

## Definition

Collagen Pro X is a dietary supplement. What are dietary supplements?

Various definitions for dietary supplements exist worldwide. In the UK, the definition developed by the Proprietary Association of Great Britain (PAGB), British Herbal Manufacturers' Association (BHMA) and the Health Food Manufacturers' Association (HFMA) is that they are:

*foods in unit dosage form, e.g. tablets, capsules and elixirs, taken to supplement the diet. Most are products containing nutrients normally present in foods which are used by the body to develop cells, bone, muscle etc, to replace coenzymes depleted by infection and illness, and generally to maintain good health.*

For the purposes of the European Union (EU) Directive on food supplements the term "food supplements" means:

*foodstuffs the purpose of which is to supplement the normal diet and which are concentrated sources of nutrients or other substances with a nutritional or physiological effect, alone or in combination, marketed in dose form, namely forms such as capsules, pastilles, tablets, pills and other similar forms, sachets of powder, ampoules of liquids, drop dispensing bottles, and other similar forms of liquids and powders designed to be taken in measured small unit quantities.*

Each tablet of Collagen Pro X contains four main active ingredients; hydrolysed collagen 1000mg, Grape Seed Extract 16mg, Vitamin C 97% 15.5mg, Zinc Oxide BP 4.7mg.

## Collagen

**Description:** Collagen hydrolysate provides high levels of amino acids. Among these are glycine and proline, two amino acids essential for the stability and regeneration of cartilage. A single pictogram of type II collagen contains more than 1 billion glycine molecules and 620 million proline molecules.<sup>1</sup> Collagen is the most abundant protein in our bodies. It's found in our muscles, bones, skin and tendons. It's the "glue" that helps hold the body together. It gives our skin strength and elasticity, and helps replace dead skin cells. As we age, collagen production declines, looser skin, more wrinkles and less elasticity. Increasing collagen levels can help your skin look firmer, increase smoothness, and help your skin cells keep renewing and repairing normally.

**Action:** Collagen hydrolysate can stimulate collagen synthesis in the body. Two hypotheses have been developed to explain why collagen hydrolysate stimulates the body to synthesise collagen. Firstly, although the amino acids present in collagen are not "essential", as they can be synthesised by the body, the regular intake of collagen hydrolysate could supply the required amounts of the amino acids glycine, proline and hydroxyproline. Secondly, the presence of collagen peptides could be recognised and understood by the body as a sign of degradation of the proper collagen. This could lead to the synthesis of collagen.

**Dietary source:** Good sources include well cooked meat dishes (e.g. stews of beef, pork, veal, lamb, oxtail), offal (e.g. pig's foot, brain, tongue, marrowbones), minced beef, cooked pork meats (e.g. sausage, boiled ham, shoulder), meat stock (e.g. veal, chicken or beef), fish (particularly small fish, such as sardines, where the bones are consumed). Collagen can also be found in processed foods containing gelatine such as processed cheeses, instant soups, sauces, ice cream, jellies, milk jellies, sweets (e.g. marshmallows) and all gelatine products.

**Metabolism:** Following oral administration, collagen hydrolysate is hydrolysed, absorbed in the gastrointestinal tract and transported in the bloodstream in the form of peptides and amino acids (proline, hydroxyproline, glycine) to the articular cartilage.<sup>10, 11</sup>

**Pregnancy and breastfeeding:** Safety in pregnancy and breastfeeding has not been established. However, collagen is a natural constituent of an omnivorous diet.

**Adverse effects:** Allergic reactions to collagen may occur.

**Dose:** Evidence suggests that collagen hydrolysate in doses of up to 10 g daily for 6 months is safe.<sup>9</sup>

**Bioavailability:** Studies have shown that a high percentage of an oral dose of collagen hydrolysate is absorbed. A Dutch trial using a simulated gastrointestinal tract model showed that 82% of an orally administered dose of collagen hydrolysate passes through the intestinal mucosa<sup>31</sup> while results from another study indicated that 90% of an oral dose of collagen hydrolysate is absorbed within approximately 6 hours.<sup>10</sup>

## Vitamin C

**Description:** Vitamin C is a watersoluble vitamin.

**Action:** The functions of vitamin C are based mainly on its properties as a reducing agent. It is required for: the formation of collagen and other organic constituents of the intercellular matrix in bone, teeth and capillaries;

**Dietary source:** Fruits and vegetables are the best sources of vitamin C . Citrus fruits, tomatoes and tomato juice, and potatoes are major contributors of vitamin C.

### **Metabolism:**

**Absorption:**Vitamin C is absorbed by passive and active transport mechanisms, predominantly in the distal portion of the small intestine (jejunum) and to a lesser extent in the mouth, stomach and proximal intestine. Some 70–90% of the dietary intake is absorbed, but absorption falls to 50% with a dose of 1.5 g.**Distribution:** It is transported in the free form (higher concentrations in leukocytes and platelets than red blood cells and plasma), and is readily taken up by body tissues (highest concentration in glandular tissue, e.g. adrenals and pituitary); body stores are generally about 1.5 g. **Elimination:**The urine is the main route of elimination, but very little is excreted unchanged (unless plasma concentration is >1.4 mg/100 mL). Vitamin C crosses the placenta and is excreted in breast milk.

**Dose:** Taking less than 1,000mg of vitamin C supplements is unlikely to cause any harm.

**Bioavailability:** Storage and cooking lead to loss of vitamin C through oxidation, and boiling results in leaching of the vitamin into the cooking water (cooking water should be consumed in gravies and soups). Microwaving and stirfrying are the best cooking methods for preserving vitamin C.

## Zinc

**Description:** Zinc is an essential trace mineral.

**Action:** The human body contains approximately 2 g of zinc, making this trace element the most abundant in the body after iron. Zinc is an essential component of over 200 enzymes.<sup>1</sup> It plays an important role in the metabolism of proteins, carbohydrates, lipids and nucleic acids.

**Dietary source:** A wide variety of foods contain zinc. Oysters contain more zinc per serving than any other food, Also red meat and poultry good source of zinc.

### **Metabolism:**

**Absorption:** Absorption occurs throughout the length of the small intestine, mostly in the jejunum, both by a carriermediated process and by diffusion. **Distribution:**Zinc is transported in association with albumin, amino acids and a 2 macroglobulin. Zinc is principally an intracellular ion and approximately 95% is found within the cells. Approximately 57% of the body pool is stored in skeletal muscle, 29% in bone and 6% in the skin, but zinc is found in all body tissues and

fluids, including the liver, kidneys, pancreas, prostate gland and retina.<sup>2</sup> **Elimination:** Elimination of zinc is mainly in the faeces; smaller amounts are excreted in the urine and via the skin.

**Dose:** Zinc is available in the form of tablets and capsules and as an ingredient in multivitamin preparations.The dose beyond the RDA is not established. Dietary supplements contain 5–50 mg (elemental zinc) per daily dose.

**Bioavailability:** Bioavailability of zinc from supplements varies and depends on the form of the zinc. There is evidence that absorption of zinc from zinc gluconate is higher than from zinc oxide,<sup>29</sup> and that organic yeast salts<sup>30</sup> and zinc bisglycinate<sup>31</sup> are more biologically available than zinc gluconate.

## Grape seed extract

**Description:** Grape seed extract is an extract from the tiny seeds of red grapes.

**Action:** Grape seed is a potent antioxidant, which inhibits the destruction of collagen by stabilising the activity of 1 antitrypsin, which inhibits the activity of destructive enzymes such as elastase and hyaluronidase (this is thought to prevent fluid exudation by allowing red blood cells to cross the capillaries)

**Dietary source:** grape seed

**Dose:** The dose is not established, but doses of 100–300 mg daily have been used in studies.

## References

- Clark KL. Nutritional considerations in joint health. *Clin Sports Med* 2007; 26: 101–118.
- Oesser S, Seifert J. Stimulation of type II collagen biosynthesis and secretion in bovine chondrocytes cultured with degraded collagen. *Cell Tissue Res* 2003; 311: 393–399.
- Oesser S, Haggenmuller D, Schulte C. Collagen hydrolysate modulates the extracellular matrix metabolism of human chondrocytes. *Ann Rheum Dis* 2006; 65(Suppl. II): 401.
- Benito Ruiz P, Camacho Zambrano MM, Carrillo Arcentales JN et al. A randomized controlled trial on the efficacy and safety of a food ingredient, collagen hydrolysate, for improving joint comfort. *Int J Food Sci Nutr* 2009; 60(Suppl 2): 99–113.
- Takada Y, Aoe S, Kato K, et al. Collagen containing preparations for strengthening bone. European Patent Application No. EP 0798 001 A2 (1.10.97).
- Weh L, Petau C. Change in the properties of tissue through the administration of gelatine. *Extract Orthopaed* 2001; 4: 12–16.
- Fernandez J, Perez O. Effects of gelatine hydrolysates in the prevention of athletic injuries. *Arch de Med Deporte* 1998; 15(66): 277–282.
- Kakimoto K, Kojima Y, Ishii K et al. The suppressive effect of gelatinconjugated superoxide dismutase on disease development and severity of collageninduced arthritis in mice. *Clin Exp Immunol* 1993; 94: 241–246.
- Moskowitz RW. Role of collagen hydrolysate in bone and joint disease. *Semin Arthritis Rheum* 2000; 30: 87–99.
- Oesser S, Adam M, Babel W, Seifert J. Oral administration of [<sup>14</sup>C] labeled gelatin hydrolysate leads to an accumulation of radioactivity in cartilage of mice (C57/BL). *J Nutr* 1999; 129: 1891–1895.
- Lohmann M. Untersuchungen zur Bedeutung von Gelatine Als Proteinbestandteil Inaugurldissertation. Agrarwissenschaftliche Fakultät, Universität Kiel 1994.
- Krug E. Zur unterstützenden Therapie bei Osteo und Chondropathien [On supportive therapy for osteo and chondropathy]. *Z Erfahrungsheik* 1979; 11: 930–938.
- Banzer W, Ziesing A, Dietmar A. Results of a clinical surveillance on collagen hydrolysate consumption in arthritis. *Med Sci Sports Exerc* 2006; 38: S438.
- Beuker F, Rosenfeld J. Die Wirkung regelmässiger gelatinesubstitution auf die funktionalität arthrotisch veränderter kniegelenke. Proceedings of the Fourth International Congress Physical Activity, Aging and Sports, Heidelberg, Germany, 27–31 August 1996.
- Fleschenhar K, Alf D. Ergebnisse einer Anwendungsbeobachtung zu KollagenHydrolysat. CHAlpha. *Orthopaed Praxis* 2005; 9: 486–494.
- Gotz B. Well nourished cartilage does not grind. *Artzliche Praxis* 1982; 34: 3130–3134.
- Oberschelp U. Individuelle Arthrotherapie ist möglich. *Ther Woche* 1985; 44: 5094–5097.
- Seeilmuller K, Bonn K, Happel H. Dem Knorpel auf die Sprünge helfen [Help and support for cartilage]. *Eur Pharmaforsch* 1993; 43: 1810–1813.
- Seeilmuller K, Heppel KH. Kann eine Gelatine/LCystineMischung die Kollagen und Proteoglykansynthese stimulieren? *Arthrotherapie* 1989; 39: 3153–3157.
- Adam M. Welche Wirkung haben Gelatinepräparate? [What effects do gelatin preparations have?]. *Ther Woche* 1991; 41: 2456–2461.
- McCarthy S, Carpenter MR, Barrell M et al. The effectiveness of gelatine supplementation treatment in individuals with symptoms of mild osteoarthritis. A randomized, doubleblind, placebocontrolled study. In Proceedings of the 2000 Annual Meeting of the American Academy of Family Physicians, Dallas, Texas, 22 September 2000. (Report of study in US Family Practice News, Dec 1, 2000.)
- Beuker F, Eck T, Rosenfeld J. Biochemical and clinical examinations on the effects of regular applications of gelatin on degenerative changes of the motoric system. *Int J Sports Med* 1996; 17(Suppl. 1): S67–S70.
- Zuckley L, Angelopoulos K, Carpenter M et al. Collagen hydrolysate improves joint function in adults with mild symptoms of osteoarthritis of the knee. *Med Sci Sports Exerc* 2004; 36: S153–S154.
- Carpenter MR, Carpenter RL, McCarthy S et al. Collagen hydrolysate supplementation improves symptoms in patients with severe osteoarthritis. *Med Sci Sports Exerc* 2005; 37: S91.
- Carpenter RL, Peel JB, Carpenter MR et al. Effectiveness of a collagen hydrolysatebased supplement on joint pain, range of motion and muscle function in individuals with mild osteoarthritis of the knee: a randomized clinical trial. *Ann Rheum Dis* 2005; 64(Suppl. 3): 1544–1545.
- Selbmann HC, Fischer IU, Moskowitz R. Collagen hydrolysate in osteoarthritis of the knee. Analysis of country specific responses. *J Bone Joint Surg Br* 2006; 88B: 104–105.
- Clark KL, Sebastianelli W, Flechsenhar KR et al. 24Week study on the use of collagen hydrolysate as a dietary supplement in athletes with activityrelated joint pain. *Curr Med Res Opin* 2008; 24: 1485–1496.
- Bruyère O, Zegels B, Leonori L et al. Effect of collagen hydrolysate in articular pain: a 6month randomized, doubleblind, placebo controlled study. *Complement Ther Med* 2012; 20: 124–130.
- Schauss AG, Stenhejm J et al. Effect of the novel low molecular weight hydrolyzed chicken sternal cartilage extract, BioCell Collagen, on improving osteoarthritisrelated symptoms: a randomized, doubleblind, placebocontrolled trial. *J Agric Food Chem* 2012; 60(16): 4096–5101.