Biotics Research Corporation

Technical Support

Products #1210 & 1215

Beta Plus™ & Beta-TCP™

Nutritional Support for Bile Production and Biliary Stasis

In the 16th century, Paracelsus introduced the concept of the tartaric diseases to explain how stones are formed in the human body by the precipitation of substances from body fluids, analogous to the deposition of tartar in wine casks. Today we know that in industrialized countries more than 80% of gallstones consist mainly of cholesterol, the prevalence of gallstones is about 10%, and in people between 40 and 50 years of age the 5-year incidence is about 3%.

Bile, Defined

Bile functions as the body's "detergent" emulsification and absorption of lipids, critical for fat digestion and assimilation. Bile is produced by the liver, and is temporarily stored in the gall bladder. Bile is released into the small intestine in response to hormones, such as cholecystokinin, when fat enters the intestine.

Bile consists of a mixture of bile salts, bile acids, cholesterol, bilirubin and phospholipids chiefly phosphatidylcholine. The ratio of individual lipids are critical to maintain a stable micellar concentration. The molar ratios are typically 5:15:80 for cholesterol/phosphatidylcholine/bile salts. If the bile concentration becomes too high, cholesterol will precipitate and gallstones will form in the gall bladder, a condition known as cholelithiasis.[1]

Bile Formation

Bile salts and acids represent oxidizedderivatives of cholesterol. About 80% of the cholesterol in the body will eventually be disposed of as cholic acid. The primary bile acids, cholic acid and chenodeoxycholic acid, possess a carboxylic acid side chain which confers hydrophilic properties to the lipophilic sterol ring and creates detergent-like molecules. The liver attaches taurine and glycine to bile acids to create bile salts (taurocholate or taurochenodeoxycholate and glycocholate or glycodeoxycholate, respectively). Bacterial enzymes in the colon can convert these to secondary bile acids, deoxycholate and lithocholate.

Bile and Digestion

Bile is needed for efficient uptake of oily nutrients (fats). When bile acids and bile salts first encounter ingested fats, they act as emulsifiers to create suspensions which can be broken down enzymatically. The process involves several important steps; sequentially indicated as:

1. The combined action of bile salts and pancreatic lipase initiates hydrolysis of triglycerides to free fatty acids and diglycerides, resulting in the formation of emulsions containing other lipid-soluble nutrients, including vitamins and carotenoids. The particle size of these emulsions ranges from 200 to 5,000 nm in diameter.

2. Lipase is then able to hydrolyze both di-and triglycerides to monoglycerides and free fatty acids. Lipase requires a smaller protein called colipase, another pancreatic product, to bind to triglycerides and activate the lipase.

3. Upon further release of bile salts, the lipid aggregates become smaller, from 3 to 10 nm in diameter. The normal endpoint of triglyceride digestion is a product containing 70% free fatty acid anions, 25% beta monoglycerides and 5% cholesterol. The micelles are then taken up by the epithelial cells of the brush border membrane via passive diffusion. After absorption, the fate of fatty acids depends upon their sizes. Medium chain fatty acids, with less than 10-12 carbons, pass directly from the mucosal cells into the portal blood and bind to serum albumin. Longer chain fatty acid anions are re-esterified with beta monoglycerides in the smooth endoplasmic reticulum to reform triglycerides. The newly synthesized triglycerides are complexed with apoproteins, cholesterol and phospholipids, to produce particles called chylomicrons. Chylomicrons are released from mucosal cells by exocytosis and enter the lymph, rather than entering the bloodstream directly.

Enterohepatic Circulation

Bile salts do not cross the mucosal barrier into the lymphatic system but rather they are reabsorbed as micelles in the lower region of the small intestine. Most of the bile salts released into the intestine are reabsorbed in the lower ileum where bacteria can reduce free bile acids to lithocholate and deoxycholate. The absorbed bile acids and salts are transported via the portal vein to the liver as complexes with serum albumin. The liver efficiently extracts them, conjugates them with amino acids and again secretes them as bile, which is returned to the gall bladder to continue to aid digestion. Bile salts are recirculated 2-3 times through the liver with each meal.

Betaine

Beets are a concentrated source of Betaine, which functions in the methylation of homocysteine, converting it into methionine and dimethylglycine. An elevated level of homocysteine, termed homocysteinemia, is a risk factor for cardiovascular complications. Dimethylglycine, in turn, functions as a methyl donor, thus aiding in both the detoxification and immune pathways. Betaine is often referred to as a "lipotropic factor" as it assists the liver in the processing of fats. Studies with betaine have correlated its use with liver protection. For example in one study, subjects exposed to carbon tetrachloride (CCl4), were followed with an oral treatment of betaine. They were observed to have a significant reduction in liver necrosis, which was attributed to betaine use. In another study, following CCl4 injection in test animals, supplemental betaine was observed to reduce liver triglycerides as well as centrilobular hepatic lipidosis.[3]

Fiber and the Binding of Bile Components

Certain kinds of dietary fiber bind bile salts. Examples include pectin (found in fruits and berries), hemicelluloses (found in cereal grains), and certain types of fiber that occur in legumes. When the diet is rich in partially soluble fiber, more bile is excreted (not reabsorbed). As a consequence, blood cholesterol levels may be reduced to account for more bile salt formation, consequently slowing the development of atherosclerosis.

Nutritional Support of Bile Formation

Bile. Bile salts, along with other components, including cholesterol, electrolytes and water are stored in the gallbladder. Bile salts act as an enzyme aide, and serve to enhance the absorption of fatty acids and some fat-soluble vitamins. Bile also serves as a fat emulsifier, thus increasing the surface area of the fat, and allowing it to become water-soluble. Thus bile aids aide in the absorption of fatty acids and cholesterol via the formation of micelles. The micelles, soluble in chime, are then easily absorbed by epithelial cells. Bile also serves in a protective

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mechanism, functioning to maintain the intestinal barrier against invading microorganisms.[4, 5]

Pancrelipase. (Pancreatic lipase) Pancrelipase functions in the hydrolysis of triacylglycerol in the presence of bile salts, thus accordingly functions in the absorption of dietary fats and lipids. Accordingly, in the presence of gastric lipase, triacylglycerol is hydrolyzed to monoglycerides and free fatty acids. Pancrelipase preparations have been shown to reduce fecal fat, indicating an improvement in the fat digestive process with the use of Pancrelipase.[6, 7]

Taurine. Taurine is a highly charged cysteine derivative, synthesized in vivo from the essential amino acid methionine. When conjugated to bile acids, an increased polarity of the bile acid results, thus increasing its amphipathic (detergent-like) properties. In one study dietary taurine was demonstrated to enhance the degradation of cholesterol and subsequent excretion via bile acids.[8] In animal studies supplementary taurine was demonstrated to both increase serum HDL, and significantly decrease total cholesterol.[9] Additionally, a significant increase in the concentration of fecal total bile acids has been observed with taurine supplementation.[10] The action of taurine on serum cholesterol was attributed to the facilitation of hepatic cholesterol 7- alpha-hydroxylase activity.[11]

Vitamin C. The enzyme noted above, cholesterol 7-alpha-hydroxylase, is the enzyme responsible for the initial step in the catabolism of cholesterol to conjugated bile acids. This enzyme is a vitamin C dependent enzyme. In studies supplemental vitamin C was shown to reduce total plasma cholesterol and triglycerides, which was correlated to a marked modification in apolipoprotein patterns.[12, 13] In patients with gallstones, vitamin C was shown to influence the environment of the gallbladder, resulting in a higher concentration of phospholipids, along with a changed ratio of bile acids, indicating an influence of vitamin C on the formation of gallstones.[14] Additionally, in women, an inverse correlation between serum ascorbic acid and the prevalence of both clinical and asymptomatic gallbladder symptomology was observed.[15]

Product Information

Beta Plus™ is available in bottles of 90 and 180 tablets. **Beta-TCP™** is available in bottles of 90 and 180 tablets.

Product Adjuncts

MCS®, **Mg-Zyme™**, **B6 Phosphate**, **Livotrit Plus®** **Phosphatidylycholine** for **Beta-TCP™**

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Beta-TCP™

Supplement Facts

Serving Size: 1 Tablet

	Amount Per Serving	% Daily Value
Vitamin C (ascorbic acid)	60 mg	100%
Taurine	100 mg	*
Pancrelipase (from porcine)	50 mg	*
Beet Concentrate** (whole)	100 mg	*
Superoxide Dismutase (from vegetable culture †)	20 mcg	*
Catalase (from vegetable culture †)	20 mcg	*

***Daily Value not established**

Other ingredients: Cellulose, stearic acid (vegetable source), magnesium stearate (vegetable source) and food glaze.

† Specially grown, biologically active vegetable culture containing naturally associated phytochemicals including polyphenolic compounds with SOD and catalase, dehydrated at low temperature to preserve associated enzyme factors.

**Whole beet concentrate from certified organically grown beets.

RECOMMENDATION: One (1) tablet with each meal as a dietary supplement or as otherwise directed by a healthcare professional.

KEEP OUT OF REACH OF CHILDREN
Store in a cool, dry area.
Sealed with an imprinted safety seal for your protection.

NDC #55146-01215 Rev. 5/08

Beta Plus™

Supplement Facts

Serving Size: 1 Tablet

	Amount Per Serving
Ox Bile Extract	100 mg*
Pancrelipase (from porcine)	50 mg*
Beet Concentrate (whole)**	100 mg*
Superoxide Dismutase (from vegetable culture †)	20 mcg*
Catalase (from vegetable culture †)	20 mcg*

***Daily Value not established**

Other ingredients: Cellulose, stearic acid (vegetable source), magnesium stearate (vegetable source) and food glaze.

† Specially grown, biologically active vegetable culture containing naturally associated phytochemicals including polyphenolic compounds with SOD and catalase, dehydrated at low temperature to preserve associated enzyme factors.

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