

## Executive Summary

### **Nutritional comparison of fresh, frozen, and canned fruits and vegetables**

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Recent and classical literature was reviewed to obtain current information on the nutrient value of fresh, canned and frozen foods with an emphasis on fruits and vegetables. Research that has undergone the scrutiny of peer review and the USDA nutrient database served as the source of information. The literature indicates that by the time they are consumed, fresh, frozen and canned fruits and vegetables may be nutritionally similar, depending on the post harvest handling and processing treatments.

Loss of nutrients in fresh products may be more substantial than commonly perceived. Storage and cooking can lead to overall losses of up to half of the original nutrient content prior to consumption. Depending on the commodity, freezing and canning processes may preserve nutrient value. While the initial thermal treatment of canned products can result in loss, nutrients are relatively stable during subsequent storage due to the lack of oxygen. Frozen products lose fewer nutrients initially because of the short heating time in blanching, but they lose more nutrients during storage due to oxidation.

Vitamin C, a water-soluble nutrient, is sensitive to heat, light, and oxygen. If fresh products are held at the appropriate temperature and consumed in a short period of time, they have more vitamin C than commercially canned products. However vitamin C degrades rapidly after harvest, and depending on commodity, as much as 77% of the nutrient (in green beans) may be lost in 7 days storage at 4°C (39°F). Vitamin C is lost when frozen vegetables are blanched, but some fruits have ascorbic acid added to prevent browning, so the nutrient level may be higher in the frozen than the fresh fruit. Between 10 to 90% of vitamin C is lost during canning, however the nutrient changes little during storage of canned products and little is lost during reheating because the heating time is short.

Among B vitamins, thiamin, B6 and riboflavin are sensitive to heat and light, resulting in loss in canned products. Since these nutrients are also water soluble, from 20-60% is lost in the blanching step prior to freezing. Water soluble polyphenolic compounds, found primarily in the skins of peaches, pears and apples, are lower in products canned without the skin compared to fresh, however if juice is included, such as in canned cherries, levels are higher in the canned than fresh products. Mineral and fiber content are similar in fresh, canned and frozen fruits and vegetables.

Fat soluble nutrients, including vitamin A, E, and carotenoids including lycopene are sensitive to heat, light, and oxygen. Since these nutrients are fat soluble, little is lost in blanching. Nutrient loss varies by commodity. For example, cooked fresh green beans

contained higher levels of beta-carotene than cooked frozen and cooked canned green beans, however cooked frozen green peas contained higher levels of beta-carotene than cooked fresh and cooked canned. Compared to fresh tomatoes, canned tomato products have been reported to have high levels of beta-carotene, a precursor of vitamin A. Processed tomatoes are also reported to have higher lycopene content than fresh, likely due to the heat-induced release of this nutrient from its cellular matrix.

Protein and carbohydrates as well as fatty acid composition is not significantly affected by canning or freezing. For example, the level of Omega 3 fatty acids in fish is not adversely affected by canning or freezing.

The literature review is complicated by variations in experimental procedure and method of reporting. Some studies measure the same cultivar, grown under controlled conditions, and evaluated as fresh, canned, or frozen. This approach provides data on the effect of processing treatment. Others obtain samples from the supermarket, measuring what the consumer has available, but increasing nutrient variability due to cultivar, growing conditions, and handling practices. Further, changes in moisture content during storage, cooking, and processing can misrepresent changes in nutrient content expressed as percent of product weight. Nutritional comparison would be facilitated if future research would express nutrient data on a dry weight basis to account for changes in moisture.

The nutritional comparison of fresh, canned and frozen products indicates that each can contribute to a health diet. Exclusive recommendations of fresh produce ignore the nutrient benefits of canned and frozen products and limits consumer choice.