A Second Look At Green Leafy Vegetables As A Source Of Vitamins And Minerals

ECHO Inc.

The following is based on information from ECHO's newest book, Edible Leaves of the Tropics 3rd edition. See book reviews for details.

A common prescription for improving nutrition, especially among children, is to promote the addition to people's diet of dark green leafy vegetables, grown in home gardens. A tremendous variety of native tropical leaf vegetables are delicious and easy to grow, providing a regular source of high-quality food at the doorstep. Leaves are even available into the dry season, especially from perennial species or seasonal leaves have been blanched and powdered for use in the dry season. Leaves can provide essential minerals and vitamins often missing in starch-based diets.

I made a survey of recent research reports on nutrition and leaf vegetables, and encountered some surprises. Many studies show that the amount of several important substances in leaves, both nutritional and harmful ones, varies greatly even within the same species and variety of plant. The amount of these substances can vary depending on such factors as season of growth and harvest, stage of maturity when harvested, storage time and conditions, whether the plants are grown in sun or shade, amount of rain, soil fertility, etc.

For example, growing conditions may cause vitamin A levels to vary as much as ten-fold in a species . (Dr. Gary Beecher at the USDA Food Composition Lab). A report on quail grass (*Celosia argentea*) mentioned that vitamins A and C were lowest in the youngest and oldest leaves; protein and nitrates were highest in the younger leaves; and oxalates were higher in the older leaves of the plant.

Several studies on post-harvest decline in nutritive value indicate that vitamin content of most leaves can drop dramatically in less than a day after harvest. A study from Sri Lanka, on eight common species, showed that just four hours of wilting at ambient temperatures could reduce vitamin C content by as much as 30%, with up to 80% loss after one day. A report from Nigeria concluded that steam-blanched, dehydrated leaves maintained just under half of their vitamin C content after six months in storage.

Some research results are perplexing. A study on the effect of leafy greens in improving the vitamin A status in lactating mothers in Indonesia, showed minimal change even with daily "treatments" of cooked leafy greens.

Before proceeding further, we need to define a term. “Bioavailability” refers to the proportion of a nutrient that, when eaten, becomes available to the body for its various uses. In other words, just because a vitamin or mineral is present in a plant does not mean that the body will be able to extract it and make use of it.

Leaves contain high amounts of provitamin A, which is converted by the human body to retinol.. (Note that retinol itself is contained in liver, milk, and eggs. While animal sources in general are far better sources of this nutrient, they are often expensive and scarce compared to vegetables.) However, several reports state that the provitamin A in leaves has a much lower bioavailable than previously believed. Furthermore, the provitamin A found in leaves in particular is likely less usable in the body than what is found in non-photosynthetic plant parts. One hypothesis is that the provitamin A in leaves is bound in a hard-to-digest “matrix” of cell structures, while that in fruits such as mango and pumpkin, or roots/tubers including carrot and sweet potato, may be more readily absorbed by the body. In fact, today the amount of vitamin A that is present AND bioavailable in vegetables is roughly half of what nutrient tables showed a decade ago (The change is due both to more accurate measurement and the awareness of lower absorption in the body.)

The lesson to be learned from this research is that people should take advantage of a variety of plants and plant parts to meet nutritional requirements. A good rule of thumb on using leaves is to eat greens very frequently in modest amounts, about half a cup of cooked leaves per day. He mentions that this rule offers efficient use of the vitamins, including provitamin A, as well as and the minerals that are also often abundant in leaves.

What is the potential of selecting high-mineral varieties of greens to improve people’s diets? Dr. Anusuya Rangarajan, now of Cornell University, studied the bioavailability of iron in 46 lines of amaranth from 12 species of amaranth using anemic rats. She found differences in iron content, with highest amounts in leafy green vegetable amaranths. Fresh leaves contained 300-1500 ppm of iron, but only 20-70 ppm were available after simulated digestion. It would be possible to select or breed for increased levels of minerals in leaves, but the research required for that sort of improvement is not likely to be conducted for very many tropical leaf crops.

There is no easy formula for growing leaves in a way that increases their nutritive value, other than the basic recommendations to protect them from water and nutrient stress as much as possible. Given the wide variation present among varieties and within different parts of the same plant, it is better to select species for the garden based on what grows easily and is most accepted in your region, rather than promoting any particular species based on its rank in a nutrient composition table. What clearly is known is that the quality of leaves deteriorates very quickly after harvest. The reports can be summarized simply as follows: a variety of fresh greens should be eaten as soon after picking as possible, stored cool and moist or sealed in plastic bags, and cooked quickly for maximal retention of nutrients. While what we know about the role of leaves in human nutrition has been modified, they should hold their place as a valuable addition in tropical diets.

For Those Who Would Like To Dig A Bit Deeper To what can we attribute the decrease in estimates of how much vitamin A can be obtained from leaves? Provitamin A is member of a class of chemicals called “carotenoids.” But there are several kinds of carotenoids, only one of which can be converted to vitamin A. Older methods of analysis did not distinguish between these different kinds of carotenoids. In more recent research, an instrument called a “High Pressure Liquid Chromatograph” was used to measure each carotenoid separately. This does not mean that the older data is useless, however. It is now realized that carotenoids serve other valuable functions in the body. This is attributed largely but not exclusively to their ability to serve as “antioxidants.” These valuable substances can reduce risk of such killer diseases as cancer.

A side note. Several of these reports included Moringa (a vegetable tree promoted over the years by ECHO) and every one shows that it’s as good as we thought all along!

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