

Polyphenols are most famous for their antioxidant effects in the body, which are critical to maintaining good health. They contribute to optimal cell function and cellular maintenance and also play a role in decreasing inflammation. Some of these effects point to the anti-cancer and neuro-protective benefits of spices and medicinal plants. Antioxidants can have significant impact on conditions that involve inflammation, such as cardiovascular disease, type 2 diabetes, asthma, immune health, and infection. Polyphenols aren't found in spices alone; they are common in the plant world, but herbs and spices contain a relatively high level of polyphenols, especially phenolic acids and flavonoids.

ANTIOXIDANT AVENGERS

We've all heard that antioxidants are good for us, but it's important to understand the complexity of food-based antioxidants. A specific food may have tremendous antioxidant potential when it is sitting on a plate, but that doesn't necessarily indicate what will happen when it gets into your body. There are antioxidants that can survive or even potentiate (increase effectiveness) once inside the digestive system, directly impacting free radicals and other inflammatory substances in the body. Other antioxidants, however, are destroyed during digestion or are converted into something that has a different effect on the body.

As medicinal plants, spices can have a number of different effects on the body because of their diverse chemistry. An important point to note when using medicinal spices is that you aren't necessarily looking for the direct anti-inflammatory or antioxidant capacity of a plant. Instead, you

should focus on how the plant influences your endogenous (internal) processes and your body's ability to reduce inflammation and oxidation (the destruction of cells). Human beings have adequate internal systems to reduce inflammation and mitigate oxidation, but our lifestyles and diet, coupled with genetic propensities, make inflammation the root cause of nearly all chronic and degenerative diseases today. Medicinal spices can offer the necessary tools and chemical messengers to stimulate internal systems and, in turn, decrease inflammation.

RESEARCH ON MEDICINAL SPICES

A lot of research examining the impact of diet on the health of a population or an individual fails to take into account the impact of medicinal spices. Too often spices are considered flavoring agents rather than medicinal substances. So, how do we know that spices have specific effects in humans, especially when they are generally combined with foods that may have similar or overlapping effects?

The largest inhibiting factor to better understanding the action of herbs and spices on the body is a lack of funding for research on culinary spices. Typically, research is funded to address a major health epidemic or acute need, or it is based on the development of drugs. Spices, as such, cannot be patented or sold as drugs, so their earning potential and the subsequent available research funds are minimal. Companies can, however, develop what they call "natural products" that have a specific

target, such as a toothpaste that reduces plaque buildup or a customized formula for joint inflammation. Or, they can isolate one or more individual constituents such as concentrated allicin from garlic. These strategies allow companies to sell products to the consumer at a much higher price than what you'd pay for the raw ingredients.

Additionally, plants can be difficult to study because of their multiple constituents (the hundreds of chemical compounds that are part of a plant), diversity in chemistry, and biological range depending on area of cultivation, season, and other factors. The use of medicinal herbs and spices can be highly seasonal, depending on whether fresh or dried ingredients are available and in what abundance, making research even more complicated. As a result, we really don't have a great variety or the highest quality of human data to assess the impact that seasonal or regional differences in plant chemistry have on human health.

What we can do is look at the chemistry of medicinal plants and observe their effect in humans, animals, or specific disease states. This type of research tends to be fairly clear and concise, so we can know exactly how turmeric affects individuals who are developing type 2 diabetes. But to understand how turmeric impacts an individual who eats it in their curry every day is significantly more complicated, and our methods of data-gathering and analysis coupled with a lack of funding make these answers to these important questions elusive. We *do* know there are positive effects, proven in research, to consuming spices regularly but we are still learning how and why these happen.

WHOLE-PLANT HEALTH

In nearly all cases, choosing a whole spice rather than an isolated extract is best for maintaining daily health and wellness. While it's much easier to study a single constituent than to study the complexity of a whole plant (never mind a spice blend!), in many cases the evidence doesn't necessarily support the isolation and concentration of these constituents over the use of the whole spice in food. As a result, we've wound up with a lot of studies on isolated constituents, a lot of patented products, and a lot of drug-like substances — and a paucity of studies that examine the long-term dietary use of whole plant medicinal herbs and spices.

Spices in their whole, natural form are delicious and dynamic. Consuming them eliminates the scientific guesswork of trying to figure out how a plant works and trying to extract those benefits to create something "better." Natural and whole spices used for health offer a variety of advantages you might lose with an isolate constituent. There's no point in extracting a specific constituent solely for its impact on circulation when the whole plant might also have benefits for resolving high cholesterol or hypertension.

SPICES AND DISEASE PREVENTION

Our use of spices tends to be based on culinary desires, traditions, and habits rather than a targeted consumption for specific disease prevention. Even in cultures where the general population consumes a lot of one

Spices, in realistic doses and in their food-based form, can be difficult to study because of their natural complexity. Thankfully, our bodies have long relationships with the plant world and know how to use plants in ways that benefit us.



spice, such as garlic, it can be nearly impossible from a data perspective to tease apart the effects of garlic from the other foods one might be eating with it, such as olive oil or whole grains. The reality that one cannot live on spices alone makes it even more difficult to get a realistic picture of the impact of a commonly used culinary dose of a spice.

We can, however, study individual spices consumed in concentrated doses for a limited period. Nearly all the research on spices focuses on the effects of using a moderate to high dose over a limited period. It is easy to extrapolate from this research to hypothesize on the impact a spice might have at a smaller dose with less frequent use. Since we tend to use spices in blends coupled with other medicinal spices, small impacts can be amplified by consistent consumption of these tasty medicinal gems.

Research on medicinal spices and their impact on human health generally falls into four types of studies: *in vitro*, animal, human, and population studies.

IN VITRO STUDIES

In vitro studies are also known as “test tube research” and typically involve a specific human cell or group of cells that are introduced to a spice or an isolated component of a specific spice. These studies are cost-effective and efficient, but they omit considerable factors that would be present in real life, such as the impact of digestion on the spice and what form the spice would be in as it travels through the body. In addition, the concentration of spices as they appear in these studies is far higher than it would be in normal dietary consumption. Finally, *in vitro* studies often use a single isolated constituent from a medicinal spice. As

spices are made up of hundreds of different constituents, it can be arbitrary or at least artificial to look at a single constituent. It can also significantly alter the medicinal effect of the plant. For example, a spice might have a constituent that is medicinally useful but not very bioavailable. In the same spice, there might be a few other ingredients that increase the bioavailability of the other constituents. Thus, the spice as a whole would be more medicinally active than any isolated part.

ANIMAL RESEARCH

Animal studies operate on the premise that other species (mice, specifically) are physiologically close enough to humans to allow us to learn about the effects of interventions on health and disease. Beyond the realm of studying potential toxicology of spices, the ethical aspects of animal studies are especially concerning with these substances that can be studied safely in humans. While there are models of animal research that do not harm the animal, this is the rare exception, unfortunately. Additionally, the administration of spices in animal research through artificial means, such as peritoneal injection instead of dietary consumption, brings up concerns in both applicability and ethics.

HUMAN CLINICAL TRIALS

Human research, especially double-blind placebo-controlled randomized clinical trials, is considered the gold-standard in looking at specific interventions in human health and disease. These studies can be controlled for other factors and allow us to learn as much as possible about a specific intervention using a variety of thoughtful

SPICE-DRUG INTERACTIONS SAFETY CONSIDERATIONS

May increase drug absorption: cayenne

May potentiate the effect of anticoagulants
in large doses: garlic, ginger

Limit to dosages typically used in food: holy basil,
fennel, juniper, rosemary, sage, thyme, and fenugreek

data collection tools. Human clinical trials, while expensive, allow us to get a clear picture of how a specific spice might impact a specific aspect of health or disease at a specific dose with a specific preparation. What these trials don't do is gauge the overall general impact of consuming one or more spices dietarily over a long period of time.

POPULATION STUDIES

These studies tend to look a group, often a specific population, that shares a lifestyle or dietary trait. For example, a study might look at a group of seniors in a specific geographic region who consume a certain diet and compare it to others who consume a different diet. While it is possible to control for a variety of things that might impact data, such as socioeconomic status or race, the most we can hope to show with this sort of data is correlation. In the case of whether or not to consume a spice, correlation may be enough to convince us, but it does lack the specificity that clinical trials provide. That said, the use of the spices in population studies is much more representative of the

realistic day-to-day use of spices in dietary preparations.

SAFETY PRACTICES

Spices are incredibly safe. We have thousands of years of history to draw global data from regarding safety of culinary use. Most spices are used in relatively small quantities in cooking. I think of them more like concentrated foods than like drugs. Their complexity and versatility, coupled with humans' coevolution with aromatic plants, allows spices to offer the human body numerous benefits without creating any significant health risks.

SPICE-DRUG INTERACTIONS

It is, of course, critical to consider safety precautions of spices interacting with drugs. People all over the world use spices in their daily cooking while simultaneously taking various pharmaceuticals. Consider the pungent curries full of concentrated spices used in nearly all meals in the Indian