

enterocytes. In the enterocytes, a reacylation takes place reforming TAGs, which are then assembled with phospholipids, cholesterol and apoproteins into chylomicrons (CM). The CM are released into the lymphatics and are transported to the systemic circulation. In the circulation the CM are degraded by lipoprotein lipase and the fatty acids are taken up in part by the endothelial tissues to be used for oxidation or for synthesis of phospholipids, components of cell membranes. GLA is metabolized to dihomogamma-linolenic acid, which is converted to prostaglandin E1. ALA is metabolized to EPA, which itself is a precursor in the synthesis of the series-3 prostaglandins, the series-5 leukotrienes and the series-3 thromboxanes. Linoleic acid, also contained in blackcurrant oil, is metabolized to ALA. Stearidonic acid is also metabolized to EPA. The metabolites of GLA and ALA are catabolized by oxidative processes, and the catabolic products are mostly excreted in the urine.

INDICATIONS AND USAGE

Blackcurrant seed oil may have cardioprotective effects as well as some efficacy in rheumatoid arthritis. It is not a useful cholesterol-lowering agent. (See gamma-linolenic acid [GLA] for other possible indications.)

RESEARCH SUMMARY

Claims made for blackcurrant seed oil are similar to those related to gamma-linolenic acid (GLA). But since blackcurrant seed oil is a source of both GLA and alpha-linolenic acid (ALA), it has carved out a separate niche for itself. Blackcurrant oil may be cardioprotective.

Many of the benefits noted with the use of GLA in rheumatoid arthritis may be observed with the use of blackcurrant oil.

CONTRAINDICATIONS, PRECAUTIONS, ADVERSE REACTIONS

CONTRAINDICATIONS

Known hypersensitivity to a blackcurrant oil-containing product.

PRECAUTIONS

Pregnant women, nursing mothers and children should avoid use of blackcurrant oil unless it is recommended by a physician. Because of possible antithrombotic activity, those with hemophilia and those taking warfarin (Coumadin) should use blackcurrant oil with caution.

ADVERSE REACTIONS

No significant adverse effects have been reported. Those taking blackcurrant oil may experience mild gastrointestinal symptoms such as diarrhea. Some cannot tolerate the number of capsules required to receive any benefit.

INTERACTIONS

No interaction between blackcurrant oil and aspirin, other NSAIDs, or herbs, such as *Allium sativum* (garlic) and

Ginkgo biloba (ginkgo) have been reported. Such interactions, if they were to occur, might be manifested by nosebleeds and/or increased susceptibility to bruising. If this does occur, the blackcurrant oil dose should be lowered or stopped.

OVERDOSAGE

There are no reports of overdosage.

DOSAGE AND ADMINISTRATION

There are several blackcurrant seed oil supplements available, each differing slightly in the amount of GLA and ALA in a capsule. GLA ranges in these capsules from 60 to 90 milligrams and ALA 70 to 90 milligrams. The usual dose consumed is from three to six capsules, containing these amounts, daily, in divided doses.

LITERATURE

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Bone Meal

DESCRIPTION

Bone meal is used as a supplement for calcium and phosphorus. It is composed of finely crushed, processed bone, usually from cattle but sometimes also from horses. Bone marrow may also be added to the product. Calcium in bone meal occurs as a calcium phosphate compound known as hydroxyapatite or hydroxylapatite. Hydroxyapatite is an inorganic compound found in the matrix of bone and the teeth; it confers rigidity to these structures. The formula of hydroxyapatite is $(Ca_3(PO_4)_2)_3 \cdot Ca(OH)_2$ or $Ca_{10}(PO_4)_6(OH)_2$.

Bone meal was at one time a popular nutritional supplement for calcium. It is still marketed as a nutritional supplement, but it is no longer as popular. The reason for this is that in the 1980s analysis of bone meal supplements revealed them

to contain substantial amounts of lead, as well as other toxic elements, such as arsenic, mercury and cadmium. A second-generation "bone meal" product called microcrystalline hydroxyapatite, or MCHA, is being marketed as a calcium supplement and is claimed to be free of contaminants.

Bone meal is also used as a high-phosphorus fertilizer and in some pet foods.

ACTIONS AND PHARMACOLOGY

MECHANISM OF ACTION

See Calcium and Phosphorus.

PHARMACOKINETICS

See Calcium and Phosphorus.

Hydroxyapatite is apparently well-absorbed from the gastrointestinal tract.

INDICATIONS AND USAGE

Bone meal is still sold as a "natural" source of calcium. Its use should be avoided owing to potential toxic-metal contamination.

RESEARCH SUMMARY

The use of bone meal as a calcium and phosphorus source is no longer recommended. Several researchers have reported that many bone meal preparations are contaminated with toxic metals. In one study, bone meal samples were contaminated with significant amounts of lead, arsenic, mercury and other metals. Dolomite and calcium carbonate supplements labeled "oyster shell" or "natural source" have also been found to be contaminated with these metals.

One researcher has advised that "physicians must consider the possibility of unrecognized self-poisoning from the consumption of such substances, especially in the context of unexplained neurologic, gastrointestinal, cutaneous and hematologic disorders."

The feeding of meat and bone meal to cattle, contaminated with bovine spongiform encephalopathy (BSE) tissue, led to an epidemic of BSE in the British cattle population in the 1990s.

CONTRAINDICATIONS, PRECAUTIONS, ADVERSE REACTIONS

CONTRAINDICATIONS

Bone meal is contraindicated in those with hypercalcemia. Conditions that cause hypercalcemia include hyperparathyroidism, hypervitaminosis D, some granulomatous diseases, sarcoidosis and cancer. Bone meal is also contraindicated in those with calcium pyrophosphate dihydrate (CPPD) deposition disease.

PRECAUTIONS

Bone meal is no longer recommended as a calcium and/or phosphorus supplement because of possible presence of toxic substances, such as lead. Children are especially sensitive to

the effects of lead. Children, pregnant women and nursing mothers should absolutely avoid bone meal supplements.

ADVERSE REACTIONS

See Calcium. Prolonged use of bone meal contaminated with toxic elements, such as lead, may cause the typical toxic effects of these substances. Lead may produce abdominal pain, anemia and central nervous system damage.

OVERDOSAGE

There are no known reports of overdosage of bone meal.

DOSAGE AND ADMINISTRATION

No recommended dose. Second-generation "bone meal" supplements known as microcrystalline hydroxyapatite, or MCHA, are available as calcium supplements and are claimed to be free of contaminants.

LITERATURE

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Borage Oil

DESCRIPTION

Borage oil is derived from the seeds of the borage plant (*Borago officinalis*), a member of the Boraginaceae family. Borage oil, also known as starflower oil and borage seed oil, is a rich source of the long-chain polyunsaturated fatty acid gamma-linolenic acid (GLA). The possible health benefits of borage oil are attributed to GLA. GLA is an unusual constituent of living matter and is found in very few plants. These include, in addition to borage, evening primrose, blackcurrant and hemp. The amount of GLA in borage oil, as the percentage of total fatty acid content, ranges from about 20% to 27%. Typical borage oil supplements contain approximately 24% GLA.

GLA is an all cis n-6 long-chain polyunsaturated fatty acid. It is comprised of 18 carbon atoms and three double bonds. GLA is also known as GLA; 18: 3n-6 and gamolenic acid. Chemically, it is known as 6, 9, 12-octadecatrienoic acid; (Z,