Organic Foods: Are They a Safer, Healthier Alternative?

Introduction

Organically grown foods are produced in accordance with the rules of organic agriculture as defined by a country’s appropriate governing body. Given the development of international organic markets, the International Federation of Organic Agriculture Movements (IFOAM) World Board has also proposed a concise definition of organic agriculture and affirmed the fundamental principles (Table 1, pg. 24). Generally, organic foods have been produced without the use of synthetic pesticides, herbicides, fungicides, or synthetic fertilizers, and cannot be genetically modified or irradiated. Organic poultry, dairy, meat, and eggs are produced without the use of growth hormones or antibiotics, and are humanely raised and slaughtered. In contrast, conventionally produced foods make no claims about use or non-use of these pesticides, fertilizers, growth hormones and/or antibiotics.

In recent years, growth in the organic food sector has increased dramatically worldwide as consumers are becoming more aware of their natural environment, and of the connection between diet and health. Global organic food sales increased from $23 billion U.S. dollars in 2002 to $40 billion in 2006. According to the Organic Trade Association, consumer sales of organic foods totaled more than $15 billion in 2006 and have seen 14-20% annual market growth in the U.S. since 2001. This includes both fresh produce and processed products, with fruits and vegetables representing 40% of the sales, and breads/grains, packaged foods, and organic dairy products representing, 10%, 12%, and 16%, respectively. In 2007, organic products represented 2.8% of the total U.S. food and beverage sales, showing 20.9% market growth. And by 2010, the projected growth is over $30 billion. The general belief in this newly emerging food sector is that the public perceives organic items as healthier, safer alternatives to conventionally produced foods. For food and nutrition professionals, the question raised is what is the origin of this belief and is there scientific validity to it? This paper will explore the potential differences and similarities between organic and non-organic foods, both in terms of nutritional value such as protein and nitrates, select vitamins, minerals, and fatty acids, as well as food safety, specifically pesticides and pest infestation.

Nutritional value of organic versus non-organic foods (Table 2, pg. 25)

Nitrate content

Consumers often cite that organic foods have greater nutritional value and benefits versus conventionally grown foods. One area of interest with regard to nutritional value is nitrate content. Vegetables and drinking water are the main contributors to dietary nitrate continued on page 24...
It is hard to believe that this year's FNCE is upon us. I am excited to be able to join the EC and other NCC members at this year’s meeting after a two year hiatus. NCC has matured and progressed with the times as is evidenced in Gretchen Forsell’s Annual Report to Members. I am quite confident that this progress will continue under our current and future elected EC members.

With NCC’s first ever pre-conference workshop on gut health, we will be offering members an opportunity to hear about complementary and integrative therapies that work, the science behind them, and how they may be applied in our own practices. I am looking forward to learning more about how our gut influences our immune system and ultimately every facet of the human body. I also look forward with anticipation seeing many friends I have not seen since St. Louis, and making new friends.

I encourage each and every one of our members to stop by Product Market Place, the Dietetic Practice Group Showcase, our member reception, and or member breakfast, and introduce yourself and tell me what you like, and don’t like about the newsletter. Your comments are always welcome – the newsletter is your member benefit and I want everyone to continue to consider it as such – a benefit.

If you are unable to make it to FNCE, then please, feel free to contact me by email, phone, fax or snail mail. My email is peaknut@cascadeaccess.com, my phone is 702-346-7968 and my fax number is 702-346-9031.

The views expressed in this newsletter are those of the authors and do not necessarily reflect the policies and/or official positions of the American Dietetic Association.

We invite you to submit articles, news and comments. Contact us for author guidelines.

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Those of you who would like to contribute an article or have topics that you would like to see in future issues, please feel free to drop me an email or give me a call – peaknut@cascadeaccess.com or 702-346-7968 – or contact any one of the capable NCC leaders listed on the back of the newsletter.

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NCC IS TEN YEARS OLD! Please join us in celebrating at this years Food & Nutrition Conference & Expo (FNCE). The NCC Executive Committee (EC) has planned many opportunities for you to learn more about complementary, integrative, and functional nutrition/medicine. There has been a great response to our first pre-FNCE conference entitled Gut Health: The Inner Tube of Life. Space is limited, so check out the NCC website for more information - the registration deadline is October 17. On Sunday evening, we will spend some time relaxing during the NCC Networking Reception. Please stop by to connect with friends from over the years as well as to form new acquaintances with those who have similar interests. We also hope that you will join us for our NCC breakfast on Tuesday morning. Along with honoring EC members, past chairs, and this year’s award winners, a presentation on vitamin C will provide you with 1 CPEU. As always, we will have some door prizes that you’ll find useful for your practice. We thank our many sponsors – Ester-C, Lipton Institute for Tea, Pharmavite, Biosan, and Sciona. Without their support, our many FNCE events would not be possible.

As the home of nutritional genomics, NCC will be front and center for the House of Delegates (HOD) discussion on this topic on Saturday, October 25. I hope that you spent some time reviewing the HOD backgrounder and providing ADA with feedback regarding where and how you first learned about nutritional genomics, what was your initial reaction, and how your area of practice would change if this was a tool you could use. Shortly after the HOD meeting, “motions for actions” will be developed, and NCC will have the opportunity to provide input. We look forward to working with the HOD and ADA to help prepare registered dietitians and students to be the leaders in this area.

Speaking of nutritional genomics, our networking relationship with the Institute for Functional Medicine (IFM) continues with a webinar on this topic on November 4 at 8 PM EST. IFM will provide you with 1 CPEU for your participation. The first 500 NCC members can register by linking to IFM PM EST. IFM will provide you with 1 CPEU for your participation. The first 500 NCC members can register by linking to IFM. We hope to have news for you very soon on our continued work with IFM as well as on additional networking relationships with other organizations who can help NCC bring educational resources to its members to enhance their practice.

We have many thoughts and ideas to move NCC forward, but there are only so many hours in a day. The EC is a dynamic group of individuals who are all extremely dedicated. If you are interested in becoming involved with the EC, please contact Dorothy Humm, NCC Nominating Chair, at dothumm@escapees.com. As usual, we have several positions open, including secretary, nominating chair, and nominating committee member, and remember that the benefits of volunteering always outweigh the efforts made.

Because of the important role complementary, integrative, and functional nutrition/medicine play in improving the health of clients, members, and their families, the EC’s goal is to make NCC the most desirable DPG to join. We would appreciate that you spread the word on the benefits of your NCC membership to your RD/DTR colleagues and friends. If there is anything we can do to improve or enhance your membership, please let me know at magettings@psu.edu.

Respectfully,
Mary Alice Gettings

The authors of the CPE article Organic Foods: Are They a Safer Alternative? and the editors of the Nutrition in Complementary Care Newsletter would like to thank the reviewers for their expertise: Mary Jo Forbord, RD, farmer & Executive Director of Sustainable Farming Association of Minnesota; Sudha Raj, PhD RD, reviewer for ADA’s Evidence Analysis Library; and Jeff Cox, investigative journalist, former editor of numerous publications including Vegetarian Times and Organic Gardening and author of numerous texts most recently, The Organic Shopper’s Bible. Special thanks is extended to content reviewer, Christine McCullum-Gomez PhD RD, a food and nutrition consultant whose area of expertise is food security/food systems. Dr. McCullum-Gomez serves on the Science and Technical Advisory Committee of The Organic Center, and serves as a column editor and/or reviewer for numerous journals including Journal of the American Dietetic Association, Journal of Hunger and Environmental Nutrition, and Journal of Nutrition Education and Behavior.

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intake in humans. And the use of nitrogenous chemical fertilizers in conventional farming may result in higher nitrate content, whereas nitrate content in organic foods might be lower secondary to the absence of such fertilizers. Total nitrate consumption is of relevance because higher amounts can have potential adverse health effects ranging from methemoglobinemia in infants, a form of anemia caused by the body’s reduction of nitrate to nitrite; to cancers of the digestive tract, bladder, and ovaries; as well as non-Hodgkin’s lymphoma. Camargo and Alonso identified potential health risks from ingested nitrite and nitrates: mutagenicity, teratogenicity, and birth defects; a role in the etiology of type 1 diabetes and the development of thyroid hypertrophy; and a potential cause of spontaneous abortions and respiratory tract infections. The U.S. Environmental Protection Agency (EPA) has set the acceptable daily intake level for nitrates at less than 10 parts per million.

An Italian study determined the nitrate contents of leafy vegetables that are thought to provide the majority of daily nitrate intake in a typical Italian diet. Since roughly 85% of the daily nitrate intake for a typical American also comes from leafy vegetables and tubers such as spinach, lettuce and radishes, this evaluation offers an assessment of their toxicological risk as well. According to the results, significantly higher nitrate levels were found in organically grown salad greens and chicory versus conventional samples, and differences in lettuce samples approached statistical significance. Based on these findings, the typical diet of an Italian adult could provide up to 63% of the acceptable daily intake (ADI) of nitrate (3.7 mg nitrate ion kg⁻¹ body weight day¹ x 60 kg) and that of a child up to 42% (3.7 mg nitrate ion kg¹ body weight day¹ x 20 kg) if they selected organic products. It is noted that the calculations overestimate nitrate content since raw vegetables were utilized; washing or cooking would likely decrease the nitrate content considerably. In addition, the authors do not specify whether the organic vegetables were ‘certified organic’. Lester notes that several conditions need to be met when making high-quality comparisons between organic and non-organic products, one of which is that a farming site be certified organic.

In another study, the nitrate contents of leafy vegetables grown in Brazil by different agricultural methods were analyzed. Watercress, lettuce, and arugula produced in a certified organic, conventional, or hydroponic agriculture system were evaluated after washing. The nitrate contents of the lettuce and arugula were significantly lower in the organic samples, whereas the nitrate content of the watercress was significantly higher in the organic samples and lower in the conventional samples. Five percent of the hydroponic samples had nitrate concentrations exceeding the maximum levels set by European Union legislation, while none of the organic or conventional samples exceeded these levels. Overall, the hydroponic samples contributed the highest levels of dietary nitrates, but even these were calculated to reach just 29% of the acceptable daily intake of nitrate in a typical Brazilian diet.

In addition, a large meta-analysis analyzed 41 studies comparing the nutrient profiles of organic versus conventional crops. Eighteen of the studies assessed nitrate contents in vegetables such as lettuce, spinach, kale, endive, chard, cabbage, celeriac, turnip, beetroot, corn salad, potato, and radish. Overall, the data indicated significantly lower nitrate content (15.1%) in the organic crops versus conventional crops.

Finally, a more recent meta-analysis from The Organic Center found that nitrate levels across matched pairs were 83.3% higher (n=15) in conventional samples. The crops analyzed included lettuce, carrot, potato, red beet, cabbage, leek, turnip, and spinach. A review published in 2007 also reported that organic crops contain fewer nitrates.

### Table 1. Organic Agriculture Definition and Principles

**Definition:**
Organic agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity, and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

**Principles:**
Organic agriculture is based on the principles of health, ecology, fairness, and care.

**U.S. National Standards:**
- Produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to enhance environmental quality.
- Organic meat, poultry, eggs, and dairy products come from animals that are given no antibiotics or growth hormones.
- Breeding and husbandry of organic cattle, swine, poultry, and other livestock must meet National Organic Program Standards for livestock origin, feed, health, and living conditions.
- Organic food is produced without using: most conventional pesticides, fertilizers made with synthetic ingredients or sewage sludge, bioengineering, or ionizing radiation.
- Before a product can be labeled “organic,” a Government-approved certifier inspects the farm where the food is grown to make sure the farmer is following all the rules necessary to meet USDA organic standards.
- Companies that handle or process organic food must also be certified.
Organic Foods

Table 2. Summary of Nutritional Value of Organic versus Non-organic Foods

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food or Compound Analyzed</th>
<th>Outcome</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate</td>
<td>Lettuce, spinach, kale, endive, chard, cabbage, celeriac, turnip, beetroot, corn salad, potato, and radish</td>
<td>Conventional &gt; organic</td>
<td>Nitrate: Organic &lt; conventional; note manipulation of produce may influence nitrate content</td>
</tr>
<tr>
<td></td>
<td>Lettuce, carrot, potato, red beet, cabbage, leek, turnip, and spinach lettuce, carrot, potato, red beet, cabbage, leek, turnip, and spinach (matched pairs)</td>
<td>Conventional &gt; organic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unwashed green salad, chicory (Italy)</td>
<td>Organic &gt; conventional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unwashed lettuce (Italy)</td>
<td>Organic = conventional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Washed lettuce, arugula (Brazil)</td>
<td>Conventional &gt; organic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Washed watercress (Brazil)</td>
<td>Organic &gt; conventional</td>
<td></td>
</tr>
<tr>
<td>Fatty acids (FA) in milk</td>
<td>Polyunsaturated FA, Total omega-3 FA</td>
<td>Organic &gt; conventional</td>
<td>Preliminary research has found that organic milk has higher polyunsaturated FA, total omega-3 fatty acids, a more beneficial omega 6:omega 3 ratio, higher alpha-linolenic acic, and higher levels of conjugated linoleic acid; production system affects milk composition</td>
</tr>
<tr>
<td></td>
<td>Lower omega 6:omega 3 (which is considered beneficial)</td>
<td>Organic &gt; conventional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monounsaturated FA</td>
<td>Conventional &gt; organic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conjugated linoleic, alpha-linolenic acid</td>
<td>Low input organic and low input conventional &gt; conventional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conjugated linoleic acid trans-vaccenic acid in breast milk</td>
<td>Mother consumed organic &gt; mother consumed conventional</td>
<td></td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Lettuce, spinach, kale, endive, chard, cabbage, celeriac, turnip, beetroot, corn salad, potato, and radish</td>
<td>Organic &gt; conventional</td>
<td>Vitamin C: Organic &gt; conventional</td>
</tr>
<tr>
<td></td>
<td>Corn, frozen</td>
<td>Organic &gt; conventional</td>
<td></td>
</tr>
<tr>
<td>Iron, magnesium, phosphorus</td>
<td>Lettuce, spinach, kale, endive, chard, cabbage, celeriac, turnip, beetroot, corn salad, potato, and radish</td>
<td>Organic &gt; conventional</td>
<td>Iron, magnesium, phosphorus: Organic &gt; conventional</td>
</tr>
<tr>
<td></td>
<td>Protein, crude</td>
<td>Conventional &gt; organic</td>
<td>Protein: Organic &lt; conventional; note lack of chemical nitrogen fertilizers; Amino Acid profile better</td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td>Conventional &gt; organic (N.S.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lettuce, spinach, kale, endive, chard, cabbage, celeriac, turnip, beetroot, corn salad, potato, and radish</td>
<td>Conventional &gt; organic</td>
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<tr>
<td></td>
<td>Lettuce, carrot, potato, red beet, cabbage, leek, turnip, and spinach</td>
<td>Conventional &gt; organic</td>
<td></td>
</tr>
<tr>
<td>Phenolic acids</td>
<td>Marionberries, corn</td>
<td>Organic &gt; conventional</td>
<td>Phenolic acids: Organic &gt; conventional</td>
</tr>
<tr>
<td>Salicylic acid</td>
<td>Soups</td>
<td>Organic &gt; conventional</td>
<td></td>
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<tr>
<td>Flavonoids</td>
<td>Quercetin intake</td>
<td>Organic &gt; conventional</td>
<td>Flavonoids: Organic &gt; conventional</td>
</tr>
<tr>
<td></td>
<td>Quercetin and kaempferol</td>
<td>Organic &gt; conventional</td>
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</tbody>
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1 P<0.0001  2 P<0.05  3 P=0.068  4 P<0.01  5 P<0.001  6 Non-significant trend

The above findings support some results while refuting others. Given the scope of the supporting evidence and results, it appears that organically produced foods tend to have lower nitrate contents versus conventional foods. It is important to consider the varying methods used in these studies, such as washing or no washing, and to account for variations as any manipulation of the produce can affect nitrate content.

Fatty acid content in milk

Fatty acids (FA) provide another area of relevance in the debate between organic and non-organic foods. In particular, polyunsaturated FA (PUFA) in the omega-3 group are of interest due to various positive health benefits, whereas omega-6 FA are shown to be pro-inflammatory and are linked...
with more negative health outcomes. Ellis et al. analyzed milk samples from 19 conventional and 17 organic dairy farms over a 12 month period in order to compare the agricultural system effects on FA proportions in milk. The organic milk had significantly higher percentages of PUFA and total omega-3 versus the conventional milk, as well as a more desirable ratio of omega-6 to omega-3; also, the conventional milk had significantly higher percentages of monounsaturated FA. A number of factors affect the FA profile of milk, including geographic location, breed, season, and the cow’s diet; nonetheless, the FA differences persisted even after accounting for these factors.

Similarly, Butler et al. found that milk from both low-input organic and low-input conventional farms had significantly lower saturated FA and greater PUFA and MUFA levels compared to milk from high-input conventional farms. During the outdoor grazing period, the low-input milk (organic and conventional) also had significantly greater concentrations of conjugated linoleic (60% and 99%, respectively) and alpha-linoleic acids (39% and 31%, respectively); alpha-tocopherol (33% and 50%, respectively); and carotenoids (33% and 80%, respectively) than the high-input conventional milk. During the housing period, the low-input organic milk had greater percentages of saturated FA (4%), lower MUFA (1%), and lower omega-6 content (24%), along with trends towards a higher content of alpha-linolenic acid (38%) and a higher lutein content (30%), as compared to the high-input conventional milk. During the second half of the grazing period, there were significant differences between the two low-input systems. The organic milk was higher in alpha-linolenic acid, while the non-organic milk had higher levels of antioxidants and conjugated linoleic acid. The authors note that production systems do appear to influence milk composition via processes connected to stage and length of the grazing period and diet composition.

The fatty acid profile of organic milk may also relate to the development of eczema. For example, the consumption of organic dairy products was associated with a lower risk of eczema in the first two years of life. Previous researchers involved with the same cohort study, the KOALA Birth Cohort Study, reported that the breast milk of mothers consuming primarily organic dairy and organic meat products had higher levels of conjugated linoleic acid trans-vaccenic acid compared to mothers who consumed no organic dairy or organic meat products. Kummeling et al. hypothesized that a high intake of omega-3 FA and/or conjugated linoleic acid from organic dairy may be protective against eczema (independent of atopy), and also the mother’s intake of these fatty acids during pregnancy and lactation contributes to this protection.

It would be beneficial to consumers if labeling beyond ‘organic’ and ‘conventional’ identified those milk products with more optimal FA profiles. Although Horizon Organic® Milk Plus DHA (docosahexaenoic acid) Omega-3 is fortified with 32 mg DHA in 8 ounces, no information is provided about the specific FA profile.

Contents of various nutrients

A review by Rembialkowska reported that as a rule, organic crops contain more vitamin C, phenolic compounds, essential amino acids, and total sugars than conventional crops. Of 35 nutrients analyzed, Worthington identified that vitamin C, iron, magnesium, and phosphorus were significantly higher by 27%, 21.1%, 29.3%, and 13.6%, respectively, in organic versus conventional crops. Furthermore, on average, the organic crops had greater amounts of all 21 minerals analyzed.

Asami et al. measured ascorbic acid (AA) concentrations in marionberries and corn grown by organic, conventional, or sustainable agricultural practices. All samples were compared following three typical preservation processes: freezing, freeze-drying, and air-drying. Significantly higher AA concentrations were found in the frozen corn harvested from sustainable samples versus organic and conventional; likewise, organic corn had significantly higher AA than conventional corn. AA was largely undetectable in the marionberries.

Benbrook et al. analyzed matched pairs of organic and conventional samples and found that vitamin C, alpha-tocopherol, and phosphorus levels were higher in the organic samples (63%, 62%, and 63%, respectively). The conventional samples had equivalent levels of beta-carotene (50%) and higher potassium levels (58%).

Rossi et al. studied protein quality and composition of organic versus conventional wheat and found that crude protein was significantly higher in the conventional wheat. Worthington noted similar findings of lower crude protein in organic crops, and Benbrook et al. found protein levels to be higher in 85.2% of the conventional versus organic crops they tested. It is proposed that when plants are presented with nitrogen-rich fertilizers, they amplify protein production. Synthetic fertilizers supply nitrogen in a form that is easily accessible to the crops. Nitrogen supplied to organic crops is more complex as it is obtained via the soil from legumes that have affixed nitrogen from the air, composted manure, etc. Thus, organic crops take up nitrogen more slowly and do not have spikes in growth. This allows attention to other metabolic plant functions like vitamin C production. Although organic foods may contain less total crude protein, their essential amino acid profiles are perhaps actually better. Given the increase in nitrates from synthetic fertilizers used in conventional farming, the lower total crude protein in organic crops may be an indirect benefit.

In summary, vitamin C content appears to be greater in some organic foods. Rembialkowska’s review noted that
the higher vitamin C in organic crops is beneficial to health because vitamin C inhibits the \textit{in s	extsubscript{u}tu} formation of carcinogenic nitrosamines, thereby diminishing the negative impact of the nitrates previously discussed. Iron, magnesium, and phosphorus content may be higher in organic foods,	extsuperscript{15-17} while containing lower total crude protein versus conventional foods, but perhaps with more essential amino acids.

**Phenolic acids and flavonoids**

Phenolic acids refer to various secondary plant metabolites used for growth, reproduction, and protection against pathogens. Given that organically produced crops do not have the added ‘protection’ of chemical pesticides to ward off pathogens, and would therefore hypothetically need to synthesize more phenolic acids, it follows that organic foods may have higher levels of phenolic acids.\textsuperscript{25,28} To test this hypothesis, Asami et al.\textsuperscript{25} compared the total phenolic (TP) contents in marionberries and corn grown by organic, conventional, or sustainable practices. All of the sustainable and organic samples of marionberries and corn were significantly greater in TP when compared with conventional samples. Similarly, the meta-analysis of Benbrook et al.\textsuperscript{16} found organic samples had higher levels of total phenolics, total antioxidant capacity, quercetin, and kaempferol when compared across matched pairs of organic versus conventional samples.

Researchers also compared flavonoid contents, including quercetin, kaempferol, and naringenin, from dried tomato samples collected over a 10 year period from two matched organic or conventional plots.\textsuperscript{29} Significantly higher levels of all three flavonoids were found in the organic tomato samples, with the 10 year averages of quercetin and kaempferol as 79% and 97% higher respectively. Flavonoid levels in the organic samples also increased over time, whereas levels in the conventional tomatoes were unchanged. This difference may be related to the accumulation of organic matter in the organic treated plots.

A double-blinded randomized crossover study by Grinde-Pedersen et al.\textsuperscript{28} investigated differences between organic and conventional intervention diets and the effects on intake and excretion of quercetin, kaempferol, hesperetin, naringenin, and isorhamnetin. Of the five flavonoids, only quercetin content was significantly different between the organic and conventional intervention diets, as it was highest in the organic diet. With regards to flavonoid excretion in urine samples, both quercetin and kaempferol were significantly higher after consumption of the organic diet compared to the conventional diet. Manach et al.\textsuperscript{30} indicate that polyphenols’ bioavailability varies greatly. Although the total amount of polyphenols and their derivatives excreted in urine is roughly correlated with maximum plasma concentrations, because of numerous metabolic changes to these compounds, biomarkers of intake are not currently available. With regard to biomarkers of antioxidant status, Trolox equivalent antioxidant capacity (TEAC) was significantly decreased after consumption of the organic diet; other markers of antioxidant status were not different. The authors also cite previous studies in which TEAC was not changed with consumption of a flavonoid-rich diet.

Salicylic acid is another phenolic acid that has been examined. Its concentration in plants increases when they are infected by pathogens. Baxter et al.\textsuperscript{31} compared the salicylic acid contents of 11 organic soups to 24 non-organic soups. Salicylic acid was found in all of the organic soups, and in most of the non-organic soups tested. However, the organic soups had significantly higher salicylic acid contents compared to the non-organic soups.

Overall, the findings cited above\textsuperscript{16,25,28,29,31} support the hypothesis that organic crops contain greater levels of various phenolic acids, including some flavonoids. Still, the importance of balance between the intake and excretion of flavonoids is less clear.\textsuperscript{30}

**Food safety of organic versus non-organic foods**

**Pesticides – dietary exposure**

Another reason cited by consumers for selecting organic over conventional foods is that organic foods are safer because they do not contain any pesticide residues. While it is true that organic farming does not utilize synthetic pesticides, there is a lack of evidence to support that pesticide residues on conventional foods are necessarily harmful to the consumer. In the United States, the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA) are responsible for monitoring the pesticide levels in the food supply, and have created appropriate reference levels that are not to be exceeded due to concern of adverse health effects. An independent analysis of NHANES 1999 - 2000 data reported that an average 6 to 11 year old child is exposed to chlorpyrifos (an organophosphorus pesticide used on crops such as wheat, corn, and soybeans) at doses four times the dose the EPA considers acceptable for long-term exposure.\textsuperscript{32}

Curl et al.\textsuperscript{33} investigated organophosphorus (OP) pesticide exposure in 39 children ages 2-5 years in Seattle, Washington. Based on food diaries kept by their parents, the children were classified as consuming either a primarily organic or conventional diet. The children on conventional diets had significantly greater levels of urinary total dimethyl metabolites, a subset of OP pesticides, versus the children on organic diets. These results remained even after deletion of those children with residential OP pesticide use. While this study was not necessarily representative of Seattle’s general population, the results suggest that diet is the primary culprit for OP pesticide exposure in children.
Lu et al.\textsuperscript{34} took a longitudinal look at OP pesticide exposure in children. Twenty-three children, ages 3-11 years, submitted two spot daily urine samples during a study period where they first consumed their conventional diets, then substituted organic items into their diets, and finally returned to their conventional diets. Two OP metabolites, malathion dicarboxylic acid (MDA) and 3,5,6-trichloro-2-pyridinol (TCPY), were significantly lower in urine samples during the organic diet substitution period compared to both of the conventional diet periods. Both MDA and TCPY are pesticides commonly used on vegetable, fruit, and wheat crops. A more recent update by Lu et al.\textsuperscript{35} further supports the hypothesis that conventional foods are the primary source of children’s OP pesticide exposure. The 23 children from the prior study were followed over sampling periods during the summer, fall, winter, and spring. Organic diets were substituted during the summer and fall periods; at the end of the organic diet periods, OP urinary metabolite concentrations of MDA and TCPY were reduced to non-detectable or close to non-detectable levels. A seasonal difference was noted in the OP urinary metabolite concentrations, which appears to be consistent with intake of fresh fruits and vegetables during the year. Imported produce is likely more commonly consumed during the winter and spring seasons and is suspected to have higher OP pesticide residues compared to matched items eaten during the summer; this idea is supported in a report by the U.S. EPA, Office of the Inspector General.\textsuperscript{36} This report noted a significant change in residues and risk from imported versus domestic crops following the passage of the Food Quality Protection Act (1996).

Baker et al.\textsuperscript{37} evaluated pesticide residue data derived from the USDA’s Pesticide Data Program (PDP), the California Department of Pesticide Regulation’s ( DPR) Marketplace Surveillance Program (California EPA 1999), and from the Consumers Union (CU). Their aim was to analyze the frequency of detection of pesticides, detection of multiple pesticides, and pesticide levels in foods grown with various agricultural methods, including organic, conventional, integrated pest management (IPM), and foods certified as containing no detectable residues (NDR). IPM refers to a prevention-based approach to agriculture involving natural predators, pathogens, and parasites. NDR foods are analyzed to ensure that pesticide residues fall below a certain limit. For this study, the IPM and NDR foods were grouped together as they were considered to be equal. In terms of the frequency of detection of pesticide residues in fresh fruits and vegetables from all three databases, organic foods had significantly lower pesticide detection compared to IPM/NDR and conventional samples (Table 3). With regard to the detection of multiple pesticide residues, Baker et al.\textsuperscript{37} found a significantly lower percentage of organic samples with multiple residues versus IPM/NDR and conventional samples across all three data sets. When results from all three data sets were combined to analyze pesticide residue levels in 54 conventional-organic Crop Samples, Organic Foods

Pesticide Data Pairs (CPDP), 69% of the organic samples had significantly lower residue levels compared to conventional and IPM/NDR samples.

Overall, organic foods, especially fruits and vegetables, appear to have lower levels of pesticides when compared to conventional foods.\textsuperscript{37} Dietary intake seems to be the primary exposure to pesticides.\textsuperscript{33-35} Therefore, dietary substitution of organic products may be beneficial in terms of lowering OP pesticide exposure particularly in children.

**Pesticides – human health effects**

As previously noted, pesticides in the food supply are cause for concern; however, it is important to determine what the actual link is between pesticides and ill health. Given the difficulty of conducting randomized control trials to evaluate the effect of these potentially harmful chemicals and the issue of how to measure pesticide exposure, this topic remains quite controversial. Bassil et al.\textsuperscript{38} conducted a systematic review of the literature published between 1992 and 2003 and found adequate evidence to recommend reduced pesticide use. A positive relationship was seen between high and prolonged pesticide exposure and risk of several solid-tumor cancers, including brain, prostate, and kidney, along with Non-Hodgkin’s lymphoma and leukemia. Another review by Infante-Rivard and Weichenthal\textsuperscript{39} looked specifically at literature published between 1999 and 2004 that assessed childhood cancer risk with levels of either residential or parental occupation pesticide exposure. Fifteen of the 21 studies reviewed showed significantly greater risk of childhood cancer with pesticide exposure, leading the authors to conclude that there is at least some association between pesticide exposure and childhood cancer. However, the authors also note that it is unlikely that a 1:1 cause-and-effect relationship exists for any specific pesticide and cancer, but that cancer development is probably dependent on several factors, including genetics.

Carreon et al.\textsuperscript{40} investigated a possible connection between rural pesticide exposure and cases of gliomas, the most common type of brain tumor in adults. This epidemiological study focused on 341 female glioma cases compared to 527 controls, who completed interviews discussing lifetime agricultural pesticide exposure, specific pesticide exposure, and childhood pesticide exposure. Table 3. Frequency of pesticide residues in organic and conventional samples tested by three testing programs\textsuperscript{37}

<table>
<thead>
<tr>
<th></th>
<th>Pesticide Data Program</th>
<th>California Department of Pesticide Regulation</th>
<th>Consumers Union</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Samples</td>
<td>23%</td>
<td>6.5%</td>
<td>27%</td>
</tr>
<tr>
<td>Conventional Samples</td>
<td>73%</td>
<td>30.9%</td>
<td>79%</td>
</tr>
</tbody>
</table>
Organic Foods

years of pesticide use, and farm activities such as washing pesticide-contaminated clothes. No association was seen between pesticide use and glioma occurrence, including use of insecticides, herbicides, or fungicides, or performing various farm activities. Thus, exposure to various specific pesticides was not associated with increased risk of glioma.

In response to concerns that higher rates of breast cancer are found in California, the biggest agricultural state in the U.S., Reynolds et al. investigated whether there was a link between breast cancer incidence and areas of recent high agricultural pesticide use. The authors collected information on invasive breast cancer cases, pesticide use data, and census information to create data sets in census block groups in California. They found no connection between breast cancer incidence and women living in areas with recent high levels of agricultural pesticides.

However, Roberts et al. reported that pregnant women living near fields sprayed with organochlorine insecticides (dicofol and endosulfan) were six times more likely to give birth to children with autism spectrum disorders (ASD) than women living many miles from the treated fields. The closer the mother lived to the treated fields, and/or more pounds of insecticides applied, the greater the risk. Another recent study showed that children who were exposed prenatally to the OP pesticide chlorpyrifos had significantly poorer mental and motor development by three years of age and increased risk for behavior problems.

Lee et al. reported a strong, positive association between serum concentrations of organochlorine (OC) pesticides (oxychlordane and trans-nonachlor) and insulin resistance in nondiabetic adults. Chlordane, which was used as an agricultural pesticide on home lawns and gardens, was banned in the 1980s. However, the breakdown products of chlordane are still persistent in the tissue of fish, birds, and mammals, and are found in breast milk. Furthermore, Lee et al. cite Dougherty et al. when noting that pesticides banned for over two decades, such as chlordane, continue to be present at significant levels in the food supply. Lee et al. also suggest that these findings related to nondiabetic adults, coupled with their earlier findings in which prevalence of type 2 diabetes was strongly positively associated with lipid-adjusted serum concentrations of persistent organic pollutants (POPs), including OC pesticides and other polychlorinated biphenyls (PCBs), indicate further study of the relationship between dioxin and diabetes should be done. Findings from reviews have been mixed, with those that do not provide hard evidence of a link between pesticide exposure and negative health effects to reviews indicating a positive association between pesticide exposure and various cancers, and additionally, findings that suggest an association between pesticide use and various negative outcomes in high-risk populations such as pregnant women and children, as well as, other disease conditions. Given the length of time in which pesticides remain in the food supply, further investigations of this issue are warranted.

Pest infestation and product quality

Another aspect of food safety in organic versus conventional foods is pathogen infestation and the consequent quality of products. In the U.S., the FDA and USDA monitor pathogen outbreaks and contamination. The use of pesticides and insecticides are typically thought to be cost-effective in relation to decreasing crop loss. However, this is not necessarily the case as total crop losses due to pest infestation and damage almost doubled between 1945 and 1989, despite a ten-fold increase in insecticide use. Alterations in agriculture practices, including decreased use of crop rotation and crop heterogeneity, are considered partially to blame for the increase in crop losses. Crop rotations and cover cropping used in organic agriculture reduce soil erosion, pest problems, and pesticide use.

Pest and pathogen infestation can be problematic in both conventional and organic farming systems. In organic farming, pathogens and pests can be avoided by use of crop rotations and crop planting time. For example, winter wheat production in the northern U.S. can be timed to avoid infestation by the Hessian fly (Mayetiola destructor), which lives only as an adult for a few days. The USDA provides estimates of fly-free dates for growers sowing varieties that would otherwise be susceptible to this pest. Plant pathogens are frequently suppressed in organic farming systems by the enhanced microbial complexity and activity that are brought about by using soil amendments with organic materials such as composts and manure.

To minimize potential contamination of crops with various microbial pathogens, organic farmers who use raw animal manure on crops for human consumption must wait at least 120 days between manure application and harvest of crops. Loncarevic et al. evaluated the bacteriological quality of 179 samples of unwashed organic leaf lettuce in Norway. Thermotolerant coliform bacteria (TCB) were found in 8.9% of the samples, and were identified as E. coli. In four of the 16 samples containing E. coli, the contamination level was above that considered to be of acceptable bacteriological quality. L. monocytogenes was found in two samples; no samples contained E. coli O157 or Salmonella spp. Eight out of the 12 (67%) total farm producers were responsible for one or more of the positive samples. In this study, the farmers were given questionnaires to record information regarding production and fertilizer application; only 50% (6 of 12) of the questionnaires were answered. Proper adherence to recommendations from the Soil Association regarding manure treatment and storage in organic systems may help decrease the numbers of pathogens in stored manures used as fertilizers. From the questionnaire responses, it is not clear that appropriate procedures were followed by the farmers with regard to manure, which may account for these results.
Sagoo et al.\textsuperscript{53} investigated 21 different uncooked certified organic vegetables in the United Kingdom to determine their microbiological quality. Altogether 3200 organic vegetable samples were obtained from a wide variety of retailers, and analyzed for \textit{E. coli}, \textit{Listeria} spp., \textit{L. monocytogenes}, \textit{Campylobacter} spp., \textit{Salmonella} spp., and \textit{E. coli} O157. Forty-eight samples contained \textit{E. coli} (1.5%), and 11 of these samples (0.3%) contained levels greater than acceptable limits as established by the Public Health Laboratory Service (PHLS). Four of the six samples with \textit{Listeria} spp. (0.1%) contained levels greater than the acceptable limit. \textit{L. monocytogenes}, \textit{Salmonella} spp., \textit{Campylobacter} spp., and \textit{E. coli} O157 were not found in any samples. Overall, per the PHLS guidelines, only 15 (0.5%) of the analyzed samples were of unsatisfactory microbiological quality. In the U.S. (Minnesota), Mukherjee et al.\textsuperscript{54} reported that there was no statistically significant difference in \textit{E. coli} prevalence in certified organic versus conventional produce.

Johannessen et al.\textsuperscript{55} analyzed the bacteriological quality of organic iceberg lettuce produced in Norway with consideration of the application of organic bovine fertilizers, including 6 month-old firm manure and younger manure slurry. Soil with and without inorganic and organic fertilizers was analyzed for aerobic plate count (APC), TCB, and \textit{E. coli}, as were lettuce seedlings and lettuce heads that had been fertilized with the inorganic or organic fertilizers. Over the course of two trials conducted a year apart, no differences were detected in terms of the bacteriological quality of the lettuce.

Rossi et al.\textsuperscript{27} assessed mycotoxins and pest infestation in their study of organic versus non-organic wheat. Mycotoxins are secondary metabolites of mold and are largely toxic to humans.\textsuperscript{56} Concentrations of Ochratoxin A (OTA) were well below acceptable upper limits in both wheat samples, while deoxynivalenol (DON) was significantly lower in organic samples versus conventional. In this preliminary survey conducted in Italy, organic grains had more pest infestations compared to non-organic samples, along with a greater number of damaged kernels which was significantly correlated with the presence of live arthropods.\textsuperscript{27}

In California, Letourneau and Goldstein\textsuperscript{57} compared organic and conventional farms in relation to pest damage of tomato crops. Pest damage did vary between farms, but did not correlate with whether the land was farmed with conventional or organic methods. No differences were found between the two farming systems in terms of damage to tomato crops. The authors note that their findings do not uphold the idea that withdrawal of synthetic insecticides leads to greater crop losses due to pest damage.

The findings from Rossi et al’s preliminary survey\textsuperscript{27} suggest that organic foods may be at higher risk for pest infestation since they do not have protection from the post-harvest pesticides, fungicides, or insecticides used in producing conventional foods. However, results from Letourneau and Goldstein\textsuperscript{57} contradict these findings. Furthermore, additional evidence indicates that the use of manure or similar organic fertilizers does not negatively affect the bacteriological quality of crops.\textsuperscript{51,53,55} Letourneau and Goldstein\textsuperscript{57} found that arthropod communities on organic farms contained a greater diversity of species and a greater abundance of natural enemies (predators and parasitoids) of pest species. Insect pests can be kept in check by greater diversity of non-herbivorous arthropods.\textsuperscript{49} Also, increasing application of insecticides does not appear to help protect conventional crops.\textsuperscript{47,48}

### Conclusions and implications for practice

The aforementioned data indicate that as compared to conventional crops, organic crops have lower nitrate concentrations; likely higher nutrient concentrations of various vitamins and minerals such as vitamin C; and greater amounts of phenolic acids, omega-3 fatty acids, and conjugated linoleic acid. The lower crude protein found in organic crops may be balanced by the trend for greater essential amino acid content. Organic crops also have decreased pesticide residues. Given the trend of a negative link between pesticides and overall health, the decreased exposure with organic crops seems advantageous, especially for children and at-risk populations such as pregnant women. The bacteriological quality of organic crops appears to be on par with conventional crops, and indeed, there is evidence that the greater diversity of species associated with organic farming is of benefit in controlling pest species.

It is important, yet extremely difficult, to take into consideration all of the multiple variables that affect farming outcomes, including climate, soil composition, rainfall, wind, and sunlight. Certainly, more research is necessary to define the nuances in nutritional content between the different agriculture systems, as there are still many questions and multiple areas that warrant further investigation.

It is also important to consider the higher cost associated with organic food items.\textsuperscript{58} Due to supply and demand, organic products tend to be more expensive than their conventional counterparts with regard to market cost. It is critical to consider all of the factors that affect what drives individual consumers, as those on a limited budget may not have the ability to pay for higher-priced organic items, regardless of whether or not they are also considering the environmental cost of conventional agriculture. Compared to conventional produce, organic produce can cost 10-30% higher whereas animal products and processed foods may be up to 100% more.\textsuperscript{58} Certainly, locally grown organic products, when in-season, may be comparable in cost to conventional products. Finding local sources for fresh produce and other organic products is one way consumers can play a role in conserving energy and water, helping to safeguard agricultural terrain, and to avoid paying more for groceries despite the rising cost of energy.\textsuperscript{58} Highlighting and promoting farmers’ markets and other opportunities for consumers to find comparably priced,
locally grown items are essential, especially for those of lower economic standing. In addition, the nutritional quality of any food item is affected by the length of time between harvest and consumption, and vitamin contents may diminish over the long journey to the grocery store. At this point in time, the evidence suggests that organic foods are more nutrient dense with regard to the specific nutrients cited above, and may in fact be safer in terms of pesticides and related risks. The higher cost of organic foods may be assuaged as the market share steadily grows, and as farmers markets and locally-grown items become more prevalent and utilized. Individuals may also choose to grow some of their own produce in home gardens. Personal preferences and values should guide the consumer, keeping in mind the important rule of variety and moderation when selecting their diet.60

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References


**Functional Foods**

*The Benefits of Soy*

Allegra Burton, MPH, RD

Whether you’re a vegetarian or an omnivore, soy is a healthful, versatile addition to anyone’s diet. Naturally low in fat and cholesterol free, soy is a complete protein and provides a number of healthful benefits, including cardiovascular and bone health. Whole soybeans contain approximately 40% protein, 33% carbohydrate, and 22% oil. Soybeans also contain vitamins, minerals, fiber, omega-3 fatty acids, isoflavones, and other nutrients. Soy is a versatile addition to a variety of meals and snacks and is readily available in a number of forms, from tofu and soymilk to soy nutrition bars and soy burgers.

**Soy protein**

Soybeans are high in protein: 38-45% protein by weight. Soy protein is one of the few plant-based proteins that contains all nine essential amino acids in quantities that meet human needs, and is therefore considered a complete protein. Soy protein is also the only plant-based protein that is equivalent to animal sources of protein. The protein digestibility-corrected amino acid score (PDCAAS) for soy protein is 1.0, the highest possible score, and is equivalent to that of eggs.

**Vitamins and minerals**

Soy is rich in riboflavin, thiamin, folate, and vitamin K. One quarter cup of roasted soy nuts provides 0.325 mg of riboflavin, 0.184 mg of thiamin, 88 mcg of folate, and 15.9 mcg of vitamin K.1 Soy oil is a source of vitamin E, containing 1.25 mg per tablespoon. Soy is also a good source of minerals, including potassium, iron, magnesium, manganese, phosphorus, zinc, copper, and selenium, and one quarter cup of roasted soy nuts provides 587 mg of K+, 1.70 mg of Fe, 98 mg of Mg, 0.939 mg Mn, 279 mg of P, 2.05 mg of Zn, 464 mcg of Cu, and 8.3 mcg of Se.1

**Soy isoflavones and equol**

Soy is rich in phytochemicals termed isoflavones. Soy isoflavones, also known as phytoestrogens, are plant-based compounds with antioxidant benefits and may enhance the immune system.2 The term phytoestrogen is a confusing label since isoflavones exert both estrogenic-like and non-estrogenic-like actions, and have many other mechanisms of action.3 These bioactive phytochemicals are thought to be responsible for some of soy’s health benefits in conjunction with soy protein.

The three main forms of soy isoflavones are genistein, daidzein, and glycitein. Some people have the ability to convert daidzein to equol (an intermediary metabolite of the isoflavone daidzein), while others cannot. This difference in ability may explain why some individuals’ responses in soy studies differ, as equol is the most potent antioxidant and has the most affinity for estrogen receptors among the isoflavones and their metabolites.4

**Soy and heart health**

Research has shown that consuming soy may help reduce elevated blood cholesterol levels as well as lower blood pressure. Both soy protein and soy sterol and stanol esters have FDA-authorized heart health claims backed by numerous clinical trials.5,6 According to the FDA, incorporating 25 grams of soy protein per day as part of a balanced diet low in cholesterol and saturated fat may reduce the risk of heart disease. The FDA heart health claims are based on the cholesterol-lowering effects of soy protein and sterols/stanols.

Soy has also been studied for other potential cardiovascular benefits. Some research shows that soy dietary factors may improve blood pressure, endothelium-mediated vasodilation, arterial compliance, and atherosclerosis. In contrast, other findings show no benefits for blood pressure and endothelium-mediated vasodilation or cholesterol-lowering effects.7 Results vary depending on the soy components studied, populations selected, compliance, and equal production capability. The consensus is that soy protein and sterols decrease serum LDL-cholesterol by approximately 3-5% and 10% respectively.8,9

Jenkins et al. showed that hypercholesterolemia could be managed successfully through a portfolio diet that included soy foods and plant sterols (22.5 g soy protein and 1.0 g sterol per 1000 kcal) when compared with a statin drug in a four-week metabolic study.10 The study found that the portfolio approach resulted in reductions in LDL-cholesterol levels similar to those achieved with first generation statin drugs. In follow-up research, this group compared data from the metabolically-controlled study to a real-world one-year intervention using the portfolio diet, and found that the participants who were compliant and followed the portfolio diet (~33%) had reductions in LDL cholesterol levels that were greater than 20% at one-year, which were similar to the first generation statin drug results in the first study.11

The American Heart Association (AHA) says that while soy protein and soy isoflavones do not appear to have clini-
cally significant effects that are superior to those of other proteins for heart health, soy products are generally beneficial because of their overall nutrient profile. The 2006 AHA Diet and Lifestyle Recommendations suggest that eating soy foods in place of animal products, which can be high in saturated fat and cholesterol, may benefit cardiovascular and overall health. Soy foods are a good recommendation for anyone interested in maintaining heart health, by adding plant-based sources of protein and other nutrients to their diets.

Soy and bone health

A review of fifteen clinical trials that looked at the effects of isoflavones or isoflavone-rich soy protein on bone mineral density demonstrated that soy may help reduce bone loss and prevent osteoporosis. Most trials were conducted for one year or less and involved fewer than 30 participants per group. The findings from these studies are inconsistent; however, they generally suggest that isoflavones reduce bone loss in younger, postmenopausal women. Similarly, epidemiologic data of Asian populations generally show that isoflavone intake is associated with higher bone mineral density. The clinical data suggest that an intake of approximately 80 mg/day of isoflavones is needed to achieve skeletal benefits, whereas the epidemiologic data suggest lower amounts are effective.

An epidemiological study on the relationship between the risk of fracture and soy intake found that soy food consumption was associated with significantly lower risk of fracture, especially in the early years of menopause. In further research supporting isoflavones and bone health, a meta-analysis of nine studies found that isoflavone intervention significantly inhibited bone resorption and stimulated bone formation.

Research in this area is ongoing and although soy foods and soy isoflavones should not be used as substitutes for osteoporosis medications, nutrition and healthcare professionals can feel confident in recommending soy foods to postmenopausal women concerned about bone health.

Sources of soy

Consumers have many food choices for including soy in their diets. In addition to traditional soy foods such as tempeh, tofu, and edamame, there are soy nutrition bars, shakes, soymilk, yogurt, burgers, crumbles, hotdogs, nuggets, sausages, pasta, salad dressings, roasted soy nut butter, snack chips, roasted soy nuts, and sterol-fortified spreads and juice. For heart health benefits, it is reasonably easy to consume the FDA-recommended 25 grams of soy protein per day as part of a diet low in saturated fat and cholesterol by choosing from these many combinations. Foods made from whole soy, such as soymilk, tofu, soy nuts, and whole soy nutrition bars provide additional benefits as they contain all of the naturally-occurring nutrients found in whole soybeans, including high-quality protein, fiber, unsaturated fats, vitamins, minerals, and isoflavones.

Traditional soy foods defined

Some consumers may shy away from eating certain traditional soy foods because they are uncertain of what they are. Here are some brief definitions:

**Edamame**: Fresh green soy beans harvested before they are fully mature. Served steamed or boiled.

**Soy sprouts**: Prepared similarly to other bean sprouts; good source of vitamin C.

**Tofu**: The liquid from finely ground and squeezed soybeans is curdled (often with calcium salts, thus calcium-set) similar to the process of making cheese; hence the name bean curd.

**Soymilk**: This is the liquid removed from finely ground and squeezed soybeans; it is used similarly to cow’s milk.

**Okara**: The pulp left after squeezing finely ground soybeans; a rich source of fiber.

**Tempeh**: Whole cooked soybeans fermented with a grain, frequently rice or barley, and a mold culture; results in a firm cake that can be used like meat in stews and spicy dishes.

**Miso**: A fermented soy bean paste made from whole soybeans, salt, grain, and a culture; used for soup bases and flavoring.

**Soy sauce**: Also called shoyu; cooked whole soybeans are fermented with a mold and aged in a salty brine for 12 to 18 months. (Soy sauce is not a source of soy protein.)

**Natto**: Fermented cooked whole soybeans incubated either in straw (traditionally) or in plastic bags (commercially). Natto is traditionally eaten for breakfast, seasoned with soy sauce and served over rice.

Take home message

Soybeans are both nutrient dense and energy dense. In addition to high-quality protein, fiber, a balanced omega-6/omega-3 fatty acid ratio, and vitamins and minerals, soy contains health promoting phytochemicals and provides benefits beyond nutrient support. Soy is versatile and available in many forms, and is an excellent plant-based source of protein and other nutrients for healthcare professionals to add to their own diets and to recommend to patients and clients.
**Functional Foods**

Discover how easy it is to add soy to your diet - pour soymilk on your cereal, stir-fry some tofu, add soy crumbles to a casserole, or snack on a handful of soy nuts - and take advantage of soy’s health benefits and versatility.

Allegra Burton, MPH, RD is a health educator, committed to helping people lead healthier lives through nutrition education and awareness. Allegra has extensive experience as a consultant, clinical, and private practice dietitian, and as a public speaker and writer. Contact Allegra at ABurton@pharmavite.net or 818-221-6200.

**References**

What the science says about CAM and fibromyalgia

According to reviewers who have assessed the research on CAM and fibromyalgia, much of the research is still preliminary, and evidence of effectiveness for the various therapies used is limited.

- Research on acupuncture—stimulation of anatomical points with thin metallic needles—for fibromyalgia has produced mixed results. One review article notes that three studies found some evidence to support the use of electroacupuncture (in which the needles are pulsed with electric current). However, the effects of electroacupuncture in these studies were mostly short lived, and two studies of traditional acupuncture had negative results.

- Some researchers believe that low levels of magnesium may contribute to fibromyalgia. However, there is no conclusive scientific evidence that magnesium supplements relieve fibromyalgia symptoms. Two small studies had conflicting results.

- A review of the research on massage therapy for fibromyalgia notes only modest, preliminary support. Two studies had some positive findings, but two others found either no benefits or only short-term improvements.

- Supplements containing the amino acid derivative SAMe are used for a variety of conditions. Although several small studies of SAMe for fibromyalgia have had mixed results, there is some evidence of a benefit. Reviewers conclude that more research is needed.

- Finally, according to reviewers, research evidence is insufficient to draw conclusions about the effectiveness of other CAM treatments—biofeedback, chiropractic care, hypnosis, and magnet therapy—used for fibromyalgia.

NCCAM research on fibromyalgia

The National Center for Complementary and Alternative Medicine (NCCAM) funds clinical trials that look at CAM for fibromyalgia. Recent projects include studies of:

- The effects of tai chi on fibromyalgia patients’ musculoskeletal pain, fatigue, sleep quality, psychological distress, physical performance, and health status
- Brain-imaging techniques for determining whether acupuncture relieves pain due to fibromyalgia
- The effectiveness of a form of electroencephalograph (EEG) biofeedback in treating fibromyalgia

If your patients are considering CAM for fibromyalgia

- If considering a practitioner-provided CAM therapy such as acupuncture, encourage them to check with the insurer to see if the services will be covered. Although acupuncture treatment is generally safe, complications can result if needles are not adequately sterilized or if the treatment is not properly delivered.
Fibromyalgia

- If your patient is considering dietary supplements, keep in mind that they can act in the same way as drugs. They can cause medical problems if not used correctly or if used in large amounts, and some may interact with prescription medication.
- Encourage patients to tell all their health care providers about any complementary and alternative practices you use. Give them a full picture of what you do to manage your health. This will help ensure coordinated and safe care.

Selected References


Adapted from the National Center on Complementary and Alternative Medicine (NCCAM) At A Glance Fact Sheet of the same name. Available at: http://nnccam.nih.gov/health/pain/fibromyalgia.htm. The NCCAM publication is not copyrighted and is in the public domain. Accessed 09/18/2008.
CPE Objectives and Questions
Organic Foods: Are They a Safer, Healthier Alternative?

Continuing Professional Education Activity
Approved for 2 hours of continuing professional education credit.

After reading this CPE article, the food and nutrition professional will be able to:

1. Identify the utilization patterns and prevalence of consumption of organic foodstuff.

2. State the qualifying standards that define and differentiate organic foodstuff from non-organic items.

3. List the macro and micro nutrient content differences between organic and non-organic food items.

4. List the phytochemical content differences of organic versus non-organic plant products.

5. Delineate the food safety concerns of organically produced food products.

Questions:

1. True/False: In the past 5-10 years, market share of organic foods has nearly doubled, totaling more than 15 billion dollars in 2006.

2. True/False: Compared to organic milk, conventionally produced milk is higher in omega-3 fatty acids.

3. True/False: Organic foods are nutritionally inferior due to the lower total crude protein and essential amino acid profile.

4. True/False: There is an association between pesticide exposure and incidence of chronic diseases such as cancer, autism spectrum disorders, obesity, and insulin resistance.

5. True/False: Use of herbicides, insecticides, and pesticides decreases the risk of crop loss consequent to pest infestation.

6. True/False: Organic farmers rely on crop rotation, crop planting time, and cover cropping to reduce pest and pathogen infestation while promoting soil conservation and environmental sustainability.

7. Which of the following is NOT true about organic foods:
   A. Use of synthetic pesticides and/or fertilizers is prohibited
   B. Can not be genetically modified or irradiated
   C. Animal derived products are free of growth hormone and antibiotics
   D. Are less expensive and nutritionally inferior

8. Which compounds are higher in organically farmed produce (fruits & vegetables) versus conventionally grown:
   A. Omega-6 fatty acids
   B. Total crude protein
   C. Saturated fat
   D. Vitamin C, iron, magnesium, phosphorous, and phenolic acids

9. Which is not a reason consumers cite for preferring organically cultivated foods versus conventionally grown products:
   A. Greater nutritive value
   B. Reduced exposure to pesticide residue
   C. Lower cost
   D. Environmental protection and sustainability

10. Which phytochemicals are purportedly higher in organically cultivated foods and foodstuffs:
    A. Organophosphorous compounds
    B. Nitrosamines
    C. Sulforphane
    D. Quercetin, kaempferol, and salicylic acid

Instructions to receive credit:

1) Read the article, “Organic Foods: Are They a Safer, Healthier Alternative?”

2) Answer the following questions. For each question, select one best response. Compare your answers to the answer key on page 38.

3) Mail, fax or e-mail the following information to Annie Griffin, RD, LD: article title, request for CPE credit, name, address, telephone number, e-mail address, and ADA member registration number.
   Annie Griffin, RD, LD
   13611 Fernlace Court NW
   Pickerington, OH 43147
   Phone: 740-927-0773
   Fax: 1-877-614-4188
   ahsugriffin@aol.com

4) Once this information has been received, Kathy will e-mail verification of completion for the CPE credit. Complete and retain the certificate on page 79 for your records along with the verification in case you are audited by CDR.

FALL 2008 - Organic Foods                  EXPIRATION DATE: 09-09

COPY I: COMPLETION VERIFICATION
Please obtain a separate Certificate of Completion Form for license verification and your own records. You should record each session on your Learning Activities Log (Step 4), and retain a completed form for your file in the event you are audited by CDR.

Continuing Professional Education

Certificate of Completion
American Dietetic Association/NCC- DPG

Title of Program

Participant Name

RD/DTR ID Number_____________

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CDR Accredited Provider # AM003
Sarah Harding Laidlaw, MS, RD, CDE
Retain original copy for your records
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COPY II: LICENSE VERIFICATION
Please present a completed form to your Licensure Board upon request.

Certificate of Completion
American Dietetic Association/NCC- DPG

Title of Program

Participant Name

RD/DTR ID Number_____________

Date Completed

2.0 CPEUs Awarded _____ CPE Level: II

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