

# LECITHIN NUTRITION

## WHY CHOOSE ADM'S LECITHIN FOR NUTRITION?

Lecithin contains choline, which is an important precursor for many biochemical functions. Choline helps provide structure and fluidity in cell membranes, improves transfer of nerve impulses to the brain and circulatory system, and aids in lipid and cholesterol transport and metabolism<sup>1</sup>. Consuming an adequate daily intake of choline (550 mg/day for adult men and 425 mg/day for adult women), supports brain, liver, and heart health<sup>1</sup>.

Ultralec<sup>®</sup> deoiled lecithin is considered an excellent source of choline. The FDA permits a product to be labeled an "excellent source of choline"<sup>2</sup> if a serving contains more than 110 mg of choline and as a "good source of choline"<sup>2</sup> if a serving contains more than 55 mg of choline.

### KEY BENEFITS

- 4 g (1.5 tsp or 0.5 Tbsp) provides enough choline to meet "excellent source" claim<sup>2</sup> for choline
- 2 g (0.75 tsp) provides enough choline to meet "good source" claim<sup>2</sup> for choline
- Contains polyunsaturated fatty acids, which have been shown to decrease serum LDL cholesterol when substituted for saturated fatty acids in a diet low in saturated fats and cholesterol<sup>12</sup>
- Manufactured with an acetone-free process, yielding a bland flavor and aroma
- Easy-to-use dry form
- Convenience of three granulation sizes—powder, fine granule, and granule
- Ultralec<sup>®</sup> F is the only true small granule product on the market; others are coarse powders

Ultralec deoiled lecithin is produced through a patented ultrafiltration process that does not use acetone to extract the oil. (Acetone extraction is the typical method for producing a deoiled lecithin.) Although the bulk of the acetone is stripped from competitive products, residual acetone is always left in the final product. As the lecithin ages, acetone reacts through



an aldol condensation to form highly odoriferous compounds such as mesityl oxide. Because Ultralec deoiled lecithin avoids the use of acetone, our process eliminates the off-flavors and odors often associated with acetone-extracted deoiled lecithin. Ultralec deoiled lecithin is convenient to use because it is a dry product. By offering different granulation sizes, our Ultralec P powder, Ultralec F fine granule, and Ultralec G granule give you the flexibility needed for a wide range of applications.



For customers around the world, ADM draws on its resources—its people, products, and market perspective—to help them meet today's consumer demands and envision tomorrow's needs.

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Ultralec deoiled lecithin is confirmed GRAS and can be used in a variety of applications such as supplements, nutrition bars, beverages, spreads, and dressings. It can also be used to aid dispersion of powders into liquids, emulsify fats and oils, and keep baked goods moist and tender.

Capsule series of products are standardized, high clarity lecithins designed for high-speed encapsulation systems. These products are designed for encapsulation applications requiring a low viscosity lecithin product. The product's low peroxide value and brilliant sheen permit consistently clear lecithin capsules.

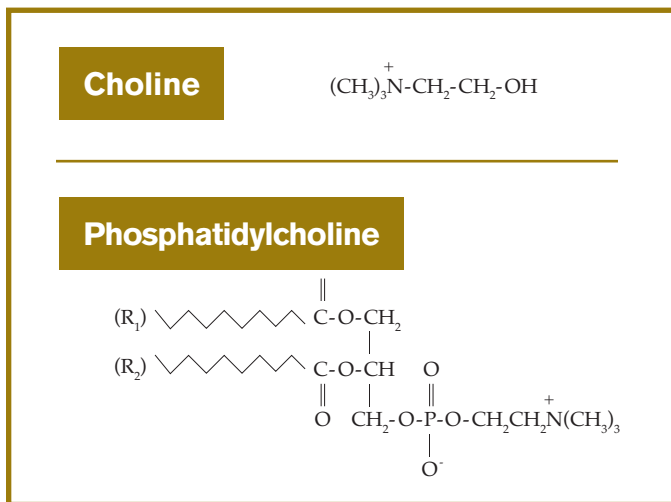
Advantages of liquid- and semisolid-filled hard gelatin capsules include:



- Improved bioavailability,
- Improved content uniformity of low-dose active substances,
- Reduced dust for handling potent compounds,
- Enhanced stability,
- Sustained release.

**Table 1**

Chemical Structures of Choline and Phosphatidylcholine (R1 and R2 are predominately polyunsaturated acids)



## WHAT IS LECITHIN, AND WHY IS IT IMPORTANT?

The word lecithin comes from the Greek word lekithos, meaning egg yolk, because it was first isolated from egg yolk. The term "lecithin" is often referred to in medical terminology as phosphatidylcholine. However, lecithin also denotes commercial soybean lecithin, which is a complex mixture of phospholipids, triglycerides, and carbohydrates produced from soybeans. The chemical structure of choline is shown in Table 1.



It is found in foods, primarily in the form of phosphatidylcholine, which is a phospholipid. Ultralec deoiled lecithin typically contains 23% phosphatidylcholine. Choline makes up 13% of the phosphatidylcholine molecule and therefore, Ultralec deoiled lecithin typically contains 3% choline.

The trend toward low-fat consumption of foods makes it more difficult for many people to achieve the Adequate Intake (AI) for choline. (Table 2 shows Adequate Intakes. The Adequate Intake of a nutrient is the amount that appears to sustain good health. Adequate Intake is used for nutrients that have not yet received enough scientific study to merit the setting of an official Recommended Dietary Allowance (RDA).)

As stated, Ultralec deoiled lecithin is an excellent source of choline in the diet. A serving of Ultralec deoiled lecithin (0.5 Tablespoon, 4 g) contains 120 mg of choline. This is approximately the same amount of choline found in one egg (50 g, Table 2). However, one egg contributes approximately 75 calories and 212 mg of cholesterol to the diet, while Ultralec deoiled lecithin contributes about 25 calories and 0 mg of cholesterol. There-

**Table 2 Choline Adequate Intake (AI) Summary**

<i>Boys and girls 0-6 Months</i>	125 mg/day of choline
<i>Boys and girls 7-12 Months</i>	150 mg/day of choline
<i>Boys and girls 1-3 Years</i>	200 mg/day of choline
<i>Boys and girls 4-8 years</i>	250 mg/day of choline
<i>Boys 9-13 Years</i>	375 mg/day of choline
<i>Boys 14-18 Years</i>	550 mg/day of choline
<i>Girls 9-13 Years</i>	375 mg/day of choline
<i>Girls 14-18 Years</i>	400 mg/day of choline
<i>Men 19 Years and Over</i>	550 mg/day of choline
<i>Women 19 Years and Over</i>	425 mg/day of choline
<i>Pregnant Women</i>	450 mg/day of choline
<i>Lactating Women</i>	550 mg/day of choline

Different genders and ages have different choline requirements. Table 2 is a summary of the AI recommendations from the 1999 DRI.

fore, people with dietary patterns that don't include eggs, organ meat, and nuts should consider supplementing their diets with Ultralec deoiled lecithin.

## ADDITIONAL CONSIDERATIONS

### EXERCISE

A limited number and selected studies have been conducted showing the relationship between strenuous exercise and choline. One such study showed that strenuous physical activity reduced the plasma choline concentration in trained athletes<sup>3</sup>.

### PREGNANCY

The demand for choline greatly increases during pregnancy because of increasing transport of choline from the mother to the fetus<sup>4,5</sup>. Choline and its metabolites are needed for the function and integrity for cell membranes, and choline also directly affects neurotransmission<sup>7</sup>.

### LACTATION

The need for choline, which is increased in pregnancy, is further increased during lactation because a large amount of choline is secreted into breast milk<sup>6</sup>. The choline content of breast milk will influence the infant's circulating choline levels<sup>6</sup>.

## WHAT ARE THE BENEFITS OF CHOLINE?

### HEART FUNCTIONS

Phosphatidylcholine is the predominant phospholipid, and unsaturated fatty acids are the predominant fatty acids of lecithin, and research shows that consuming polyunsaturated fatty acids in place of saturated fatty acids reduces serum LDL cholesterol levels in a diet low in saturated fats and cholesterol<sup>8</sup>.

### BRAIN DEVELOPMENT AND FUNCTION

Several mechanisms have evolved through nature to ensure that a developing animal receives an adequate amount of choline. Examples include the high concentration of phosphatidylcholine found in bird eggs and the large amounts of choline found in human milk<sup>9</sup>. These mechanisms suggest that an adequate supply of choline supply might be crucial during this time of development.



Several studies in rats have shown perinatal supplementation with choline results in improved memory performance in rat pups<sup>10,11</sup>.

### LIVER FUNCTION

The liver is an important site for the utilization of choline. Markers of liver dysfunction are considered signs of choline deficiency and have been used to estimate the daily requirement for choline<sup>1</sup>. This latter study emphasizes that in choline deficiency situations, lecithin serves as an adequate source of choline for the body.



Phosphatidylcholine is an important component of the liver's ability to assemble and secrete fat.

## LECITHIN TECHNICAL FUNCTIONS AND APPLICATIONS

Ultralec<sup>®</sup> deoiled lecithin and Capsulec capsule grade lecithin can be used in a variety of nutritional supplements such as lecithin granules, capsules, and tablets. Ultralec deoiled lecithin is also used in a variety of other applications such as nutrition bars, beverages, spreads, and dressings. Use it to disperse powders into liquids, emulsify fats and oils, and keep baked goods moist and tender.

## WHO NEEDS LECITHIN?

Everyone. One serving of Ultralec deoiled lecithin is an excellent source of choline, which has been recognized as an important part of everyone's diets.

In addition to our deoiled lecithin, ADM offers a comprehensive line of quality lecithin products, including standard fluid, complexed, and modified varieties. We also possess the technical expertise to help you successfully incorporate them into your products.

To learn more about Ultralec deoiled lecithin or any of the other quality ADM ingredients, please contact us.

### Additional Resources on Choline

WebMD ([www.webmd.com](http://www.webmd.com))

PDRHealth ([www.pdrhealth.com](http://www.pdrhealth.com))

National Academies Press ([www.nap.edu](http://www.nap.edu))

- 1 Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. The National Academies Press, Washington, D.C. 1998.
- 2 Subject to FDA guidelines for nutrient content claims, which require such claims to include the following verbiage: "Contains \_ mg choline per serving, which is \_% of the Daily Value for choline (550 mg)" or "Contains \_% of the Daily Value of choline per serving. The Daily Value for choline is 550 mg."
- 3 Conlay L.A., et al. Decreased plasma choline concentrations in marathon runners. *N Engl J Med* 1986;315:892.
- 4 Zeisel, S.H. Choline, homocysteine, and pregnancy. *Am J Clin Nutr* 2005;82:719-20.
- 5 Molloy, A.M., Mills, J.L., Cox, C., et al. Choline and homocysteine interrelations in umbilical cord and maternal plasma at delivery. *Am J Clin Nutr* 2005;82:836-42.
- 6 Ilcol, Y.O., Ozbek, R., Hamurtekin, E., Ulus, I.H. Choline status in newborns, infants, children, breast-feeding women, breast-fed infants, and human breast milk. *J Nutr Biochem* 2005;16:489-99.
- 7 Zeisel, S.H. Nutritional importance of choline for brain development. *J Am Coll Nutr* 2004;23:621S-626S.
- 8 Institute of Medicine Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Chapter 11 (Part 2). The National Academies Press, Washington, D.C. 2002.
- 9 Zeisel, S.H., et al. Choline, phosphatidylcholine, and sphingomyelin in human and bovine milk and infant formulas. *J Nutr* 1986;116:50-58.
- 10 Meck, W.H., et al. Pre- and postnatal choline supplementation produces long-term facilitation of spatial memory. *Dev Psychobiol* 1988;21:339-5.
- 11 Tees, R.C., et al. Altering the impact of early rearing on the rat's spatial memory with pre- and postnatal choline supplementation. *Soc Neurosci Abstr* 1991;17:1401.
- 12 Institute of Medicine Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Chapter 8. The National Academies Press, Washington, D.C. 2002.

DEOILED LECITHINS			
Product	Typical Analyses		
ULTRA-FILTERED DEOILED LECITHINS			
Ultralec® P	AI, % 97 min. H2O, % 1.0 max.	Color: Light gold Form: Powder	Viscosity: N/A
Ultralec F	AI, % 97 min. H2O, % 1.0 max.	Color: Light Gold Form: Fine granules	Viscosity: N/A
Ultralec G	AI, % 97 min. H2O, % 1.0 max.	Color: Light gold Form: Granules	Viscosity: N/A
FLUID LECITHINS			
Product	Typical Analyses		
CAPSULE GRADE LECITHINS			
Capsulec 51-UB	AI, % 51 min. H2O, % 0.50 max. HI, % 0.01 max.	Color: 17 max. AV: 36 max. Form: Transparent fluid	Viscosity: 20 max. (Stokes, 25°C)
Capsulec 51-SB	AI, % 51 min. H2O, % 0.50 max. HI, % 0.01 max.	Color: 14 max. AV: 36 max. Form: Transparent fluid	Viscosity: 20 max. (Stokes, 25°C)
Capsulec 62-UB	AI, % 62 min. H2O, % 0.50 max. HI, % 0.01 max.	Color: 17 max. AV: 36 max. Form: Transparent fluid	Viscosity: 85 max. (Stokes, 25°C)
Capsulec 62-SB	AI, % 62 min. H2O, % 0.50 max. HI, % 0.01 max.	Color: 14 max. AV: 36 max. Form: Transparent fluid	Viscosity: 85 max. (Stokes, 25°C)

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