Lipoid

PHOSAL® Curcumin | Natural Phospholipids

The Superior Formulation for Bioavailable Curcumin

We Invest in Quality.

PHOSAL® Curcumin – The Superior Combination of Ingredients

Curcuminods, the main yellow pigments found in turmeric (Curcuma longa), a traditional indian spice, are well known for their health-promoting effects. The therapeutic potential of curcuminoids is considerably limited by their very low bioavailability. Curcuminoids are almost insoluble in water. As a result, turmeric extract from powder capsules agglomerates in the gastrointestinal tract. Only a few curcumin molecules from the surface of the agglomerates can be absorbed, whereas the most passes the body without being absorbed. In clinical trials, daily doses of up to 12 g of turmeric powder are therefore used in order to achieve sufficiently high blood levels [1].

A significant increase in bioavailability can be achieved by formulation with the phospholipid phosphatidylcholine from lecithin [2]. Since phosphatidylcholine also stands out by its health-promoting effects, the formulation with curcuminoids (PHOSAL® Curcumin) is a particularly recommended combination of ingredients. PHOSAL® is Lipoid's unique technology for increasing the bioavailability of lipophilic nutrients.

PHOSAL® Curcumin is a novel combination of curcuminoids with phosphatidylcholine from sunflower. As a component of bile, phosphatidylcholine contributes physiologically to the digestion of fats. The phospholipid consists of a hydrophilic ("water-loving") and a lipophilic ("fat-loving") part. It can combine with fats and fat soluble nutrients and disperse them in an aqueous environment.

In the gastrointestinal tract, PHOSAL® Curcumin facilitates the formation of small fat droplets that contain the curcuminoids with a phosphatidylcholine shell. These so called micelles are also formed during the physiological process of fat digestion and allow for the uptake of fat soluble nutrients into the epithelial cells of the small intestine (enterocytes). The formulation of curcuminoids with phosphatidylcholine contributes significantly to the uptake of the active ingredients following entirely nature's own mechanisms. In addition, the inclusion into micelles protects the sensitive curcuminoids from premature degradation, thereby providing an additional bioavailability-enhancing effect [3].

GASTROINTESTINAL HEALTH | **LIPID METABOLISM** | **LIVER HEALTH**

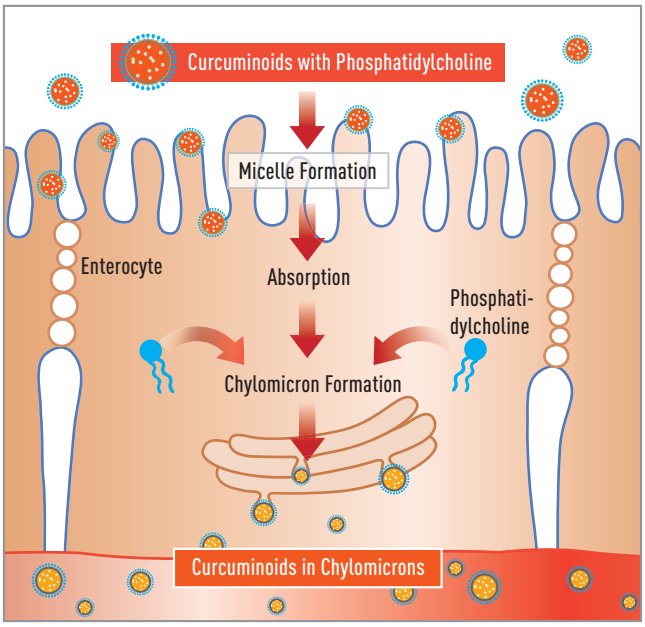

Fig. 1: Phosphatidylcholine, that mediates between water and fat, facilitates the formation of micelles and thereby promotes the absorption of curcuminoids into the enterocytes. In the enterocytes phosphatidylcholine is needed to package dietary fats and lipophilic actives such as the curcuminoids into chylomicrons, which are then released into the lymph. The formulation with phosphatidylcholine significantly improves the systemic availability of curcuminoids.

PHOSAL® Curcumin – Allows the Use of EFSA-Approved Health Claims

Besides its role in facilitating the uptake of lipophilic nutrients, phosphatidylcholine is also an essential factor for the formation of lipoproteins and chylomicrons, the body's own transport vesicles for fats. In the enterocytes, dietary fats and fat-soluble nutrients are packaged in chylomicrons and released into the lymph for systemic distribution. Phosphatidylcholine is used to "package" lipophilic nutrients, so that sufficient availability of the phospholipid contributes to the systemic distribution of the curcuminoids (Fig. 1). For the production of phosphatidylcholine, the body relies on the supply of its precursor choline. Choline can be produced in the liver, but the capacity of this endogenous synthesis is limited. As part of the cellular membranes of every living cell, phosphatidylcholine is also the most important, natural source of choline that is supplied in different amounts through the diet. As many of the choline-rich foods are also higher in fat and cholesterol, reducing fat may be associated with a reduced choline uptake and a limitation of the body's ability to synthesize phosphatidylcholine. An additional supply of choline in the form of phosphatidylcholine supports the metabolization of fats and helps to prevent hepatic fat accumulation.

A dose of 1.5 g PHOSAL® Curcumin contains ≥ 82.5 mg choline and allows the use of health claims for liver function, homocysteine and fat metabolism, approved by the European Food Safety Authority (EFSA).

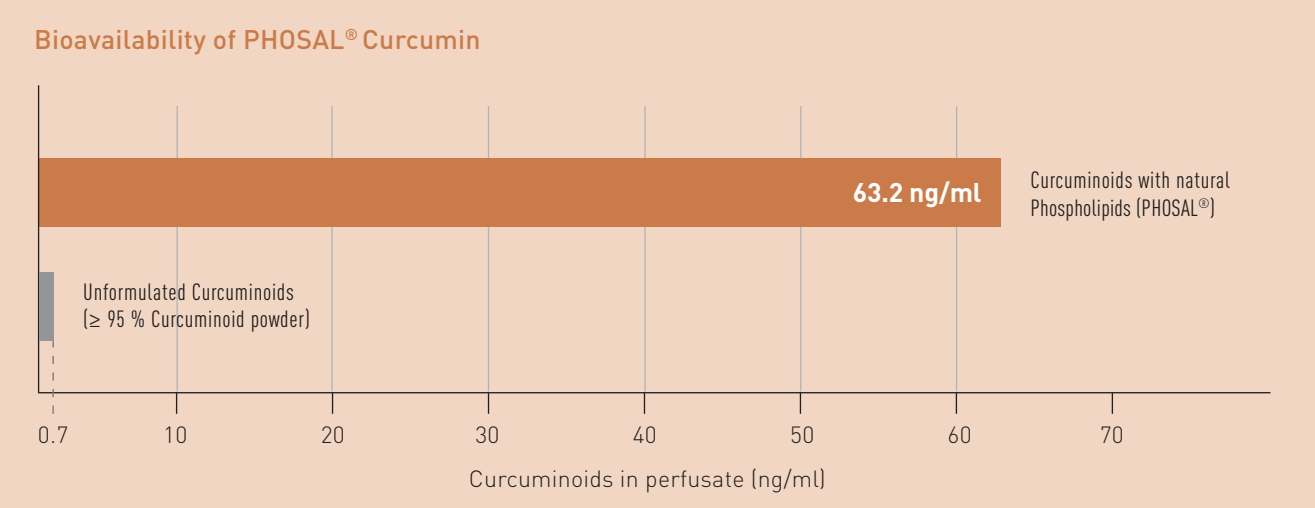

Fig. 2: According to our in vitro digestion / cell culture study, the formulation of curcuminoids with natural phosphatidylcholine from sunflower (PHOSAL® Curcumin) increases the bioavailability by a factor of about 90, compared to unformulated curcuminoid extract powder.

Increased Bioavailability of Curcuminoids

The improvement of the bioavailability of the curcuminoids by formulation with natural phosphatidylcholine from sunflower (PHOSAL® Curcumin) could be verified in an in vitro digestion / Caco-2 cell culture model, that represents a standard for bioavailability studies in the pharmaceutical industry. Whereas in the experiment with unformulated curcuminoid powder, only minimal concentrations of curcuminoids could be detected after passage through the cells (0.7 ng/ml). The experiment with the formulation PHOSAL® Curcumin provided significantly higher concentrations of the curcuminoids (63.2 ng/ml) (Fig. 2). According to these data, the bioavailability could be improved by a factor of about 90 [4].

PHOSAL® Curcumin naturally provides outstanding bioavailability for Curcuminoids.

Regulatory *(Further regulatory data upon request)*

Ingredients	Sunflower phosphatidylcholine (non-GMO), medium-chain triglycerides, curcumin extract, ethanol, food fatty acids, natural mixed tocopherols from sunflower
Safety	We affirm that the product is non-toxic, safe and suitable for oral use
Vegan	The product can be declared as vegan
Non-GMO	The product meets the non-GMO standards set by Regulation (EC) No. 1829/2003
Allergen	The product does not contain any allergens

Applicable Health Claims

A dose of 1.5 g PHOSAL® Curcumin provides ≥ 82.5 mg choline and allows for the use of EFSA-approved health claims:

- Choline contributes to normal homocysteine metabolism
- Choline contributes to normal lipid metabolism
- Choline contributes to the maintenance of normal liver function

Recommended Applications

Soft capsules, liquids

PHOSAL® Curcumin is a reddish liquid formulation, suitable for the use in softgel capsules, liquids, tonics, and beverages. The self-stabilizing properties of the novel formulation facilitate product handling and ensure long shelf-life. PHOSAL® Curcumin contains ≥ 6 % natural curcuminoids, and about 50 % phosphatidylcholine from sunflower.

References *(Additional references upon request)*

[1] Vareed S., Kakarala M., *et al.* (2008). Pharmacokinetics of curcumin conjugate metabolites in healthy human subjects. *Cancer Epidemiology and Prevention Biomarkers, 17 (6),* 1411 - 1417.

[2] Mirzaei, H., Shakeri, A., *et al.* (2017). Phytosomal curcumin: A review of pharmacokinetic, experimental and clinical studies *Biomedicine & Pharmacotherapy, 85,* 102 - 112.

[3] Priyadarsini, K. I. (2014). The chemistry of curcumin: from extraction to therapeutic agent. *Molecules, 19 (12),* 20091 - 20112.

[4] Gebhardt, P., van Hoogevest, P., *et al.* (2019). A liquid phospholipid formulation of a curcumin extract with high concentration of phosphatidylcholine (PHOSAL® Curcumin) improves the oral bioavailability of curcuminoids. An in vitro study using Caco-2 intestinal epithelial cells. *Agro Food Industry Hi Tech, 30. (Article has been submitted and is currently in the review process).*

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REUSAGE OF WASTE

NO HARMFUL CHEMICALS

NATURAL & SUSTAINABLE

ISO 9001 GMP CERTIFIED