

New whole plant therapy shows promise as an effective and economical treatment for malaria

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A research team reports a promising new, low-cost combined therapy for treating the most deadly form of malaria that offers a much higher chance of outwitting the parasite than current modes. Credit: UMass Amherst

In the worldwide battle to curtail malaria, one of the most prevalent and deadly infectious diseases of the developing world, drug after drug has fallen by the wayside as the malaria parasite has become resistant to it. Only artemisinin, derived from the sweet wormwood plant, *Artemisia annua*, remains as an effective treatment, but it is expensive to produce (particularly when combined with other antimalarial medications to make it less prone to resistance) and is frequently in short supply.

A new study by scientists at Worcester Polytechnic Institute (WPI) and

the University of Massachusetts has shown that the powdered dried leaves from the *Artemisia annua* plant may be a far more effective antimalarial treatment than purified artemisinin, delivering 40 times more artemisinin to the blood and reducing the level of [parasite infection](#) more completely in mice. The effectiveness of the whole plant, versus the purified drug, may be due, in part, to the presence in *Artemisia annua* leaves of other compounds, including flavonoids also known to have antimalarial abilities, which may create a [combination therapy](#) that works synergistically to combat the parasite and ward off resistance.

These are some of the conclusions of a paper titled "Dried whole plant *Artemisia annua* as an antimalarial [therapy](#)," published online today by the journal [PLOS ONE](#).

Using the dried whole plant, instead of purified artemisinin, could significantly lower the cost of treating malaria, since it would eliminate the need to extract the drug from the plant and purify it, and could greatly expand access to antimalarial therapy, according to Pamela Weathers, professor of biology and biotechnology at WPI and a co-author of the new study. "*Artemisia* can be grown readily in most climates," she says. "It is a relatively simple process to harvest the leaves, pulverize them, test samples for their potency, measure out doses, and put them in capsules. This could become the basis for local businesses and be a wonderful socioeconomic stimulus in developing countries."

Weathers has been studying the antimalarial abilities of *Artemisia annua* for more than two decades. She first described the efficacy of using of the whole plant as an antimalarial treatment in a 2011 paper published in *Photochemistry Reviews*. In the latest study, a high-yield cultivar of the plant developed in her lab was administered to mice by her team, led by Stephen Rich, a molecular parasitologist at the University of Massachusetts Amherst. The effects of the whole plant therapy were compared to the effects of comparable doses of pure artemisinin.

The researchers found that mice receiving a dose of the dried leaves containing a low level of artemisinin showed a significantly greater reduction in blood-borne parasites over the course of 12 to 72 hours than mice receiving the same dose of the pure artemisinin drug. When plant material containing a high level of artemisinin was given to mice, the whole plant was as effective as a high dose of the drug in clearing parasites from the blood. Interestingly, plant material with a low level of artemisinin was as effective in killing parasites as a high dose of the drug, although its effects seemed to wane after 72 hours, suggesting that multiple doses would be necessary to fully treat a malarial infection.

Weathers says the effectiveness of the whole plant treatment seems to be due, in part, to the fact that artemisinin from the dried leaves enters the bloodstream far more readily than the pure drug. "In our 2011 study, we showed that it takes about 40 times less artemisinin to achieve a comparable blood serum level when the compound is administered in the form of the whole plant," she says. "This is consistent with the results of earlier studies in which people consumed teas made from whole leaves from *Artemisia annua*."

Weathers says the effectiveness of using the whole plant as a therapy is likely a product of the plant's complex biochemistry. "The leaves of *Artemisia* contain a host of compounds that are of interest for their apparent but lesser antimalarial abilities," she says. "These include at least six flavonoids that have been shown to work synergistically with artemisinin to kill malaria parasites. This makes the *artemisia* leaves a combination therapy all by themselves. In fact, we have referred to the whole plant as pACT (plant Artemisinin Combination Therapy), to distinguish it from the Artemisinin Combination Therapies (ACT) that are now recommended for malaria treatment by the World Health Organization.

Artemisia annua is classified as a "generally regarded as safe" (GRAS)

herb that has been consumed by humans and used as an herbal therapy for thousands of years. Weathers says she has been actively working for several years to establish the foundation for a new model for using whole plant therapy to combat malaria. She said she envisions local operations where farmers would grow the high-producing cultivars of *Artemisia* she and others have developed as a supplemental crop and deliver the leaves to processing stations, where they would be dried, pulverized, and homogenized, and where the powder would be placed in capsules or compacted into tablets.

"By decentralizing the production of pACT, and giving local farmers and business people the opportunity to earn a living from producing it, we will not only make an effective therapy broadly available at an affordable price, we will help stimulate the economies of developing nations. It is exciting to be involved with a project that can be beneficial in so many ways.

"When you consider that [artemisinin](#) and some of the flavonoids in *Artemisia annua* have been to have a therapeutic effect against host of other diseases, including *Leishmania*, schistosomiasis, and other ailments that are serious health hazards in the [developing world](#), the long-term possibilities of this research grow exponentially."

More information: [dx.plos.org/10.1371/journal.pone.0052746](https://doi.org/10.1371/journal.pone.0052746)

Provided by Worcester Polytechnic Institute

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