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Research & Development Article

Antioxidant levels in frozen produce

Antioxidants in Fresh & Frozen Fruit & Vegetables: Impact Study of Varying Storage Conditions, Environmental Quality and Food Safety Research Unit, University of Chester, July 2013

Nutritional Content of Fresh Versus Frozen Foods Report, Leatherhead Food Research, May 2013

The research was commissioned by the British Frozen Food Federation but carried out independently by scientists at the University of Chester and Leatherhead Food Research.

Comment

New scientific studies show antioxidant levels in frozen produce can be higher than in fresh. Two independent new scientific studies on compounds in fresh and frozen fruits and vegetables have indicated that frozen may have higher levels of some antioxidants than their fresh counterparts.

Investigating the content of the most commonly bought fruit and vegetables, evidence from over forty tests conducted within two studies established that in 66% of cases, frozen fruit and vegetables had higher nutritional levels of antioxidant-type compounds – including Vitamin C, polyphenols, anthocyanins, lutein and β carotene – on day three of storage.

On this basis, researchers recommended frozen fruit and vegetables as effective in providing antioxidants needed to maintain a healthy diet. Over the last two decades it has widely been reported that antioxidants in diet can help to keep the immune system healthy by cancelling out the cell-damaging effects of free radicals.

In two separate studies, conducted by the University of Chester and Leatherhead Food Research, scientific researchers:

- Purchased fresh and frozen fruit and vegetable samples from each of the four main UK supermarket chains
- Stored each product for half a week - as might be the situation for a consumer who conducts a bi-weekly shop [source: IGD ShopperVista]
- Prepared composite samples from each produce type for analysis
- Analysed each sample for antioxidant-type compounds – Vitamin C, polyphenols, anthocyanins, lutein and β carotene
- Evaluated the results of the analysis to establish the differences between fresh and frozen.

Professor Graham Bonwick of the University of Chester's Environmental Quality and Food Safety Research Unit, who led one of the studies, said: "Our data concluded that the concentrations of antioxidant compounds measured in frozen resembled those observed in corresponding fresh produce prior to refrigerated storage. However, unlike frozen, some fresh produce concentrations exhibited a decrease during refrigerated storage to levels below those observed in the corresponding frozen produce. The effects were most noticeable in soft fruits."

At Leatherhead Food Research, author of the second study Dr. Rachel Burch, said: "These results demonstrate that frozen can be nutritionally comparable to 'fresh' produce. We must disregard the mistaken opinion that 'fresh' food is always better for us than frozen food."

Brian Young, director-general of the British Frozen Food Federation said: "Fast and highly organised methods of 'harvest-to-freeze' have evolved with the express purpose of minimising nutrient losses. In contrast, 'fresh' food has been shown to spend up to a month in the chain of producers, wholesalers and retailers before consumers have access to store and prepare them. During this time we know that product deterioration takes place - to the extent that they can have lower nutritional value than their frozen equivalent."

Downloadable copies of the reports and further educational information on frozen foods for the foodservice industry can be found at www.bfff.co.uk.

Report conclusions

Broccoli

- Frozen broccoli had a slightly higher level of Vitamin C on day 3
- Fresh broccoli had a higher level of total polyphenols on day 3
- Frozen broccoli had a higher level of lutein on day 3
- Frozen broccoli had a higher level of β carotene on day 3
- Total anthocyanins not tested: not relevant

Carrots

- Frozen carrots had slightly higher levels of Vitamin C on day 3
- Frozen carrots had slightly higher levels of total polyphenols on day 3
- Frozen carrots had a higher level of lutein on day 3
- Frozen carrots had a higher level of β carotene on day 3
- Total anthocyanins not tested: not relevant

Brussels sprouts

- Frozen Brussels sprouts had higher levels of Vitamin C on day 3
- Total polyphenols not tested: not relevant
- Frozen Brussels sprouts had a higher level of lutein on day 3
- Frozen Brussels sprouts had a higher level of β carotene on day 3
- Total anthocyanins not tested: not relevant

Spinach

- Fresh spinach had a higher Vitamin C content on day 3
- Fresh spinach had a higher level of total polyphenols on day 3
- Frozen spinach had a higher level of lutein on day 3
- Frozen spinach had a higher level of β carotene on day 3
- Total anthocyanins not tested: not relevant

Peas

- Frozen peas had a comparable Vitamin C content on day 3
- Frozen peas had a slightly higher level of total polyphenols by day 3
- Frozen peas had a slightly higher concentration of anthocyanins by day 3
- Fresh peas had a substantially higher level of β carotene by day 3
- Frozen and fresh peas had a comparable level of lutein by day 3

Green Beans

- Frozen green beans had a higher Vitamin C content by day 3
- Frozen green beans had a substantially higher level of total polyphenols by day 3
- Frozen green beans had a slightly higher concentration of anthocyanins by day 3
- β carotene concentrations were below detection limits in both fresh and frozen samples
- Frozen and fresh green beans had a comparable level of lutein by day 3

Cauliflower

- Fresh cauliflower had a higher Vitamin C content by day 3
- Frozen cauliflower had a higher level of total polyphenols by day 3
- Frozen cauliflower had a substantially higher concentration of anthocyanins by day 3
- β carotene concentrations were below detection limits in both fresh and frozen samples
- Lutein concentrations were below detection limits in both fresh and frozen samples

Sweetcorn

- Frozen sweetcorn had a higher Vitamin C content by day 3
- Fresh sweetcorn had a higher level of total polyphenols on day 3
- Frozen sweetcorn had a slightly higher concentration of anthocyanins by day 3
- β carotene concentrations were below detection limits in both fresh and frozen samples
- Lutein concentrations were below detection limits in both fresh and frozen samples

Blueberries

- Frozen blueberries had a higher Vitamin C content by day 3
- Frozen blueberries had a higher level of total polyphenols by day 3
- Frozen blueberries had a higher concentration of anthocyanins by day 3
- Fresh blueberries had a slightly higher level of β carotene by day 3
- Fresh blueberries had a higher level of lutein by day 3

Raspberries

- Frozen raspberries had a comparable Vitamin C content on day 3
- Fresh raspberries had a higher level of total polyphenols by day 3
- Frozen raspberries had a higher concentration of anthocyanins by day 3
- Frozen blueberries had a higher level of β carotene by day 3
- Frozen raspberries had a higher level of lutein by day 3