11 Healthfulness and quality of products

Organic producers strive to deliver organic products that have outstanding health benefits, quality and taste. This ambition is supported by research. Scientists are looking for evidence to prove that organic food is healthier and for ways to improve its quality and taste.

Lucy van de Vijver

Healthfulness of organic produce

Many consumers buy organic products because they assume these products are healthier. Despite the great need for it, so far little evidence to back this claim has been presented in scientific literature.

Dutch researchers have taken on the challenge of addressing this research question. Their approach is unique in that they are not only analysing the nutrient content and possible harmful components of organic products, but also carrying out investigations involving consumers, to determine the actual impact organic food has on human health. One example is the Koala birth cohort study, which focuses in particular on the effect organic food has on allergies (see Box 'More CLA in breast milk').

From a scientific perspective, the only way to definitively demonstrate the health effects of a certain type of food is to conduct an intervention study. To do this, people have to be selected and then assigned to one of two groups. From that moment on, one group is given only organic food to eat, and the other group is given conventional food. This type of study is very expensive and generally very long term. To come to any conclusions in the short term about health effects, scientists need to find biomarkers known to influence health over the longer term.

"Finding biomarkers for positive health effects takes a lot of time"

Lucy van de Vijver

A lot of research has been conducted into biomarkers for specific diseases, but very little into biomarkers for good health. The Dutch researchers therefore began looking for such biomarkers in chickens (see Box 'Biomarkers for health effects'). This type of research takes a lot of time. Moreover, indications gained through research with model animals, such as chickens, are not enough. Repetition is needed, preferably also in animals such as pigs, which physiologically resemble humans. "Not only do we need to find health effects, we should also explain their causes. All of this can easily take ten years", explains Lucy Van de Vijver, programme director of Food Quality and Health at the Louis Bolk Institute.

More CLA in breast milk

Mothers who consume dairy products that are at least 90 per cent organic have more Conjugated Linoleic Acid (CLA) in their breast milk than mothers who consume conventional dairy products. Their children have a 30 per cent less chance of suffering from eczema at the age of two if they too consume dairy products that are at least 90 per cent organic. This was demonstrated by the initial results of the Koala birth cohort study. It is assumed that CLA has a positive effect on human health.

The Louis Bolk Institute began this research in 2000. Koala is a Dutch acronym for Child, Parent and Health, Lifestyle and Genetic Constitution. It is a prospective birth cohort study designed to identify factors that influence the clinical expression of atopic diseases such as eczema and wheezing.
At the start of the project almost 3000 pregnant women were recruited. The researchers were especially looking for women with alternative lifestyles. For this reason, the study group contains a relatively high number of women who eat organic food. They represent about 15 per cent of the group, whereas only 2 per cent of the Dutch population falls into this category. Through detailed questionnaires, information was collected when the women's infants were 3, 7, 12 and 24 months of age. Researchers expect that the effect of organic food consumption may become even more evident as the children grow older. They therefore want to prolong this study.

Biomarkers for health effects

Small differences in feed have implications for immune reactivity, metabolites and gene activity in healthy animals. This was demonstrated through research with chickens that were fed either organic or conventional feed. This research is the first step on the way to using biomarkers in research involving people.
In the experiment, two generations of chickens were fed either organic or conventional feed. An important prerequisite for this kind of research is that the exact origin and composition of the feed be known and that the two types of feed be otherwise as identical as possible. The ingredients of both the organic and conventional feed originated from controlled production or farms known for their use of best practices. The most consistent difference between the two types of feeds is that the conventional feed had on average a 10 per cent higher protein content.
The chickens in the study were monitored very closely, and the clearest differences between the two groups were found in weight, responsiveness of the immune system, metabolism reactions in the blood and liver and gene regulation in the intestine. These appear to be interesting biomarkers for the relation between food and health. While the research results do not necessarily indicate that organic food is 'healthier', most of the researchers cautiously conclude that organic food may contribute to the 'preservation' of good health.

Components of organic food

In addition to looking at the effects organic food has on health, research is focused on the specific components of different foodstuffs. Dutch researchers are investigating a whole range of products produced in the Netherlands, including eggs, cabbage, carrots and meat. Although similar studies have taken place in other countries, it is necessary to repeat this research in the Netherlands because soil, cultivation methods and animal husbandry systems may differ among countries.

In this research a distinction has been made between substances known to have beneficial health effects and substances that are potentially harmful. In the first case, researchers would like to find specific links to organic production. In the latter case, the intention is to eliminate or minimise any negative images related to organic products. In both cases, extensive analysis of the products is required – not only to establish what is in them, but also to find evidence of more positive factors and hopefully reduce the number of negative factors associated with organic production.

Large variation

One difficulty in researching the components of food products is the large variation that can be found. "There are differences between organic and conventionally produced products, but they are often not large enough to be significant. Moreover, these factors vary too much within the products themselves", concludes Van de Vijver. Her comments are based on comparison of the different studies conducted in the Netherlands and abroad. Take, for example, the polyphenols.

Contaminants and micro-organisms

For years, many researchers and the conventional food sector believed that organic food increases food safety risks. This idea surfaced repeatedly in studies based solely on theoretical assumptions. The organic sector wanted to find out whether this was actually true.
Researchers consequently studied animal and plant products, looking for potentially hazardous contamination with heavy metals, mycotoxins, pesticide residues, pathogenic micro-organisms and nitrate. The result? Only organic carrots showed on average a higher nitrate content than conventional carrots. However, the variation between samples was very large. These findings have already resulted in specific recommendations for the fertilisation of carrots.
Otherwise no differences were found between the two systems with respect to the presence of metals and mycotoxins. Campylobacter was more common among organic chickens. The presence of Salmonella in pigs depended on the experience of the farmer. One-third of conventional pigs are infected with the bacteria. Among organic pig farmers, one half of those with one to four years of experience had infected animals, whereas Salmonella was found on only one in fourteen farms run by farmers with more years of experience. As expected, no antibiotics and much lower levels of antibiotic-resistant bacteria were found in organic meat and eggs.

These secondary plant metabolites are assumed to inhibit infection in humans. Of the fifteen studies that have looked into these components, eight concluded that organic products have more of these healthy substances, five found no difference, and two found fewer in organic products. In addition, the variation among the results was very large – too large to claim that "organic food contains more healthy nutrients than conventional food". Therefore, Van de Vijver can only conclude that "on average organic products contain as many or slightly more of the components that have beneficial health effects, and on average just as many or fewer harmful components".
In any case, this Dutch research was able to shatter the myth that organic production increases food safety risks (see box 'Contaminants and micro-organisms'). In a comparison between organic and conventional products of the presence of contaminants and micro-organisms, organic products scored on average just as well or better. Where the risk of contamination was shown to be higher among organic products, researchers were able to trace the cause and producers were able to eliminate it.

Reducing undesirable components

Additional research is directed at preventing the presence of undesirable components. Some of these substances are known to be harmful to human health. Others may not have been proven to be harmful, but still diminish the healthful image of organic products. One example is contamination with genetically modified organisms.

Chloropropham in potatoes

The issue of chloropropham (CIPC) demonstrates the success that can be achieved through optimal cooperation between industry and research. In 2006 the organic potato sector was alarmed by various discoveries of the chemical germination inhibitor chloropropham. This substance is prohibited in the organic sector. Ten of the thirteen samples taken in stores contained traces of the substance, five of these were above the limit set by the organic certification organisation SKAL. All of the values were far below the conventional standard for pesticide residues. Further research demonstrated that the farmers were not to blame. Contamination took place during transport and at washing and packaging stations. The substance is persistent and easily absorbed into wood, for example, that has come in contact with conventionally treated potatoes.
To prevent this cross-contamination, the researchers proposed a protocol that included a number of rules such as: work with two separate processing lines, use chloropropham-free crates (preferably in a different colour than those used for conventional potatoes), clean the machines and use chloropropham-free trucks. These measures have already proved to be effective. Whereas 67 per cent of the samples taken in 2006 showed traces of the germination inhibitor, this was the case for only 12 per cent in 2007. In a new sampling round in 2008, only 6 per cent of the samples had traces of chloropropham.

Every substance and every product demands its own unique approach. In case a substance enters the product unnoticed, it is important to determine how it got there. The next question is how to reduce or eliminate it. In some cases it may be sufficient to change the animals' feed, while in other cases it may be necessary to alter cleaning methods. Sometimes a problem will solve itself, as was the case with dioxin in eggs. At one time it appeared that many organic eggs contained elevated levels of this substance. Further investigation revealed that chickens raised on small farms and in private yards were particularly likely to have unacceptably high levels of dioxin. This is because these chickens are generally outdoors more often. They eat more worms, which bind dioxin in their fat. On large-scale poultry farms, the chickens tend to stay inside more, where there is food and water and where they feel safer. Thanks to the upscaling of organic poultry farms, dioxin levels in eggs have now decreased significantly. Small-scale poultry farmers can prevent high dioxin levels by giving the chickens food and water inside and by limiting the time they spend outside. For more on this issue, see Chapter 9.
Sometimes undesirable substances are needed to ensure a longer shelf-life for the product. The objective in that case is to minimise the amount of a specific substance, such as nitrite in processed meat products. In products such as ham, it is normal to add 120 to 150 ppm nitrite. But research has shown that taste, shelf-life and colour are preserved just as well at 80 ppm. Eliminating nitrite altogether is not possible without making major concessions with respect to colour and food safety.

Kees van Wijk

Research into the prevention or reduction of undesirable substances takes place in close cooperation with the industry. This leads to solutions that can be implemented immediately by farmers, retailers and processors.

Enhancing positive characteristics

The distinctiveness of organic agriculture can be increased by further enhancing its positive characteristics. One way is to increase the CLA content of milk. Dairy farmers can achieve this by allowing their cows to graze longer and by feeding them more roughage. Another possibility is to put a product on the market specifically because of its exceptional characteristics. For example, the introduction of the Santana apple was successful because this particular apple has been proven to be hypoallergenic. This means that many people who are allergic to apples can eat this apple with little or no side effects. Research has shown that about 75 per cent of patients with an apple allergy do not show an allergic reaction to Santanas. Researchers oversaw the process of introducing this new apple variety from start to finish – from cultivation and harvesting all the way through to storage in the supermarket. Most Santana apples are organically grown.

Distinguished taste

The organic sector can also distinguish itself through taste. One of the reasons consumers buy organic products is because they find them better tasting. “We want to use and expand on that argument”, explains Kees van Wijk of Wageningen UR. “If farmers produce tasty varieties, this gives consumers an extra impulse to buy organic.” Research has shown that this is possible. Old varieties of potato, carrot, onion, cabbage, garlic and pumpkin often have much more taste. The question is whether they can be profitably cultivated, stored and sold. The first step is to ask consumers in stores to taste and evaluate the new varieties. If they are positive about the tasty varieties, the next, more long-term, step is to improve these varieties where necessary in order to achieve a higher yield and less susceptibility to disease. Organic farmers participate in this type of research by testing these varieties on their farms. In addition to taste, the product’s appearance is important to consumers, especially to those who buy their food in supermarkets. Moreover, consumers who favour a particular apple variety would like to buy it throughout the year. But how can the quality be preserved for so long during storage? The apple has to remain hard and crisp, and not have a rough peel or begin to develop a brown core. Most apple varieties cannot be stored successfully for a whole year, but the feasible storage time can be extended. Researchers are trying to accomplish this for Topaz and Santana apples, two varieties that are often grown organically. Topaz can normally be stored well until about the first of April and it appears possible to extend this period by about a month. So far, however, tested measures have succeeded either in preserving the apple’s hard texture or minimizing storage defects. It has not yet been possible to achieve both improvements at the same time. But the researchers are optimistic. The same tests are now being conducted on Santana apples, which can normally be stored until the first of March.

“Organic production can distinguish itself with better-tasting varieties.”

Kees van Wijk

Literature

Kummeling I., Thijs C., Huber, M., Vijver L.P.L, van de, Snijders, B.E.P., Penders, J., Stelma, F., Ree, R. van, Brandt, P.A. van den and P.C. Dagnelie. 2008. Consumption of organic foods and risk of atopic disease during the first 2 years of life in the Netherlands. British Journal of Nutrition 99: 598-605.

Rist L., Mueller, A., Barthel, C., Snijders, B., Jansen, M., Simões-Wüst, A.P., Huber, M., Kummeling, I., Mandach, U. von, Steinhart H. and C. Thijs. 2007. Influence of Organic Diet on the Amount of Conjugated Linoleic Acids in Breast Milk of Lactating Women in the Netherlands. British Journal of Nutrition 97: 735-743.

Huber, M.D. (editor). 2007. Organic, More Healthy? A search for biomarkers of potential health effects induced by organic products, investigated in a chicken model. Louis Bolk Institute, publication number M22.

Hoogenboom, L.A.P., Bokhorst, J.G., Northolt, M.D., Vijver, L.P.L. van de, Broex, N.J.G., Mevius, D.J., Meijs, J.A.C. and J. van der Roest. 2008. Contaminants and microorganisms in Dutch organic food products: a comparison with conventional products. Food Additives & Contaminants 2008. Part A: 25:10: 1197-1209.

Information

Dr Lucy Van de Vijver
e-mail: l.vandevijver@louisbolk.nl
Researcher Food Quality and Health
Louis Bolk Institute

Machteld Huber MD
e-mail: m.huber@louisbolk.nl
Researcher Food Quality and Health
Louis Bolk Institute

Kees van Wijk
e-mail: kees.vanwijk@wur.nl
Researcher Vegetable Production
Applied Plant Research
Wageningen UR