DrPaulApproved

MICRONUTRIENTS

VITAMINS,

MINERALS

& MORE

ASPARAGINE,
CALCIUM,CARNITINE,
CHOLINE

DR PAUL APPROVED-VOLUME 5

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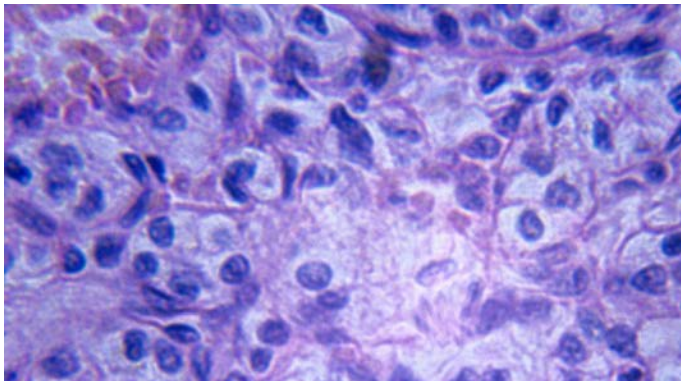
Supplement Recommendation

Check Vitamin Levels At Home:
https://trylgc.com/paulthomasvitamin

ASPARAGINE

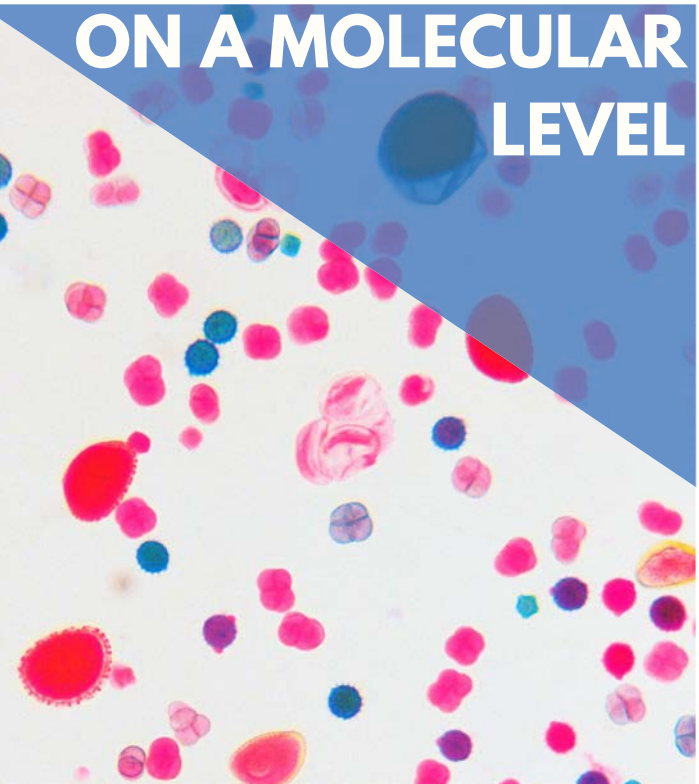
WHY IS IT IMPORTANT?

The major health concerns regarding asparagine seem to come when there is a problem with the enzyme asparagine synthetase (ASNS). The enzyme ASNS converts aspartate to asparagine and glutamine to glutamate. Health problems are either due to the lack of asparagine (not enough in the diet or not enough made due to the lack of ASNS function) or due to the accumulation of aspartate and glutamine when the enzyme is missing or not working properly.



Asparagine is an amino acid that we typically all can make from either aspartate or glutamine that we get in our diets. I was not aware of deficiency states for this amino acid until a couple of my own patients tested low for this amino acid on the Spectracell Micronutrient Test (MNT). [www.spectracell.com]

ON A MOLECULAR LEVEL



Asparagine seems to have a role in:

- Proper sequences of amino acids and proteins (amino acids are the building blocks of proteins)
- It is the safe storage form of aspartate, needed to make DNA, RNA and ATP
- It provides amino groups for the production of other amino acids when they are needed

Asparagine in proteins is an attachment site for carbohydrates involved in the formation of collagen, enzymes and in cell to cell recognition.

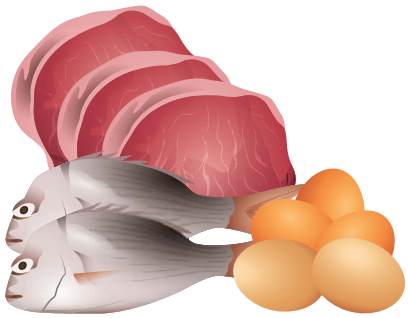
Aspartate is involved in cellular energy in the citric acid cycle and in the urea cycle helps in the removal of excess ammonia.

SYMPTOMS OF DEFICIENCY

There is limited published data on asparagine deficiency symptoms. In a study "Deficiency of asparagine synthetase causes congenital microcephaly and a progressive form of encephalopathy" [link below] four families with this genetic defect were found and their babies had congenital microcephaly (small heads), intellectual disability, progressive cerebral atrophy and intractable seizures.

In over 10,000 patients tested by MNT, 23% were found to have deficient asparagine function with the main symptoms being reported being those of fatigue and immune stress (autoimmune issues like rheumatoid arthritis, and allergies).

This is one of those deficiencies that you or your physician would not discover unless specialized testing like MNT was done or the genetics were determined through an extensive or specific genetic analysis.



FOOD SOURCES

Asparagine is considered a dispensable amino acid since it is present in all proteins, and our body can make more from aspartate and glutamine. There is no RDA, though cooking, storage and acidity can destroy asparagine.

SAFETY AND TOXICITY

RDA (Recommended Daily Allowance)

It appears safe to supplement up to 6 grams daily in adults. If supplementing children I would make the following estimations of need:

Infants - up to 1 gm daily
Children - up to 2 gms daily
Teens/adults - up to 6 gms daily

Since there is very little literature on supplementing this amino acid, I would use symptoms and MNT to assess the effects of your supplementing after 3 - 6 months at a particular level of supplementing.

No toxicity has been reported.

http://www.ncbi.nlm.nih.gov/pubmed/?term=Molecular+Basis+for+the+Activation+of+a+Catalytic+Asparagine+Residue+in+a+Self-Cleaving+Bacterial+Autotransporter
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3625782/
http://www.ncbi.nlm.nih.gov/pubmed/24139043

CALCIUM

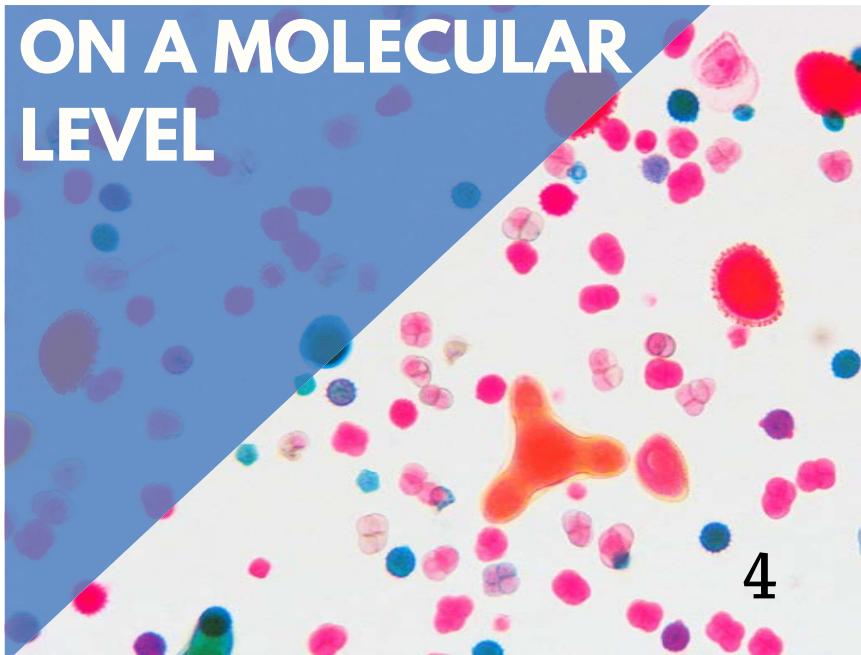
WHY IS IT IMPORTANT?

Blood calcium levels are tightly regulated to a narrow range so blood levels are not a good measure of calcium status. Vitamin D is needed for proper calcium absorption, parathyroid hormone acts on the kidney when blood calcium is low to increase active 1,25-OH D_3 (calcitriol) which then promotes increased absorption of calcium and release of stored calcium from bone.

Calcium is the most abundant mineral in the body with most of it in the bones and teeth. In addition to it's role in the structure of bone and teeth, calcium has important roles in:

- Bone formation and remodeling (osteoclasts dissolve bone and osteoblasts synthesize new bone)
- Cell signaling (contraction and relaxation of blood vessels and muscles, nerve impulses, hormone secretion)
- Calcium is required for 7 vitamin K-dependent clotting factors

ON A MOLECULAR LEVEL



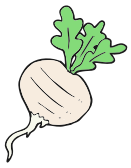
SYMPTOMS OF DEFICIENCY

Acute calcium deficiency would likely be the result of low parathyroid hormone that can be due to magnesium deficiency, kidney failure or vitamin D deficiency. Symptoms may include muscle or nervous irritability, muscle spasms and cramps or in severe cases tetany. Chronic calcium deficiency results in bone loss which causes rickets in children and osteoporosis or osteomalacia in adults and children

As dietary protein increases there is an increase in urinary excretion of calcium. Higher sodium intake has also been associated with increased urinary excretion of calcium. Kidney stones are typically calcium oxalate or calcium phosphate, and tend to occur in those with higher urinary excretion of calcium. Interestingly, higher dietary intakes of calcium actually lower urinary excretion of calcium making the standard recommendation for those who suffer from kidney stones to reduce calcium intake to be misguided. The recommendation should be to reduce protein and sodium intake and drink more water.

Adequate calcium seems to be protective against colorectal cancers, hypertension (especially pregnancy induced) and may reduce insulin resistance being protective against type-2 diabetes.





Most people get their calcium from fortified cereals or dairy. It is however quite possible to get adequate calcium with a dairy free diet if you know what to eat.

FOOD SOURCES

Food Source	mg calcium
Firm tofu (1/2 cup)	861
Collard greens (1 cup)	357
Turnip greens (1 cup)	197
Kale (1 cup)	187
Greens (1 cup)	100 - 300
Beans & legumes	100 - 200
Sardines (7 filets)	327
Seeds and nuts	70 - 100
Orange juice (1 cup -fortified)	500
Medium orange	65
Soy milk (1 cup)	300
Molasses (1 TBS)	178
Milk/ yogurt (8 ounces)	300-415
Cheese (1 ounce)	140 - 160

SAFETY AND TOXICITY

Toxicity has never been seen with foods although there is possible increased prostate cancer in those with a very high dairy intake.
Mild toxicity related to excessive intake of calcium supplements, or as part of antacids that are high in calcium, can result in: loss of appetite, nausea, vomiting, constipation, abdominal pain, dry mouth, thirst, frequent urination.
If calcium intake exceeds 2 - 4 grams daily on an ongoing basis, this can decrease the uptake of magnesium, zinc, iron, manganese and other minerals which can result in decreased reflexes, muscle weakness, ataxia and anorexia.

RDA (Recommended Daily Allowance)

TOLERABLE UPPER LIMITS MG/DAY
Infants unknown (since they are in rapid bone growth - intake may be high but safe if just from breast milk or formula)

RDA for infants is listed as 210 - 170 mg, 500-1,300 mg children and 1300 mg for teens and adults. If your diet is low in calcium, I suspect you can avoid toxicity by keeping supplementation below 2000 mg a day and would recommend only 1000 mg as supplements and add calcium rich foods.
Remember to take a vitamin D supplement or you will not be absorbing much of the calcium from the diet or supplements.
Take vitamin D with vitamin K2 so that the increased calcium absorption gets stored in the bones where it belongs.

http://www.ncbi.nlm.nih.gov/pubmed/18339051
http://www.hsph.harvard.edu/nutritionsource/calcium-sources/

CARNITINE

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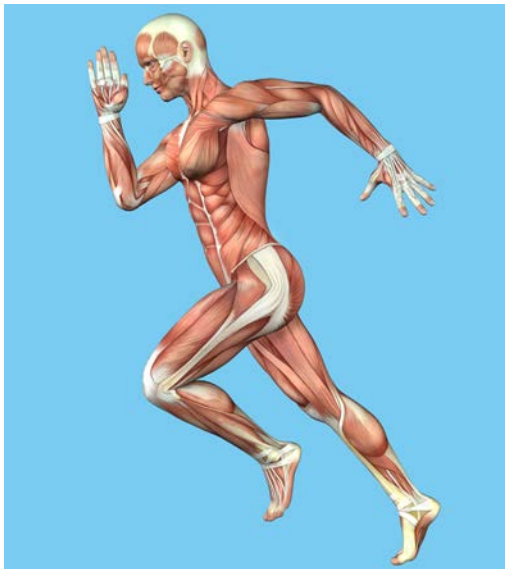
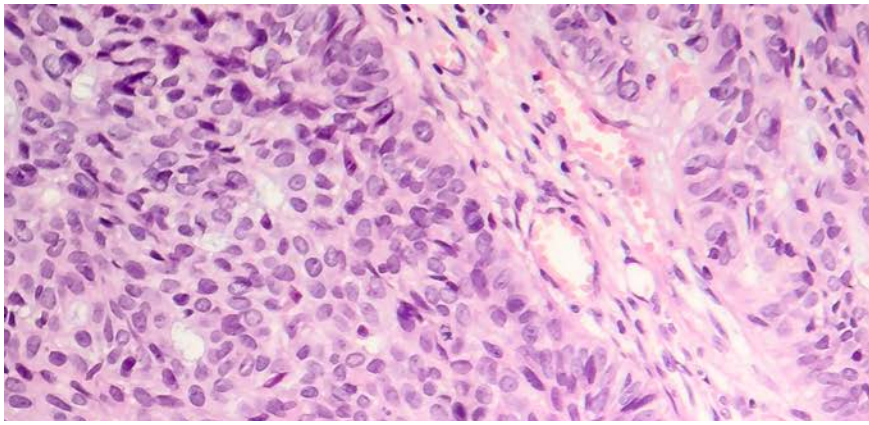


WHY IS IT IMPORTANT?

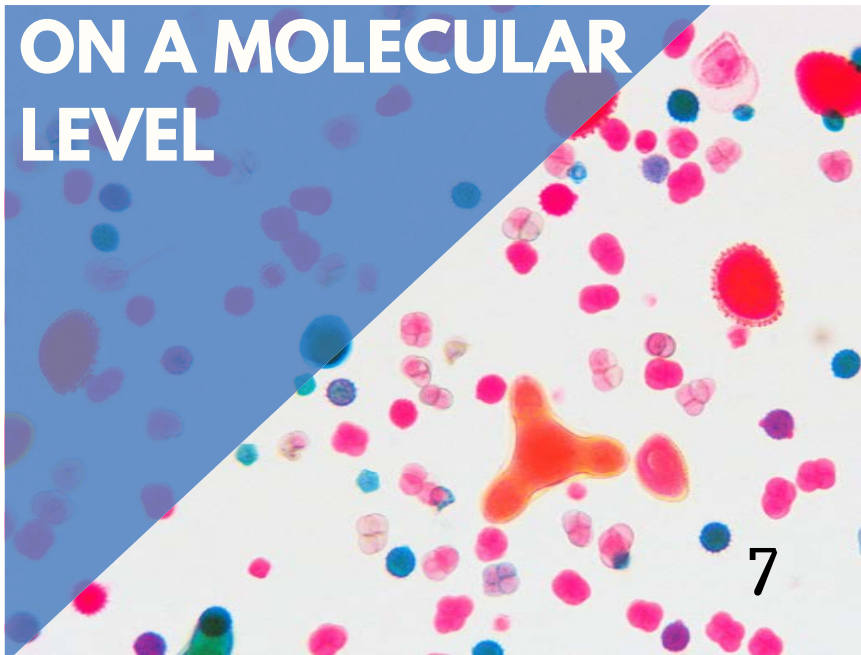
Carnitine has been known to lower triglycerides and cholesterol in those who are relatively low in carnitine.



Carnitine is made in the body from the essential amino acids L-lysine and methionine. This conversion requires niacin (B_3), vitamin B_6, vitamin C and iron. Carnitine (L-Carnitine) is essential for energy production in the cell:

- It enables activated fatty acids to enter the mitochondria
- Beta-oxidation of the fatty acids in the cell to produce ATP (the major energy source of our cells)
- Modulation of acyl-CoA/CoA ratio
- Energy storage in the cell as acetyl carnitine
- Detoxification by removal of poorly metabolized acyl groups excreting them as carnitine esters

ON A MOLECULAR LEVEL

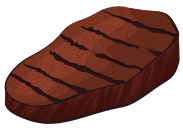


SYMPTOMS OF DEFICIENCY

In children, the major symptoms of carnitine deficiency are related to the decreased energy of muscles leading to heart failure in severe cases and weakness of major muscles affecting the ability to walk or other gross motor skills in the very young child. The impaired lipid metabolism of carnitine deficiency results in lipid accumulation in skeletal muscle, heart and liver. This results in muscle weakness and fatigue.

Due to the great needs for oxygen in the heart and brain, times of stress (illness in the ICU, any heart compromise) and times of memory challenge (Alzheimer's, depression, Autism spectrum etc.) may benefit from carnitine support. At the cellular level, carnitine levels drop quickly when there is lack of oxygen.

Since carnitine is the shovel that gets energy into the cell, fatigue and weakness should be considered possible signs of carnitine deficiency. Due to the rapid changes in blood levels at any given time, blood levels while suggestive of an issue when low, are rarely helpful. Rather than a muscle biopsy for carnitine levels, I prefer to use micronutrient testing MNT (www.spectracell.com).



Adults who eat meat and other animal products typically get 60 - 180 mg a day of carnitine. Vegans average 10 - 12 mg daily.

FOOD SOURCES

Food Source	mg
Beef (4 ounces)	56-162
Whole milk (1 cup)	8
Fish (4 ounces)	4 - 7
Chicken (4 ounces)	3 - 5
Cheese (2 ounces)	2
Whole wheat bread (2 slices)	0.2
Asparagus (1/2 cup)	0.1

SAFETY AND TOXICITY

At daily doses exceeding 3 grams a day, supplements can cause nausea, vomiting, abdominal cramps, diarrhea and a fishy body odor. In children I have occasionally seen stomach upset at doses as low as 250 mg, which can be reduced if taken with food.
There are rare reports of muscle weakness in uremic patients and seizures in patients with seizure disorders.

RDA (Recommended Daily Allowance)

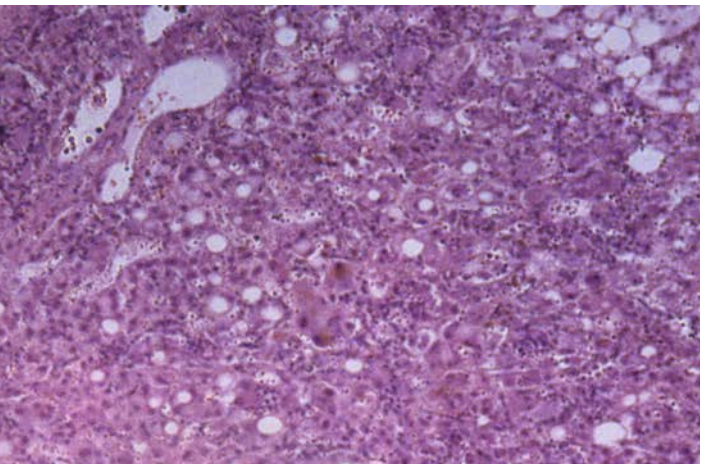
There is no established RDA or upper limit of tolerability, however I would limit supplementation doses to:

Infants 125 mg twice a day
children 250 mg twice a day
Teen & adults 500 mg twice a day

Carnitine should only be taken as L-carnitine, and there seems to be a benefit of taking Coenzyme Q10 and pantothenate with carnitine, especially if those nutrients are low or borderline.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1222323/pdf/11802770.pdf
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3495906/
http://www.ncbi.nlm.nih.gov/pubmed/24500444
http://www.ncbi.nlm.nih.gov/pubmed/15591002
http://ods.od.nih.gov/factsheets/Carnitine-HealthProfessional/

CHOLINE



WHY IS IT IMPORTANT?

Choline is essential for cell growth being an essential part of cell membranes.

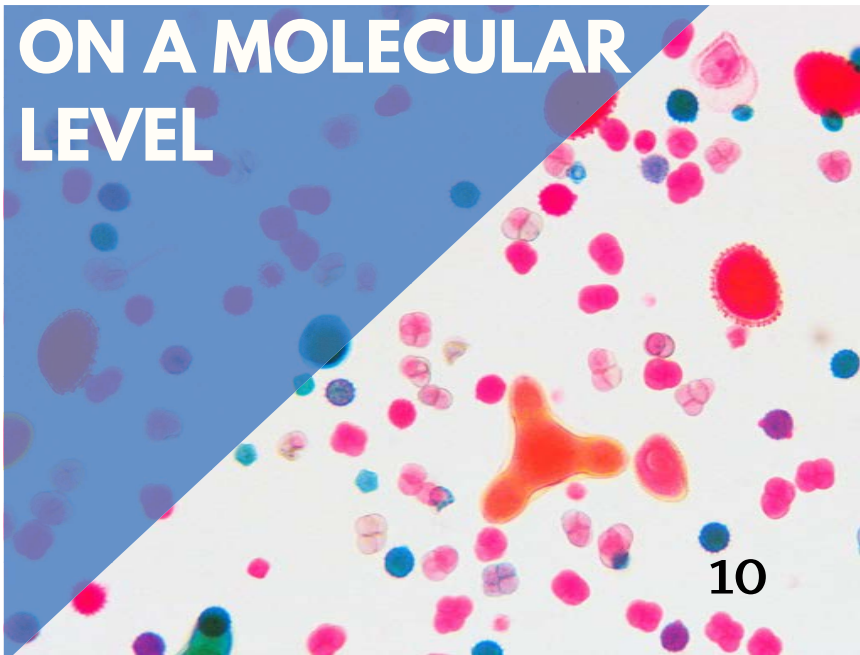
In the liver, fat and cholesterol are packaged into VLDL (very low density lipoproteins) for transport in the blood to tissues where they are needed.
Phosphatidylcholine is required to make VLDL and without it fat and cholesterol accumulate in the liver.

The functions in the body supported by choline include:

- Serves as a source for methyl groups for the biosynthesis of other compounds
- Involved in one carbon metabolism with vitamins B12, folate, ethanol amine and betaine (betaine formation requires choline)
- Betaine is a major donor of methyl groups for the methylation cycle
- Is a major component of cell membranes as phosphatidyl choline
- Phosphatidyl choline is involved in cholesterol and lipoprotein metabolism

The choline molecule is part both phosphatidlycholine and sphingomyelin, important in cell membranes. As the precursor of acetylcholine this molecule is vital for nerve conduction, memory and muscle control.

ON A MOLECULAR LEVEL

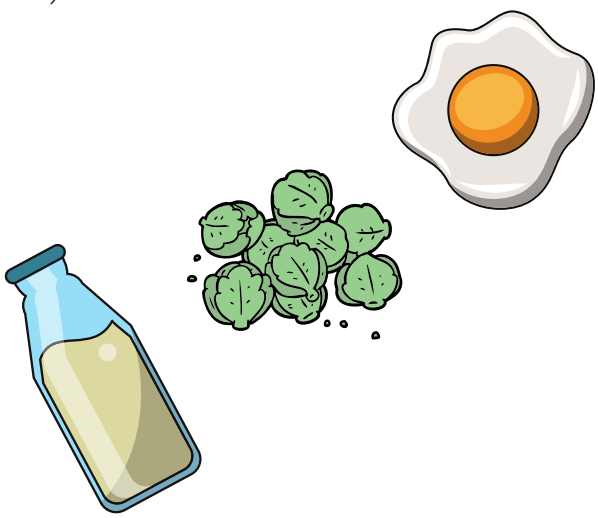


SYMPTOMS OF DEFICIENCY

Liver dysfunction including hepatitis and cirrhosis, and fatty liver can be seen in extreme choline deficient states. Due to it's role in cell membranes and nerve conduction, those deficient may have depression or memory loss, Alzheimer's and dementia. It has been used in Huntington's chorea, tourette's and cerebellar ataxia, seizures and schizophrenia. It is unclear that deficiency actually causes these conditions, but may be involved.

The most important role seems to be during pregnancy in the prevention of neural tube defects, and for adequate nutrition as part of infant formulas.

Due to the role in the methylation cycle, this nutrient in states of long term deficiency will be related to cardiovascular issues (arteriosclerosis, MI's stroke etc.) and increased cancer risk.



FOOD SOURCES

Food Sources	mg
Beef liver (3 ozs)	355
Wheat germ (1cup)	172
Egg (1)	126
Fish (3 oz)	60 - 70
Beef (3 oz)	67
Brussel sprouts (1 cup)	63
Broccoli (1 cup)	62
Milk (1 cup)	20 - 40
Peanut butter (2 TBS)	20

Supplements of choline salts are available. Phosphatidylcholine and lecithin are only about 13% choline thus about 4 grams would provide 500 mg choline.

SAFETY AND TOXICITY

No adverse effects have been seen with intakes up to 10 grams a day in adults. At 20 grams a day of choline as choline salts, excess cholinergic stimulation has been seen with increased salivation, sweating, nausea, dizziness, depression and EKG changes. No symptoms other than upset stomach were noted when doses of choline were up to 100 grams a day. Obviously at high intakes there will be additional high caloric intake that may have it's own problems. Moderation recommended.

RDA (Recommended Daily Allowance)

ADEQUATE INTAKE mg/day
Infants 150
children 200 - 400
teens and adults 550

TOLERABLE UPPER LIMITS grams/day
Infants unknown (1 gram likely ok)
children 1 - 2
teens/ adults 3

Since methotrexate inhibits dihydrofolate reductase and thus limits methyl groups, additional choline can be helpful. Given the high content in meats and eggs, vegetarians who do not consume eggs, should supplement choline.

http://www.ncbi.nlm.nih.gov/pubmed/24022817
http://www.ncbi.nlm.nih.gov/pubmed/23493015
http://lpi.oregonstate.edu/infocenter/othernuts/choline/
http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/Choline/Choln02.pdf

DR. PAUL'S SUPPLEMENT RECOMMENDATIONS

(Visit wellevate.me/drpaul
to get 25% discount)

Liquid calcium Magnesium 1:1 berry by integrative therapeutics

Calcium D- Glucarate by integrative therapeutics

Calcium D- Glucarate by integrative therapeutics

Disclaimer: Please check with your health care provider to see if this supplement is appropriate for you and what dose to use.

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DR. PAUL'S SUPPLEMENT RECOMMENDATIONS

DrPaulApproved

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LCholine Cocktail by Twin Lab

Choline Bitartrate by Douglas Laboratories

Disclaimer: Please check with your health care provider to see if this supplement is appropriate for you and what dose to use.