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Parsing of Data Led to Mixed Messages on Organic Food's Value

By KENNETH CHANG

A team of scientists laboriously reviewed decades of research comparing organic fruits and vegetables with those grown the usual way. They found that, as many had suspected, the organic produce, farmed without synthetic fertilizers or pesticides, was more nutritious, with more vitamin C, on average, and many more of the plant-defense molecules that in people help shield against cancer and heart disease.

That is probably not the study you heard about.

The findings, by scientists at Newcastle University in England, appeared in April 2011 and barely made a ripple in the news media or in the public consciousness.

But last month, after a team from Stanford University conducted a similar review of many of the same studies, they came to opposite conclusions — and set off a firestorm. Organic meat and produce, the Stanford researchers said in an article in Annals of Internal Medicine, is no more nutritious than conventionally grown foods.

A debate erupted between those who saw the Stanford study as validation of their belief that organic food is an expensive, pointless exercise and people who said the report ignored the main reasons they buy organic food and pay a premium: to avoid pesticides, for the health of farm workers and for environmental considerations.

So why the chasm? Part of the issue is methodology. Neither the Stanford nor the Newcastle researchers conducted new field or laboratory work; rather, both groups performed a meta-analysis, a statistical compilation of earlier work by others. It was a meta-analysis, for example, that revealed the effectiveness of aspirin in preventing the recurrence of heart attacks.

Such analyses seek out robust nuggets in studies of disparate designs and quality that offer confounding and often conflicting findings, especially in nutrition and medicine. The way the data

from various studies is divvied up or combined in a meta-analysis can make a big difference in the conclusions. In the organic food research, some studies reported many measurements, some only a few. Some included several crops grown over multiple years, while others looked at only a few samples.

In setting up such a meta-analysis, "you can't just take an average of everything," said Kirsten Brandt, the scientist who led the Newcastle study.

So, for instance, she decided that if a paper reported results for crops grown in separate years, each year should be regarded as a separate data point, because weather conditions vary so much from year to year. The Stanford group instead averaged the multiple years into a single data point.

The overall Stanford approach, Dr. Brandt said, was similar to what is used for analyzing human clinical drug studies, where the effects of a medicine should be consistent and variations indicate that a study may not have been done well. In agricultural studies, she said, the variations are expected because of differences in plant species, weather, soil and other conditions. "This difference is a genuine difference," she said, and not an indication of shoddy experiments.

Ingram Olkin, an emeritus professor of statistics at Stanford who was part of the research group there, defended its approach, but added that the Newcastle team might have also made reasonable decisions. "There is no unique art to this," he said. "A meta-analysis is a tough business."

Craig Osenberg, an ecology professor at the University of Florida who was not involved in either study, said there was no definitive method. "I can see both approaches being justifiable in different contexts," he said, "and personally I don't know which decision I would have made if I had been facing that."

The Stanford and Newcastle studies agree on many points. For most vitamins and minerals, both studies found no large difference between organic and conventional produce. The Newcastle study found that organic produce had a modest 9 percent increase in vitamin C; the Stanford study did not.

Both studies also found that organic produce contained more of the compounds known as phenols, believed to help prevent cancer and other diseases. But the Stanford study questioned whether the phenol increase was real, because the magnitude of the increase varied widely among studies.

But some plant biologists have long suspected that plants grown organically are healthier and produce fruits and vegetables that are healthier to eat.

"Most of the difference in nutrient levels in organic versus conventional foods is likely caused by conventional farmers driving down nutrient levels via their pursuit of ever-higher yields," said Charles M. Benbrook, a researcher at Washington State University and former chief scientist at the Organic Center, a nonprofit group that studies organic farming. "The other portion is from greater pest attacks in organic fields, triggering their defense mechanisms," he said, "which in turn are driving up secondary defense compounds that are also human nutrients."

The Stanford researchers have since made four corrections to their paper.

Three are trivial: a misspelling, a transposition of two digits, a transposition of two words. None change any calculations or conclusions..

The fourth correction also looks like a trivial mistyping, but may reflect deeper issues. In a table comparing the amounts of nutrients in fruits and vegetables, the data for "total flavanols" was actually for "total flavonoids." Flavanols are a class of compounds that plants produce for self-defense. Flavanols are found, for example, in cocoa and green tea, and are thought to help prevent against cancer, heart disease and other ills in humans. Flavonoids are a larger class that includes flavanols.

The Stanford meta-analysis found no difference in total flavonoids between organic and conventional produce, basing that conclusion on five papers that mentioned "flavonoids," "flavonols" or "flavanols," but by Dr. Brandt's count it omitted other papers among the 237 the Stanford researchers used that measured specific flavonoids. "My guess is they would find a significant effect if they did it correctly," she said.

Dr. Crystal Smith-Spangler, the lead author of the Stanford study, said the flavonoid error resulted from a miscommunication. "It doesn't effectively change any of our findings," she said.