

## “Is Local More Nutritious?” It Depends

Local food advocates and confirmed “locavores”<sup>\*</sup> are quick to claim that local food is more nutritious. But is it really? While this seems like a simple straightforward question, it is anything but! The answer, like many having to do with food and nutrition, is a definite, “It depends.”

By the time fruits and vegetables reach your kitchen counter – whether from a stall at a local farmers market, or the supermarket produce department – several factors determine their nutritional quality: the specific variety chosen, the growing methods used, ripeness when harvested, post harvest handling, storage, extent and type of processing, and distance transported. The vitamin and mineral content of fruits and vegetables depends on decisions and practices all along the food system – from seed to table – whether or not that system is local or global. But before concluding there is no nutritional justification for eating locally, let’s take a closer look at this system.

- Variety. Most varieties of fruits and vegetables found in supermarkets today were chosen first and foremost for yield (how many pounds, pecks, bushels, etc. are harvested per acre), growth rate, and ability to withstand long-distance transport. Unfortunately, these traits which benefit national and international produce distribution often come at a cost: nutritional quality.<sup>1</sup> Fruit and vegetable varieties differ in appearance and taste, as well as their vitamin, mineral, and phytochemical content.<sup>2,3,4</sup> Farmers producing for a local and direct market (farmers’ market, community supported agriculture (CSA) members, or a local restaurant or grocer, for example), are more likely to prioritize taste and nutritional quality over durability when making varietal decisions.
- Production Method. Production methods that improve the health of the soil – such as the use of cover crops and composted manure for fertilizers – tend to yield crops with higher nutritional content. The roots of crops grown organically or in some Integrated Pest Management systems are healthier and grow deeper allowing them to more efficiently take up nutrients. Composted manures and other organic fertilizers release nutrients more slowly and over longer periods than synthetic chemical alternatives, which also enhances nutrient uptake by the plants.<sup>1</sup>
- Ripeness. When produce is ready for harvest varies from one fruit and vegetable to another and depends on whether it is “climacteric” not.<sup>5</sup> Climacteric fruits – such as apples, nectarines, melons, apricots, peaches, and tomatoes – are capable of generating the ripening hormone ethylene, after being detached from the mother plant. Non-climacteric crops – for example, peppers and citrus – reach commercial maturity on the plant only. Being somewhat autonomous, from the ripening point of view, climacteric fruits will change in taste, aroma, color and texture as they reach and pass a transitory respiratory peak related to ethylene

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\* “Locavore”, the 2007 [New Oxford American Dictionary](#) Word of the Year, refers to a person whose diet focuses on foods grown and produced nearby, typically 100 miles. The term reflects a growing trend of using locally grown ingredients, taking advantage of seasonally available foodstuffs that can be bought and prepared without the need for extra preservatives. The “locavore” movement encourages consumers to buy from farmers’ markets or even to grow or pick their own food, arguing that fresh, local products.

production. Climacteric produce such as tomatoes reach full red color even when harvested green while non-climacteric vegetables, such as bell peppers, will not. As a general rule, the more mature the product, the shorter its post-harvest life. So, if destined for distant markets, climacteric fruits are often harvested as early as possible, after reaching their physiological maturity, in order to withstand mechanical harvesting and long-distance transport without damage.

While full color may be achieved after harvest, nutritional quality may not. Total vitamin C content of red peppers, tomatoes, apricots, peaches and papayas has been shown to be higher when these crops are picked ripe from the plant<sup>6 7</sup> which, in the case of tomatoes, is attributable to increased sun exposure while attached to the mother plant.<sup>8</sup> While the vitamin C content of tomatoes, for example, will increase to some degree after picking, it will not reach levels found in those allowed to vine ripen.<sup>7</sup> Because tomatoes make up nearly a quarter of total US vegetable consumption,<sup>9</sup> following production and harvest practices that maximize their nutritional content is particularly important to public health of Americans.

- **Post-harvest Handling.** Maintaining nutritional quality after fruits and vegetables are harvested requires careful handling. This means, chilling (to remove the “field heat”) immediately, preventing bruising, and maintaining specific temperature, and humidity during storage and distribution. Careful handling preserves plant integrity and quality and careless handling chemically alters plant structure, often diminishing nutritional quality. Further, nutrients differ in how they are affected by various farming and post-harvest practices.<sup>10 11</sup> Bruising from handling is one of the most common problems. Mechanical harvesting methods like those used in mass production have the potential to be most damaging and can result in accelerated nutrient losses.<sup>6</sup> Bulk handling involving forklifts or trucks after picking significantly contributes to crop injury particularly with apples.<sup>10</sup> Delicate items like berries and tomatoes are also easily affected. In tomatoes, there has even been evidence of abnormal ripening following impact bruising.<sup>12</sup>
- **Processing and Packaging.** Fruits and vegetables are increasingly found on supermarket shelves pre-cut in open containers or in various types of packaging. These items are considered “fresh cut” or “lightly or minimally processed products” and have increased in sales in the US in billions of dollars since the mid-1990s. These products are highly perishable, as they have already experienced stress<sup>13</sup> and are left without intact skin for protection and prevention of nutrient loss.<sup>8</sup> Minimal processing – cutting, slicing, chopping, peeling, etc. – while tremendously useful from a food service standpoint, causes injuries to the plant tissues and initiates enzymatic changes, such as ethylene production, respiration, accumulation of secondary metabolites and water loss from tissues. This increases susceptibility to microbial spoilage, which not only compromises food safety,<sup>14</sup> but alters chemical make-up and promotes loss of nutrients. The effect of processing on antioxidants and phytonutrients vary.<sup>15</sup> To preserve moisture and humidity as well as protect fresh-cut products, films and coatings are used. Packaging can help preserve some nutrients in fresh-cut products, particularly if done at the right time and under appropriate conditions, mainly

because it delays ripening and deterioration. Other techniques such as irradiation, chemical preservation (dips in ascorbic acid, calcium chloride, and/or citric acid), modification of pH, and reduction of water activity (with sugars/salts) are also used to control deterioration of processed products.<sup>16</sup>

- Storage. Due to continued respiration and enzymatic activity, minimally processed fruits and vegetables suffer changes in nutritional value and sensory quality including loss of texture, appearance and flavor during storage,<sup>14</sup> especially if factors such as temperature, atmosphere, relative humidity and sanitation are not well regulated.<sup>13</sup> Fresh-cut produce must be maintained at lower temperatures than whole fruits and vegetables, as they tend to have higher respiration rates, which increase as temperature rises. Temperature maintenance is considered most deficient factor in post-harvest handling of minimally processed foods, which is why contained, modified atmospheres are important.
- Transportation. The advent of refrigerated trucks and rail cars has made it possible to eat fresh California or Mexico produce in the Northeast. But even when temperature and humidity are optimal from harvest to supermarket, there is some nutrient loss during days-long trip. If temperature control is faulty, losses accelerate. Bruising damage, with subsequent decrease in nutrition quality, is likely when transported at high speeds on bumpy roads. The longer the trip, the more potential for damage.<sup>10</sup>

### *The Bottom Line*

While all of the factors affecting nutritional quality of fruits and vegetables – crop variety, production method, post-harvest handling, storage, and processing and packaging – apply equally to produce that is produced locally or on farms across the country, relying on local sources for your produce needs has some distinct advantages. First, even when the highest post-harvest handling standards are met, foods grown far away that spend significant time on the road, and therefore have more time to lose nutrients before reaching the marketplace.<sup>17 18</sup> Second, farmers growing for a local (and especially a direct) market favor taste, nutrition and diversity over shipability when choosing varieties. Greater crop diversity from the farmer means greater nutritional diversity for the eater. Third, in direct and local marketing strategies, produce is usually sold within 24 hours after harvest, at its peak freshness and ripeness, making consuming them a more attractive prospect. Fourth, during this short time and distance, produce is likely handled by fewer people, decreasing potential for damage, and typically not harvested with industrial machinery. Minimizing transportation and processing can ensure maximum freshness and flavor, and nutrient retention. This may seem like an overly simplistic explanation of why local fruits and vegetables are more healthful than those from our conventional long haul agricultural system. In the Northeast, diets based on foods available locally can be nutritionally adequate year-round. Concerns over nutritional adequacy usually arise because people are unaware of what is available.<sup>19</sup> Fortunately, this guide can provide you with information regarding the delicious seasonal items of the Northeast, and how to prepare and store them.

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