CONTRAINDICATIONS, PRECAUTIONS, ADVERSE REACTIONS

CONTRAINDICATIONS

Chicken collagen II is contraindicated in those who are hypersensitive to any component of a chicken collagen II-containing product.

PRECAUTIONS

Because of lack of long-term safety studies, nutritional supplements containing chicken collagen II should be avoided by pregnant women and nursing mothers.

Those with rheumatoid arthritis who are interested in trying chicken collagen II should consult with their physicians before doing so.

ADVERSE REACTIONS

Chicken collagen type II supplements are generally well tolerated. There is one report of transient flushing in a patient with juvenile rheumatoid arthritis.

DOSAGE AND ADMINISTRATION

Chicken collagen II, derived from chicken sterum, is available as capsules and tablets. Some use 500 to 1000 mg daily. However, in the clinical trials showing possible mild effectiveness of chicken collagen type II, lower doses and different delivery forms were used. In these trials, the substance was first dissolved in 0.1 M acetic acid and added to orange juice prior to ingestion. The dose used in the trial of juvenile rheumatoid arthritics was 100 micrograms (0.1 mg) daily for one month followed by a dose of 500 micrograms (0.5 mg) daily. In a subsequent larger clinical trial involving rheumatoid arthritics, a dose of 20 micrograms (0.02 mg) daily appeared to have mild benefits in some. Higher doses did not.

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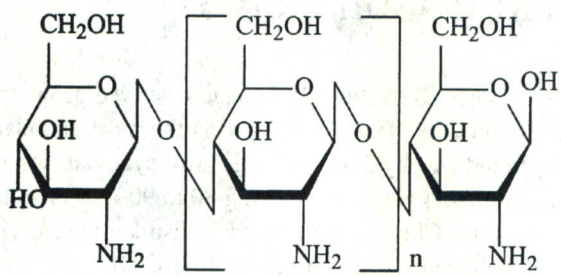
Chitosan

DESCRIPTION

Chitosan and chitin are polysaccharide polymers containing more than 5,000 glucosamine and acetylglucosamine units, respectively, and their molecular weights are over one million Daltons. Chitin is found in fungi, arthropods and marine invertebrates. Commercially, chitin is derived from the exoskeletons of crustaceans (shrimp, crab and other shellfish). Chitosan is obtained from chitin by a deacetylation process.

Chitin, the polysaccharide polymer from which chitosan is derived, is a cellulose-like polymer consisting mainly of unbranched chains of N-acetyl-D-glucosamine. Deacetylated chitin, or chitosan, is comprised of chains of D-glucosamine. When ingested, chitosan can be considered a dietary fiber. Chitosan has the following chemical structure:



Chitosan

Chitosan itself is the major source of the nutritional supplement glucosamine.

ACTIONS AND PHARMACOLOGY

ACTIONS

Chitosan may have hypocholesterolemic activity in some and may be beneficial in renal disease in some.

MECHANISM OF ACTION

Chitosan is, at the pH of the gastrointestinal tract, a positively charged polymer and can bind to negatively charged substances. It is believed that chitosan, similar to cholestryamine, has bile acid sequestration activity and that this may be the mechanism for its putative hypocholesterolemic effect. There is some evidence that chitosan binds to bile acids and some evidence that the polymer affects the metabolism of intestinal bile acids. However, in contrast to cholestyramine, chitosan does not have consistent hypocho-

lesterolemic activity. There is also evidence that chitosan binds to fats in the intestine, blocking their absorption.

The mechanism of action of chitosan's possible beneficial effects on renal disease in some is unknown. Chitosan can absorb urea and ammonia, but it is unclear whether this mechanism has anything to do with its putative renal effects.

PHARMACOKINETICS

Ingested chitosan can be considered as a cellulose-like dietary fiber. After ingesting, there is minimal digestion and most of the ingested chitosan is excreted in the feces.

INDICATIONS AND USAGE

There is some evidence that supplemental chitosan may have favorable effects on lipids and may be of some use in renal failure. There is some suggestion from available research data that it might be helpful in preventing atherosclerosis and could play a role in wound healing, some types of diabetes and liver disease or injury. Claims that it can help reduce weight, fight cancer, heal ulcers, aid digestion and boost immunity are unsubstantiated.

RESEARCH SUMMARY

There are several studies, in both animals and humans, demonstrating chitosan's effect on lipids. These effects have generally been more dramatic in various animal models, possibly due to higher chitosan intake in many of those studies. Some of these animal studies show very dramatic reductions in cholesterol and in LDL-cholesterol. Some have observed increases in the HDL-cholesterol, as well.

In humans, results have been less clear-cut, though still suggestive of positive effects. In one recent placebo-controlled, double-blind study, there was a significant decrease in LDL-cholesterol among subjects receiving 2,400 milligrams of chitosan daily, compared with placebo subjects. Chitosan had no significant effect on serum total cholesterol or on HDL-cholesterol, but it slightly increased triglycerides. Others have reported similar effects: reduced LDL-cholesterol with little or no effect on HDL and total cholesterols. A few others, however, have reported no lipid effects. Differences may be due to dissimilar dosing.

In animal models of chronic renal failure, chitosan produced decreases in serum urea nitrogen, serum creatine and serum phosphate. It also ameliorated anemia and increased fecal weight, fecal water content, fecal nitrogen and fecal sodium. The apparent protein ratio was decreased in a dose-dependent pattern in some of these studies, and survival times were markedly and significantly extended.

In a human study of 80 patients with chronic renal failure, similarly encouraging results were obtained. Half of these patients received 30 chitosan tablets (each containing 45 milligrams of chitosan) three times a day for a total of 4,050 milligrams daily. After four weeks on this regiment, these subjects experienced significant reductions in urea and creatine levels in serum, compared with controls. Significant gains were also measured in physical strength, appetite and sleep patterns after 12 weeks of chitosan supplementation. It is interesting to note that chitosan at this dose also significantly reduced total serum cholesterol levels (and increased serum hemoglobin levels).

Favorable lipid results would suggest that supplemental chitosan might help prevent atherosclerosis. This idea has been tested in some animal models with promising results. Using the apolipoprotein E-deficient mouse model of atherosclerosis, for example, researchers recently showed that a 5% chitosan diet could produce "a highly significant inhibition of atherogenesis"—42% inhibition in the whole aorta and 50% inhibition in the aortic arch, compared with controls. These positive effects were attributed to a 65% reduction in blood cholesterol levels (after 20 weeks on the 5% chitosan diet).

Some research has demonstrated that topical preparations containing chitosan can help speed wound healing. Other preliminary studies suggest that chitosan might be useful in lean type non-insulin-dependent diabetes mellitus. In an animal model of this disease, chitosan significantly reduced blood glucose, cholesterol and triglycerides. (The same results, however, could not be obtained in obese type NIDDM.) Still other similarly preliminary studies suggest that chitosan might help protect the liver against some toxins. More research in these areas is needed.

Claims have been made that chitosan can help reduce weight. There is insufficient data to support this claim. Two recent studies failed to find any weight-loss effect from the use of chitosan in overweight subjects. In the larger and longer-term of these two studies, 51 healthy obese women were given either placebo or 2,400 milligrams of chitosan for eight weeks. No significant weight reduction was noted in the treatment group.

Similarly, there is insufficient data to support claims that chitosan fights cancer, heals ulcers, aids digestion, or boosts or otherwise modifies immunity.

CONTRAINDICATIONS, PRECAUTIONS, ADVERSE REACTIONS

CONTRAINDICATIONS

Known hypersensitivity to a chitosan-containing product.

PRECAUTIONS

Children, pregnant women and nursing mothers should avoid using chitosan.

Those with shellfish allergies should exercise caution in taking chitosan supplements.

ADVERSE REACTIONS

Occasionally, gastrointestinal side effects, such as nausea and diarrhea have been reported.

INTERACTIONS

DRUGS

No interactions are known. However, chitosan might bind to certain drugs, especially lipophilic drugs.

NUTRITIONAL SUPPLEMENTS

Vitamin C is believed to enhance the putative benefits of chitosan. Chitosan might bind to the fat soluble vitamins A, D, E and K, as well as carotenoids and flavonoids. It might also bind to some minerals such as zinc.

FOODS

Chitosan might bind some dietary lipids. It may also bind the fat-soluble vitamins A, D, E and K, as well as flavonoids, carotenoids and some minerals, such as zinc, found in foods.

OVERDOSAGE

There are no reports of overdosage.

DOSAGE AND ADMINISTRATION

There are several chitosan supplements available. Those who use chitosan for cholesterol-lowering effects typically use 1000 to 1200 milligrams twice a day, taken before or after meals and with a glass of water. Chitosan can be contaminated with such metals as lead, mercury, iron, copper and arsenic.

Chitosan supplements should not be consumed within two hours of taking the fat-soluble vitamins A, D, E and K, carotenoids (e.g., lycopene, lutein), flavonoids (e.g., genistein, quercetin, ipriflavone) or prescription medication.

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Chlorella

DESCRIPTION

Chlorella is a genus of unicellular green algae belonging to the Phylum *Chlorophyta.* Chlorophytes comprise a major component of the phytoplankton. Chlorella is a popular food supplement in Japan and is marketed as a nutritional supplement in the United States. Chlorella, along with wheat grass, barley grass and spirulina, are sometimes referred to as "green foods." There are several species of chlorella. Those most commonly used in nutritional supplements are *Chlorella vulgaris* and *Chlorella pyrenoidosa.*

Chlorella is rich in protein. In addition, it is rich in chlorophyll, carotenoids, such as astaxanthin, canthaxanthin, flavoxanthin, loraxanthin, neoxanthin and violaxanthin. Chlorella also contains the xanthophyll, echinenone.

ACTIONS AND PHARMACOLOGY

ACTIONS

Chlorella has putative anticarcinogenic, immunomodulatory, hypolipidemic, gastric mucosal-protective and detoxification activities.