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Meat sensory panels to monitor effects on eating quality of changes to production and processing systems

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Problem: Declining red meat consumption and Changing production systems

Australians are among the world's highest consumers of meat products, yet consumption of red meat is declining, despite access to high quality red meat . These declines have been equated with the changing lifestyle of Australian consumers, and concerns in the community over health issues . The greatest impact has been felt in the sheep meat industry as consumers turn to alternative protein sources such as chicken. Research has identified the characteristics most important to Perth consumers when purchasing meat as tenderness, freshness, taste, good reliable quality, low fat, flavour, and health benefits.

Lamb rated lower than expected on tenderness, juiciness, flavour, health benefits, good reliable quality and value for money . The first three factors in this list relate to the eating quality of the meat and it has been shown that repeat purchases of a meat cut are overwhelmingly influenced by previous experience of the eating quality of the meat . Monitoring of eating quality of meat is particularly important to ensure quality will be maintained as the industry response to changing consumer demands has been to produce consistently larger and leaner lambs all year round. The impact on eating quality of these changes in genetic selection, feeding, handling, management and processing systems for animals and carcasses needs to be determined.

Eating quality of meat

Eating quality of meat can be defined in terms of the sensory attributes, tenderness, juiciness, and flavour . Tenderness and juiciness are the two sensory components of the perceived texture of lamb, while the flavour of cooked lamb is considered to be it's most distinctive palatability characteristic . Flavour, juiciness and tenderness are complex multidimensional sensory characteristics, which cannot be readily measured by the use of objective test methods. Therefore, sensory evaluation plays a primary role in the quantification of meat quality characteristics. It is particularly applicable to the monitoring of the impact that research, production and processing initiatives have on eating quality in lamb.

Sensory evaluation

The role of sensory evaluation tests are to accurately measure the human responses to a food while minimizing potential biasing effects. This facilitates acquisition of important information about the sensory characteristics of a food .

The choice of panel and tests used in sensory evaluation

The type of panel and test method must match the stated objective of the investigation . There are two types of sensory evaluation panel available; the consumer panel and the trained panel. When hedonic information is sought a consumer panel is used, and when analytical information is sought a trained panel and analytical testing is utilized. Hedonic tests are those that quantify degree of liking, and analytical tests indicate if a difference exists between two samples . The evaluation of eating quality in lamb requires an analytical approach where the variation of differences in tenderness, juiciness, and flavour intensity are quantified. The most common method uses a trained panel to rate variations in sensory characteristics of interest in relation to previously set anchor values.

The establishment of a trained panel for sensory evaluation

Establishment of a trained panel has four phases:

- Recruitment
- Screening;
- Training; and
- Evaluation

Recruitment is the process of procuring interested individuals with desirable characteristics from within the community.

Screening utilizes a series of sequential triangle tests to determine if the potential panelists are able to discriminate between a series of samples that exhibit a comprehensive range of differences. The advantage of sequential triangle tests is that fewer tests are required to distinguish the more discriminating panelists .

The objectives of training are to familiarize the selected panelists with test procedures; improve an individual's ability to recognize and identify sensory attributes; and improve an individual's sensitivity and memory of those attributes.

Evaluation is carried out after completion of the training phase to establish the reliability and validity of the panel results.

A panel trained in descriptive attribute sensory evaluation can be a tool used to increase market competitiveness and profitability in the agri-industry by guiding the improvement in meat quality. Meat sensory evaluation panels trained in descriptive attribute techniques, terminology and sensory standards for evaluation of beef exist in the eastern states but there is currently no panel trained for the evaluation of lamb in Australia . Therefore, the development of a lamb sensory evaluation panel is required so that all further research into genetics, feeding, management, handling and processing systems can be evaluated in terms of their impact on lamb eating quality.

Research Objectives

The aim of this project is to establish a panel trained in sensory evaluation of lamb. The objectives of the project are:

- to recruit and screen potential panelists from the community;
- to train selected individuals in sensory evaluation procedures and recognition of eating quality attributes; and
- to evaluate the panel's performance after training

Once established the panel will be available to the sheep meat industry to assist the industry in the reduction of the variability of sheep meat eating quality and to assist in the establishment of quality assurance parameters for sheep meat production

Methods

The M. Longissimus dorsi was used through out the study. The range of treatments utilized in training and evaluation were; Aged crossbred Lamb, unaged crossbred Lamb, unaged Merino Lamb, crossbred Mutton, and Cold toughened crossbred Lamb.

1. Sample preparation
   Frozen backstraps were defrosted for twenty-four hours at 4° C. The backstrap was then sliced across into two centimetre thick

steaklets. These were cooked on a Silex grill to an internal temperature of 65° C. After a short standing period the steaklets were cut into 1.5 cm cubes. Thorough mixing of the meat cubes of each sample ensured that variations in meat characteristics were randomized across all panelists.

2. Sample presentation

Six test samples were presented to each panelist in each panel with 2 minutes elapsing between each test to reduce sensory fatigue and halo effects. Each test sample consisted of two cubes of meat. The panelists were instructed to taste the samples from left to right. Randomization of presentation order was used to ensure that each panelist evaluated every sample during the course of the session but no two panelists evaluated the same sample at the same time. All panelists received a ballot sheet numbered with the session code and a test number. After the test series was completed each sheet was decoded from a master sheet to determine which sample the individual panelist had evaluated in each test. The results were entered into the database for the individual samples.

3. Evaluation method

The aim of the evaluation process was to investigate the consistency of the panelists in their evaluation within a panel, between panels and between sessions. Panel evaluation was spread over four sessions. A series of test were also run to compare the shear force value of samples with the rating of tenderness given by the panel for the same sample.

Session 1

This aim of this session was to investigate the consistency of evaluations within a panel. The panelists were divided into two groups. Each set of six samples was divided in half to give two groups of three samples. This was done so that each group of panelists could evaluate the three samples twice within one panel to give a total of six samples per panel. The same group of panelists then evaluated the second set of three samples in the second panel. This meant each treatment was sampled twice within a panel by every panelist.

Session 2

This aim of this session was to investigate the consistency of panelist's evaluations between panels. The panelists were divided into two groups. Two samples of each treatment type were divided in half to give four groups of six samples. This was done so that each group of panelists could evaluate one set of six samples once in one panel and then repeat the same six samples in the second panel.

Sessions 3 and 4

This aim of these sessions was to investigate the consistency of panelist's evaluations between sessions. The panelists were divided into two groups. Two samples of each treatment type were divided in half to give four groups of six samples. This was done so that each group of panelists could evaluate one set of six samples once in one session and then repeat the same six samples in the second session a week later.

Comparison of Panelist results to shear force measurements

The samples were obtained from a trial carried out to determine the effectiveness of varying levels of electrical stimulation and aging on the tenderness of lamb carcasses. Sensory evaluation was carried out at Curtin University, and the Warner-Bratzler shear force values were determined at Agriculture Victoria, Werribee.

Statistical analysis

The Binomial test was used to determine if a significant difference existed between the samples used in the sequential triangle tests. The evaluation data consists of two repeat evaluations of the same sample in all cases. The paired T test was used to analyze the data, with six treatments (sample types) and two observations per treatment per panelist for each session. This allows significant differences over repeat evaluations to be identified. The linear correlation value between the shear force value and the panel's measure of tenderness was determined.

Results & Discussion

Forty-nine individuals from within the community were screened for discriminatory ability in eating quality characteristics of lamb using sequential triangle testing. Twelve individuals were identified as possessing good discriminatory skills. Training was carried to familiarize these twelve individuals with test procedures; and improve each individual's ability to recognize and quantify sensory attributes; thus permitting precise and consistent sensory judgements. On completion of training a series of evaluation panels were run. This involved repeated measurements of the same sample over time.

Examination of evaluation results showed that, overall, there was no significant difference for the evaluation of tenderness over time. This established that the panelists can reliably quantify tenderness in lamb. Evaluation of juiciness and flavour intensity showed significant differences in one or more samples for all comparisons. The comparison of the panel's results to the shear force value taken on the same sample showed a negative correlation, such that as shear force increases, the panel rating of tenderness decreases. This indicates that the panel was an accurate instrument for the measurement of sensory tenderness.

Conclusions

A panel of twelve individuals has been recruited from the community and trained in sensory evaluation procedures and recognition of the eating quality attributes of sheep meat. The evaluation process has established that the panelists can reliably quantify tenderness in lamb. Further training of panelists in juiciness and flavour evaluation is required with exposure to the full range of variables, to ensure complete reliability in evaluation of these attributes.

Since establishment, the panel has been working with researchers and the meat industry to evaluate the impact of lamb production and processing systems on eating quality and is available to other Australian researchers. Looking to the future, consideration must be given to establishment of an ongoing recruitment and training program for the panel to remain viable.

A minimum of eight people would be required for a trained panel to produce reliable and consistent results. However, attrition of the panel will occur as individual's circumstances change and they find themselves unable to continue as sensory panelists. Therefore, a reserve of potential panelists and a continuous training program should be developed to ensure that this tool remains available to the sheep meat industry in the future. Continued use and support of the panel by the sheep meat industry and researchers is required for this.

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