

# Is 'fresh' always best?

The freshness of the produce we consume has become a major issue in the public's eye. High standards are being demanded, and more and more fast food chains and major retailers are using the word "fresh" in their marketing. But just what does "fresh" mean, and how well equipped is our cold chain to deliver it? Carly Fordred spoke to five industry experts to find out.

## What constitutes freshness to consumers?

Anecdotal evidence suggests that consumers' brains have been wired to desire and demand 'fresh' food.

So what is "fresh", and is it possible that consumers now perceive that the refrigerated and frozen food we find in supermarkets is not?

Dr Silvia Estrada-Flores, principal consultant at Food Chain Intelligence and Australian member of the International Institute of Refrigeration (IIR) refrigerated transport commission, thinks that society needs to rethink the concept of freshness.

**"Retailers seem to have contributed to the confusion caused by the use of the term 'fresh' by their desire to label everything as fresh when it may have benefited by being aged or stored"**  
Dr Alister Sharp

"If by 'fresh food' we mean that the product has just been brought out of the orchard, farm or sea, with no treatment

or refrigeration whatsoever, then only the lucky farmers collecting the goods have seen fresh products," she says.

"The rest of us buy food in shops, supermarkets or restaurants. In all these cases, perishable food has been stored and treated in ways that maintain the shelf-life of the product enough to be sold and eaten."

"To me, fresh food needs to be thought of as 'non-spoilt' food that has retained its desirable characteristics, such as flavour, aroma, texture, colour and most importantly, nutritional value," she says.

"There are misconceptions out there," says Dr Nick Smale, also a member of the IIR refrigerated transport commission. "Mostly around fruit: for example, Today Tonight and the amazement that your apples might have been harvested several months ago."

The amazement Dr Smale speaks of is evidence of a changing world. Where once fruits and vegetables were seasonal, it's become the norm for consumers to expect this produce year round.

Dr Alister Sharp, consultant and Australia's third member of the IIR refrigerated transport commission, explains.

## Meet the experts



**Dr David Tanner**  
– technical manager, global supply chain, Zespri International Limited, New Zealand.



**Dr Alister Sharp,**  
Transport Studies Consultancy. Australian commission member of the International Institute of Refrigeration (IIR) Commission D2 – Refrigerated transport.



**Dr Nick Smale,**  
Diageo Australia. Australian commission member of the IIR Commission D2 – Refrigerated transport.



**Dr Silvia Estrada-Flores,** principal consultant, Food Chain Intelligence. Australian member of the IIR Commission D2 – Refrigerated transport.



**Associate Professor Quang Tuan Pham,** University of NSW, School of Chemical Engineering and Industrial Chemistry. Australian member of the IIR Commission C2 - Food science and engineering.



“Retailers seem to have contributed to the confusion caused by the use of the term ‘fresh’ by their desire to label everything as fresh when it may have benefited by being aged or stored.”

“In the distant past it was generally recognised that some products were seasonal: we had ‘spring lamb’, ‘new potatoes’ and ‘new seasons’ apples’, but in recent years retailers have sought to offer product out-of-season, often transported from far away, or stored for months. To do this, retailers have concealed the age and/or origin of the produce by failing to point out that apples sold in December were harvested in April or May, or that fish sold from the deli counter has been thawed from frozen fish, possibly imported from abroad.”

### Freezing and transporting

Should consumers think that produce that has been frozen or transported long distances is substandard compared to something that is “fresh”?

### “To me, fresh food needs to be thought of as ‘non-spoilt’ food” Dr Silvia Estrada-Flores

Dr Smale says no, “As long as the cold chain is well controlled and the product is suitable for the duration of transport. I believe problems during transport occur more frequently during short transport legs than long ones – so length of transport isn’t a good indicator if the food will be good.”

Quang Tuan Pham, associate professor at the School of Chemical Sciences and Engineering at the University of New South Wales adds, “Most consumers do have pre-conceived ideas that ‘fresh is better’ and ‘chilled is better than frozen’. I don’t think that’s justified in general. Certainly there are far more people getting sick from so called ‘fresh’ food than from frozen food.”

“The greatest damage to frozen food, in fact, does not occur during freezing or storage but during thawing by the consumers at home. If the food is thawed for longer than necessary, or at a temperature which is higher than necessary, or incorrectly defrosted in the microwave, then it can look and smell terrible or even be unsafe,” he says.

The responsibility of keeping the cold chain in tact, says Dr Estrada-Flores, lies with the key players at each link of the chain.

“The quality of both frozen and chilled products depends on the level of service that each player in the chain – from growers through to manufacturers to retailers – provides for that product. For temperature-sensitive products, quality is a function of time and temperature.”

“All the technical elements to have the ‘ideal cold chain’ can be in place, but if there is no coordination and transparency amongst the supply chain players, there is always an element of uncertainty in the levels of freshness that consumers are getting in their food purchases.”

Dr David Tanner, technical manager – global supply chain, at New Zealand’s Zespri International Limited, and past AIRAH president, concedes that “Frozen food is often considered less ‘fresh’ than chilled foods (foods that are stored at around 0–1°C).”

“This is not necessarily true,” he continues, “but it’s more about perspective. For fruit and vegetables, chilled is indeed more ‘fresh’ as the product is still respiring and therefore still alive.”

“Not all products are acceptable for freezing (storage at or below -18°C), others do not respond well to chilling (storage at or around 0°C) and some fruits are susceptible to chilling injury below 13°C, such as bananas.”

### How long is too long?

How long can each of these products be kept fresh if the cold chain is maintained?

“In the well publicised case of Granny Smith apples in Woolworth’s, laboratory tests concluded that apples sold in their supermarkets had been stored for up to 10 months in refrigeration. The fact is that most apples sold in shops and retail will be stored between two to seven months as a minimum, without any significant loss in quality if stored in adequate conditions,” says Dr Estrada Flores.

These conditions normally include temperatures between -1°C and 0°C, and relative humidity’s between 90 to 95%. Consumers should be aware, Dr Estrada-Flores says, “That

cold storage is often the only alternative to maintain the food diversity and choice in supermarkets.”

“All primary production has natural seasons, be it fruit, vegetables, cattle or fish. An all-year round supply chain must therefore have the means to store and transport products in conditions that maximise shelf-life and quality.”

“The shelf-life for chilled beef at 0°C to 1°C is between one and three weeks. Frozen beef can last between 10 and 12 months, however, both cases represent ‘ideal supply chain’ conditions.”

“In chilled foods, the recommended maximum temperature for transport and storage of chilled goods is 5°C. Although this temperature is not ideal for all products, as per our meat example, it will maintain a minimum level of food safety if the product is commercialised before its sell-by date.”

Professor Pham says, “It depends on several factors: the type of food, how it has been pre-processed, how it is packaged, the storage atmosphere, temperature and air humidity.”

## “The industrial part of the cold chain is normally well controlled and failure is very infrequent”

Professor Q Tuan Pham

“An important factor is the water activity of the food, which measures the amount of ‘free’ water in the food. Pure water has a water activity of 1. Water activity is lowered if there are dissolved matter such as salt or sugar, or if the food has been dried. Foods with low water activities (honey, jams, sauces, etc.) keep longer and often can be kept for weeks at room temperature or in the refrigerator, while food with high water activities (meat, vegetables) need to be frozen in order to be stored for more than a few days. With living foods such as horticultural products, modified atmospheres will help prolong storage life.”

Dr Sharp adds, “All changes in produce are chemical, and most chemical changes can be slowed by reducing temperature, but freezing will damage many products by altering the texture, and others suffer ‘chilling damage’ if cooled below a certain temperature still well above their freezing point. An additional problem with products that ripen is that the ethylene gas released during ripening will trigger ripening of other produce, requiring that such products be segregated during storage and transport.”

“Chilled (ie. not frozen) seafoods, meats, milk and milk products are generally best stored close to 0°C, as are most temperate fruits and vegetables. Some varieties of nectarines and peaches become ‘woolly’ if stored below 3°C, tomatoes lose their flavour, and green beans become ‘glassy’ and are attacked by moulds, if stored in our fridge (below 8°C). Most tropical fruits deteriorate if stored below 10°C or even 13°C. Some fruits even require different temperatures depending on whether they are ‘green’ or ripe.”

According to Dr Tanner, “Today’s cold chain is able, if used appropriately, to keep produce generally long enough in order to transport it to markets in peak condition.”

“The current best-practice for seafood,” he adds, “is to use lower temperatures (as low as, or lower than -35°C) than were used 10-20 years ago, as this minimises the size of the ice crystals formed in freezing, which is a positive for product quality.”

Dr Tanner says that fruits are able to be delivered anywhere in the world, using air freight for short shelf-life products or container or ship transport for medium to long shelf life products.

## Breaking the chain

What if the cold chain is broken? Is it really the suppliers at fault, or are the consumers unknowingly creating their own problems?

“The cold chain’s generally pretty good – but I believe many refrigerated foods deteriorate more between the supermarket and the consumer (ie. in the shopping trolley, boot of the car then a domestic fridge) than they do in a good commercial cold chain,” says Dr Smale.

“In industrial cold stores, most frozen food can be kept for months, sometimes years, without noticeable effect. Also, industrial freezing usually take place quite soon after harvest, so we are starting with a fresher product in the first place. The weak point of the cold chain occurs when the consumer buys it from the store, transports it home in a hot car, and puts it in a home freezer (which is much warmer than industrial freezers) for weeks or months,” adds Professor Pham.

“Industrial freezer stores typically operate at -18°C or colder, while home freezer usually operate around -10°C and are furthermore subjected to frequent fluctuations due to door opening, fresh food being put in and warming the surrounding frozen food, etc.”

“The industrial part of the cold chain is normally well controlled and failure is very infrequent.”

“Another weak point is in the display cabinets at the store,” he adds. “Often these are designed for visibility and attractiveness rather than to maximise cold chain integrity. Food may be exposed to heating from light or open air, and product may get stacked above the safety line,” Professor Pham concludes.

Dr Sharp sees problems laying somewhere else.

## Fresh: What does it all mean?

According to Dr Sharp, definitions of the word ‘fresh’ have become “so varied as to have become meaningless without qualification”. He provides the following examples:

‘Fresh-picked’: “This statement is only meaningful if accompanied by the picking date and storage life.”

‘Fresh’ vs ‘Frozen’: “‘Chilled’ (ie. cooled but not frozen) meat is generally recognised as superior to meat that has been frozen (chilled Australian beef brings a much higher price in export markets than frozen beef), but consumers are confused, and maybe misled by the sale of thawed, frozen meat or fish.”

‘Fresh’ vs ‘Aged’: “Nobody wants to eat meat that hasn’t yet been aged to become tender.”

‘Fresh’ vs ‘Stored’: “If storage allows us access to out-of-season produce, then it is good, and can be acknowledged on the label.”

‘Fresh’ vs ‘Stale’: “With bread and cakes the difference is clear, but the time for the transition varies from minutes to hours, days or months, depending on the product.”

“Today we have the possibility of excellent cold chain performance in the form of good equipment, deep knowledge of what is required, and the ability to monitor storage conditions,” he says. “But we don’t necessarily have good actual cold chain performance because of a reluctance to invest in operator training, and commercial pressures to cut corners.”

**“The current best-practice for seafood is to use lower temperatures (as low as, or lower than -35°C) than were used 10–20 years ago, as this minimises the size of the ice crystals formed in freezing, which is a positive for product quality”**  
Dr David Tanner

“According to the USFDA, frozen foods are safe indefinitely provided they are not thawed,” says Dr Tanner. “So their expiration dates apply only to quality and nutritional value. This also assumes that the food is frozen as soon as possible after it is harvested/killed.”

“Food should be frozen in either its original packaging or packed in freezer bags or heavy-duty foil for maximum freshness,” he continues. “The only likely negative impact of long-term frozen product is the loss of water, termed ‘freezer burn’. ‘Freezer-burned’ foods are generally still safe to eat.”

### Technological advances

Our experts have identified numerous technologies that have significantly aided the refrigeration life of products. These include:

- Packaging methods (modified atmosphere packaging, active packaging, anti-microbial packaging, etc.).
- The availability of time-temperature indicators and wireless temperature loggers, allowing the temperature of products to be monitored throughout the cold chain.
- Advances in the computer modelling of refrigeration processes, which enable the effects of environmental conditions on food quality and safety to be predicted.
- The use of antifreeze proteins (AFP).
- Antimicrobial substances in surfaces in contact with foods.
- Use of ozone as a bactericide.
- The advent of ‘super freezer’ containers that store products as low as -60°C. These containers are for cargo which is best preserved at ultra low temperatures (Dr Tanner cites sashimi-grade tuna as one such product).

AFPs are naturally occurring chemicals that inhibit ice crystallisation, according to Professor Pham. “They can be used to prevent water freezing at temperatures well below freezing, thus creating ‘superchilled’ products where biochemical degradation is slowed down without tissue damage and loss of texture or moisture due to ice formation. To date their use in the food industry has been limited due to cost, but with recent success in the synthesis of AFPs in 2007, the cost is likely to come down.”

### Conclusion

The consensus among our experts seems to be that the cold chain is capable of maintaining “fresh” produce long after it is harvested.

Yet consumers still have concerns about freshness. How can they be corrected?

Dr Sharp suggests that the answer is for growers, wholesalers and retailers to take the initiative to educate consumers. He suggests they do the following:

- Distinguish between stored and freshly harvested produce using plain-English labels.
- Label fruits with the harvest date and estimated storage life.
- Label with the best storage conditions so (for example) consumers know not to store tomatoes in the fridge.
- Introduce labels that show the remaining high quality storage life.
- Discontinue the sale of thawed, frozen produce.

According to a number of our experts, simple information provided at the point of sale would also be beneficial.

“If there was some simple information about the nutritional value of stored products versus freshly harvested - that might help allay some fears,” Dr Smale says.

“I think the strong selling point of frozen food and chilled food is convenience, and that will continue to be the case. Families are getting smaller, cities bigger, most people busier or less inclined to cook sophisticated meals at least on working days, so the market for frozen and chilled food will continue to develop no matter what the customer perceives,” Professor Pham adds.

“That said, there is a case for better information via web pages, TV programs, high school education, and better information on frozen food packages. Consumer information and education on proper handling and thawing is especially important,” he concludes. ■

### Further reading

Our experts have suggested the following books for further reading:

- Favell, D.J. 1998. *A comparison of the vitamin C contents of fresh and frozen vegetables*. Food Chemistry, 62(1):59-64.
- Scott C.E. & Eldridge, A.L. 2005. *Comparison of carotenoid contents in fresh, frozen and canned corn*. Journal of Food Composition and Analysis 18 (2005) 551–559.
- Clinton, S.K., 1998. *Lycopene: chemistry, biology, and implications for human disease*. Nutrition Reviews 56, 35–51.
- Stahl, W., Sies, H., 2002. *Carotenoids and protection against solar UV radiation*. Skin Pharmacology and Applied Skin Physiology 15, 291–296.
- Paull, R.E. (1999). *Effect of temperature and relative humidity on fresh commodity quality*. Postharvest Biology and Technology. 15:263-277.
- M. Frith. *Our tests show supermarket apples are up to 10 months old*. The Sydney Morning Herald, Jan 20, 2008.