

Welsh Lamb Meat Quality Project

Results Summary



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Background

The Welsh Lamb Meat Quality Project has conducted research trials across the UK, exploring on-farm and processing factors which may influence meat eating and nutritional quality. These assessments aim to ensure and enhance the world leading excellence of PGI Welsh Lamb.

Meat eating quality and nutritional quality of a sample of PGI Welsh Lamb was investigated in the four trials conducted between 2020 and 2023.

Nearly 2,000 consumers rated the sensory quality of 13,400 Welsh Lamb meat samples. The on-farm factors investigated include breed type; lamb gender; muscle cut; lamb finishing diet; seasonality; lamb sire and processing factors including meat ageing period, carcase hanging and packaging.

Lambs were sourced from four Welsh abattoirs, involving 66 farms as a representative of production systems in Wales. The lambs were selected to meet a carcase specification deadweight of 18-21kg, conformation E, U, R and fat class 2, 3L, 3H.

Panels were held at twelve locations across the UK. Consumer panellists taste tested seven lamb samples, rating samples on – aroma, tenderness, juiciness, flavour and overall liking. Panellists also answered a series of background demographic questions including about their lifestyle and previous experience when purchasing lamb.

In addition, all samples were assessed for intramuscular fat content, individual fatty acid composition, zinc and iron content. Further additional meat quality assessments include amino acid analysis (Trial 2 and 3), shear force and colour assessments (Trial 3).



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-  Trial 1: Breed type, lamb gender and muscle cut
-  Trial 2: Diet and meat ageing period
-  Trial 3: Seasonality and lamb gender
-  Trial 4: Carcase hanging and product packaging
-  Multiple trials

Trial 1

Breed type, lamb gender and muscle cut

The first trial investigated the factors – breed type (hill, crossbred and terminal sired lamb), lamb gender (ram and castrate) and muscle cut (loin, chump and topside). The trial took place in 2019-2020.

- Panellists showed no sensory preference to any particular breed type or lamb gender.
- All cuts on average scored well, muscle cut had the largest impact on eating quality. The grilled chump and loin scored higher for tenderness, juiciness, flavour liking, aroma and overall liking than topside. This is likely linked to the grilled cooking method which was standardised throughout all trials.
- Topside had the lowest intramuscular fat content at 3% and lower levels of saturated and monounsaturated fatty acids. Chump had the highest amount of polyunsaturated fatty acids. Breed type and lamb gender had little impact on the nutritional fat composition of lamb. Topside was highest in iron and chump highest in zinc.
- The average intramuscular fat content was 2.5%. The omega-6:omega-3 ratio was low (<2) and this is considered to be healthy.



Trial 2

Lamb finishing diet and meat ageing period

In Trial 2, lamb finishing diet and meat ageing period were investigated. The 6-week pre-slaughter finishing diets included: grass only, grass and concentrates, indoor concentrates and brassica/root based diets. Meat samples were aged for 7, 14 or 21 days. Panellists taste tested loin and topside muscles.

- Lamb finishing diet did not affect consumer assessed meat quality but did affect the resultant lamb meat nutritional quality. Grass and brassica/root finished lamb meat had higher amounts of healthy omega-3 fatty acids in comparison to concentrate based finished lambs.
- Grass finished lamb meat had higher amounts of healthy omega-3 fatty acids and was higher in five essential amino acids in comparison to concentrate based finished lambs.
- Panellist satisfaction scores increased with ageing period.
- No effect on fatty acids or the major fatty acid groups was found with the three ageing periods. No difference was found between the three ageing periods for zinc, however, iron content decreased with the length of ageing period.



Trial 3

Seasonality and lamb gender

The third trial investigated the effect of four finishing seasons (May 2021, August 2021, November 2021 and February 2022) with an equal number of castrate, ewe and ram lambs at each slaughter timepoint. Eating and nutritional quality of lamb loins were assessed. Additional chump muscle cuts were sampled for amino acid, shear force and colour assessment.

- Eating quality results indicated that lamb meat throughout all seasons had good sensory quality. There was a slight season effect, with lambs slaughtered in August having the highest sensory scores and those slaughtered in February having lower sensory scores (all above the acceptability range).
- Consumer taste panellists had no preference between castrate and ram lamb meat. Ewe lamb meat had slightly higher sensory scores for all meat quality attributes.
- Colour of lamb meat was found to darken as the season progressed. Lambs finished and slaughtered in August and November had higher red, yellow and chroma chump values compared to May.
- Shear force values showed that season had an effect. August and November slaughtered lamb was recorded as the most tender. There was no gender difference observed with shear force values.
- Lamb gender did not affect total protein or amino acid content, however season affected three amino acids – tryptophan, histidine and proline.
- Intramuscular fat, saturated and monounsaturated fat were not affected by gender. As the season progressed these fats increased possibly due to lambs laying down intramuscular fat as lambs mature.

Trial 4

Muscle cut, hanging and packaging method

ACHILLES TENDON



CROSS-LEGGED



The final trial took place in 2022. This trial investigated the effect of carcass hanging method (Achilles tendon or hind “cross-legged”), packaging (vacuum packing and modified atmosphere packaging; MAP) and muscle cut (loin, chump and topside) on the eating and nutritional quality.

- Meat from lambs hung ‘cross-legged’ had higher eating quality scores than those hung by the Achilles tendon for all eating quality attributes (tenderness, juiciness, aroma, flavour and overall liking).
- Vacuum packaged lamb had higher sensory scores than MAP packaged for all attributes, especially juiciness and flavour liking.
- Hanging nor packaging method impacted the nutrition quality of the lamb meat. Muscle cut did affect all fatty acid groups, with the chump having the highest amount of every grouped fat. Loin had the lowest polyunsaturated fat and therefore lower omega-3 and omega-6 content.



Demographics

Over the four trials a total of 1,920 consumers attended 96 consumer panels at twelve locations. Each panellist completed a questionnaire covering their demographic status, attitudes and habits with regards to lamb purchase and consumption. Questionnaires were completed before panellist's taste tested seven samples of PGI Welsh Lamb.

Role of lamb in the panellist's diet. Older panellists, families without children and those with more than one adult in the household were most likely to regard lamb as an enjoyable and regular component of their diet. Locations with lower populations (<100,000) responded more positively regarding lamb in their diet than those in higher population areas (>200,000). Amongst the four UK regions involved, the Midlands and Borders were the most positive about lamb.

Consumption of lamb. Over the four years of the project, 51% of panellists consumed chops/cutlets monthly or weekly, 40%, 44% and 38% consumed lamb cubes/mince, leg of lamb and takeaways monthly or weekly, respectively. It was found that 32% of panellists consumed shoulder or roast loin and only 18% ate takeaway lamb dishes monthly or weekly.

Purchasing habits. Consumer taste panellists most often purchased lamb from supermarkets, and less frequently from butchers and farm shops. These purchasing habits were influenced mainly by region, with consumers from Wales, Midlands and Borders and from smaller population areas more likely to use a butcher or farm shop.

Opinion on lamb. On average, panellists thought lamb was healthy and easy to prepare, but expensive. Flavour and aroma were viewed as consistently good.

Importance of attributes for choosing lamb. The descending order of importance to the panellists in the four trials were: sensory attributes of tenderness and juiciness; past experience of enjoyment, good value, appearance and aroma; animal welfare, knowledge of source, healthiness, environmental impact and ease of preparation.

Factors affecting consumer sensory scores. Consumer sensory scores of PGI Welsh Lamb were not affected by income or composition of the household. There were small but significant effects of age group, gender, region and population size on many of the mean sensory scores.

Willingness to pay. Several demographic factors influenced the price panellists were willing to pay for the different qualities of lamb. Those in the highest household income bracket or youngest age group were willing to pay more for 'premium quality' product. Over the duration of the project, the price panellists were willing to pay showed a consistent reflection of the rise in cost of living over the period of these trials.

Drivers of consumer satisfaction. After tasting PGI Welsh Lamb the main drivers for consumer satisfaction were flavour liking, tenderness followed by juiciness. This agrees with international findings using the Meat Standards Australia approach. Consumers in this project responded to lamb quality in a manner that is consistent with the internationally accepted work on this subject.



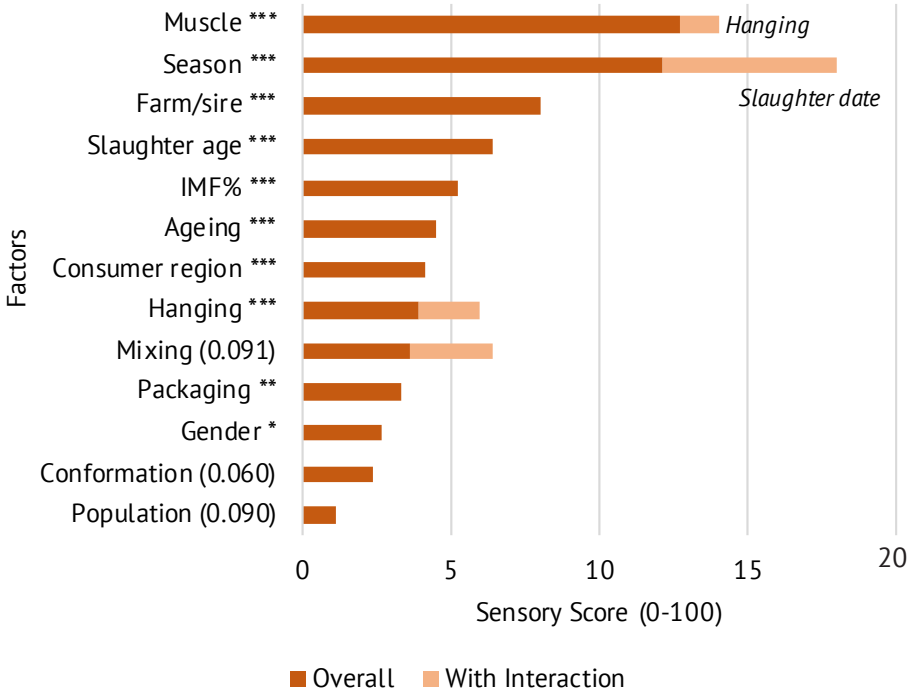
Overall Results

At the end of the study all datasets from across the four trials were combined and analysed.

- Lamb gender had no effect on consumer sensory scores, however there were sensory effects observed if lambs were managed in mixed sexed finishing groups (i.e. ewe lambs and ram lambs).
- Lamb finishing diet did not affect consumer sensory scores, IMF or zinc content, but fatty acid and iron content was impacted.
- The average omega-6:omega-3 ratio was below 2.0 for all diets, which is healthy. The healthiest (lowest) omega-6:omega-3 ratio was derived from the grass-fed animals.
- Fat class did not affect eating quality but did affect muscle fat composition (increased Intramuscular fat, saturated fat and monounsaturated fat).
- Effects of slaughter date on eating quality were largely due to seasonality, (as discussed in Trial 3). Effects on fatty acid composition were due to differences in diets of the lambs supplied.



Factors affecting eating quality for the WLMQ Project



- Welsh Lamb meat is healthy and nutritious

- Grass /forage fed lamb had higher omega-3 and essential amino acids

- Consumer panellist reported meat eating quality as good



Conclusion

Sensory Quality

In descending order of impact on sensory quality, the factors having the most impact were muscle cut and season. The third factor was farm or lamb sire, there was not sufficient information to understand this effect.

'Cross-legged' hanging showed considerable potential to improve eating quality, especially for the loin. Vacuum packaging also had a positive impact on eating quality.

There was an effect of lamb gender and finishing in single gender groups that warrants further investigation.

There is a considerable potential for this information to be applied within the Welsh Lamb industry, ensuring that the lamb produced is of consistently high eating quality.

Nutritional

The main factors influencing fatty acid and mineral composition were muscle, season and finishing diet, followed by carcass fat class and age at slaughter. Age at slaughter, season and carcass fat class mainly affect the neutral lipids and component saturated and monounsaturated fats, while diet influenced the composition of the polyunsaturated fats in the phospholipids.

All lamb in these trials had a highly valuable nutritional content for human health, finishing diets can be adopted to positively influence the omega-6:omega-3 ratio of the meat. Grass-based diets had the lowest and most healthy ratio of omega-6:omega-3 fatty acids.

