Meat technology-What's new

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WHAT'S NEW

Summaries of recent publications

E-mail or post?

We have received a number of requests for MTU newsletters to be sent out electronically rather than as a hard copy. The newsletters are uploaded each issue onto the website (www.meatupdate.csiro.au). By signing on from the main page link, readers can receive an email notification when the new issues are uploaded onto the website.

Omega-3 content of lamb meat

Health experts recommend increased consumption of omega-3 long-chain polyunsaturated fatty acids (n-3 LC PUFA) to combat cardiovascular disease. Beef and lamb are a source of n-3 LC PUFA and the Australian lamb industry has identified it as a key nutrient in its product. Food Standards Australia New Zealand (FSANZ) has defined levels where a product can claim to be a 'source' or a 'good source' of n-3 LC PUFA as 30 mg and 60 mg per serve, respectively, of eicosapentaenoic acid (EPA, 20:5n-3) plus docosahexaenoic acid (DHA, 22:6n-3). Experiments were conducted in Western Australia to quantify the n-3 LC PUFA content of lamb from three different feeding regimes: kikuyu pasture; lot feeding on pellets; and lot feeding on pellets supplemented with linseed at 8% of total dry matter.

Lambs on green pasture and from linseed-supplemented rations had similar EPA plus DHA content of 21 to 22 mg/100 g in the muscle of loin chops; whereas, lambs on an unsupplemented ration had only 10 mg/100g. When the lambs born in June and July were held over summer, the content more than halved to 9.5 mg/100 g, indicating that lambs slaughtered at the end of spring yielded more n-3 LC PUFA than when carried over the dry summer in WA.

Based on 140 g of fresh lamb per serving, both pasture finishing in spring, and linseed supplementation in summer, were able to produce lamb that meets the FSANZ cut-off of 30 mg of EPA plus DHA to qualify as a 'source' of n-3 LC PUFA.

The effect of storage temperature on blown-pack spoilage

Blown pack spoilage of vacuum-packed meat is associated with various species of *Clostridium* bacteria and is a significant problem in some areas, leading to a reduction in storage life. *Clostridia* are mainly psychrophilic (cold loving) bacteria and the problem tends to be more prevalent in colder areas. The issue has attracted research in Ireland and New Zealand. Irish researchers inoculated samples of beef and lamb with eleven different bacteria at levels from <10 to 10^3 CFU/cm^2 and stored them at temperatures of –1.5, 1 and 4°C for up to 100 days.

Regardless of the storage temperature and inoculum level, packs inoculated with *Cl. estertheticum* ssp. *estertheticum* were the fastest to spoil, followed by *Cl. estertheticum* ssp. *laramiense*. Both of these also generally produced the largest volumes of gas, and there was no difference between beef and lamb. Blown packs were evident after as little as 14 days storage at 4°C at high inoculum levels. Six bacteria produced observable amounts of gas within 42 days and a further four strains produced gas within 100 days.

Higher storage temperatures led to more rapid onset of blown packs for most organisms. Spoilage occurred in approximately half the time when the temperature increased from –1.5 to 4°C in the case of *Cl. estertheticum*. The level of inoculum also affected rate of onset of spoilage, with samples inoculated at a higher level spoiling earlier. Therefore, contamination of product should be minimised and storage temperature kept as low as possible to delay onset of blown-pack spoilage.

Production and properties of beef lung protein concentrates

Beef lungs are an under-utilised source of protein. Mostly they are consigned to rendering, but in countries with BSE, the meat meal produced cannot be marketed for many of its traditional uses and it is often incinerated. A French group has been developing techniques for production of a dried protein concentrate from beef lungs. Previous work used membrane filtration to concentrate the proteins, but this is an expensive process due to the high capital and maintenance cost of the equipment, but the current investigations used alkaline solubilisation followed by acid precipitation and concentration.

After collection, beef lungs were ground and the emulsion adjusted to pH 9.0 using sodium hydroxide. An extraction temperature of 20°C for 60 minutes resulted in a yield almost equivalent to that obtained at 30°C for 2 hours. The protein powder produced after acid precipitation at pH 4.0 and freeze drying, had a similar yield and composition to that produced using the membrane technique. The powder had a protein content of 76% (which is typical of protein concentrates), and a lipid residue of 15%.

The solubility of the protein concentrate was about 70% at pH 7, and it displayed good emulsifying properties which would allow it to be used in meat products in place of sodium caseinates.

Reducing water use for beef head washing

Estimates in the US suggest that between 2000 and 2800 L of water is used to process each beef carcase, with about 80 L used to wash the head prior to inspection. This is similar to estimates in Australia where about 2400 L is used to process each beef carcase. In the US an excessive amount of water appears to be used in head-wash cabinets to guarantee a clean appearance and so ensure that the inspector is satisfied and the line is not halted—which can cost up to $2000 per minute in a large plant.

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An investigation was undertaken at Texas A&M University to determine the optimum amount of water to be used for head washing to satisfy the USDA inspector. Video-image analysis was used to measure the intensity of red colour of heads after manual washing with different amounts of water from a typical washing nozzle. Statistical analysis of the data from washing heads was used to determine the optimum quantity of water.

Substantially less water was used with manual washing, due to the ability to target highly contaminated areas; and a satisfactory result for 21 heads could be achieved using an average of 18.75 L of water per head. When 10 additional heads were sprayed with set amounts of water up to 60.5 L, it was found that all heads were approved when a total of 30.6 L was applied. As more water was applied, the percentage of red saturation in the image decreased. Analysis of the data revealed that at 4 standard deviations from the mean, the red saturation is 16 percent at which 99.994% of heads would be accepted for inspection, or less than 1 in 15,000 rejected. This would require a water volume of 33.5 L per head. At 3 standard deviations above the mean, the water use would reduce to 25.7 L per head where 99.73 percent of heads would be accepted.

Prediction of beef carcase yield using bioelectrical impedance

Estimates of the yield grade in the United States are subjective and based on data compiled in the 1950s, and do not accurately predict true saleable meat yield. Bioelectrical Impedance Analysis (BIA) was trialled as an objective alternative to the current yield grading system, to measure percent saleable meat and percent fat trim.

The BIA variables were measured on a chilled carcase 48 h after slaughter, by inserting sets of electrodes in the *semimembranous* muscle posterior to the aitch bone and in the intercostal muscle adjacent to the 1st and 3rd ribs. An alternating electrical current (425 µA at 50 kHz) was introduced between the positive and negative terminals of the probes which were 10 cm apart, and the decrease in voltage caused by the carcase resistance was measured. Carcase weight and length were recorded and derived values from the BIA measurements were used in data analysis. Measurements were made on carcases from 41 animals selected over a range of expected yields. The carcases were then fabricated into sets of standard primal and sub-primal cuts which were trimmed to ≤6 mm of fat. These represented the saleable meat yield which was calculated as a percentage of the cold carcase weight. The percentage of trimmed fat was also measured from each carcase.

The results were used to develop predictive equations for percent saleable meat and fat trim. These accounted for 81% of the variation in saleable meat yield, and 84% of the variation in percent fat trim. The authors believed that BIA would allow carcases to be more accurately allocated to an appropriate yield grade thus providing a better definition of the value of the carcase.

The new meat? Tissue-engineered skeletal muscle

So you think that 'meat' is the muscle of food animals. Well a group of Dutch scientists have the vision that in the future tissue engineering will be used to grow meat from stem cells in a bioreactor. The claimed advantages are that the end product will be disease free, that there will be a reduction in the land area required for grazing livestock and there will be a reduction in greenhouse gas emissions.

Before artificial meat production becomes a reality, there are considerable technical challenges to overcome. These include selection of the stem cell and directing it to form muscle fibres outside the body, development of a three-dimensional structure, co-culturing with other cells so that fat and veins are also formed, and provision of the correct biochemical and biophysical stimulation required for development of a functional muscle structure.

Once the technical challenges in development of artificial meat have been overcome, there is the not inconsiderable challenge of marketing the product.

We're moving

The CSIRO site at Cannon Hill will close in May this year, and Meat Industry Services, along with the rest of the CSIRO Food and Nutritional Sciences staff located in Queensland, will be re-locating to new premises at Coopers Plains that are shared with several other State Government Departments.

The Cannon Hill site has had a long association with the Australian meat industry since the CSIRO Meat Research Laboratory moved into their 'new' laboratories in January 1967.

Improved, more modern facilities, combined with closer proximity to scientists working in related areas of expertise promises better outcomes for researchers, consumers and industry partners.

The information contained herein is an outline only and should not be relied upon in place of professional advice on any specific matter.

Contact us for additional information

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