

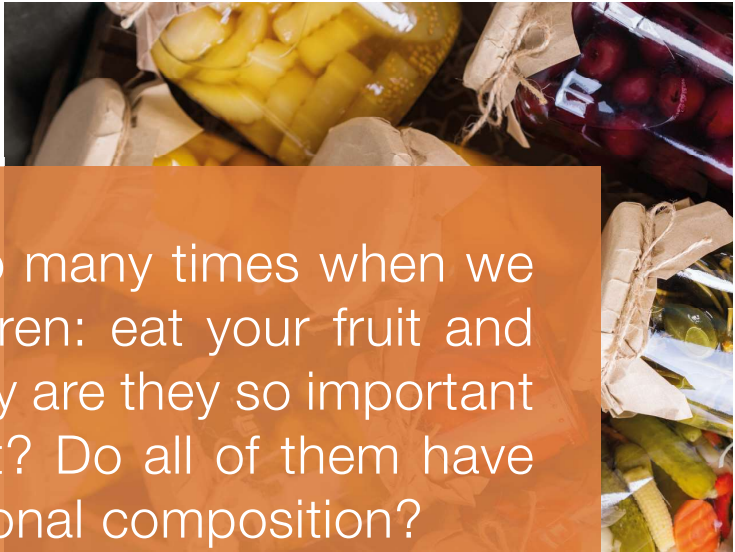
Putting the rainbow
on your plate

with preserved
fruit and vegetables




Author: Martina Zurli

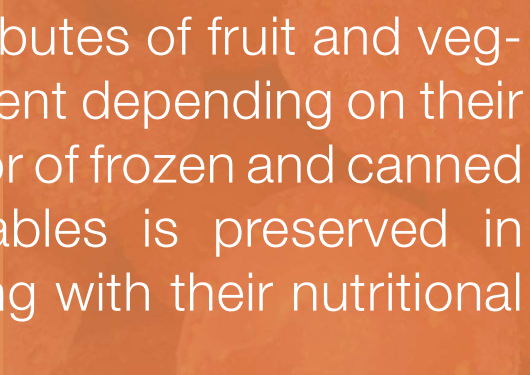
Certified Nutritionist



We heard so many times when we were children: eat your fruit and veggies! But why are they so important in a healthy diet? Do all of them have the same nutritional composition?



A healthy diet rich in fruit and vegetables has been linked to positive health outcomes. Studies researching the effect of a vegetable-rich diet observed an inverse dose-response gradient for **premature mortality, cancer, cardiovascular disease, coronary heart disease, and stroke**. This means that the higher the fruit and vegetable intake was, the lower the risk of those outcomes.



The positive attributes of fruit and vegetables are different depending on their colours. The color of frozen and canned fruit and vegetables is preserved in many cases along with their nutritional content.

YELLOW-ORANGE

The colour is due to carotenoids. Among them, beta-carotene is the most important one because it is the main precursor of vitamin A (retinol). Vitamin A contributes to the maintenance of normal vision and to the normal function of the immune system. Beta-carotene can be found in **apricot**, **frozen mango**, **canned peaches**, persimmon, **frozen** and **canned carrots**, and **canned pumpkin**, which also contains potassium.



While being high in vitamin C, citrus fruits (e.g. lemons, grapefruits, oranges and **canned mandarins**) also contain flavanones such as hesperetin, and phytosterols in oranges.



Vitamin C content in canned mandarins is even higher than in fresh ones, as well as in canned peaches, which also have higher folate and antioxidant levels when compared to fresh peaches.



“Vitamin C content in **canned mandarins** is even higher than in fresh ones.”

GREEN

The green colour is due to chlorophyll, the pigment that allows plants to absorb light and convert it into energy.

In spite of their colours, vegetables in the green group are also rich in pro-vitamin A, similarly to the yellow-orange group. Vegetables such as **frozen kale**, while being high in vitamin K are also high in pro-vitamin A. Beta-carotene can also be found in other leafy green vegetables and **frozen broccoli**, which are also high in vitamin C, as well as kiwi. Green vegetables also contain other carotenoids such as lutein, zeaxanthin and beta-cryptoxanthin.

Leafy vegetables such as lambsquarters, nettles, **frozen spinach** and other leafy vegetables can contribute to your calcium intake. Kale and broccoli also contain flavonoids. **Frozen brussels sprouts** contain among the highest levels of glucosinolates. These compounds are converted into isothiocyanates, which showed anti-cancer activities in animal and laboratory studies.

Beyond being Popeye's favour-

ites, **canned** and **frozen spinach** are also a source of magnesium, which contributes to a reduction of tiredness and fatigue. Spinach is high in folate, a salt of folic acid also called vitamin B9. The term "folic" is from the Latin word folium (which means leaf), where the component was first observed.



Canned and **frozen asparagus** are also a source of folate, and so are **frozen brussels sprouts**.

The consumption of green vegetables was most strongly associated with decreased risk of cardiovascular diseases.



BLUE-PURPLE

The blue and purple colour is due to anthocyanins, a flavonoid which is particularly abundant in this group.

A number of studies suggest that anthocyanin-rich foods may play an active role against cardiovascular and neurodegenerative diseases, as well as the prevention and treatment of type 2 diabetes and in attenuating obesity and inflammation in cells, animals, and humans. Berries outstand the category, particularly elderberry, blackberries, mulberries, black currants, and açai. Those small fruits are very delicate and have a short shelf-life. Therefore, freezing is a great way to preserve their nutrients, freshness and quality. A study suggests that anthocyanins in **frozen berries** may be more bioavailable, because of the disruption of the structure of the plant tissue, due to freezing.



Among the various vegetables, anthocyanin-rich foods include red cabbage, purple carrots, and eggplant, whose skin is rich in these compounds.

Canned beetroots are part of this group as well. Some studies suggest potential health benefits such as a reduction of the risk of cardiovascular disease and hypertension. Beetroots also contain betalains, which have been associated with protection against degenerative diseases and are a source of potassium.

“anthocyanins in frozen berries may be more bioavailable, because of the disruption of the structure of the plant tissue, due to freezing.”



WHITE

This group is characterized by antioxidants. These are flavonoids that contribute to the cream or white colour of cauliflower, white and yellow onions, and turnips. White fruit and vegetables are packed with phytonutrients.

Frozen cauliflower belongs to the Cruciferae group, and thus contains sulforaphane which may be protective against a variety of cancers as well as against cardiovascular and neurodegenerative diseases. It also contains plant sterols, which contribute to the maintenance of normal blood cholesterol levels.

Canned mushrooms contain biotin, and are also a source of selenium, which contributes to the protection of cells from oxidative stress and to the normal function of the immune system.

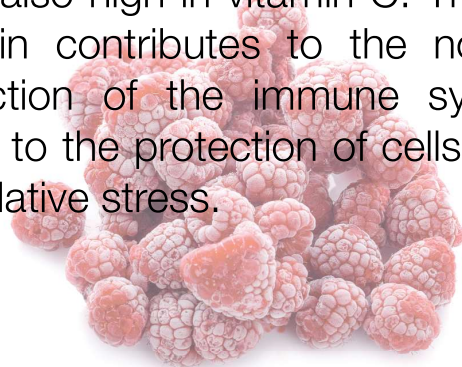
Allicin and quercetin can be found in garlic and onions.

RED

The main responsible for the red colour is lycopene. Lycopene belongs to carotenoids, which are natural pigments. They perform critical functions in photosynthesis and photoprotection. Lycopene has been studied for its potential inhibitory effect on prostate cancer. This carotenoid can be found in tomatoes, watermelon, pink grapefruit, guavas and red bell peppers.

Among polyphenols, we can find flavonoids such as anthocyanins in fruit which can be found frozen, such as **frozen cherries, cranberries, and red raspberries**. Likewise, we can find flavanols (including catechins and proanthocyanidins) in **frozen strawberries** and in the skin of red apples.

Other bioactive compounds are citrulline in watermelon and ellagic acid, contained in pomegranates, cherries and strawberries, which are also high in vitamin C. This vitamin contributes to the normal function of the immune system and to the protection of cells from oxidative stress.



Picking from different fruit and vegetable groups allows us to vary flavour, taste, and texture to avoid preparing dull and boring meals. In turn, this makes a healthy diet much easier and pleasant to follow.

An interesting research aimed to test meal colour variety as a new intervention strategy to boost healthy food showed that prompting participants to eat a colourful meal increased the proportion of healthy foods consumed compared to typical meals. Participants even evaluated colourful meals to be the tastiest! Including a diversity of colourful fruit and vegetables is an easy way to ensure adequate intakes of the wide array of the micronutrients and phytochemicals they contain. **Processed fruit and vegetables can contribute to this.** Colouring your table every day with the rainbow could not be easier!



“Including a diversity of colourful fruit and vegetables is an easy way to ensure adequate intakes of nutrients. **Processed fruit and vegetables** can contribute to this.”

Varying the colours also makes it easier to prepare meals that are not only healthy but also appealing. Finding food attractive is not only important for children, but also for grown-ups. Before eating with our mouths, we eat with our eyes: as we judge the food before eating it, the **visual appeal** is just as important as the taste!

Reference list

Gomes, F.S. and Reynolds. "Effects of fruits and vegetables intakes on direct and indirect health outcomes – Background paper for the FAO/WHO International Workshop on fruits and vegetables", 2020.

Dagfinn, A. et al. "Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality—a systematic review and dose-response meta-analysis of prospective studies". *International Journal of Epidemiology*, 2017.

U.S. Department of Agriculture, Agricultural Research Service. *FoodData Central*, 2019. fdc.nal.usda.gov.

César G. Fraga, et al. "The effects of polyphenols and other bioactives on human health", *Food & Function*, 2019.

Joy C Rickman, et al. "Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 1. Vitamins C and B and phenolic compounds", *Journal of the Science of Food and Agriculture*, 2007.

IARC Working Group on the Evaluation of Cancer-Preventive Strategies, "IARC Handbooks of Cancer Prevention Volume 8 - Fruit and Vegetables", 2003.

M. Mirahmadi, et al. "Potential inhibitory effect of lycopene on prostate cancer", *Biomedicine & Pharmacotherapy*, 2020.

Milton-Laskibar, I., et al., "Current Knowledge on Beetroot Bioactive Compounds: Role of Nitrate and Betalains in Health and Disease", *Foods*, 2021.

Mozos, I., et al., "Effects of Anthocyanins on Vascular Health", *Biomolecules*, 2021.

Lee, Y.-M., et al., "Dietary Anthocyanins

against Obesity and Inflammation", *Nutrients*, 2017.

Mattioli, R., et al., "Anthocyanins: A Comprehensive Review of Their Chemical Properties and Health Effects on Cardiovascular and Neurodegenerative Diseases", *Molecules*, 2020.

Róžańska, D., et al., "Anthocyanins in prevention of type 2 diabetes", *Adv Clin Exp Med.*, 2018.

South Dakota State University, "Freezing blueberries improves antioxidant availability." *ScienceDaily*, 2014.

European Commission. EU Register of nutrition and health claims made on foods. Available from: <http://ec.europa.eu/nuhclaims/>. [Accessed 15th June 2022].



PROFEL
European association of
fruit and vegetables
processors
Avenue de Nerviens
9-31 1040 Brussels
<https://profel-europe.eu/>
+32 2 500 87 59
profel@profel-europe.eu

