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Meat Technology Update

Newsletter 3/03 *June 2003*

‘Use by’ and ‘Best before’ dates

The new Food Standards – as developed for Australian domestic markets by Food Standards Australia and New Zealand (FSANZ), and implemented by State Authorities – include changes to labelling requirements. One of the changes that has caused some confusion in the meat industry is the requirement for ‘Use by’ or ‘Best before’ dates on pre-packed meat and meat products. The areas of confusion relate to the situations in which the different labelling options apply; who is required to apply dates; and, in particular, how to determine suitable storage or display-life dates.

When is date labelling required?

Date labelling is only required on pre-packed product at point of retail sale. Naked meat for retail sale through butcher shops does not require date labelling; however, retail butchers should have knowledge of the expected shelf life of the product they sell. As customers become more accustomed to date labelling, they may be seeking this advice from the retail butcher.

Boning rooms that prepare product for wholesale distribution do not have to apply a shelf-life-limiting date but may instead apply a ‘Packed on’ date. Wholesalers using a ‘Packed on’ date must be able to provide information about expected shelf life to their customers, if requested. This is to enable the retail pre-packer to determine the ‘Use by’ or ‘Best before’ date to be declared on the final label.

‘Use by’ or ‘Best before’ dates

The term ‘Use by’ is specifically for foods that will have a food-safety risk after a specified storage period. The term ‘Best before’ applies to all other food products. Under normal circumstances of hygienic handling and storage, uncooked meat and meat products will be spoiled before an unacceptable food-safety risk arises. In addition, the risks of food-safety hazards associated with meat are not usually related to storage time. Food-safety problems arise typically from under cooking, temperature abuse or mishandling of

Figure 1. Retailers need to understand the difference between ‘Use by’ and ‘Best before’.

cooked product – and not from excessive storage time. Consequently meat and meat products, whether pre-packed in over-wrapped trays or vacuum packed, may be labelled with a ‘best before’ date rather than a ‘Use by’ date.

It is not an offence to sell food that has gone beyond its ‘best before’ date. It is an offence in the new legislation to sell food that has gone beyond its ‘Use by’ date. This provision applies to food that is labelled with a ‘Use by’ date even when it could have been legitimately labelled with a ‘best before’ date.

It is difficult to conceive of a situation where uncooked meat that will be cooked prior to serving should be subject to ‘Use by’ dating. A possible exception may be modified atmosphere packaged (MAP) meats where the atmosphere is high in oxygen, e.g. 80% oxygen and 20% carbon dioxide. With ‘case-ready’ MAP meat using this type of gas mixture, it is possible that spoilage and the risk of a food-safety hazard could increase while the product still retains a bright red bloom and appears edible. Here a ‘Use by’ date may be appropriate.

A ‘Use by’ date may also be justified with cooked products. For

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example, there are reports that modified atmospheres containing oxygen and carbon dioxide inhibit the growth of spoilage organisms more than *Listeria monocytogenes* on precooked poultry meat in refrigerated storage. In this case it may be appropriate to apply a 'Use by' date if there is a risk that the microbiological hazard could increase to an unacceptable level before the product is obviously spoiled.

It is an offence to sell product after the 'Use by' date

Storage-limiting dates – whose responsibility is it?

Firstly, processors must be aware that regulators are not responsible for establishing storage-limiting dates. This is the responsibility of the meat packer.

Secondly, meat packers need to be aware of the limits of their responsibility. For example, are packers responsible for what happens after the product leaves their control? Should they allow for the temperature abuse that might occur after retail sale? There are no absolute answers to these questions but packers should ensure that their product will survive reasonable handling and storage conditions during the declared shelf life of the product. While packers cannot be held responsible for poor handling or temperature abuse, they should not expect that their product will remain under ideal conditions for its entire storage life.

When determining shelf life, the following aspects of meat storage should be considered.

Frozen meats

Frozen product will not become unsafe when it is maintained in a frozen state. It will gradually lose palatability as the fats oxidise and the meat develops a rancid flavour. Frozen meat may also become unattractive if there is freezer burn or frosting inside the pack. Frozen products can be assigned a lengthy 'Best before' date but obviously storage life is not unlimited.

The storage life of frozen product depends on the stability of the fat, the temperature of storage and the type of packaging. The fats in beef and sheep meats are relatively stable and, under ideal conditions, bulk beef and lamb could still be palatable after 2 years. Ideal conditions include secure packaging that prevents moisture loss and freezer burn and a stable storage temperature of -18°C or lower. Higher storage temperatures and loose, or torn, packaging will reduce the shelf life. Also, retail cuts and ground product with increased surface-to-weight ratios could suffer increased exposure to air and this increases the risk of onset of rancidity and freezer burn.

Domestic freezers cycle more frequently, and over a greater temperature range, than commercial freezers. As a result the extent of freezer burn is potentially greater in domestic frozen storage than in

In domestic situations, frozen meat can be stored safely for 6-12 months

a processor's cold store. In practice, 6-12 months is appropriate in most situations that include domestic frozen storage.

Chilled meats

The storage life of chilled meat is particularly sensitive to temperature. There are several key temperatures in the storage and handling of chilled meat. In general, chilled product kept below 7°C does not support the growth of food-poisoning organisms that are a significant hazard on raw meat. The exception is *Listeria monocytogenes* because it may grow slowly at temperatures below 7°C. *Listeria* is not regarded as a hazard associated with fresh meat but could be a hazard on some sliced processed meats or other cooked meats with extended shelf lives. Maintaining temperatures at, or below, 5°C throughout the cold chain from the abattoir to the retail customer is a requirement of the Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products. Lower storage temperatures may be desirable to maximise the shelf life. Although meat may be kept at, or just below, 5°C during distribution and retail display, this temperature is not optimal from the point of view of shelf life and maximum shelf life should not be expected.

Processors are not directly responsible for what happens to product once it leaves their control, but the product still has their name on it so they should make sure that they allow for some reasonable level of poor handling and storage.

Severe abuse can never be predicted. When establishing a 'Best before' date for chilled meats, it is recommended that maximum storage under ideal conditions is determined and then half of this time is claimed for the 'Best before' date. For example, if it can be shown that a product can be kept in a well-controlled commercial cool room for 14 days, then put a 'Best before' date of 7 days on the product. This is a conservative approach and experience of the performance of a product under commercial conditions may justify a longer storage life.

Vacuum-packed meats

Vacuum-packed meat can have a long storage life under ideal conditions. Beef primal cuts will last in excess of 12 weeks at 0°C storage temperature. As handling is increased and the piece size reduced, the rate of spoilage in vacuum packs is likely to increase. As a result the shelf life is reduced. For example, the same beef primal when sliced into steaks would have approximately 6 weeks shelf life; when diced only 3 weeks; and, when minced, as little as 7-10 days.

Under good conditions sheep meat lasts only about 70% as long as beef, and pork shelf life is about 50% of that of beef. In commercial practice vacuum-packed meat prepared for local sale may be packed in bags that have a higher oxygen-transmission rate and less shrink capacity than the bags used for export product. If, in addition, there is

temperature variation in the cold chain, shelf life could be reduced to approximately half the times indicated above.

Naked and over-wrapped meats

Unwrapped and over-wrapped meat has a shelf life of a few days. As with vacuum-packed meat, beef lasts longer than sheep meat, which lasts longer than pork. The smaller the meat pieces and the greater the handling that occurs during preparation, the shorter the expected shelf life will be.

The first sign that meat is at the end of its shelf life is brown or grey discolouration. At this point the flavour and odour of the meat may be acceptable but because of the appearance, the product could be rejected by consumers. The next stage is when the meat demonstrates off odours and stickiness. At this stage the meat is not suitable for consumption although there is not necessarily an increased food-safety risk.

Modified atmosphere packaged (MAP) meats

Most MAP fresh meats for retail distribution are in oxygen-rich atmospheres contained in low-oxygen-transmission film. Another type of pack is a low oxygen atmosphere in low-oxygen-transmission peelable film. When the film is peeled it exposes a high-oxygen-transmission film. The pack then becomes oxygenated and the meat blooms to a bright red colour.

High oxygen (80% oxygen/20% carbon dioxide) case-ready packs of fresh meat have a demonstrated shelf life under normal commercial conditions of 5-10 days. This time is dependent on the product, the packaging used, and the storage and handling conditions applied.

Meat in a low oxygen atmosphere (less than 500 ppm oxygen) within conventional low-oxygen-transmission film, or peelable barrier film can be stored for 3-6 weeks depending on the amount of carbon dioxide volume in the pack. Once peeled to allow oxygenation and blooming of the meat, a shelf life no longer than over-wrapped product is expected.

Ultra-low oxygen packs that contain oxygen scavengers can achieve a storage life in excess of 6 weeks under good handling and storage conditions. Once the meat blooms after oxygen is allowed to enter the pack, the shelf life again becomes similar to that of over-wrapped meat.

Freezing chilled product

Chilled product can be frozen towards the end of its chilled storage life. Then the 'Best before' date applicable to the chilled product no longer applies; however, as the product was already at (or near) the end of its storage life, the product should be used immediately once thawed, as no further shelf life can be expected.

If vacuum-packed meat, or MAP product in particular, is frozen towards the end of its shelf life, the consumer should be told on the pack that the product must be used immediately after it is thawed.

Temperature labelling

The storage life of all types of meat products is highly dependent on the distribution and storage temperature. Any 'best-before' or 'use-by' date must be established in relation to an expected commercial storage temperature – in the case of chilled meat, probably 4-5ºC. This temperature should be stated on the product label. The specific requirement of the Food Standards Code is that: 'the label on a package of food must include a statement of any specific storage conditions required to ensure that the food will keep for the specified period indicated in the (a) use-by date; or (b) best-before date.' It is acceptable to state the specified storage conditions as 'Keep refrigerated' but it is more informative to specify a storage temperature e.g. 'Store below 4°C'.

Setting the storage life

To develop meaningful 'Use by' and 'Best before' dates, processors must know their products and processes. While general information is available on acceptable storage times, it should only be used as a guide. The most effective method of arriving at shelf-life-limiting dates is to store product and monitor its condition over the expected storage time. Once the storage life under commercial storage conditions is determined, then a retail/consumer shelf life can be claimed and applied.

Table 1 summarises the available information on acceptable meat storage times in different styles of packaging and conditions. These storage times can be taken as a guide but should be confirmed under the specific conditions that apply to the production, storage, distribution and display of each company's product. The information in Table 1 applies to product for the domestic market; distribution and storage temperatures of 4-5°C are assumed. Different acceptable storage times may apply to product prepared and distributed for export where different conditions may apply.

Table 1. Guideline storage times for meats packed under good manufacturing practices.

Product/Process	Beef Cuts	Sheep Meats
Vacuum packed (VP) whole primal cuts	6 weeks	4 - 5 weeks
VP sliced meats	3 weeks	12 – 15 days
VP diced meats	10 – 14 days	7 – 10 days
VP minced meats	5 – 7 days	4 – 5 days
MAP high O_2	5 – 10 days	4 – 7 days
MAP low O_2	3 – 6 weeks	2 – 4 weeks
MAP ultra-low O_2	6 – 7 weeks	4 – 5 weeks
Over-wrapped meats	4 – 5 days	3 – 4 days
Fresh mince	1 day	1 day

Validating storage life of meat and meat products

Processors may decide that they want to validate the choice of a 'Best before' date. This can be done by microbiological testing, although the end of the storage life is not always determined by microbial populations.

Samples of product should be held and tested for bacterial levels over the predicted storage life of the product. For example, if pre-packed product has an expected 14-day 'Best before' date, samples could be held under representative storage conditions and tested at 7, 14, 21 and 28 days for total viable count.

For chilled meat products packed or stored in the presence of oxygen, the microbial flora will normally be dominated by *Pseudomonas* species and these organisms are responsible for spoilage conditions such as off odours and sliminess. For these products, total viable count can be used as a guide to the onset of spoilage. When the total viable count is about 10 to 100 million per gram, the meat is likely to be spoiled by off odour and stickiness. Counts between 1 million and 10 million per gram mean that the meat is near to spoilage. There may be no noticeable sign of spoilage at these counts although brown discolouration may occur in some cases. From the increase in counts over the storage time, it is possible to determine the time at which the meat will be spoiled due to microbial activity. The time taken to reach a microbial population that is indicative of spoilage is influenced by the initial hygiene of the meat and the storage conditions. Thus this type of storage life assessment really only applies to the conditions of the test, not commercial conditions.

For conventionally packaged meat the relationship between the microbial count and spoilage is reasonably straightforward. For vacuum-packed meat and MAP product the relationship is more complex, and the results of storage-life tests on these products should be interpreted by an experienced meat microbiologist. For example, the total viable count (TVC) on vacuum-packed meat is not a good indicator of spoilage and TVC is not a helpful guide in determining the 'Best before' date for this product.

Microbiological counts are not the only criterion for judging storage life. Subjective organoleptic assessment (on its own or combined with microbiological testing) should be used to validate 'Best before' dates. Products should be stored under appropriate conditions and assessed for off appearance and odour throughout, and beyond, the intended shelf life. Although the intention is to assess product for spoilage, raw product should not be tasted and tasting of cooked product is not recommended if there are other signs of spoilage.

If there is reason to believe that a 'Use by' date rather than a 'Best before' date is required, it may be necessary to conduct a challenge study to determine the 'Use by' date. Challenge studies are where microorganisms of interest are inoculated onto product and monitored during storage under controlled conditions. These studies may be useful when assessing new packaging systems. They give information on the response of pathogenic microorganisms in the food system.

Further reading

Chilled Meat for Export Workshop Proceedings (1991) CSIRO.

Vacuum Packed Primal Cuts (2000), MLA Packaging & Processing Innovation Information Package.

Packaging Options for Case-ready Chilled Meats Part II – Modified-atmosphere Packaging, (2000) MLA Packaging & Processing Innovation Information Package.

For more information, contact one of the Meat Industry Services staff listed below.

Food Science Australia Meat Industry Services Section

The Meat Industry Services (MIS) Section of Food Science Australia is an initiative supported by Meat and Livestock Australia (MLA) and the Australian Meat Processor Corporation (AMPC) to facilitate market access for, and support world-class practices in, Australia 's meat industry.

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