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# Herbal Supplements Are Often Not What They Seem

By ANAHAD O'CONNOR

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Americans spend an estimated \$5 billion a year on unproven [herbal supplements](#) that promise everything from fighting off [colds](#) to curbing hot flashes and boosting memory. But now there is a new reason for supplement buyers to beware: DNA tests show that many pills labeled as healing herbs are little more than powdered rice and weeds.

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Using a test called DNA barcoding, a kind of genetic fingerprinting that has also been used to help uncover labeling fraud in the commercial seafood industry, Canadian researchers tested 44 bottles of popular supplements sold by 12 companies. They found that many were not what they claimed to be, and that pills labeled as popular herbs were often diluted — or replaced entirely — by cheap fillers like soybean, wheat and rice.

Consumer advocates and scientists say the research provides more evidence that the herbal supplement industry is riddled with questionable practices. Industry representatives argue that any problems are not widespread.

For the study, the researchers selected popular medicinal herbs, and then randomly bought different brands of those products from stores and outlets in Canada and the United States. To avoid singling out any company, they did not disclose any product names.

Among their findings were bottles of echinacea supplements, used by millions of Americans to prevent and treat colds, that contained ground up bitter weed, Parthenium hysterophorus, an invasive plant found in India and Australia that has been linked to [rashes](#), nausea and [flatulence](#).

Two bottles labeled as St. John's wort, which [studies have shown may treat mild depression](#), contained none of the medicinal herb. Instead, the pills in one bottle were made of nothing but rice, and another bottle contained only Alexandrian senna, an Egyptian yellow shrub that is a powerful laxative. Ginkgo biloba supplements, promoted as

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memory enhancers, were mixed with fillers and black walnut, a potentially deadly hazard for people with nut [allergies](#).

Of 44 herbal supplements tested, one-third showed outright substitution, meaning there was no trace of the plant advertised on the bottle — only another plant in its place.

Many were adulterated with ingredients not listed on the label, like rice, soybean and wheat, which are used as fillers.

In some cases, these fillers were the only plant detected in the bottle — a health concern for people with allergies or those seeking gluten-free products, said the study's lead author, [Steven G. Newmaster](#), a biology professor and botanical director of the [Biodiversity Institute of Ontario](#) at the University of Guelph.

The [findings, published in the journal BMC Medicine](#), follow a number of smaller studies conducted in recent years that have suggested a sizable percentage of herbal products are not what they purport to be. But because the latest findings are backed by DNA testing, they offer perhaps the most credible evidence to date of adulteration, contamination and mislabeling in the medicinal supplement industry, a rapidly growing area of [alternative medicine](#) that includes an estimated 29,000 herbal products and substances sold throughout North America.

“This suggests that the problems are widespread and that quality control for many companies, whether through ignorance, incompetence or dishonesty, is unacceptable,” said David Schardt, a senior nutritionist at the [Center for Science in the Public Interest](#), an advocacy group. “Given these results, it’s hard to recommend any herbal supplements to consumers.”

Representatives of the supplement industry said that while mislabeling of supplements was a legitimate concern, they did not believe it reached the extent suggested by the new research.

Stefan Gafner, the chief science officer at the [American Botanical Council](#), a nonprofit group that promotes the use of herbal supplements, said the study was flawed, in part because the bar-coding technology it used could not always identify herbs that have been purified and highly processed.

“Over all, I would agree that quality control is an issue in the herbal industry,” Dr. Gafner said. “But I think that what’s represented here is overblown. I don’t think it’s as bad as it looks according to this study.”

The [Food and Drug Administration](#) has used bar-coding technology to warn and in some cases prosecute sellers of seafood found to be “misbranded.” The DNA technique has also been used in [studies of herbal teas](#), which showed that a significant percentage contain herbs and ingredients that are not listed on their labels.

But policing the supplement industry is a special challenge. The F.D.A. requires that companies test the products they sell to make sure that they are safe. But the system essentially operates on the honor code. Unlike prescription drugs, supplements are generally considered safe until proved otherwise.

Under a 1994 federal law, they can be sold and marketed with little regulatory oversight, and they are pulled from shelves generally only after complaints of serious injury. The F.D.A. audits a small number of companies, but even industry representatives say more oversight is needed.

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“The regulations are very appropriate and rigorous,” said Duffy MacKay of the [Council for Responsible Nutrition](#), a supplement industry trade group. “But we need a strong regulator enforcing the full force of the law. F.D.A. resources are limited, and therefore enforcement has not historically been as rigorous as it could be.”

An F.D.A. spokeswoman did not respond to a request for comment.

DNA bar coding was developed about a decade ago at the University of Guelph. Instead of sequencing entire genomes, scientists realized that they could examine genes from a standardized region of every genome to identify species of plants and animals. These short sequences can be quickly analyzed — much like the bar codes on the items at a supermarket — and compared with others in an electronic database. An electronic reference library at Guelph called the International Barcode of Life Project, contains over 2.6 million bar code records for almost 200,000 species of plants and animals.

The testing technique is not foolproof. It can identify the substances in a supplement, but it cannot determine their potency. And because the technology relies on the detection of DNA, it may not be able to identify concentrated chemical extracts that do not contain genetic material, or products in which the material has been destroyed by heat and processing.

But Dr. Newmaster emphasized that only powders and pills were used in the new research, not extracts. In addition, the DNA testing nearly always detected some plant material in the samples — just not always the plant or herb named on the label.

Some of the adulteration problems may be inadvertent. Cross-contamination can occur in fields where different plants are grown side by side and picked at the same time, or in factories where the herbs are packaged. Dr. Gafner of the American Botanical Council said that rice, starch and other compounds were sometimes added during processing to keep powdered herbs from clumping, just as kernels of rice are added to salt shakers.

But that does not explain many of the DNA results. For instance, the study found that one product advertised as black cohosh — a North American plant and popular remedy for hot flashes and other [menopause](#) symptoms — actually contained a related Asian plant, *Actaea asiatica*, that can be toxic to humans.

Those findings mirror a [similar study of black cohosh supplements](#) conducted at Stony Brook University medical center last year. Dr. David A. Baker, a professor of obstetrics, gynecology and reproductive medicine, bought 36 black cohosh supplements from online and chain stores. Bar coding tests showed that a quarter of them were not black cohosh, but instead contained an ornamental plant from China.

Dr. Baker called the state of supplement regulation “the Wild West,” and said most consumers had no idea how few safeguards were in place. “If you had a child who was sick and 3 out of 10 penicillin pills were fake, everybody would be up in arms,” Dr. Baker said. “But it’s O.K. to buy a supplement where 3 out of 10 pills are fake. I don’t understand it. Why does this industry get away with that?”

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