factors associated with eating behavior. Stable isotopes can be used to identify individuals having omnivore, lacto-ova and vegan diets, as well as sugar intake [Choy K et al. *J Nutr* 2013]. Dietary biomarkers for protein, fish oil, citrus fruit, and garlic can objectively assess dietary consumption without the bias of self-reported dietary intake errors, but assessments of their precision for most biomarkers are still in their infancy [Hedrick VE et al. *Nutr J* 2012].

Dr. Schoeller concluded that traditional dietary methods are inaccurate, imprecise, and differentially biased, while the technology enhanced traditional methods are more accurate and precise, but probably also differentially biased. Biosensors are less differentially biased but very imprecise. The rapidly expanding field of less traditional methods for monitoring food intake is more objective, but their accuracy, precision, and utility requires further research and development.

The Perception of Organic Foods: Is It Correct?

Written by **Phil Vinall**

The consumer often perceives organic foods as being safer, more nutritious, and in general, better for the environment. After analyzing the published data, however, Roger Clemens, DrPH, CFS, CNS, University of Southern California, Los Angeles, California, USA, has concluded that the evidence is inconsistent.

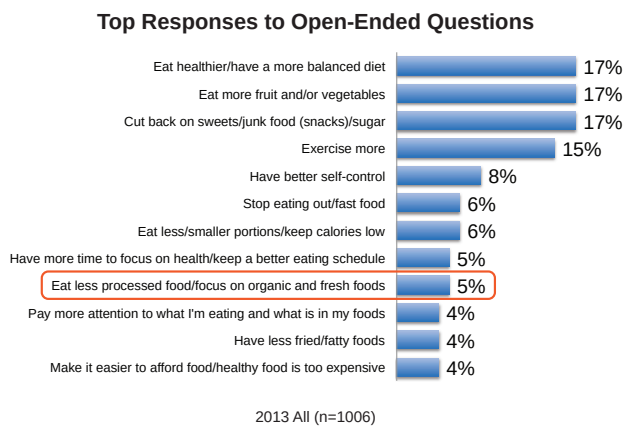
A 2012 systematic review of the literature comparing the health effects of organic and conventional foods concluded that, published literature lacks strong evidence that organic foods are significantly more nutritious than conventional foods [Smith-Spangler C et al. *Ann Intern Med* 2012]. One erroneous perception is that the government evaluates the quality of organic foods through programs like the National Organic Program (NOP). However, the NOP only oversees the growing process not the quality of the food produced. With respect to crops, a United States Department of Agriculture (USDA) organic seal indicates that irradiation, sewage sludge, synthetic fertilizers, *prohibited* pesticides, and genetically modified organisms were not used [USDA. NOP Organic Standards. http://www.ams.usda.gov/AMSv1.0/nop]. The USDA organic seal on meats verifies that meat producers have met animal health and welfare standards, did not use antibiotics or growth hormones, used 100% organic feed, and provided animals with access to the outdoors.

When the 2013 Food and Health Survey [International Food Information Council Foundation. 2013; http://www.foodinsight.org/foodandhealth2013.aspx] on attitudes toward food safety, nutrition, and health asked 1006 consumers how they could improve their diets, they identified four ways: eat healthier/have a more balanced diet; eat more fruit and/or vegetables; cut back on sweets/junk food/sugar; and exercise more. Eating less processed foods and more organic foods (5%) was fourth from the bottom (Figure 1).

Only 27% of consumers reported regularly buying products because they were advertised as "organic" on the label. Women and younger consumers (aged 18 to 34 years) and highly educated consumers (college graduates) are more apt to have purchased organic.

The International Food Information Council performed a Consumer Perceptions of Food Technology Survey in 2012 [http://www.foodinsight.org/Resources/Detail.aspx?topic=2012ConsumerPerceptionsofTechnologySurvey]. The results showed that only 13% of Americans make food choices out of concern about the use of biotechnology in food production. Among these, 15% said they eat less of, do not eat, or do not buy such foods; while 6% said they eat organic.

Figure1. Response to Survey on How Americans Would Improve Their Diet



Source: 2013 Food and Health Survey; http://www.foodinsight.org/foodandhealth2013.aspx

Studies have shown that just putting the label "organic" on foods evokes lower calorie estimates and a willingness to pay more for the product. Organic labels also stimulate the consumer to view the product as having more positive nutritional value [Lee WJ et al. *Food Quality Preference* 2013]. In one study, Czech consumers (n=1054) of organic foods reported they felt these foods had positive health benefits, were environmentally friendly, and tasted better [Zagata L. *Appetite* 2012].

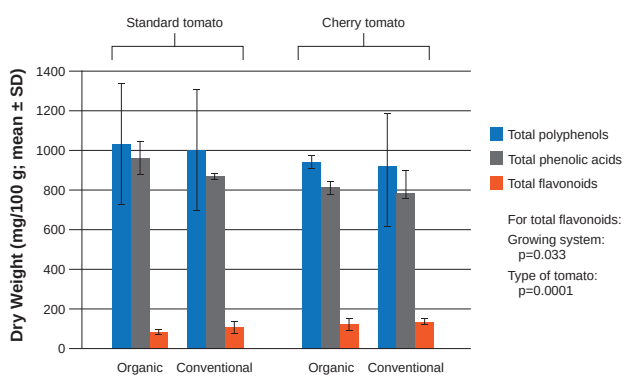
However, according to Dr. Clemens, there is no research available that organic foods are safer than conventional foods, and flavor and nutritional profiles are indistinguishable. According to the USDA, the organic seal is simply a confirmation of a method of production, not a safety endorsement. In addition organic foods are not

free of pesticides, only, according to the NOP, that there is a minimal risk from inert ingredients and that the use of pesticide products for organic foods will not adversely affect the public health or environment [USDA; Agricultural Marketing Service; NOP. *Program Handbook: Guidance and Instructions for Accredited Certifying Agents & Certified Operations* 2010]. All plants contain natural pesticides. For instance, cabbages contain at least 49 natural pesticides some of which are known mutagens and carcinogens.

There is also little evidence of a difference in nutrient quality between organically and conventionally produced food products. The small differences that do exist are attributed to differences in production methods [Dangour AD et al. *Am J Clin Nutr* 2009]. Phosphorus levels are significantly higher in organic foods, however, compared with conventional produce, although the difference is not clinically significant. *Escherichia coli* contamination risk does not differ between organic and conventional produce, but the risk for isolating bacteria resistant to three or more antibiotics is higher in conventional than in organic chicken and pork [Smith-Spangler C et al. *Ann Intern Med* 2012].

Cultivations systems account for some of these differences. The organic growing system affects tomato quality parameters such as nutritional value and phenolic compound content (Figure 2) [Hallman E. *J Sci Food Agric* 2012].

Figure 2. Effect of Cultivation System on Standard and Cherry Tomatoes



SD=standard deviation.

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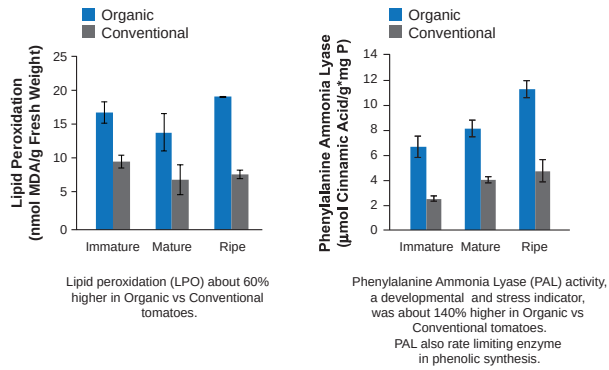
Lipid peroxidation and phenylalanine ammonia lyase are significantly higher in organic tomatoes compared with conventionally grown tomatoes because of the stressing conditions associated with organic farming. This contributes to the fruit's nutritional quality from vitamin C and phenolic compounds (Figure 3) [Oliveira AB et al. *PloS One* 2013].

Figure 3. Agricultural Stress Induced by Organic and Conventional Farming Systems



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However, another study comparing tomato quality and nutritional parameters reported no significant differences between organic and conventional farming systems for all tomato fruit parameters measured, including quality (pH, soluble solids, acidity, and color), content of bioactive compounds with antioxidant activity (beta-carotene, lycopene, ascorbic acid, and total phenolics), and antioxidant activity [Juroszek P et al. *J Agric Food Chem* 2009].

When Vicini and colleagues studied milk claims made in food labeling to assess the quality of milk produced by conventional, organic, and recombinant bovine somatotropin (rbST)-free (processor-certified not from cows supplemented with rbST) methods, no meaningful differences in the milk compositional variables were detected [Vicini J et al. *Am Diet Assoc* 2008]. Results of a 2012 meta-analysis indicated that organic dairy products contain significantly higher protein, alanine, total omega-3 fatty acid, cis-9, trans-11 conjugated linoleic acid, trans-11 vacenic acid, eicosapentanoic acid, and docosapentanoic acid compared with the other two types of conventional production. The authors attributed the differences to feeding regimes [Palupi E et al. *J Sci Food Agric* 2012].

The evidence for the superiority of organic foods over conventionally grown foods is inconsistent, concluded Dr. Clemens, but we should remember that the United States enjoys one of the safest, most nutritious, and affordable food supplies in the world and should enjoy it wisely.