight, feeding strategy, and growth rate.

Intramuscular fat: Intramuscular fat produces a marbling effect that has been shown to affect flavour, juiciness, tenderness, and visual characteristics of meat, with increasing marbling in meat being linked to increased palatability; however, fat levels above 7.3% are considered too high. Meat with a fat content between 3 and 7.3% is generally considered acceptable. The quantity of intramuscular fat or the degree of marbling is affected by many factors, namely, animal breed, carcass fat level, slaughter weight, feeding strategy, and growth rate.

The carcass fat levels are relatively easy to ascertain at slaughter, either by visual analysis of the carcass (beef and lamb) or by measurement of fat depths in pork.

Handling: Handling of animals can heavily influence eating quality. However, good pre-slaughter handling can only maintain the quality which already exists – it does not enhance it. High stress for animals prior to slaughter depletes muscle glycogen, leading to high pH immediately after slaughter. This is associated with a number of quality problems including Pale, Soft and Exudative (PSE) and Dark Firm and Dry (DFD) meat, with associated shelf-life challenges. Cattle and pigs are susceptible to poor pre-slaughter handling and within this, entire male animals are particularly susceptible. Close management and control of pre-slaughter handling is essential.

Transport: Transport is considered a major stressor for farm animals and can have negative effects on health, wellbeing, and product quality. Therefore, minimising travel distance can improve meat quality as extended animal transport is associated with muscle glycogen depletion and 'dark-cutting' beef. Other effects of transport on meat quality demonstrated by research include increased toughness and decreased palatability. It should be noted that the quality of roads and driving are perhaps more important to eating quality than transport time, but time of transport is one of the only metrics available to estimate the effect of transport, and so is used instead.



IN PROCESSORS

The hanging position of the carcass can impact the eating quality of specific cuts in the carcass, while at the same time causing additional toughness in some other less valuable cuts.



The Scottish meat processing sector has very rigid but robust systems for the processing and conversion of muscle to meat. To supply Scotch Beef and Lamb, meat processors must be part of the QMS Processor Assurance Scheme, and it is this which is most likely to be used as the vehicle for delivery of a quality management system. Provided that a workable system can be identified, it can be included as a requirement for any product which uses the Scotch Beef or Lamb certification. Factors within the slaughter process which are under the control of the processor include:

Lairage time: The time spent in the lairage is crucial for all classes of livestock, to a greater or lesser degree but is particularly important for bulls. Bulls should be moved as quickly as possible from transport to slaughter as acute stress can have a negative impact on meat quality.

Electrical stimulation regime: The primary reason for the use of electrical stimulation in the meat industry is to allow rapid chilling of carcasses without the risk of cold-shortening; however, rapid chilling isn't practised within the industry now as often as it was in the past, and a clearer understanding of the optimum pH/temperature environment throughout the carcass chilling process would aid greater precision in the application of/need for electrical stimulation.

Carcass chilling regime: There are strong inter-relationships between the temperature of the carcass and the pH decline of the muscles. This must be carefully controlled through chill temperature and appropriate application of electrical stimulation. There is an optimum window for temperature/pH decline, and carcasses which fall outside this window are prone to muscle shortening.

Shortened muscle fibres produce tough meat. This can occur when early post-mortem variables of pH, temperature and time interact in such a manner as to induce cold-shortening. Pre-rigor muscle shortens on exposure to temperatures below about 10°C.

Hanging method: The hanging position of the carcass can impact the eating quality of specific cuts in the carcass, while at the same time causing additional toughness in some other less valuable cuts. Carcasses are normally suspended by the Achilles tendon, but as an alternative, the hip bone (Tenderstretch) can be used. Hanging by the hip bone has the effect of causing the leg to fall downwards, stretching the muscles along the back and causing up to a 20% increase in tenderness.

Maturation method and duration: There are two main types of maturation which are used in the industry. Dry ageing and wet ageing. The dry ageing process normally involves the storage of beef at 0–4°C, uncovered, for 3–5 weeks under a relative humidity of 75–80% in a controlled air flow environment. Wet ageing of meat takes place in vacuum packs. Using this method, the enzymes still have time to tenderise meat enough to make it acceptable, and the method has the advantage that there is no weight loss in the meat due to moisture loss. Wet ageing also costs less for the manufacturer than dry ageing since the meat doesn't need to be stored or monitored, ultimately resulting in a lower consumer cost.

However, some argue that wet ageing does not produce the same complex flavours that dry ageing does, but the literature is divided on differences in detectable eating quality between wet and dry ageing. It is worth noting that the term 'dry ageing' is likely to carry more consumer appeal than 'wet ageing', but in truth the marketing term for wet ageing will be 'extra matured' and will make no mention of the term 'wet'.

Regardless of the maturation method used, beef improves as it ages, provided that enzymic breakdown can continue. This improvement is rapid over the first few days and then slows. It is generally accepted that about 70% of the improvement happens in the first few days, while the meat continues to improve up to at least 21 days, although some argue that up to 28 days is beneficial. Any quality management system will include the application of a desired minimum maturation period to improve consistency.

Muscle selection for different products: Muscle tenderness and flavour differences have been reported in many studies. Generally the differences in flavour intensity are small. Results from the study of Jeremiah et al. (2003) showed that sensory panellists scored 'beef intensity' over a range of only 10% after tasting 33 different beef muscles.

Additional factors can impact eating quality, but generally to a lesser degree. These include hot boning, and muscle restraint techniques to prevent shortening (such as wrapping or binding muscles in film).



INTERNATIONAL MEAT EATING QUALITY SYSTEMS

Multiple commercial systems to manage eating quality are in operation globally. Many of these schemes are based on a range of quality cues. These systems exist for all three species in the study.



The United States Department of Agriculture (USDA) quality grade, which has seven categories, is determined by considering the degree of marbling and firmness, as observed in the cut surface of the rib and relating this to the maturity of the carcass. Quality grades are Prime, Choice, Select, Standard, Commercial, Utility and Cutter. The yield grade has five categories numbered from 1 to 5, with yield grade 5 being the most desirable as it is the highest yielding for saleable meat. Payment is based on a mixture of yield grades and quality grades. Smith et al. (2007) state that among Prime through to Standard carcasses, grade predicted flavour, tenderness and overall palatability of loin steaks with 30 to 38% accuracy, but could explain no more than 8% of the variation in panel ratings/shear force values of round steaks. These findings are representative of other findings across the world, where the relationship between prediction systems and tenderness of meat is relatively loose.

Japan Meat Grading Association (JMGA) delivers the beef grading standard, outputting a Yield Score and a Meat Quality Score (in a similar manner to the USDA grading system). Each carcass is individually assessed after slaughter by an association grader. Meat quality grade parameters are assessed after quartering between the 5th and 6th ribs in JMGA grading. Marbling is assessed against 12 beef marbling score (BMS) standards increasing in amount from 1 to 12. The BMS scores are in turn related to five beef marbling grades: excellent (BMS 8–12), good (BMS 5–7), average (BMS 3–4), below average (BMS 2) and poor (BMS 1). There are five meat colour and brightness grades as well as five firmness classifications. Seven Beef Fat Standards (BFSs) are used to describe fat colour and a fat texture, lustre, and a quality grade is assigned from a combination of the BFS number and visual appraisal of fat lustre, and quality.

The Overall Meat Quality score (1-5) is based on these four assessments and is graded down to the lowest grade among these four items. The final carcass grade is a combination of Yield and Quality Grade. There appears to be very limited evidence in the literature relating JMGA grade to the actual eating quality of the meat, but the parameters are very similar to those in the USDA system and can thus be treated in a similar way.

The Meat Standards Australia (MSA) system is exceptionally well researched, designed to improve and predict meat eating quality based on almost 1.2 million consumer taste tests by more than 171,000 consumers from 11 countries. The system has evolved to include a range of factors that influence meat eating quality.

The model accounts for the variation in genetics, production systems, cut and cooking method, delivering an all-encompassing meat quality classification system. It includes a multitude of measurements including: carcass weight; sex; genetics (mainly to account for the negative effect of *Bos indicus* on eating quality); hanging method; use of growth promoters; ossification (the hardening of bone as a predictor of biological age as younger animals are judged to have superior eating quality); marbling; rib fat; pH and temperature decline; eye muscle area; fat colour; meat colour; cut ageing; cooking method; and individual cut type.

Within the grading system itself, an overall grade is given to the carcass which influences the total payment to the producer. There are four quality grades within the MSA system: Fail, MSA 3 Star, MSA 4 Star, and MSA 5 Star. Fail meat is still sold, but is not accredited. A suggested cooking method is also given for each cut, aimed at optimising consumer eating experience.

The Canadian grading system uses maturity and marbling in assigning quality grades. The system standards were amended in 1996 to align its marbling standards with the USDA system and as a result the systems are very similar.

The Korean beef carcass grading system incorporates quality and yield grades, with five quality grades and three yield grades, resulting in 15 possible categories.

The South African meat grading system has three main classification grades with three subgrades. The system uses the sex of the animal, carcass weight, dentition, rib fat cover and carcass damage to classify carcasses.



DEVELOPING A SCOTTISH MEAT EATING QUALITY SYSTEM

The current beef supply chain in Scotland is highly fragmented, delivering a variable product due to a wide range in the age of slaughter, carcass weights, conformation grades, and fat classes. Research has shown the variability in age of slaughter against carcass weight of prime steers and highlights the extent of this problem.



To remain competitive in current world markets, it is important to differentiate from the current commodity-led supply chain to a product that is of consistently high quality. The overall objective of this proposal is the development of a system or methodology that ensures a more consistent product which meets consumer expectations. This currently does not exist within the Scottish industry.

The EUROP carcass classification grid was introduced to Europe in the 1970s with the aim of ensuring that a uniform classifying system could be used across the continent for beef and lamb. This grid also meant that producers could be rewarded for supplying cattle and sheep with the carcass classification (and therefore yield of carcass cuts) that the market demanded. The system was not designed to reflect eating quality and there is almost no relationship between the carcass grade and eating quality of the meat. As the system has been in place for over 50 years, there may be a number of difficulties in replacing it with a more modern system.

The current beef supply chain in Scotland is highly fragmented, delivering a variable product due to a wide range in the age of slaughter, carcass weights, conformation grades, and fat classes. Research has shown the variability in age of slaughter against carcass weight of prime steers and highlights the extent of this problem. The full economic cost of such existing variable supply chains is large and economically unsustainable in the long term. Processing facilities within Scotland operate under very stringent conditions, and placing carcasses with this much variability within a robust chilling regime will undoubtedly result in a high degree of variability in pH-temperature decline and subsequent meat quality. The variability in the visual aspect of prime cuts and meat quality will result in low levels of consumer satisfaction.

Collect and use data

Every animal slaughtered in the UK today has a wealth of data associated with its identification that could be hugely beneficial in predicting meat eating quality. This includes sex, age, breed, dam, dam breed, movements, distance travelled, lairage time, electrical stimulation, hanging method, chilling regime, maturation method, maturation period etc. The models developed within the Meat Standards Australia system illustrate the importance of these factors in predicting meat eating quality.

Developing a central industry database which incorporates all of the above parameters is essential. Collating this data into a single database will greatly enhance the ability to make informed decisions in improving meat quality. The development of this novel database will not only contribute to a meat eating quality-based supply chain, but also has the potential to provide practical information for beef farmers, which will allow management practices, production efficiency and profitability to be improved.

Validate data

While the EUROP classification system is still required for trade, a consumer-focused valuation system is also needed in order to increase value within the beef supply chain and improve the consistency and eating quality of Scottish beef. There are good examples of alternative grading systems which support this approach (e.g. Meat Standards Australia and USDA), and integrating versions of these systems in addition to EUROP, has potential to improve the footprint of Scotch beef in international markets.

A key element in enhancing the ability to quantify meat quality is the ground truthing and validation of models. It is essential that ample background scientific testing and validation is conducted to ensure robust evidence is accumulated and a high degree of industry confidence is established in the Scottish beef and lamb sectors. With the advancement of artificial intelligence and technology, it may be possible to develop a system that can use objective measurements in processors to validate and verify improved eating quality.



DEVELOPING A SCOTTISH MEAT EATING QUALITY SYSTEM

Factors that deliver quality

As already demonstrated, eating quality is impacted by many factors. Systems which are currently in use are broadly composed of very similar indicators or measures. Some systems are focused on the prediction and/or management of quality across a very restricted range of indicators.

There are two aspects to quality systems – the factors used to manage quality and the factors which are used to indicate that quality to the consumer.



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Virtually all quality indication systems do the following:

- 1 Reflect the level of fat in the carcass, with higher levels of fat being used to provide higher quality meat.
- 2 Offer a focused range of meat cuts – with specific meat cuts being focused on specific uses.
- 3 Use longer maturation periods for the meat (although this is not usual with pork).

Many quality indication systems use the following indicators:

- 1 Breed differentiation: Breed differentiation is commonly used in beef and occasionally used in pork. Breed differentiation is less regularly used in lamb.
- 2 Packaging differentiation: Occasionally skin-packing is used as a quality indicator, but it is more often used to control quality (as is vacuum packing).
- 3 Star or grade indicators used to indicate the eating quality of the meat.
- 4 Tiering as part of an own-brand range.

Many quality management (as opposed to indication) systems specify:

- 1 The use of electrical stimulation systems to control pH fall
- 2 The use of ultimate pH as an indicator of quality
- 3 The type of packaging used
- 4 The maturation period of the meat
- 5 The type of cuts which can be used in each product
- 6 The fat class of the carcass
- 7 The breed of animal which can be used

Pre-slaughter factors which impact eating quality include: genetics; management method; diet/nutrition; age at slaughter; fat class at slaughter; pre-slaughter transport; pre-slaughter handling; lairaging time and method; and slaughter method.

Post-slaughter factors which impact eating quality include: time to bleeding out of the animal; electrical stimulation regime; hanging position; chilling regime; maturation regime; physical interventions; packaging type; microbiological control; and product tiering and labelling.



DEVELOPING A SCOTTISH MEAT EATING QUALITY SYSTEM

Tighten carcass weight specifications by creating two categories; Commodity and Prime. Having a carcass weight specification between 280-360kg for Prime cattle will greatly reduce the variability in terms of post-slaughter responses such as pH-temperature decline.



Making changes on-farm

BEEF

Creating a new payment grid for cattle to verify a premium quality product for the Scottish red meat supply chain could provide quality, consistency, and ultimately economic benefits. This grid would be priced to incentivise producers to deliver a product that increases the probability of higher quality, more consistent beef carcasses. Premiums would be associated with the following criteria:

Tighten carcass weight specifications by creating two categories; Commodity and Prime. For example, having a carcass weight specification between 280–360kg for Prime cattle will greatly reduce the variability in terms of post-slaughter responses such as pH-temperature decline.

Reduce the age at slaughter for Prime cattle. This will not only improve production efficiency, but reducing the age at slaughter from its current position of more than 26 months to 16-months will also reduce toughness associated with greater collagen cross-linkages, delivering a more consistent product to the consumer. It is appreciated that the 16-month age limit could be challenging and it may be necessary to gradually reduce the age restriction over time, starting at 25 months and moving down to the ideal limit over an extended period. This will also improve the environmental performance of the animals.

Target steers and heifers to premium ranges: Ensure that Prime cattle are only steers and heifers. Collagen matures more quickly in bulls, resulting in tougher meat. Stress levels associated with pre-slaughter handling are also much greater in bulls which can result in tougher meat, associated with greater collagen cross-linkages, poor ultimate pH; increasing the risk of dark cutting meat, and poor shelf-life.

Set fat class tiers: Only animals of fat class 4L and above would be permitted to enter the Tier 1 quality mark. Only animals of fat class 3L and above permitted to enter Tier 2 quality mark.

LAMB

Creating a new payment grid for lambs to deliver premium quality product for the Scottish red meat supply chains could provide quality, consistency, and economic benefits. This grid would be priced to incentivise producers to deliver a product that increases the probability of higher quality, more consistent lamb. Premiums would be associated with the following criteria:

Set sex criteria: Only female and castrated lambs would be eligible for Tier 1 classification. If an ultra-premium line is required, this would use only female lambs.

Specify fat class: Animals of fat class 2, 3 and 4 can ensure good everyday quality. Premium eating lines will require lambs within a 3H/4L range.

Specify the age of the animal: Ensuring lambs are slaughtered at under nine months of age can ensure high eating quality.

Set weight criteria: Ensure that lambs are slaughtered between 16–20kg can make it easier to enable consistent cooking of meat, and hence the consumer eating experience.



DEVELOPING A SCOTTISH MEAT EATING QUALITY SYSTEM

The main impact of meat eating quality model would have is the long-term, strategic improvement in Scottish red meat quality through the development of a robust, value-based, meat quality assessment system which communicates findings to the consumer.



Making changes in processors

It is recommended that the following new processor measurements be considered for inclusion within the development of the eating quality model. Some of these are more difficult to achieve, and in consultation with the industry a staggered implementation schedule could be implemented. The model would use the following components: hanging method (Achilles vs Tenderstretch); marbling (the level of intramuscular fat, which has a positive effect on eating quality. This is measured between the 10th and 11th rib); rib fat (minimum rib fat of 3mm); pHu (pH temperature decline is difficult to determine on each carcass so ultimate pH would be useful to eliminate dark cutters); eye muscle area; fat colour; meat colour; meat texture; meat firmness; and cut ageing. If an in-processor method of verification could be developed, it would provide significant improvements in consistency and quality.

The consumer message: tiers

The effective implementation of an eating quality system requires a method of communicating the quality to the consumer. A number of communication methods are possible but can broadly be broken down to either verbal messaging (highest eating quality, good everyday eating quality, everyday eating quality), or, more appropriately 5 star, 4 star, 3 star beef, as well as beef which would be sold without a quality indicator. These different levels would be referred to as tiers.

Impact of a Scottish meat eating quality model

The main impact of meat eating quality model would have is the long-term, strategic improvement in Scottish red meat quality through the development of a robust, value-based, meat quality assessment system which communicates findings to the consumer. Effective delivery will improve the reputation of the Scottish red meat industry and will also increase the knowledge base of producers, processors, and consumers.

The economic benefit from improved quality

While some of the farm level interventions will require some effort to manage, in many cases, the factors which enable good eating quality are also associated with high economic and environmental performance.

These are hidden benefits, and it is to the advantage of the industry to draw attention to them. Animals that are reared quickly consume less feed per kg of carcass weight and are associated with a higher degree of tenderness. In addition, high health animals grow more quickly, have more tender meat, and are associated with lower antibiotic use, giving cost reductions and meeting government targets around antibiotic use. Animals with calm temperaments are easier to handle, and are less likely to be stressed, reducing the likelihood of tough meat.

Finally, many of the traditional breeds have been shown to perform extremely well on forage-based (and less expensive) rations. Data from feeding systems (unpublished but known to the author) indicates that the cost per kg of gain for traditional breeds is, in many cases, much lower than for other more yield-focused breeds.



DELIVERING CHANGE

When implementing change within a business sector, a lack of understanding has been shown to be a significant disincentive to compliance because, without the correct level of understanding, some tasks are seen as meaningless and without value.

The design of incentives is critically important to the development of a quality development and management system. Farmers in Scotland are mainly driven by market signals (usually price), legislative requirements, policy signals, level of knowledge and the technical ability of the farm team.

The Scotch PGI has delivered over £100 million into the supply chain over the previous 10 years. This is a substantial advantage and farmers will be motivated to ensure that this premium remains or even increases in the future.

Multiple individual factors influence farmer behaviour. The main motivating factors include price; profit; pressure to remain a member of premium schemes/farm assurance; guidance from environmental schemes; peer pressure; the opportunity to improve; pressure from legislation; and messaging from representative or advisory organisations.

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CONCLUSIONS

The authors of this report have spent decades working in both processing and farming, and it is our experience that the management of meat quality is much closer to ideal within the processing environment than on-farm.

While the scientific literature carries different estimates of the relative importance of management of eating quality at farm level vs processor level, it is conclusive that both parties have a significant impact. This means that the delivery of consistently high eating quality is a joint responsibility between the farming and processing sectors. However, this does not mean that the task is equal. The authors of this report have spent decades working in both processing and farming, and it is our experience that the management of meat quality is much closer to ideal within the processing environment than on-farm.

About 30% of beef quality is affected by what happens on-farm, with 70% under the control of the processing sector, while for lamb, it is suggested that about 70% of eating quality is at farm level. As processing practice becomes increasingly standardised across the industry, so the proportional importance of farm practice increases.

While there is definitely room to optimise meat quality management in Scottish processors, and the use of a Meat Standards Australia-style system would further improve the quality of output (although there would be a financial cost to balance against this), the bulk of work now lies at farm level.

It is worth reiterating at this point that there is almost no relationship between EUROP grid grades and eating quality, bar a small potential relationship to the fat class of the animal. This means that communicating eating quality to farm level is not possible at present.

Variability at farm level is much greater than in the meat processing sector. There is an array of systems, genetic mixes, handling systems, transport systems, diets, weights, fat levels and more. The multiplicity of methods means that animals which enter the meat plant are highly variable. While good practice in processors can mitigate some of these, substantial differences between animals of different types, or from different systems.

A more consistent approach at farm level is critical if meat eating quality, and to a greater degree, consistency of eating quality is to be substantially improved. Discussion around optimising the use of genetics, nutrition, and how health and welfare is approached on-farm could enable development of an industry-wide consensus on management practices that could lead to meat eating quality improvements in the short to medium term, driving consumer choice and willingness to pay in future.





RECOMMENDATIONS

The following table provides a list of activities which are necessary if a meat quality eating system is to be delivered in Scotland with Short term (S), Medium term (M) and Long term (L) timescales.

REPRESENTATIVE SECTOR TARGETS

Obtain industry consensus in Scotland regarding the desire to improve eating quality of red meat	S
Establish agreement to deliver the improvements over a 10-year period	M
Agree and implement staged improvement targets, with a range of quality tiers. Farm and processor interventions should be considered	M
Develop rules for farm assurance which will enable and ensure participation in the overall quality improvement programme	S & M
Measurement of quality baselines and improvements over the 10-year period	M & L
Create a targeted marketing and communication programme to persuade farmers to take up best practice	M & L
Engagement with farmers to encourage uptake of on-farm best practice	S, M & L
Development and implementation of methods of communicating quality tiers to customers	M
Estimation of economic benefits of full implementation of quality programme	M
Enable a greater feedback loop between different sectors within the red meat supply chain	S, M & L

PROCESSOR TARGETS

Agreement of key components which impact meat quality at processor level and those which should be included across different tiers of the quality standard	S
Design and agreement of the components of each quality tier	S
Development and implementation of assurance programme to ensure adherence to the agreed quality practices	M
Discussion with processors around the alteration of the payment grid to incentivise animals with higher eating quality. Ideally this grid should be cost neutral, but this has to be balanced against returns which can be obtained for each category of product	M
Implementation of the new payment grid	M
Participation in quality measurement and feedback programmes	M & L

FARM TARGETS

Encouraging on-farm management changes focussed on optimising nutrition, health and welfare and genetics to improve performance, consistency, and quality of carcasses	S & M
Engagement with industry to progress implementation of quality management practices	M
Agreement of key components which impact meat quality at farm level and which can be audited and guaranteed. Additional components can be added over time	S
Changes to farm assurance which can be used to assure that the practices are being implemented	S
Knowledge exchange to encourage uptake of the practices across Scotland	S, M & L
Demonstration of potential economic benefit of increased eating quality across the whole Scottish industry	S & M



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