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# PHOSPHOLIPIDS HEALTH BENEFITS

A SUMMARY OF DIETARY PHOSPHOLIPID HEALTH CLAIMS

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## Executive Summary

**Ecovatec's revolutionary technology has unlocked the amazing potential of Egg Phospholipids.** Phospholipids make up the majority of the cell membranes in our bodies, holding and sustaining the protein molecules through which cells communicate via hormones and neurotransmitters. Healthy membranes allow our cells to remain "fluid" and flexible and thereby function properly. Healthy membranes make for healthy cells.

Purified phospholipids are already being produced commercially and are regularly used in nutraceutical products. Many of the health claims of phospholipids are supported by Health Canada. However, many of the products available on the market are soy-derived phospholipids which have a different composition than those egg-derived. For further information about the benefits of egg vs soy phospholipids, read our *Egg vs Soy Lecithin white paper*.

Egg phospholipid supplements have been shown to have the following **health benefits: anti-inflammatory** and **cancer-fighting** properties, improved **cardiovascular** health, **neurological** performance (including nerve function, learning, and memory), and **liver** function.

## Background

Phospholipids are a major component of all cell membranes. Their unique structure makes them useful in water solutions and fat/oil solutions and they are frequently used as emulsifiers (prevent oil and water separation). Phospholipid products are usually called lecithin and have a variety of commercial uses including pharmaceutical, cosmetic, and dietetic. Pure phospholipid supplements are also becoming more common and they are often added to other nutraceuticals and multi-vitamins. This paper examines the health benefits of dietary supplementation with egg-derived phospholipids.

Dietary phospholipids are usually taken from soy, chicken, or marine origins and each have various benefits to their source. Canada's Natural Product Claims<sup>1</sup> recognizes that phospholipids assist in regulating cellular responses for healthy body functioning. Dietary phospholipids are great sources of **choline** and **phosphorous**, both of which are recognized by Health Canada as factors in the maintenance of good health, in normal growth and development, and to support biological functions which play a key role in the maintenance of good health<sup>2</sup>.

Health Canada<sup>2</sup> also recognizes choline as **supporting liver function**, whereas phosphorous is known:

- to support the development and maintenance of **bones and teeth**;
- as an **electrolyte** for the maintenance of good health;
- to **prevent phosphorous deficiency**;
- to maintain the body's ability to **metabolize nutrients**.

## The Components of Phospholipids and their Importance in the Body

Ecovatec's egg-derived phospholipids are made up of approximately 84% phosphatidylcholine (**PC**), 12% phosphatidylethanolamine (PE), and 4% other (sphingomyelin)<sup>12</sup>. Each of these molecules have many biological functions that are being studied by scientists for their health benefits, however the most agreed-upon benefits are provided by **PC**.

## A Review of the Health Effects of Dietary Phospholipids (PL)<sup>3</sup>

A review paper by Küllenberg, et al. (2012) examines the scientific literature and health claims of dietary phospholipids. For detailed information on each of the studies reviewed, citations are provided in the review paper. Some of the review paper studies are directly cited below.

### Inflammation:

- the PC in dietary PL was found to significantly reduce the development of arthritis in rats due to a reduction of inflammation.<sup>3,4</sup> The leukocytes (cells that are part of the inflammatory reaction) were reduced by 40% in the knee joint fluid after treatment with PC. It was also suggested that arachidonic acid (Omega 6 Fatty Acids) found in egg-derived PC was critically involved in the process.
- *Treede et al.* (2007)<sup>3,5</sup> found that PC has anti-inflammatory properties in vitro and their results show that dietary supplementation of PC is likely to alleviate the symptoms of ulcerative colitis and Chron's disease. PC can be used by intestinal cells that produce the mucus that protects the intestines and also inhibits factors that lead to the chronic inflammatory reaction.

### Cancer:

- Several studies have shown that PL can help with tumor and metastasis inhibition<sup>3</sup>. For example, one study showed that liver cancer cells showed a reduction in growth when cultured in presence of PC in vitro. A second study also showed a significant reduction of total liver cancer cells as the PC was promoting cancer cell death.
- *Dial et al.* (2005) also found that ibuprofen combined with PC prevented the growth of colon cancer.<sup>3,6</sup>
- Sphingomyelin was also shown to have a drastic preventative effect on colon cancer formation.<sup>3</sup>

#### Blood Cholesterol:

- In human patients with abnormally high lipid (fat) levels, the total cholesterol, “bad” cholesterol, and triglycerides (bad fat) were significantly reduced after 30 days of treatment with dietary PL, whereas “good” cholesterol increased.<sup>3</sup>
- In rabbits, researchers found that supplementation with PC lowered cholesterol and triglycerides by reducing the very low-density lipoproteins (bad fats) and by increasing the secretion of bile cholesterol.<sup>7</sup>

#### Neurological Effects:

- Memory decline and challenges in learning due to ageing has been found to be a consequence of reduced PC in the brain tissue. Dietary PL supplementation may improve learning abilities and visual-function in these patients.<sup>3</sup>
- Chronic alcohol consumption also decreases the PL in brain cell membranes and depletes brain antioxidant systems. Dietary PL can reverse the membrane changes and PC can act as an antioxidative agent in the treatment of alcohol-induced brain changes.<sup>3,8</sup>
- Supplementation of PC in college students was also found to improve memory because of the increased choline available to the brain.<sup>3,9</sup>
- Sphingomyelin is also found in the “myelin sheath” that surrounds some nerve cells. This myelin is crucial for proper nerve function. For example, patients with multiple sclerosis (MS) lose the myelin sheath around their spinal cord nerves, preventing the signal from their brain from reaching their muscles.

#### Liver Diseases:

- Dietary PL has been shown in many cases to improve liver health, especially “fatty liver” whether alcohol induced<sup>3,10</sup> or due to a low protein diet<sup>11</sup>.
- During alcohol consumption, liver cells show reduced membrane PL, therefore adding dietary PL reduces the liver injury as it can be directly incorporated into the membrane.<sup>3</sup> The linoleic fatty acid found in many types of PC is thought to be the cause of the improvements in liver health when treated with PC supplementation.<sup>10</sup>
- *Erami et al* (2016) showed that the egg yolk treatment on rats with a low protein diet prevented fatty liver development was likely due to the egg-yolk derived PL.<sup>11</sup>

## Sources

<sup>1</sup>Government of Canada, Health Canada, Health Products and Food Branch, Natural Health Products Directorate, Bureau of Product Review and Assessment. “Search licensed natural health products.”, 13 Apr. 2016, <https://health-products.canada.ca/lnhpd-bdpsnh/index-eng.jsp>

<sup>2</sup>Government of Canada, Health Canada, Health Products and Food Branch, Natural Health Products Directorate. “Multi-Vitamin/Mineral Supplements.” *Ingredient Search*, 8 May 2007, [http://webprod.hc-sc.gc.ca/nhpid-bdpsn/atReq.do?atid=multi\\_vitmin\\_suppl](http://webprod.hc-sc.gc.ca/nhpid-bdpsn/atReq.do?atid=multi_vitmin_suppl)

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<sup>4</sup>Hartmann, Petra, et al. “Anti-Inflammatory effects of phosphatidylcholine in neutrophil leukocyte-Dependent acute arthritis in rats.” *European Journal of Pharmacology*, vol. 622, no. 1-3, 2009, pp. 58–64., doi:10.1016/j.ejphar.2009.09.012.

<sup>5</sup>Treede, Irina, et al. “Anti-Inflammatory Effects of Phosphatidylcholine.” *Journal of Biological Chemistry*, vol. 282, no. 37, 2007, pp. 27155–27164., doi:10.1074/jbc.m704408200.

<sup>6</sup>Dial, Elizabeth J., et al. "Phosphatidylcholine-Associated nonsteroidal anti-inflammatory drugs (NSAIDs) inhibit DNA synthesis and the growth of colon cancer cells in vitro." *Cancer Chemotherapy and Pharmacology*, vol. 57, no. 3, 2005, pp. 295–300., doi:10.1007/s00280-005-0048-x.

<sup>7</sup>Polichetti, Elisabeth, et al. "Dietary polyenylphosphatidylcholine decreases cholesterolemia in hypercholesterolemic rabbits." *Life Sciences*, vol. 67, no. 21, 2000, pp. 2563–2576., doi:10.1016/s0024-3205(00)00840-7.

<sup>8</sup>Jayaraman, T., et al. "Impact of Essentiale L on ethanol-induced changes in rat brain and erythrocytes." *Singapore Medical Journal*, vol 49, no. 4, 2008, pp. 320-327.

<sup>9</sup>Ladd, Sandra L., et al. "Effect of Phosphatidylcholine on Explicit Memory." *Clinical Neuropharmacology*, vol. 16, no. 6, 1993, pp. 540–549., doi:10.1097/00002826-199312000-00007.

<sup>10</sup>Navder, Khursheed P., Enrique Baraona, and Charles S. Lieber. "Polyenylphosphatidylcholine Attenuates Alcohol-Induced Fatty Liver and Hyperlipemia in Rats." *The Journal of Nutrition*, vol. 127, 1997, pp. 1800-1806.

<sup>11</sup>Erami, Kazuo, et al. "Dietary Egg Yolk Supplementation Improves Low-Protein-Diet-Induced Fatty Liver in Rats." *Journal of Nutritional Science and Vitaminology*, vol. 62, no. 4, 2016, pp. 240–248., doi:10.3177/jnsv.62.240.

<sup>12</sup> Yamamoto, Takehiko. *Hen eggs: their basic and applied science*. CRC Press, 1997.