Myo-Inositol

DESCRIPTION
Myo-inositol, the major nutritionally active form of inositol, is vital to many biological processes of the body, participating in a diverse range of activities. Myo-inositol is one of nine distinct isomers of inositol. It is essential for the growth of rodents, but not for most animals, including humans. Humans can make myo-inositol endogenously, which they do from glucose, and, even though myo-inositol is sometimes referred to as a vitamin, it is not a vitamin for humans or most animals. However, the dietary intake of myo-inositol can influence the levels of circulating and bound myo-inositol in the body and may influence certain biological activities. Nutritional supplementation of this cyclitol may affect behavior and may have anti-depressant and anti-anxiety activities. For more information on Inositol supplementation, see Inositol Hexanicotinate.

Myo-inositol intake from the average diet is approximately one gram daily. The major dietary forms of myo-inositol are inositol hexaphosphate or phytic acid, which is widely found in cereals and legumes and associated with dietary fiber, and myo-inositol-containing phospholipids from animal and plant sources.

Myo-inositol is also known as inositol, hexahydroxycyclolanehexane, cyclohexanexol, mouse antiallopecia factor and, chemically, as cis-1,2,3,5-trans-4,6-cyclohexanexol. Myo-inositol is abbreviated as Ins and sometimes as just I. It is represented by the following chemical structure:

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myo-Inositol

Another naturally occurring isomer of inositol, D-chiro-inositol, has been found to have activity against insulin resistance. However, at present, D-chiro-inositol is neither available as a nutritional supplement nor as a drug. A hexanicotinate conjugate of myo-inositol, inositol niacinate or inositol nicotinate, is available in Europe as a drug for the treatment of circulatory problems.

ACTIONS AND PHARMACOLOGY

ACTIONS
Myo-inositol may have antidepressant and antianxiety activity.
MECHANISM OF ACTION
The mechanism of action of myo-inositol has yet to be fully elucidated. However, much is known about the biological roles of myo-inositol and some speculation can be made. Myo-inositol is metabolized to phosphatidylinositol, which makes up a small, but very significant, component of cell membranes. Phosphatidylinositol can be converted to phosphatidylinositol-4,5-bisphosphate, a key intermediate in biological signaling. Phosphatidylinositol-4,5-bisphosphate is the precursor of at least three second-messenger molecules. These are inositol-1,4,5-triphosphate, which modifies intracellular calcium levels, diacylglycerol, which regulates some members of the protein kinase C family, and phosphatidylinositol-3,4,5-triphosphate, which is involved in signal transduction.

Some of the second-messenger activity is related to activation of serotonin receptors. It is hypothesized that the mechanism of action of myo-inositol’s possible benefit in the management of depression, panic attacks and obsessive-compulsive behavior may be explained by myo-inositol’s role as a second-messenger precursor.

PHARMACOKINETICS
Myo-inositol is absorbed from the small intestine following ingestion and is transported by the portal circulation to the liver and then by the systemic circulation to various tissues in the body, including the brain. Myo-inositol crosses the blood-brain barrier.

Within the liver and the various tissues of the body, myo-inositol enters into a wide range of diverse biochemical pathways. Myo-inositol reacts with CDP-diacylglycerol to form the phospholipid phosphatidylinositol, which can be incorporated into membrane structure. Phosphatidylinositol, via kinase reactions, forms phosphatidyl-4,5-bisphosphate, which is the precursor to inositol-1,4,5-triphosphate, diacylglycerol, phosphatidylinositol-3,4,5-triphosphate, myo-inositol 1,3,4-triphosphate and myo-inositol 1,3,4,5-tetrakisphosphate, among others. The myo-inositol phosphates can be dephosphorylated via phosphatases.

It is believed that the mechanism of action of lithium is due, in part, to its inhibition of the phosphatase that converts myo-inositol-monophosphate back to myo-inositol.

INDICATIONS AND USAGE
Myo-inositol has exhibited positive effects in a number of studies related to depression, panic attacks and obsessive-compulsive disorder. On the other hand, it generally has not been effective in treating Alzheimer’s disease, autism, schizophrenia and electroconvulsive therapy-induced memory impairment. The suggestion, from animal studies, that myo-inositol might be helpful in preventing neural tube defects has not been tested in humans.

RESEARCH SUMMARY
Inositol levels in cerebrospinal fluid are decreased, compared with general populations, in many suffering from depression. In one double-blind study, 28 depressed patients received placebo or high-dose (12 grams daily) myo-inositol for four weeks. Overall, significant improvement was achieved in the treatment group but not in the placebo group. There was improvement in both monopolar and bipolar depression in this pilot study. Myo-inositol, however, was not shown, in another study, to enhance or speed the response of depressed subjects to SSRIs (selective serotonin reuptake inhibitors). More research is needed in this area.

In another double-blind study, 21 patients with panic disorder, with or without agoraphobia, received 12 grams daily of myo-inositol or placebo for four weeks. Again, the treated group, overall, achieved improvement (frequency and severity of both panic attacks and agoraphobia declined significantly), compared with no significant improvement in the placebo group.

And in a third double-blind study, this one with a crossover component, 13 patients with obsessive-compulsive disorder (OCD) received 18 grams of inositol or placebo for six weeks each. Subjects improved significantly more, as reflected by significantly lower scores on the Yale-Brown Obsessive Compulsive Scale, when taking myo-inositol than when taking placebo. Myo-inositol, in a subsequent study, did not enhance the effects of SSRIs in subjects with treatment-refractory OCD. Again, more research is needed to confirm and further elucidate myo-inositol’s role in treating OCD. Its effectiveness, to the extent demonstrated to date, combined with its general lack of serious side effects, make it an attractive potential therapy in these psychiatric disorders.

Myo-inositol has not demonstrated the same promise in Alzheimer’s disease, autism, schizophrenia and electroconvulsive therapy-induced memory impairment. Studies related to these conditions have produced negative results. And in children with attention deficit disorder, myo-inositol aggravated rather than ameliorated symptoms in one small study.

In general, it appears that myo-inositol may be effective in many of the same disorders in which the SSRIs have shown some usefulness. This may not be surprising since myo-inositol has been shown to help reverse desensitization of serotonin receptors.

Myo-inositol is also being investigated for possible use in pediatric respiratory depression syndrome and for prevention of neural tube defects. Its usefulness with respect to the latter has been demonstrated in embryonic mice, but its use in humans may be curtailed or limited due to the fact that it has also been shown to induce uterine contractions.
CONTRAINDICATIONS, PRECAUTIONS, ADVERSE REACTIONS

CONTRAINDICATIONS
Known hypersensitivity to a myo-inositol-containing product.

PRECAUTIONS
Because of lack of long-term safety data, myo-inositol should be avoided by pregnant women and nursing mothers. Also, high-dose myo-inositol may induce uterine contractions.

Because of the hypothetical possibility that myo-inositol may exacerbate hypomanic or manic symptoms in those with bipolar disorder, those with this condition should use supplemental myo-inositol with caution and under medical supervision.

ADVERSE REACTIONS
Myo-inositol supplementation is generally well tolerated. Gastrointestinal effects such as nausea and diarrhea are occasionally reported.

INTERACTIONS
DRUGS
Theoretically, high-dose myo-inositol may have additive effects with selective serotonin reuptake inhibitors (SSRIs) such as fluoxetine, sertraline, paroxetine, fluvoxamine and citalopram, and with 5-hydroxytryptamine receptor agonists, such as sumatriptan.

NUTRITIONAL SUPPLEMENTS
No interactions known.

FOODS
Very small amounts of the inositol isomer, scyllo-inositol, are present in some foods. Scyllo-inositol has been reported to inhibit uptake of myo-inositol into the brain. Since the amount of scyllo-inositol intake is likely to be very little, this potential interaction is insignificant.

HERBS
Theoretically, high-dose myo-inositol may have additive effects with St. John’s Wort.

OVERDOSE
Not reported.

DOSAGE AND ADMINISTRATION
For the management of depression and panic attacks, 12 grams of myo-inositol daily, in divided doses, were used in clinical studies. In the clinical studies performed with myo-inositol, effects, if any, were seen in about one month. Compliance with such doses may be a problem.

LITERATURE


