Shelf life

From Wikipedia, the free encyclopedia

Shelf life is the length of time that a commodity may be stored without becoming unfit for use, consumption, or sale.[1] In other words, it might refer to whether a commodity should no longer be on a pantry shelf (unfit for use), or just no longer on a supermarket shelf (unfit for sale, but not yet unfit for use). It applies to cosmetics, foods and beverages, medical devices, medicines, explosives, pharmaceutical drugs, chemicals, tires, batteries, and many other perishable items. In some regions, an advisory *best before*, mandatory *use by*, or *freshness date* is required on packaged perishable foods.

This pack of diced pork says 'display until' 7 May and 'use by' 8 May

Package testing: Heat sealing film for evaluation of shelf life of lettuce

Contents

Background

Shelf life is the recommended maximum time for which products or fresh (harvested) produce can be stored, during which the defined quality of a specified proportion of the goods remains acceptable under expected (or specified) conditions of distribution, storage and display.[2]

Most expiration dates are used as guidelines based on normal and expected handling and exposure to temperature. Use prior to the expiration date does not guarantee the safety of a food or drug, and a product is not necessarily dangerous or ineffective after the expiration date.[3]

According to the USDA, "canned foods are safe indefinitely as long as they are not exposed to freezing temperatures, or temperatures above 90 °F (32.2° C). If the cans look ok, they are safe to use. Discard cans that are dented, rusted, or swollen. High-acid canned foods (tomatoes, fruits) will keep their best quality for 12 to 18 months; low-acid canned foods (meats, vegetables) for 2 to 5 years. 80 °F (27 °C).[4]

"Sell by date" is a less ambiguous term for what is often referred to as an "expiration date". Most food is still edible after the expiration date.[5] A product that has passed its shelf life might still be safe, but quality is no longer guaranteed. In most food stores, waste is minimized by using stock rotation, which involves moving products with the earliest sell by date from the warehouse to the sales area, and then to the front of the shelf, so that most shoppers will pick them up first and thus they are likely to be sold before the end of their shelf life. This is important, as consumers enjoy fresher goods, and furthermore some stores can be fined for selling out of date products; most if not all would have to mark such products down as wasted, resulting in a financial loss.

Shelf life depends on the degradation mechanism of the specific product. Most can be influenced by several factors: exposure to light, heat, moisture, transmission of gases, mechanical stresses, and contamination by things such as micro-organisms. Product quality is often mathematically modelled around a parameter (concentration of a chemical compound, a microbiological index, or moisture content).[6]

For some foods, health issues are important in determining shelf life. Bacterial contaminants are ubiquitous, and foods left unused too long will often be contaminated by substantial amounts of bacterial colonies and become dangerous to eat, leading to food poisoning. However, shelf life alone is not an accurate indicator of how long the food can safely be stored. For example, pasteurized milk can remain fresh for five days after its sell-by date if it is refrigerated properly. In contrast, if milk already has harmful bacteria, the use-by dates become irrelevant.[3]

The expiration date of pharmaceuticals specifies the date the manufacturer guarantees the full potency and safety of a drug. Most medications continue to be effective and safe for a time after the expiration date. A rare exception is a case of renal tubular acidosis purportedly caused by expired tetracycline.[7] A study conducted by the U.S. Food and Drug Administration covered over 100 drugs, prescription and over-the-counter. The study showed that about 90% of them were safe and effective as long as 15 years past their expiration dates. Joel Davis, a former FDA expiration-date compliance chief, said that with a handful of exceptions - notably nitroglycerin, insulin and some liquid antibiotics - most expired drugs are probably effective.[8]

Shelf life is not significantly studied during drug development, and drug manufacturers have economic and liability incentives to specify shorter shelf lives so that consumers are encouraged to discard and repurchase products. One major exception is the Shelf Life Extension Program (SLEP) of the U.S. Department of Defense (DoD), which commissioned a major study of drug efficacy from the FDA starting in the mid-1980s. One criticism is that the U.S. Food and Drug Administration (FDA) refused to issue

guidelines based on SLEP research for normal marketing of pharmaceuticals even though the FDA performed the study. The SLEP and FDA signed a memorandum that scientific data could not be shared with the public, public health departments, other government agencies, and drug manufacturers.[9] State and local programs are not permitted to participate.[10] The failure to share data has caused foreign governments to refuse donations of expired medications.[11] One exception occurred during the 2010 Swine Flu Epidemic when the FDA authorized expired Tamiflu based on SLEP Data.[12] The SLEP discovered that drugs such as Cipro remained effective nine years after their shelf life, and, as a cost-saving measure, the US military routinely uses a wide range of SLEP tested products past their official shelf life if drugs have been stored properly.[13]

Preservatives and antioxidants may be incorporated into some food and drug products to extend their shelf life. Some companies use induction sealing and vacuum/oxygen-barrier pouches to assist in the extension of the shelf life of their products where oxygen causes the loss.

The DoD Shelf-Life Program defines shelf-life as,

> The total period of time beginning with the date of manufacture, date of cure (for elastomeric and rubber products only), date of assembly, or date of pack (subsistence only), and terminated by the date by which an item must be used (expiration date) or subjected to inspection, test, restoration, or disposal action; or after inspection/laboratory test/restorative action that an item may remain in the combined wholesale (including manufacture's) and retail storage systems and still be suitable for issue or use by the end user. Shelf-life is not to be confused with service-life (defined as, A general term used to quantify the average or standard life expectancy of an item or equipment while in use. When a shelf-life item is unpacked and introduced to mission requirements, installed into intended application, or merely left in storage, placed in pre-expended bins, or held as bench stock, shelf-life management stops and service life begins.)[14]

Shelf life is often specified in conjunction with a specific product, package, and distribution system. For example, an MRE field ration is designed to have a shelf life of three years at 80 °F (27 °C) and six months at 100 °F (38 °C).[15]

Temperature control

Nearly all chemical reactions can occur at normal temperatures (although different reactions proceed at different rates). However most reactions are accelerated by high temperatures, and the degradation of foods and pharmaceuticals is no exception. The same applies to the breakdown of many chemical explosives into more unstable compounds. Nitroglycerine is notorious. Old explosives are thus more dangerous (i.e. liable to be triggered to explode by very small disturbances, even trivial jiggling) than more recently manufactured explosives. Rubber products also degrade as sulphur bonds induced during vulcanization revert; this is why old rubber bands and other rubber products soften and get crispy, and lose their elasticity as they age.

The usually quoted rule of thumb is that chemical reactions double their rate for each temperature increase of 10 °C (18 °F) because activation energy barriers are more easily surmounted at higher temperatures. However, as with many rules of thumb, there are many caveats and exceptions. The rule works best for reactions with activation energy values around 50 kJ/mole; many of these are important at the usual temperatures we encounter. It is often applied in shelf life estimation, sometimes wrongly. There is a widespread impression, for instance in industry, that "triple time" can be simulated in practice by increasing the temperature by 15 °C (27 °F), e.g., storing a product for one month at 35 °C (95 °F) simulates three months at 20 °C (68 °F). This is mathematically incorrect (if the rule was precisely accurate the required temperature increase would be about 15.8 °C (28.4 °F)), and in any case the rule is only a rough approximation and cannot always be relied on.

The same is true, up to a point, of the chemical reactions of living things. They are usually catalyzed by enzymes which change reaction rates, but with no variation in catalytic action, the rule of thumb is still mostly applicable. In the case of bacteria and fungi, the reactions needed to feed and reproduce speed up at higher temperatures, up to the point that the proteins and other compounds in their cells themselves begin to break down, or denature, so quickly that they cannot be replaced. This is why high temperatures kill bacteria and other micro-organisms: 'tissue' breakdown reactions reach such rates that they cannot be compensated for and the cell dies. On the other hand, 'elevated' temperatures short of these result in increased growth and reproduction; if the organism is harmful, perhaps to dangerous levels.

Just as temperature increases speed up reactions, temperature decreases reduce them. Therefore, to make explosives stable for longer periods, or to keep rubber bands springy, or to force bacteria to slow down their growth, they can be cooled. That is why shelf life is generally extended by temperature control: (refrigeration, insulated shipping containers, controlled cold chain, etc.) and why some medicines and foods *must* be refrigerated. Since such storing of such goods is temporal in nature and shelf life is dependent on the temperature controlled environment, they are also referred to as cargo even when in special storage to emphasize the inherent time-temperature sensitivity matrix.

Temperature data loggers and time temperature indicators can record the temperature history of a shipment to help estimate their remaining shelf life.[16]

According to the USDA, "foods kept frozen continuously are safe indefinitely."[4]

Packaging

Barrier packaging can often help control or extend shelf life. When moisture content is a mechanism for product degradation, packaging with a low moisture vapor transmission rate and the use of desiccants help keep the moisture in the package within acceptable limits. When oxidation is the primary concern, packaging with a low oxygen transmission rate and the use of oxygen absorbers can help extend the shelf life. Produce and other products with respiration often require packaging with controlled barrier properties. The use of a modified atmosphere in the package can extend the shelf life for some products. Some active packaging is also available with antibacterial properties.

Parallel names

Best before

Best before or *best by* dates appear on a wide range of frozen, dried, tinned and other foods. These dates are only advisory and refer to the quality of the product, in contrast with *use by* dates, which indicate that the product may no longer be safe to consume after the specified date.[17] Food kept after the *best before* date will not necessarily be harmful, but may begin to lose its optimum flavour and texture. Eggs are a special case, since they may contain salmonella which multiplies over time; they should therefore be eaten before the *best before* date, which is, in the USA, a maximum of 45 days after the eggs are packed.[18]

Sometimes the packaging process involves using pre-printed labels, making it impractical to write the *best before* date in a clearly visible location. In this case, wording like *best before see bottom* or *best before see lid* might be printed on the label and the date marked in a different location as indicated.

Use by

Generally, foods that have a *use by* date written on the packaging must not be eaten after the specified date. This is because such foods usually go bad quickly and may be injurious to health if spoiled. It is also important to follow storage instructions carefully for these foods (for example, if they specify that the product must be refrigerated).

Bathroom products and toiletries usually state a time in months from the date the product is opened, by which they should be used. This is often indicated by a graphic of an open tub, with the number of months written inside (e.g., "12M" means use the product within 12 months of opening).[19] Similarly, some food products say "eat within X days of opening".

A tag sealing a bag of hot dog buns displays a *best before* date of February 29.

Open dating

Open dating is the use of a date stamped on the package of a food product to help determine how long to display the product for sale. This benefits the consumer by ensuring that the product is of best quality when sold. An open date does not supersede a use-by date, if shown, which should still be followed.[4]

A foil milk bottle top from the UK displays a use by date of 26 December pressed into the foil.

Sell by / display until

These dates are intended to help keep track of the stock in stores. Food that has passed its *sell by* or *display until* date, but has not yet reached its use by / best before date will still be edible, assuming it has been stored correctly. It is common practice in large stores to throw away such food, as it makes the stock control process easier; another common practice is for wholesalers to repurchase the expired product and resell it to discount stores at much lower clearance sale prices. These practices reduce the risk of customers unknowingly buying food without looking at the date, only to find out the next day that they cannot use it. Tampering with the posted date is illegal in many countries.

Most stores will rotate stock by moving the products with the earliest dates to the front of shelving units, which encourages customers to buy them first and hopefully saves them from having to be either marked down or thrown away, both of which would result in financial loss.

Issues associated with sell by / use by dates

According to the UK Waste & Resources Action Programme (WRAP), 33% percent of all food produced is wasted along the cold chain or by the consumer.[20] At the same time, a large number of people get sick every year due to spoiled food. According to the WHO and CDC, every year in the USA there are 76 million foodborne illnesses, leading to 325,000 hospitalizations and 5,000 deaths.[21]

According to former UK minister Hilary Benn, the use by date and sell by dates are old technologies that are outdated and should be replaced by other solutions or disposed of altogether.[22] The UK government's Department for Environment, Food and Rural Affairs revised guidance in 2011 to exclude the use of sell by dates. The guidance was prepared in consultation with the food industry, consumer groups, regulators, and Waste & Resources Action Programme (WRAP). It aims to reduce the annual £12bn of wasted supermarket food.[23]

Enforcement

Regulations in Canada

The Canadian Food Inspection Agency produces a *Guide to Food Labelling and Advertising* which sets out a "Durable Life Date".[24][25] The authority for producing the guide comes from the Food and Drugs Act. The guide sets out what items must be labelled and the format of the date.[26] The month and day must be included and the year if it is felt necessary and must be in the format year/month/day. However, there is no requirement that the year be in four digits.[24]

A best before date used on the bottom of a box in Canada

Regulations in Hong Kong

In Hong Kong, prepackaged food which from the microbiological point of view is highly perishable and is therefore likely after a short period to constitute an immediate danger to human health, are required to use the 'Use by' label instead of the 'Best before' label. Examples include pasteurised fresh milk, packed egg and ham sandwiches, etc. Dates are usually presented in the DD MM YY (or YYYY) format.[27]

Regulations in the European Union

In the EU food quality dates are governed by Regulation (EU) 1169/2011 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R1169&from=da

Regulations in the UK

According to the Department for Environment, Food and Rural Affairs dates must be in the day/month or day/month/year format.[28]

Regulation in the US

Sale of expired food products, *per se*, is lightly regulated in the US. Some states (like New York) bar such sale, and/or require expiration dates on all foods, but many (like California) do not. However, sale of contaminated food is generally illegal, resulting in product liability.[29]

After losing an expensive lawsuit, one pharmacy chain – CVS – implemented a system that causes its registers to recognize expired products and avert their sale.[30]

US federal government guidelines

The Food and Drug Administration, which regulates packaged foods and drugs, only requires a use-by, or expiration, date on infant formula and some baby foods, because formula must contain a certain quantity of each nutrient as described on the label. If formula is stored too long, it loses its nutritional quality, and also separates or form lumps that will clog the bottle nipple.[31]

The United States Department of Agriculture (USDA), which regulates fresh poultry and meats, only requires labeling of the date when poultry is packed. However, many manufacturers also add sell-by or use-by dates.[3]

The DoD Shelf-Life Program operates under the DoD Regulation 4140.1-R, DoD Material Management Regulation, ([32])

> A. There are items in the Department of Defense (DoD) and the Federal Supply System that require special handling due to certain deteriorative characteristics. These items are to be properly maintained to ensure that the customer is provided fresh, useable material. The purpose of this Manual is to establish a shelf-life program and process, with special emphasis on those items having these known deterioration characteristics, to mitigate the risk of shelf-life expiration and lapses of shelf-life items/material beyond their inspect/test dates.
> B. Provide policy and basic procedures for the management of both non-consumable and consumable shelf−life items that may be hazardous material (HAZMAT) or non-hazardous material, spanning all classes of supply and stored at all levels of the Federal Supply System. Shelf-life management for hazardous material follows the same procedures as those for any shelf-life items, except that hazardous material should receive priority processing over non-hazardous material. Issues and guidelines concerning the acquisition, storage, handling, transportation, and disposal of hazardous material are addressed in Chapters 3 and 5 of this Manual. Class I perishable subsistence, Class III bulk petroleum, Class V ammunition, and Class VIII-B blood, are excluded from this Manual and shall continue to be managed in accordance with existing regulations. Commodities excluded from this Manual may be represented by their respective DoD Component to the DoD Shelf-Life Board. The definitions for “classes of supply” may be found in Appendix 16 of DoD 4140.1-R.
> C. This Manual endorses the pollution prevention measures in DoD Instruction 4715.4 for hazardous material (HAZMAT) minimization (HAZMIN), as well as, the establishment of hazardous material control and management (HMC&M) philosophies which include consolidation and reutilization practices that embrace HAZMIN and HAZMAT elimination to reduce the hazardous waste (HW) stream.
> D. Appendices A through K augment this Manual and furnish additional information germane to the DoD Shelf-Life Management Program. Appendix L serves as a quick reference index to this Manual.

Beer

Freshness date

A *freshness date* is the date used in the American brewing industry to indicate either the date the beer was bottled or the date before which the beer should be consumed.

Beer is perishable. It can be affected by light, air, or the action of bacteria. Although beer is not legally mandated in the United States to have a shelf life, freshness dates serve much the same purpose and are used as a marketing tool.

Beginnings of freshness dating

General Brewing Company of San Francisco marketed their Lucky Lager Beer as "Age Dated" as early as late 1935.[33] They stamped a date on each can lid to indicate that the beer was brewed before that date. This was not to ensure that the beer was "fresh" but to ensure that it had been aged properly. So many breweries had rushed beer to market before it was ready when Prohibition ended, that customers were wary of getting "green" beer. The Boston Beer Company, maker of Samuel Adams, was among the first contemporary brewers to start adding freshness dates to their product line in 1985. For ten years there was a slow growth in brewers adding freshness dates to their beer. The practice rapidly grew in popularity after the Anheuser-Busch company's heavily marketed "Born-On dates" starting in 1996. Many other brewers have started adding freshness dates to their products, but there is no standard for what the date means. For some companies, the date on the bottle or can will be the date that the beer was bottled; others have the date by which the beer should be consumed.

Related concepts

The concept of shelf life applies to other products besides food and drugs. Gasoline has a shelf life, although it is not normally necessary to display a sell-by date. Exceeding this time-frame will introduce harmful varnishes, etc. into equipment designed to operate with these products, i.e. a gasoline lawn mower that has not been properly winterized could incur damage that will prevent use in the spring, and require expensive servicing to the carburetor.

Some glues and adhesives also have a limited storage life, and will stop working in a reliable and usable manner if their safe shelf life is exceeded.

Rather different is the use of a time limit for the use of items like vouchers, gift certificates and pre-paid phone cards, so that after the displayed date the voucher etc. will no longer be valid. Bell Mobility and its parent company, BCE Inc. have been served with notice of a $100-million class-action lawsuit alleging that expiry dates on its pre-paid wireless services are illegal.[34]

See also

- Accelerated aging
- Cold chain
- Digital permanence
- Food waste
- Modified atmosphere
- Moisture vapor transmission rate
- Packaging and labelling
- Permeation
- Redox
- Shelf stable

References

1. Oxford English Dictionary, 2nd ed.
2. Gyesley, S. W. (January 1991). Henyon, DK, ed. "Total Systems Approach to Predict Shelf Life of Packaged Foods". ASTM International.: Food Packaging Technology: 46 –50. doi:10.1520/STP14842S. ISBN 978-0-8031-1417-3. ASTM STP 1113-EB. |chapter= ignored (help)
3. "The_Truth_About_Food_Expiration_Dates". Retrieved 2008-09-01.
4. "Food_Product_Dating". Retrieved 2015-04-24.
5. *See* "Expiration dates". Consumer Affairs. Retrieved 11 November 2011.
6. Azanha, A.B.; Faria (July 2005). "Use of mathematical models for estimating the shelf-life of cornflakes in flexible packaging". *Packaging Technology and Science*. **18** (4): 161–222. doi:10.1002/pts.686.
7. Pomerantz, JM. "Recycling expensive medication: why not?". *MedGenMed*. **6**: 4. PMC 1395800. PMID 15266231.
8. Cohen, Laurie P. (2000-03-28). "Many Medicines Prove Potent for Years Past Their Expiration Dates.". *Wall Street Journal*. **235** (62). pp. A1 (cover story).

9. "US Army Medical Materiel Agency (USAMMA)". Usamma.army.mil. 2013-11-20. Retrieved 2014-02-08.
10. "Maximizing State and Local Medical Countermeasure Stockpile Investments Through the Shelf-Life Extension Program.". Upmc-biosecurity.org. Retrieved 2014-02-08.
11. "Essentialdrugs.org". Essentialdrugs.org. Retrieved 2014-02-08.
12. "Stockpiled Antivirals at or Nearing Expiration". Fda.gov. Retrieved 2014-02-08.
13. http://www.usamma.army.mil/assets/docs/dlar.pdf
14. "The DoD Shelf-Life Program - Shelf-Life Management Manual - Definitions". Archived from the original on 2011-07-22.
15. "Nanotechnology applied to raton packaging". *SSC National Press Release*. June 2004. `|first1=` missing `|last1=` in Authors list (help)
16. Meyers, T (June 2007). "RFID Shelf-life Monitoring Helps Resolve Disputes". *RFID Journal*.
17. Food Standards Agency - Eat well, be well - Best before (http://web.archive.org/web/20060421171954/http://www.eatwell.gov.uk/foodlabels/label
18. "Shell Eggs from Farm to Table". *Food Safety and Inspection Service*. United States Department of Agriculture. 2011-04-20. Retrieved 2012-09-08.
19. Orus, Pilar; Sonia Leranoz (June 2005). "Current trends in cosmetic microbiology". *International Microbiology*. **8** (2). Retrieved 6 April 2011.
20. Household Food and Drink Waste in the UK, WRAP 2009
21. WHO | Food safety and foodborne illness (http://www.who.int/mediacentre/factsheets/fs237/en/)
22. Shields, Rachel (2009-06-07). "Kitchen bin war: tackling the food waste mountain". *The Independent*. London. Retrieved 2010-05-23.
23. Batty, David (2011-09-15). "Government bins 'sell-by' dates to reduce food waste". *The Guardian*. London. Retrieved September 15, 2011. "The "sell-by" date on food packaging is to be removed in a bid to cut the £12bn worth of food needlessly binned every year. [...] The Department for Environment, Food and Rural Affairs produced the guidance in consultation with the food industry, consumer groups, regulators, and the Waste and Resources Action Programme (Wrap)."
24. Guide to Food Labelling and Advertising (http://www.inspection.gc.ca/food/labelling/guide-to-food-labelling-and-advertising/eng/1300118951990/1300118996556)
25. Durable Life Date (http://www.inspection.gc.ca/english/fssa/labeti/guide/ch2ae.shtml#a2_11)
26. Date Labelling on Pre-packaged Foods (http://www.inspection.gc.ca/food/consumer-centre/food-safety-tips/labelling-food-packaging-and-storage/date/eng/1332357469487/1332357545633)
27. Centre for Food Safety (http://www.cfs.gov.hk/english/multimedia/multimedia_pub/files/Read_the_Food_Label
28. Guidance on the application of date labels to food (http://www.defra.gov.uk/publications/files/pb132629-food-date-labelling-110915.pdf)
29. Updated by: Kathleen Michon, J.D. "Lawsuits Involving Food Poisoning". Nolo.com. Retrieved 2014-02-08.
30. http://www.consumercal.org/article.php?id=1779 @1:40
31. "Eat By Date - Shelf Life & Food Storage Information". `|first1=` missing `|last1=` in Authors list (help)
32. "The DoD Shelf-Life Program - Shelf-Life Management Manual - DoD 4140.27-M - Chapter 1, General".
33. Bill Yenne. 2004. Great American Beers: Twelve Brands That Became Icons. (https://books.google.com/books?id=XaEfHBz2uaYC&pg=PA72&lpg=PA72&dq=Lucky+Lager+Beer+Age+Dated&sour 20Lager%20Beer%20Age%20Dated&f=false)
34. [1] (http://ca.news.yahoo.com/100m-class-action-alleges-expiry-dates-bell-pre-150805068.html) Archived (https://web.archive.org/web/20120516235849/http://ca.news.yahoo.com/100m-class-action-alleges-expiry-dates-bell-pre-150805068.html) May 16, 2012, at the Wayback Machine.

Further reading

- Anonymous, "Cold Chain Management", 2003, 2006, [2] (http://www.iaph.uni-bonn.de/Coldchain/)
- Anon, Protecting Perishable Foods During Transport by Truck, USDA Handbook 669, 1995, [3] (http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELDEV3021003)
- Kilcast, D., Subramamiam, P., "Food and Beverage Stability and Shelf Life", Woodhead Publishing, 2011, ISBN 978-1-84569-701-3
- Labuza, T. P., Szybist, L., "Open dating of Foods", Food and Nutrition Press, 2001; other edition: Wiley-Blackwell, 2004, ISBN 0-917678-53-2
- Man, C. M., Jones. A. A., "Shelf-Life Evaluation of Foods", ISBN 0-8342-1782-1
- Robertson, G.L., "Food Packaging and Shelf Life: A Practical Guide", CRC Press, 2010, ISBN 978-1-4200-7844-2
- Steele, R., "Understanding and Measuring the Shelf-Life of Food", Woodhead Publishing, 2004, ISBN 1-85573-732-9
- Weenen, H., Cadwallader, K., "Freshness and Shelf Life of Foods", ACS, 2002, ISBN 0-8412-3801-4

External links

- USDA - Food Product Dating and storage guidelines (http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/food-product-dating/food-product-dating)
- FDA - Food freshness and smart packaging (https://web.archive.org/web/20090401172349/http://www.fda.gov/Fdac/features/2002/502_food.html)
- How to store your food (http://www.csiro.au/resources/refrigerated-storage-of-perishable-foods)

Categories: Food safety | Packaging | Drug safety | Food retailing

---