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Editorial

Vitamin Degradative During Processing and Storage of Fruit and Vegetables

Anjan Borah*

Assistant Professor of the Food Technology and Nutrition Department (FTN), Lovely Professional University, India

***Corresponding Author:** Anjan Borah, Assistant Professor of the Food Technology and Nutrition Department (FTN), Lovely Professional University, India.

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Fruits and vegetables must be harvested at the proper stage, size and at the peak quality. Although quality couldn't be improved after harvest but careful harvesting, proper packaging, storage and transport gives better quality produce. Depending on the severity of the treatment both micro and macro nutrients are lost up to significant amount during processing of fruits and vegetables. Among others vitamins are mostly affected during thermal processing of fruits and vegetables. Vitamins are low-molecular-weight organic compounds that are indispensable in very small amounts in the diet. Vitamins play various specific and individual functions to promote growth or reproduction, or to maintain health and life. Generally leafy vegetables are good sources of most vitamins. The vitamin content of fruits and vegetables depends upon variety, growing conditions and several other factors. Vitamin degradation or loss occurred due to processing and cooking varies widely according to the method and type of food. It is not likely that processing methods will cause a real increase in nutrient concentration, but they may make nutrients more detectable instrumentally and perhaps more available biologically. The chemical changes during processing and storage of health-promoting food components e.g. carotenoids, ascorbic acid, anthocyanins and folates has been discussed below.

The major alterations of the highly unsaturated carotenoids during processing and storage are isomerization and enzymatic or non-enzymatic oxidation. Isomerization of trans-carotenoids, the usual configuration in nature, to the cis-isomers is promoted by acids, heat and light. The release of organic acids during slicing, pulping or juicing of fruits and vegetables can be sufficient to provoke isomerization, but this isomerization occurs to a greater extent during thermal treatment. As consequences, the color turns paler, provitamin A activity is reduced and bioavailability is also affected. The trans-isomer of the provitamin A carotenoid b-carotene is preferentially absorbed over the cis-isomers while the reverse is reported for the vitamin A-inactive lycopene, the cis-lycopenes being better absorbed. Enzymatic or non-enzymatic oxidation is the main cause of carotenoid destruction during processing and storage of food. It depends on the availability of oxygen and is promoted by light, heat, metals and enzymes; it is inhibited by antioxidants. Enzyme-catalyzed oxidation takes place prior to heat treatment, during peeling, slicing and pulping. Non-enzymatic oxidation occurs during and after thermal processing. It is increased by destruction of the cellular structure, increase of surface area or porosity, duration and severity of processing, duration and conditions of storage, permeability of the packaging material to oxygen and exposure to light. Oxidation begins with the introduction of oxygen into the carotenoid molecule, forming carotenoid epoxides, followed by cleavage. Successive fragmentations result in small volatile compounds. Now devoid of color and the health-promoting activities of carotenoids, these compounds could give rise to desirable flavor, as in tea and wine, or off-flavor, as in dehydrated carrot.

Degradation of ascorbic acid primarily involves oxidation to dehydroascorbic acid, followed by hydrolysis to 2,3-diketogulonic acid and further oxidation, dehydration and polymerization, forming a wide array of nutritionally inactive products. Uncatalyzed oxidation is essentially negligible; oxidations catalyzed by trace metals in food accounts for much of the oxidative degradation of ascorbic acid. Both ascorbic acid and dehydroascorbic acid have vitamin C activity. Loss of this activity occurs when dehydroascorbic acid is hydrolyzed with ring opening, forming of 2,3-diketogulonic acid. This hydrolysis is favored by alkaline conditions. Dehydroascorbic acid is most stable at pH 2.5-5.5; its stability decreases as pH increases.

Folates can suffer large losses during food processing and preparation due to it's reactivity and solubility in water. Aside from considerable leaching to water used in washing, blanching, canning or cooking, oxidative degradation can occur. Unfortunately, studies on processing effects on folates are still very limited. The naturally occurring form, tetrahydrofolic acid, is extremely susceptible to oxidative degradation while the synthetic form used in food fortification, folic acid, is very stable. Oxidative cleavage of tetrahydrofolic acid, and to a lesser extent, folic acid yields nutritionally inactive products.

In conclusion processing changes the color, texture, flavor, and nutritional quality of many fresh fruits and vegetables. Again most common thermal processsing techniques adopted by food processing industries are found to have degradative effect on Vitamins. Losses are inevitable to some extent, but investigation and better understanding of the possible causes, including the influencing factors, can help to find measures that can be taken to diminish such losses.