

# P-5-P

## Pyridoxal-5-Phosphate

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This information is provided as a medical and scientific educational resource for the use of physicians and other licensed health-care practitioners ("Practitioners"). This information is intended for Practitioners to use as a basis for determining whether to recommend these products to their patients. All recommendations regarding protocols, dosing, prescribing, and/or usage instructions should be tailored to the individual needs of the patient considering their medical history and concomitant therapies. This information is not intended for use by consumers.

Designs for Health's P-5-P formula delivers 50 mg of vitamin B6 (as pyridoxal-5-phosphate) to support healthy vitamin B6 status and its corresponding 150 enzymatic activities essential for overall health.\* This includes supporting fat, protein, and carbohydrate metabolism, the proper synthesis of amino acids, DNA, hemoglobin, and neurotransmitters, and promoting healthy inflammatory responses and overall nerve, mental, cardiovascular, and women's health.\* The recommended dietary intake of vitamin B6 is 1.3 mg per day for adults.<sup>1</sup> Although vitamin B6 is widely available in foods, P-5-P supplementation may be beneficial for certain individuals with chronic or malabsorptive diseases, pregnant women, alcoholics, smokers, those on certain medications, or with genetic polymorphisms.\*

### Formula Highlights

- Contains 50 mg of vitamin B6 (as pyridoxal-5-phosphate) per 1-capsule serving
- Delivers bioactive form of vitamin B6
- Gluten-free, dairy-free, and soy-free
- Non-GMO

### Vitamin B6

Vitamin B6 consists of six vitamers, including pyridoxal-5-phosphate (P-5-P).<sup>2</sup> P-5-P is the only biologically active form of vitamin B6 among the vitamers, and thus, all other consumed forms must be converted into P-5-P by the liver.<sup>2</sup> P-5-P acts as a coenzyme for more than 150 enzymatic activities.<sup>3</sup> Specific actions of vitamin B6 include the support of gluconeogenesis, glycogenolysis, one-carbon unit transfers, homocysteine homeostasis, tryptophan metabolism, and innate and adaptive immune responses.<sup>3,4</sup> Synthesis of various neurotransmitters are vitamin B6-dependent, including dopamine, serotonin, and gamma-aminobutyric acid (GABA).<sup>5</sup> Vitamin B6 also holds antioxidant properties by quenching reactive oxygen species and mitigating the formation of advanced glycation end-products.<sup>2</sup>

Vitamin B6 is present in a variety of whole foods; therefore, a severe vitamin B6 deficiency is uncommon in developed countries.<sup>2</sup> However, certain individuals may have an impaired ability to convert vitamin B6 into its active form of P-5-P.<sup>2</sup> Human studies reveal individuals with inadequate P-5-P status are often pregnant, obese, an alcoholic, or a smoker.<sup>1-3</sup> This may also be the case for those taking certain medications, having genetic polymorphisms, or having certain chronic or malabsorptive diseases, such as kidney disease, diabetes, gestational diabetes, rheumatoid arthritis, irritable bowel syndrome, celiac disease, Crohn's disease, and ulcerative colitis.<sup>1-4,6</sup> Human clinical studies demonstrate stress hormones may also decrease P-5-P status in the body.<sup>2</sup>

Research has revealed an inverse relationship between plasma P-5-P and markers of inflammation.<sup>3,7</sup> Based on participants of the Framingham Heart Study and National Health and Nutrition Examination Survey and subjects in case-control and cross-section studies, there is an inverse relationship between plasma P-5-P and C-reactive protein (CRP).<sup>4</sup> This has occurred without an indication of low vitamin B6 intake, excess catabolism of the vitamin, or genetic polymorphisms.<sup>4</sup> According to their results, low plasma P-5-P (<20 nmol/L) is approximately 2.5-fold higher in individuals with higher CRP of at least 10 mg/L compared to individuals with CRP of  $\leq 3$  mg/L.<sup>4</sup> Current evidence suggests that plasma P-5-P is mobilized to sites of active inflammation due to P-5-P-dependent enzymes in the inflammatory response.<sup>4</sup> Thus, P-5-P supplementation may be helpful during times of inflammation.<sup>4</sup>

### Why Pyridoxal-5-Phosphate?

Most commercial supplements deliver vitamin B6 in the vitamere form of pyridoxine (PN), which must be converted to the bioactive form of P-5-P endogenously.<sup>8</sup> Supplementing directly with P-5-P avoids this step. Additionally, in vitro research suggests that potential adverse side effects of vitamin B6 supplementation are related to supplements in the form of PN, not P-5-P.<sup>1,8</sup>

### Benefits\*

- Supports healthy vitamin B6 status
- Supports fat, protein, and carbohydrate metabolism
- Supports healthy synthesis of amino acids, DNA, hemoglobin, and neurotransmitters
- Promotes healthy inflammatory responses
- Supports nerve, mental, cardiovascular, and women's health

### Supplement Facts

Serving Size 1 capsule

Amount Per Serving		% Daily Value
Vitamin B-6 (as Pyridoxal-5-Phosphate)	50 mg	2941%

**Other Ingredients:** Microcrystalline cellulose, cellulose (capsule), vegetable stearate.

### **P-5-P and Homocysteine**

Vitamin B6, folate, and vitamin B12 are essential for homocysteine metabolism and a deficiency in one or more may result in hyperhomocysteinemia.<sup>9</sup> A vitamin B6-dependent pathway converts homocysteine into cysteine.<sup>9</sup> Human studies demonstrate that hyperhomocysteinemia is a risk factor in many chronic diseases and conditions, such as migraines, Alzheimer's disease, dementia, and cardiovascular disease (CVD).<sup>9-11</sup>

A systematic review of prospective cohort studies (n = 317,834) observed an inverse relationship between vitamin B6 and coronary heart disease (CHD), even after adjustment for traditional CVD risk factors.<sup>9</sup> The corresponding meta-analysis of six studies found that an increased 0.50 mg of vitamin B6 per day through food or supplements was associated with a 13% lower risk of CHD.<sup>9</sup>

Hyperhomocysteinemia is also associated with an increased risk of cognitive decline.<sup>12</sup> A systematic review concluded that individuals with mild cognitive impairment taking vitamin B6, vitamin B12, or folate supplementation for 1 month had a mean homocysteine reduction of 31.9%, whereas the control groups had a mean homocysteine increase of 0.7%.<sup>12</sup> A systematic review concluded that vitamin B6 may be clinically relevant for individuals with migraines that were associated with hyperhomocysteinemia.<sup>10</sup>

### **P-5-P and Women's Health**

P-5-P has been shown to support women's health in numerous human clinical trials.<sup>1,13-15</sup> A systematic review of 24 clinical studies determined that 30 mg to 80 mg of vitamin B6 per day was as effective as 35 mg to 500 mg of ginger per day in reducing nausea and vomiting in pregnant women.<sup>13</sup> Yet, the women receiving the vitamin B6 had reduced symptoms over a longer period of time (60 days) compared to the ginger group.<sup>13</sup> The American Congress of Obstetrics and Gynecology recommends 10 mg to 25 mg of vitamin B6 three to four times per day alone to support pregnant women with nausea and vomiting.<sup>1</sup>

Human studies suggest vitamin B6 may be clinically relevant for individuals with premenstrual syndrome (PMS) due to its role in increasing serotonin synthesis and the synthesis of prostaglandins and fatty acids that are involved in estrogen metabolism.<sup>14</sup> A double-blind, randomized, treatment-controlled trial (n = 72) gave women with PMS 80 mg of vitamin B6 per day or a broad-spectrum micronutrient supplement for three menstrual cycles.<sup>15</sup> The results concluded that vitamin B6 alone is supportive for women with PMS, as both experimental groups displayed reductions in PMS symptoms.<sup>15</sup> P-5-P may also be helpful in breast health.\* A systematic review of seven articles determined that groups of individuals who supplemented with vitamin B6 as low as 40 mg per day experienced attenuated breast pain compared to a placebo.<sup>14</sup>

### **P-5-P and Mental Health**

Vitamin B6 may support mental health through its role in neurotransmitter synthesis.\* A systematic review and meta-analysis concluded that higher vitamin B6 intake is associated with lower risk of depression in women, but not in men.<sup>16</sup> A double-blind, placebo-controlled clinical study recruited 478 young adults with self-reported anxiety and depression.<sup>5</sup> During a series of sensory measure tests, the individuals were given a single administration of vitamin B6 (100 mg per day), vitamin B12 (2.4 mcg), or a placebo.<sup>5</sup> Compared to the groups taking either vitamin B12 or a placebo, the vitamin B6 group had reduced self-reported anxiety and improved behavioral outcomes.<sup>5</sup> The researchers suspected this may have been due to the vitamin B6 group having increased GABA activity.<sup>5</sup>

### **P-5-P and Nerve Health**

Vitamin B6 is essential for nerve health due to its role in the maintenance of sphingolipids, which are critical for myelin sheath formation.<sup>17</sup> A rat model demonstrated that vitamin B6 can counteract the nerve-damaging effect of excessive glutamate release, which occurs in certain neurological diseases.<sup>17</sup> An animal study using primates observed that vitamin B6 mitigated neuronal death in the retina after whole brain ischemic damage.<sup>17</sup> Finally, a human clinical study of 67 hands from 40 patients with carpal tunnel syndrome concluded that the patients who supplemented with 120 mg of vitamin B6 per day for 3 months exhibited increased conduction velocity of sensory nerves and reduced clinical symptoms.<sup>18</sup>

**Recommended Use:** Take 1 capsule per day or as directed by your health-care practitioner.

For a list of references cited in this document, please visit:

<https://www.designsforhealth.com/api/library-assets/literature-reference---P-5-P-tech-sheet-references>

Dosing recommendations are given for typical use based on an average 150 pound healthy adult. Healthcare practitioners are encouraged to use clinical judgement with case-specific dosing based on intended goals, subject body weight, medical history, and concomitant medication and supplement usage.

**\*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.**

To contact Designs for Health, please call us at (860) 623-6314, or visit us on the web at [www.designsforhealth.com](http://www.designsforhealth.com).

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