Organic Foods and Your Nutritional Health

Linda B. Bobroff - May 2009

Note to the educator: These talking points include some in-depth information about the topic, including descriptions of research studies conducted to assess the relative nutritive value of organic versus traditionally grown foods. Some audiences may be interested in this level of detail while others may want the bottom line results only (which often are somewhat equivocal …); you will need to assess your particular audiences and present as much as you believe they want to hear. I thought it would be better to include too much rather than too little information since some of our clientele really do want to know about research behind the recommendations.

Notes to you are in italics and bracketed. Questions for the participants and discussion items are in bold.

You are welcome to put your name and county on the title slide; please keep the acknowledgement slide as part of your presentation. Thank you.

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| Slide # | Talking Points |
| 1  Title Slide | [Introduce the talk/workshop.]  Organic foods are becoming more a part of mainstream food consumption. It’s surprising how little we know about the nutritional value of organic foods compared with conventionally grown foods. But let’s explore what we DO know about this important topic. |
| 2  Overview | [Review the topics that you will cover.] |
| 3  Organic Foods in the Marketplace | You can see here that organic foods are becoming a larger segment of the food industry in the U.S. According to the Institute of Food Technologists [a national trade organization] sales of organic foods increased almost 20% each year between 1990 and 2005! The Organic Trade Association estimates sales of $20 billion in 2007.  **Have you changed your buying habits when it comes to organic foods? In what way? [Discuss as appropriate.]** |
| 4  Organic Foods in the Marketplace | Most of the purchases of organic foods are fruits and vegetables. **Have you noticed an increased number of organic fruits and vegetables available in your supermarket?**  Milk and dairy products are the next largest segment of the organic food market. In recent years there have been times when organic milk was not available in stores due to an inadequate supply to meet the increased demand. We’ll talk mainly about fruits and vegetables in our discussion about nutritive values of organic foods since that is where most of the studies have been done and because fruits and vegetables make up the largest market for organic foods. |
| 5  Organic Foods in the Marketplace | There are a number of reasons why people choose to buy organic foods. **Can you think of some?** *[Give them a chance to answer. Here are some possible reasons: fear of pesticides, antibiotics, hormones or other additives; desire to support sustainable agriculture; belief that organic foods are nutritionally superior; sense of superiority – “elitism” – when purchasing organic foods]*  *[The next few slides have questions about their beliefs about organic foods; you can use the answer sheet provided at the end of this document and have them fill it out before and after the slide set, or just discuss the questions.]*  Let’s start by thinking about our own beliefs about organic foods. |
| 6  Do You Agree or Disagree? | *[The following instructions are appropriate if you are using the written pre/post survey; if you are not, just discuss each of the questions on slides 6-10 with the group.]*  Write your answers in the PRE column for each of the five statements on the next few slides. We’ll come back to this after the session and fill it out again. |
| 11  Understanding “Organic” | A grass roots agriculture movement began in the 1940s to produce foods without chemical inputs such as pesticides. |
| 12  Understanding “Organic” | With the increased demand for organic foods by consumers in later decades, the **industry** requested development of federally-regulated standards. This led to the **Organic Foods Production Act of 1990** which established the **National Organic Program** **(NOP)** and the **National Organic Standards Board (NOSB)**.  The NOSB developed standards for production of organic foods and NOP standards were adopted by the USDA in October 2002. |
| 13  Understanding “Organic” | This definition of organic agriculture was developed by the NOSB in 1995.  Certified organic growers, handlers and processors must be compliant with the standards set by the National Organic Program. Organic farms must manage their operations according to the organic standards **for three years** **before their products can include the organic label.**  University of Florida IFAS Extension produces a radio show, *Gardening in a Minute*. They did a show about organic gardening; let’s see what they had to say about it.  *[Note: This is a podcast; the MP3 audio file must be in the same folder as the PowerPoint file for it to play.]* |
| 14  NOP Standards | Although farmers may **not** use **preventive** synthetic drugs, they MUST treat sick animals until they are well with appropriate medications even those that are prohibited. But, they **cannot** sell products from these animals with the organic label.  Growth-promoting hormones include rBGH – recombinant bovine growth hormone. Keep in mind that the Food and Drug Administration (FDA) has stated that milk produced with or without the use of rBGH is essentially the same, meaning that any differences are so small that they can’t be detected;still the NOP prohibits the use of rBGH in cows whose milk will be sold as organic. |
| 15  NOP Standards | Any ingredient that is high risk to humans, livestock, fish or other organisms may not be in pesticides used on organic farms. Pesticides used generally are extracts from plants or microbes, minerals, or live beneficial organisms.  Organic producers must attempt to manage pests using other methods, like physically picking pests off produce, before using even approved pesticides. Sometimes pesticide residues are unavoidable. For example there can be contamination from adjacent farms, but the allowed amount is very low on organic produce.  *Gardening in a Minute* focused on Integrated Pest Management or IPM; let’s see what they had to say. |
| 16  NOP Standards | Due mainly to concerns about contamination from the bacterium E. coli, there are strict regulations for organic producers in the **timing** of manure application. The time period depends on the crop, with longer times needed after applying manure to crops that touch the ground like zucchini or potatoes than for crops like corn that do not. |
| 17  NOP  Standards | Many people are concerned about these types of food additives; they usually are not found in organic foods. |
| 18  Organic Label | Only **certified organic producers** are allowed to use the organic seal.  For single ingredient products the label is simple – if the product is labeled organic then it is 100% organic. But with multiple-ingredient products, there can be four designations:   * **100% organic** means the 100% of the ingredients are certified organic (does not include water or salt). * **Certified organic** means that 95% of the ingredients are certified organic, also excluding salt and water. * **Made with organic ingredients** means that at least 70% of the ingredients are certified organic, again excluding salt and water * **If no label claim is made** then less than 70% of the ingredients are certified organic.   Only 100% or certified organic foods can use the **USDA Organic seal** on the food package! |
| 19  Research Interests | The two basic research questions are:   * Do organically produced foods contain more (or less) of certain nutrients than conventionally produced foods? * If there are differences, does consumption of these foods affect human health by affecting levels of these nutrients in humans and/or by reducing risk for acute and/or chronic diseases? You can probably guess that it’s **much harder** to show an effect on health than it is to measure nutrient levels in foods, although that also gets a bit tricky. |
| 20  Antioxidants in Kiwifruit | *[Note: With all of these research studies, include only as much information as your audience seems interested in.]*  This is one of several studies that have been done at the University of California at Davis. Problems with early studies include variations in cultivars used, soil type differences, irrigation and harvesting practices, different methods of sampling and analysis. One way to address these concerns is to use long-term research plots that are managed consistently over time. One such facility is the UC-Davis Long-term Research on Agricultural Systems project (LTRAS).  The kiwis were grown on the same farm about a mile apart so that the weather conditions and type of soil would be about the same. The fruits were tested five times after harvesting up to 120 days.  The levels of sugars and organic acids were similar in the two groups indicating that the **taste** would also be similar. The organically grown kiwis had higher levels of potassium, calcium and magnesium, all important minerals. Also ascorbic acid (vitamin C) and the level of polyphenols were higher in the organic fruit. However, the ascorbic acid levels decreased over the storage time in all fruit and the **differences in vitamin C content between the organic and traditionally grown kiwis were not significant after one week at 20 degrees C.**  **Why do you think researchers are interested in phenolic compounds? Discuss. [***Here is some information that you may want to include:**Phenolic compounds (sometimes called polyphenols) may play a role in protecting organically grown plants from invading plant pathogens by acting as chemical barriers. They also may be significant for human health as well. Polyphenols, which include include flavonoids and phenolic acids, are one of four types (and the most abundant) of secondary plant metabolites (phytochemicals). The other three types of phytochemicals found in plants are terpenoids, alkaloids, and sulfur-containing compounds.]* |
| 21  Antioxidants in Pears and Peaches | This study was done over a three-year period, at an experimental orchard in Rome. Researchers followed European Union (EU) organic regulations. Tilled soil of the same age (five years) was used for both groups. There were no differences between the experimental groups in color or size.    **Vitamin E** (alpha and gamma tocopherol) was higher in conventional peach samples, while alpha tocopherol only was higher in organic pears.  **Ascorbic acid** wassignificantly higher in organic vs conventional **peaches**, but the differences were very small and values low (4 to 5 mg/100 g = 1 medium peach). Ascorbic acid content of **pears** in both groups was very low (~1 mg/100g = 2/3 of one pear), and not different.    Total phenolic activity was higher in organic peaches and pears. |
| 22  Antioxidants in Yellow Plums | This study was conducted by same research group as previous, in Italy.  Three types of organic cultivation used were tilled soil, soil covered with a substance called trifolium, and soil covered with natural meadow.  The **ascorbic acid** content was low (1.6 to 2.2 mg/100 g) and not different among the groups. Natural meadow organic fruit was higher in **beta carotene** (a pre-vitamin A compound)**,** but significance not reported so we don’t know if the differences were just due to chance.  Conventional plums were higher in **alpha tocopherol** (vitamin E)compared with organic plums grown on tilled soil. The highest levels of both **alpha and gamma tocopherol** were found in the natural meadow organic group (statistically significant). Total **polyphenols** weresignificantly higher in conventional fruit. Plums grown on natural meadow had the highest levels of vitamin E among the organic crops.  Results from this study indicate that the **type of soil management** used may be more important than organic versus conventional farming practices in influencing the concentration of certain nutrients in the fruit. |
| 23  Antioxidants in Tomatoes | This study, which was conducted in France, is **one of the first *in vivo* feeding studies** of this type in humans. The researchers measured differences in nutritional quality of the tomatoes grown conventionally and organically, and then examined the effect on nutrient levels in people who consume the puree. Tomatoes were of interest because it is second most consumed vegetable in Europe (except in Italy it is #1), and because tomatoes and their products are the main sources of the carotenoid lycopene in Western countries. Lycopene may help prevent age-related macular degeneration.  Three tomato varieties were grown at a research center (conventional) and at an organic farm within 1 km (a little over ½ mile) of each other in similar environmental conditions. They were all grown in plastic tunnels. The fresh organic tomatoes consistently had higher concentrations of vitamin C, beta carotene and lycopene, and all but one polyphenol. The organic puree was higher in vitamin C and the polyphenols, but not the carotenoids.  Twenty young nonsmoking females, 21-39 years consumed 100 g/day of tomato puree for three weeks. They did not know which treatment group they were in. Then they were told to avoid tomato products for three weeks (depletion period). Blood was taken before and after supplementation and after depletion. After three weeks of consuming the tomato puree, **blood levels of vitamin C and lycopene increased similarly in both groups**.  **So what would you say is the importance of this study (or is it important) as we think about potential health impacts of organically produced produce?** [*Points for discussion: If organic produce has higher levels of important nutrients, and this shows up in higher levels of the nutrients in our bodies, then maybe eating organic produce can have a positive impact on our nutritional status and health. However, previous studies found* ***inconsistent results*** *in effects of production method on carotenoid and vitamin C levels, in tomatoes, carrots, and other vegetables. Carotenoid content in f/v depends strongly on light exposure and temperature, especially in tomatoes].* |
| 24  Flavonoids in Tomatoes | In this study tomatoes were grown by conventional and organic methods at UC-Davis. The researchers analyzed dried tomato samples that were saved over a ten-year period. They found statistically higher levels (P<0.05) of two flavonoids [quercetin and kaempferol] in the organic tomatoes. The levels of the flavonoids in the organic samples increased over time which was explained as an effect of increasing amounts of organic matter in the soil and also of reduced use of manure over the 10-year period (as the soils reached equilibrium levels of organic matter).  This was the **first report of changes in tomato nutrients over time** in organic farming systems. The researchers suggest that the differences between conventionally and organically grown tomatoes are due to the differences in nitrogen quantity and behavior in the soils and that over-fertilizing the soil in either system can reduce the flavonoid concentration in tomatoes and the health benefits of this food.  *[Note: Flavonoids are phenolic secondary plant metabolites with potent antioxidant activity in vitro. Flavonoids may protect against cardiovascular disease (epidemiological studies) and possibly cancer and dementia (less evidence). Mechanism of action in these health-promoting activities is not understood and may or may not be related to their antioxidant effects. In plants, metabolites like flavonoids function as part of the plant’s defense mechanisms and some are primary pigments that attract pollinators and seed dispersers.]* |
| 25  Comparison of Nutrients Levels | This paper reviewed 150 studies that examined the quality of foods grown with different production methods published between 1926 and 1994. |
| 26  Nutrient Levels in F/V/G | This paper reviewed 41 studies that compared crops grown with organic fertilizer or by organic farming systems with those produced by conventional farming systems. Overall organic crops contained 27% more vitamin C, 21% more iron, 29% more magnesium and 14% more phosphorus. |
| 27  Recent Review | Four scientists reviewed existing published studies to identify those that met their standards of scientific validity. They considered experimental design, focus of the study, how organic farming was defined, and number of years the organic field was managed organically. Among the high quality studies, they reviewed the analytical methods used to measure nutrient levels and a number of nutrient comparisons were eliminated in this screening process. After the screening and selection process, they ended up with 11 nutrients that they were able to compare between organic and conventional foods: 4 measures of antioxidants (total phenolics, total antioxidant capacity, quercetin, kaempferol); vitamins C and E and precursors of vitamins A; the minerals potassium and phosphorus, nitrates (higher levels of nitrates are a nutritional **disadvantage**), and total protein.  Of the 236 valid matched pairs across these 11 nutrients, the **organic foods were nutritionally superior in 145 matched pairs (61%)** and the **conventional foods were more nutrient dense in 87 matched pairs or 37%**. Some of the differences were fairly great, especially in the cases in which the organic foods contained higher levels of a given nutrient.  The organic samples had higher levels of polyphenols and antioxidants in ¾ of cases. Having higher levels of these compounds could be a nutritional and health advantage for people consuming these foods.  Most of the cases of conventional foods having higher nutrient levels involved potassium, phosphorus, and total protein, which are not nutrients of concern for most people.  The authors anticipate that within a few years there will be 20 to 30 additional studies completed and published and the data will be added to the database of The Organic Center and used to refine the analysis of the differences between organic and conventional foods. |
| 28  Understanding Higher Nutrient Levels | Two major hypotheses have been proposed to explain the increases in organic acids and polyphenols in organically grown foods:   * **Impact of fertilizers.** Conventional fertilizers provide lots of nitrogen and may accelerate the growth and development of plants. With increased focus on growth, fewer plant resources are available for production of secondary metabolites like polyphenols. * **Response to stressful environments.** Organically grown foods have to devote greater resources to protecting themselves from stresses such as insects, weeds, and pathogens by producing protective substances such as polyphenols. |
| 29  Need for Research | In 2004, the **First World Congress on Organic Food** highlighted the need for valid, reliable, and objectives studies to increase knowledge about difference between organic and conventional foods. I think we’ve seen that there are many studies being done to address the nutrient content of organic foods and hopefully in the near future we will see additional studies of the impacts of the differences in nutrient quality of organic foods on human health. Those studies are more challenging and longer term so we may need to be patient in waiting for them. |
| 30  Take Home Message | This can be our take home message today. We’ve seen that some research finds higher levels of specific nutrients in certain organically grown foods, while others show no differences or vary in the opposite direction.  We talked about various reasons that people may choose to purchase organic foods. Right now, nutrient content does not appear to be a **compelling** reason to buy organic foods, especially if they are more expensive. You may want to eat greater quantities of certain fruits and vegetables to get added nutrients. However, you may choose organic foods for one of the other reasons that we mentioned if these are important to you.  *[You can show the cartoon slides - a good time for everyone to get up and stretch and/or move to the music.]*  *[If you are using the pre/post survey, have them fill it out now, and then ask for questions. Otherwise, just ask for questions.]* |

**Nutritive Value of Organic Foods**

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| **PRE** | **Strongly**  **Agree** | **Agree** | **Not Sure** | **Disagree** | **Strongly**  **Disagree** |
| All organically-produced foods are nutritionally superior to similar conventionally-produced foods. |  |  |  |  |  |
| Organically-produced and conventionally-produced foods are essential the same nutritionally. |  |  |  |  |  |
| Some organically-produced foods are nutritionally superior to similar conventionally-produced foods. |  |  |  |  |  |
| The nutritional superiority of organically-produced foods results in health benefits for consumers who eat them. |  |  |  |  |  |
| Certain plants grown organically contain higher levels of antioxidants than similar plants grown conventionally. |  |  |  |  |  |

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| **POST** | **Strongly**  **Agree** | **Agree** | **Not Sure** | **Disagree** | **Strongly**  **Disagree** |
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