Echinacea is a pink-flowering plant in the Asteraceae (daisy) family—one that’s growing more popular in our flowerbeds. This pretty plant comes in three main varieties (*Echinacea angustifolia*, *E. purpurea* and *E. pallida*), each of which has particular botanical and pharmacognostic characteristics. *E. angustifolia* and *E. purpurea* are the two varieties most often studied and used.

The use of this botanical dates back to Great Plains native Americans, who in the 19th century shared their knowledge with the group of health professionals known as “eclectic physicians.” When the eclectic physician movement faded in the early 20th century, so did many of the remedies popular among practitioners. It wasn’t until the 1960s that echinacea began slowly reappearing on natural food store shelves.

**Active principles**

Echinacea is an extremely complex medicinal plant, containing several families of active molecules, among them specific polysaccharides (immunostimulants), glycoproteins (immunostimulants), a volatile oil, derivatives of caffeic acid and cichoric acid known as echinacosides (antioxidants), the famous alkylamides (antivirals) and polyacetylenes.

Some controversy exists over the role and predominance of these active principles. According to some, the most powerful are the alkamides. According to others, polysaccharides are the most important. That said, echinacea’s active principles work more effectively in synergy than in isolation. According to Dr. Rudolf Bauer, professor in the Department of Pharmacognosy at the University of Graz (Austria) and international expert on echinacea extract standardization, a good echinacea extract should contain alkamides (or alkylamides), cichoric acid, polysaccharides and echinacosides (derivatives of caffeic acid and cichoric acid).
The total effect of many medicinal plants can’t be explained by one single active principle. Valerian, passiflora and echinacea are good examples, reminding us that we’re dealing with polymolecular treatments. Therefore, complete extracts are more useful than extracts standardized according to a single family of molecules (standardized echinacea extracts usually guarantee echinacosides, without specifying other molecules).

The goal of standardizing medicinal plant extracts is to obtain reproducibility batch after batch. When a manufacturer standardizes an extract based on one molecule, they risk not getting a sufficient concentration of secondary substances, which are often just as important as the primary ones.

Another approach to standardization offers a more global reproducibility batch after batch, despite echinacea’s normal variations. This procedure provides a more complete characterization of the plant. Not only is the principal marker (echinacoside) present, but all secondary substances (polysaccharides, alkylamides etc) are as well. The procedure includes a complete analysis of each extract batch (by HPLC), followed by precise mixing of different batches together to obtain constant concentrations of all active principles.

Fresh or dried plants?

Researchers who compared echinacea extracts made from fresh or dried plants concluded that when the extract is made from fresh plants, the concentration of all active principles is higher. For example, alkylamides are 2.5 times more concentrated in fresh echinacea extract (79.9 mg/100 g) than in dried extract (30 mg/100 g).

Mechanism of action

Echinacea has several useful therapeutic effects to prevent and treat colds and flu. Studies have shown that echinacea is:
• anti-inflammatory,
• immunomodulatory,
• antiviral, and
• antibacterial.

These combined effects explain why it can prevent colds and flu as well as reduce the intensity and duration of symptoms.

Improving silent defences

When infected by a respiratory virus, such as rhinovirus or flu, the immune system has two kinds of reactions:

• It silently attacks the virus by generating antiviral cytokines (interferon gamma IFN-γ) and anti-inflammatories (MCP-1 and IL-8). In this case, infection is asymptomatic.

• It unleashes its entire armada and attacks full-force. White blood cells generate pro-inflammatory cytokines (interleukins IL-1 beta, IL-6, IL-8 and TNF-alpha), which increase blood supply and mobilizes other immune responses. This inflammation is responsible for the symptoms we know so well: sore throat, stuffy and runny nose, headache, cough, weakness and shivers.

One of the most interesting things about echinacea is its ability to modulate the immune response by reducing the expression of inflammatory cytokines and by increasing the expression of antiviral and anti-inflammatory cytokines. So echinacea boosts the immune system’s ability to fight off viruses and other intruders, and at the same time reduces the body’s symptoms of this defence.

Virucide

In addition to improving the body's defences, echinacea directly attacks pathogens. Researchers evaluated echinacea’s ability to inhibit and kill the viruses responsible for most upper-respiratory tract infections. They found that at concentrations similar to (or lower than) those obtained by taking the extract regularly, echinacea inhibits several strains of flu virus (H5N1, H7N7 and H1N1).
in vitro. Another study showed that echinacea also inhibits other viruses in vitro (rhinovirus 1A and 14, flu virus, respiratory syncytial virus, adenovirus types 3 and 11 and herpes simplex virus type 1).

Researchers also compared echinacea’s effectiveness to a well-known antiviral neuraminidase inhibitor: oseltamivir (Tamiflu). They found that echinacea is not only more effective than oseltamivir but, unlike the latter, echinacea use won’t result in any resistance.

Bactericide
Echinacea directly attacks bacteria that cause respiratory infections and inhibits their capacity to cause an inflammatory response. In vitro, echinacea inhibits Streptococcus pyogenes group A (which causes pharyngitis), Hemophilus influenzae and Legionella pneumophila.

Clinical results
In vitro results often become null and void once tested in people. To address this concern, many researchers have used volunteers to study echinacea’s effectiveness. The media often report on the results of these studies. Occasionally we’re told echinacea is an amazing cold and flu fighter, but more often we’re told it’s useless.

Why the controversy?
One of the most important factors affecting study results is the quality of extract used. Was the extract studied made with

- the right plant and the right dose (one negative study published in 2005 used 900 mg—instead of 3 g—of an extract that didn’t contain all the right markers),
- the right variety of echinacea (E. angustifolia or E. purpurea),
- fresh or dried echinacea,
- grown organically or with pesticides,
- echinacea harvested at the moment of optimal
concentration of active principles,
- the proper method of extraction, and
- a validated product or a house-brand extract incorrectly described in the study.

All of these factors affect the concentration of active principles, the quality of the extract and its effectiveness, which in turn affect study results and the quality of products on store shelves. Just because a product received its NPN with a monograph from the NHPD doesn’t mean its effectiveness is guaranteed. It’s also difficult to know which products use a poor-quality extract vs an effective one.

As pharmacists, it’s important to choose an organic product cultivated by the manufacturer or a product that’s undergone clinical studies. This way we’ll avoid poor-quality products riding on the science of others, and we’ll encourage companies that have invested in science and offer high-quality products.

What do the experts say?
Despite the controversy, there is consensus among experts: a good echinacea extract is effective and, when taken as prevention, can reduce the number of colds by 55%. As treatment, echinacea must be taken at the first sign of symptoms and in sufficient doses. If taken correctly, it will reduce both the intensity of symptoms and the length of illness. Several clinical studies show that high-quality extracts are effective and well-tolerated. In addition, volunteers didn’t experience any more side effects than those taking a placebo.

Side effects and interactions
Side effects of echinacea are as uncommon as those from placebo:
- erythema and itchiness;
- gastric irritation, nausea, flatulence;
clinically, no interactions have been reported. in vitro, however, we've discovered that certain molecules found in echinacea could induce cytochrome 3A4, which affects the metabolism of several medications. the concentration of these molecules, however, is not sufficient enough to have an impact. since no theoretical interaction with echinacea has been reported clinically, combining it with other products is safe.

contraindications and precautions
Echinacea or asteraceae allergy is the only confirmed contraindication. however, since echinacea is immunomodulatory, some concerns exist about its safety in immunosuppressed patients. in these cases, it should be avoided.

Some authors say echinacea is contraindicated in patients with autoimmune diseases. echinacea's mechanisms of action don't support this kind of precaution, but professional judgment is required. echinacea is considered safe during pregnancy. no age or other restrictions apply to echinacea, with the exception of the contraindications and precautions mentioned previously.

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