Collagen MultiMax 5

Code: FE3169 – 330 g

Powerful collagen blend reinforced with vitamins, minerals and nutraceuticals. New Roots Herbal Collagen MultiMax 5 contains 5 types of bioactive collagen peptides (types I, II, III, V and X) present mainly in bones, tendons, cartilage and skin.

HEALTH CLAIMS (EU Regulation 432/2012): Vitamin C contributes to the formation of collagen which helps to keep blood vessels, bones, cartilage and skin healthy. Magnesium helps to reduce tiredness and fatigue, normal muscle function, normal protein synthesis, maintenance of normal bones and normal energy metabolism. Copper contributes to the maintenance of normal connective tissue and normal functioning of the immune system.

Ingredients: hydrolyzed porcine collagen, hydrolyzed bovine collagen, magnesium citrate, corn starch, malic acid, ESM® (internal eggshell membrane), natural citrus flavour, natural lemon flavour, devil's claw root extract (*Harpagophytum procumbens*), bamboo stem and leaf extract (*Bambusa vulgaris*), hydrolyzed chicken collagen, L-ascorbic acid (vitamin C), sodium hyaluronate, cupric gluconate, boric acid and sweetener (steviol glycosides from *Stevia rebaudiana*).

Nutritional information:	**Per serving 11 g**	**Per 100 g**
Energy (kJ/kcal)	136/32	1 240/295
Fat	0,0 g	0,4 g
Saturates	0,0 g	0,0 g
Carbohydrate	1,1 g	9,8 g
Sugars	0,0 g	0,1 g
Fibre	0,0 g	0,3 g
Protein	7 g	63 g
Salt	0,5 g	4,1 g

Other nutrients:	**Per serving 11g**	**NRV***
Hydrolyzed porcine collagen (type I y III)	5 000 mg	
Hydrolyzed chicken collagen (type II)	40 mg	
Hydrolyzed bovine collagen (type I y III)	2 500 mg	
ESM® internal eggshell membrane (type I, V and X)	300 mg	
Hyaluronic acid	25 mg	
Vitamin C (L-ascorbic acid)	40 mg	50%
Magnesium (from magnesium citrate)	187,5 mg	50%
Copper (from cupric gluconate)	0,5 mg	50%
Silica (from bamboo extract)	40 mg	
Boron (from boric acid)	3 mg	
Malic acid	500 mg	
Devil's claw (*H. procumbens*) (6:1) (2,5% harpagoside	150 mg	

*NRV: Nutrient Reference Value in %

Size and format:

330 g

Recommended daily dose:

1 measuring spoon (11 g) daily.

Do not exceed the stated recommended daily dose.

DETAILS:

New Roots Herbal's **Collagen MultiMax 5** is a synergistic formula designed for osteoarticular health, which in addition to providing 5 different types of bioactive collagen peptides, also provides eggshell inner membrane (ESM®), hyaluronic acid, devil's claw, vitamin C, specific minerals and malic acid.

INGREDIENTS:

COLLAGEN: is a ubiquitous peptide in the human body and the most dominant protein in the extracellular matrix, accounting for 25% of total body protein[1]. Collagen is an important structural component of the skin; connective tissues such as cartilage, ligaments and tendons; as well as the bone matrix.

Collagen content of different types of human tissues (% dry weight):

Demineralised bone	Tendons	Skin	Cartilage	Arteries	Lung	Liver
90%	80-90%	50-70%	50-70%	10-25%	10%	4%

Collagen is produced by certain cell types, such as osteoblasts that form bone, chondrocytes that form cartilage and fibroblasts that form connective tissues. As can be seen in the table above, collagen is most abundant in strong and resilient connective tissues.

Types of collagen:

To date, up to 29 types of collagen have been characterised, however, over 90% of collagen throughout the body is of types I to V, with type I being the most abundant. There are two main groups of collagens: fibrillar and non-fibrillar collagen. Fibrillar collagen is the most abundant and forms fibres with repeated aligned shapes and makes up 90% of collagen. Non-fibrillar collagen is usually organised into meshes. The tissues and organs where the different types of collagen can be found are shown below [2,3]:

a) Fibrillar collagen	
Type of collagen	**Distribution in tissues**
I	Skin, bones, tendons, cornea
II	Cartilage, vitreous body of the eye
III	Skin, blood vessels, intestine, uterus
V	Skin, bones, cornea, placenta
XI	Cartilage, intervertebral disc
XXIV	Bones, cornea
XXVII	Cartilage
b) Non-fibrillar collagen	
Type of collagen	**Distribution in tissues**
IV	Basal membrane, capillaries
VI	Bones, blood vessels, skin, cornea, cartilage
VII	Mucous membranas, skin, bladder, umbilical cord, amniotic fluid
VIII	Skin, brain, heart, kidneys, blood vessels, bones, cartilage
IX	Cornea, vitreous body of the eye, cartilage
X	Cartilage
XII	Cartilage, tendons, skin
XIII	Skeletal muscle, heart, eyes, skin, endothelial cells
XIV	Blood vessels, eyes, nerves, tendons, bones, skin, cartilage
XV	Blood capillaries, ovaries, heart, testicles, skin, placenta, kidneys
XVI	Heart, skin, kidneys, smooth muscle
XVII	Skin
XVIII	Kidneys, lungs, liver
XIX	Skin, kidneys, liver, placenta, spleen, prostate gland
XX	Corneal epithelium
XXI	Stomach, kidneys, blood vessels, heart, placenta, skeletal muscle
XXII	Connective tissue
XXIII	Metastatic cancer cells
XXV	Eyes, brain, heart, testicles
XXVI	Testicles, ovaries
XXVIII	Nervous system cells
XXIX	Skin

Collagen MultiMax 5 (types I, II, III, V and X):

- **Collagen type I:** is the most abundant in the human body and is found in the skin, more specifically in the dermis, it is also found in tendons, ligaments, bones and cornea. The cells that synthesise collagen in the body are fibroblasts, chondroblasts and osteoblasts. It is a fibrillar type of collagen, and most probably the best researched collagen. It is the key structural composition of various tissues. Its structure is a triple helix normally formed as a heterotrimer by two identical a1(I) chains and one a2(I) chain. It is expressed in almost all connective tissues and is the predominant component of the interstitial membrane. Its main function is stretch resistance, and in most organs and particularly in tendons and fascia, type I collagen provides tensile stiffness and, in bone, defines considerable biomechanical properties related to load, tensile strength and torsional stiffness, particularly after calcification [4-6].
- Type II collagen: is the most abundant protein in cartilage, and is also present in the vitreous body of the eye. It has a similar structure to type I collagen, forming fine fibrils. Its main function is to provide tissue strength under intermittent pressure, and it is synthesised by chondroblasts. The lubricating properties of cartilage are due to Type 2 collagen fibres and hyaluronic acid which form a support to which proteoglycans are attached. This type of collagen is mainly used for joint care [7-9].
- Type III collagen: is present in the skin, muscle tissue, venous walls, intestinal walls, and the uterus. It is a molecule twice the size of collagen types I and II and is the second most abundant collagen. It is closely related to type I collagen. Its main function is related to the support of expanding organs, structural integrity of arteries, intestine and uterus providing resistance [10-12].
- Collagen type V: forms part of the interstitial tissue. It is found inside the dermoepidermal junction, in placental tissue, bone matrix and cornea. Its main function is to give elasticity to organs and it is believed to act as one of the regulatory factors of fibrogenesis [13,14].
- Collagen type X: is present in two types of cartilage: hypertrophied and mineralised. It is synthesised by chondrocytes. Its main function is to help cartilage to have elasticity and strength [15-17].

Hydrolysed collagen:

This is a protein obtained through a hydrolysis process to obtain small peptides with a low molecular weight of 3-6 KDa [18]. By reducing the molecular weight of the collagen protein, greater assimilation and absorption of this is achieved [19].

Collagen peptides in supplement form contain the building blocks for the repair of these tissues within the body. Indications for the use of collagen include repairing joint damage, muscle recovery; preventing age-related sarcopenia; improving the quality of skin, hair and nails [20,21].

Health benefits of collagen:

- Osteoarticular health

Collagen has been shown to help maintain the structural integrity of joints, bones and cartilage. As we age, so do these components in our bodies, making us more susceptible to injury. One study found that dietary collagen supplementation reduced symptoms in patients with moderate to severe osteoarthritis of the knee [22].

Another study examined the effects of dietary collagen supplementation in athletes who were at high risk of joint pain and deterioration. The results showed that athletes who took a collagen supplement had reductions in pain and possibly a lower risk of joint deterioration later in life [23].

- Skin health

Two randomised clinical trials have demonstrated the benefits of collagen for the skin. These trials involved more than 180 women over the age of 50, with generally healthy skin. These women were randomised to receive 2.5 g of collagen per day for eight weeks. Results showed a 32.2% reduction in wrinkle volume, a 65% increase in procollagen concentration and increased skin elasticity [24,25].

In addition, preliminary studies suggest that collagen peptides may improve the appearance of cellulite. Cellulite is caused by a combination of dermal matrix alterations and excess subcutaneous fat protruding into the dermis, as well as excess interstitial fluid. Collagen supplementation can help correct and improve the extracellular matrix of the skin tissue. A total of 105 women with moderate cellulite scores aged 24 to 50 years were randomised to receive 2.5 g of

bioactive collagen peptides daily or placebo for six months. The results showed a significant decrease in the degree of cellulite and a reduction in skin rippling on the thighs in women of normal weight. Skin density was significantly improved compared to placebo [(26)].

Finally, a recent study has shown benefits on hair and nail quality. In the study, 25 participants took 2.5 g of bioactive collagen peptides for 24 weeks. The results showed that there was an average 12% increase in the rate of nail growth and a 42% decrease in the frequency of nail breakage. In addition, 64% of participants achieved an overall clinical improvement in brittle nails, and this effect was evident in approximately four weeks [(27)].

- Gut health

Amino acids play an interesting role in digestive health, although we still have a lot to learn about them. We know that a large part of our immune function resides in our digestive tract and depends on our digestive health, so a healthy digestive tract promotes a healthy immune system.

A study published in 2017 supports the idea that people with inflammatory bowel disease, including Irritable Bowel Syndrome (IBS), Crohn's disease and ulcerative colitis, absorb fewer amino acids than they need. Taking a collagen supplement may improve symptoms of inflammation, oxidative stress and cell death [(28)].

- Cardiovascular health

Excessive collagen loss combined with poor collagen synthesis can weaken plaque in the arteries. This can make plaque more likely to rupture and block major arteries, leading to atherosclerosis and heart disease. Maintaining healthy levels of collagen in the body can keep arteries clean and flexible, facilitating healthy blood flow throughout the body [(29)].

ESM® (Eggshell Membrane): is a potent source of naturally occurring glycosaminoglycans (GAGs) and proteins essential for maintaining healthy cartilage and synovial fluid. ESM® is also a natural source of glucosamine, chondroitin and hyaluronic acid. Hyaluronic acid is abundant in synovial fluid, the lubricant that fills the membrane and surrounds joints to cushion bones, ligaments, tendons and muscles from friction that causes pain and restricts mobility.

Studies have been conducted prior to human trials on the safety of eggshell inner membrane [(30)], its anti-inflammatory activity [(31)] and the mechanism of action of that anti-inflammatory activity [(32)].

In a randomised, double-blind, placebo-controlled clinical study to evaluate the safety and efficacy of eggshell inner membrane for the treatment of pain and stiffness related to osteoarthritis of the knee, a 15.9% reduction in pain and a 12.8% reduction in stiffness resulted after only 10 days at a daily dose of 500 mg. Specifically, knee pain and stiffness is the most common complaint for those suffering from arthritis-related joint pain [(33,34)].

Composition:

Protein	94%
Collagen (Types I,V,X)	35%
Elastin	4-5%
Chondroitin sulphate	2%
Hyaluronic acid	2%
Glucosamine	2%
Dermatan and keratan sulphate	1%
Growth factor TGF-β, IGF-1	
Amino acids:	
-Methionine	-Lisine
-Cysteine	-Triptophan
Other substances:	
-Calcitonin	-Ovocleidin
-Ovocalixin	-Desmosine
-Ovotransferrin	-Isodesmosine

In 2018, a randomised, double-blind, placebo-controlled clinical trial was conducted at UCAM (Universidad Católica San Antonio de Murcia) on 80 patients diagnosed with osteoarthritis to analyse the efficacy of ESM® on joint pain during a period of 8 weeks of treatment.

The parameters assessed were: subjective pain perception (VAS scale), functional capacity variable (WOMAC questionnaire), strength and joint rotation angle assessment and sleep quality variable (Pittsburgh Test).

After 8 weeks of the study, participants treated with ESM® showed a reduction in joint pain compared to subjects in the placebo group. This reduction in pain was accompanied by an improvement in strength as a result of reduced functional limitation associated with the joint inflammatory process.

Although the groups treated with 300 and 500 mg of ESM® respectively showed an improvement in all the parameters evaluated, the group taking 500 mg showed the most significant results in terms of improvement, so we can affirm that the functional improvement of the subjects is dose-dependent.

The consumption of ESM® for 8 weeks improved the functional capacity and quality of life of patients diagnosed with grade I to III osteoarthritis. In addition, it tended to improve sleep quality due to a reduction in joint pain.

Finally, the daily consumption of ESM® for 8 weeks did not cause any adverse events in any of the subjects in the two egg membrane treatment groups, so it can be concluded that its consumption is safe.

Its conclusions are as follows:

- ESM® has a positive effect on mobility in people affected by joint pain.

- ESM® has been shown to have a dose-dependent anti-inflammatory efficacy depending on the severity of the joint pain and mobility limitation of the person.

- ESM® increases collagen synthesis by skin fibroblasts.

Hyaluronic acid: Hyaluronic acid, or hyaluronan (sodium hyaluronate), is a polysaccharide composed of repeating polymeric disaccharides of D-glucuronic acid and N-acetyl-D-glucosamine. In the human body, it is synthesised by synoviocytes, fibroblasts and chondrocytes. In humans, it is present in all connective tissues and organs, such as skin, synovial fluid, blood vessels, brain, cartilage, heart valves, etc. [35] Synovial fluid has the highest concentration of hyaluronic acid, and is responsible for its viscoelasticity and lubricating properties.

Oral supplementation with hyaluronic acid appeared to be effective in patients with osteoarthritis of the knee in reducing pain, improving physical function and improving quality of life [36-38].

Hyaluronic acid has been confirmed as an indispensable element in retaining internal skin hydration. According to several studies, people who ingest hyaluronic acid for four weeks show more hydrated skin, a reduction in wrinkles and an overall improvement in their appearance [39,40].

Vitamin C: is key to collagen synthesis. It has a positive effect on connective tissue as it is involved in the formation of collagen, which is essential for the proper functioning of bones, teeth, cartilage, gums, skin and blood vessels [41].

Vitamin C has the potential to accelerate bone healing after fracture and speed recovery from musculoskeletal damage by increasing type I collagen synthesis and reducing oxidative stress parameters [42,43].

Skin, under normal conditions, contains high concentrations of vitamin C, which supports important functions by stimulating collagen synthesis and aiding in antioxidant protection against UV-induced damage [44,45].

Magnesium: approximately 60% of the magnesium present in the body is found in the bones as part of the bone matrix, 26% in the muscles and the rest in the soft tissues and body fluids.

It is essential for the correct metabolism and absorption of calcium. This mineral plays a very important role at the cellular level, as it regulates the flow of calcium into the cells and together with calcium produces ATP or energy needed by the cells to carry out all bodily functions. It is also essential in the transmission of nerve impulses especially at the intracellular level and is a cofactor in many enzymatic processes necessary for cellular energy utilisation, which explains the need for high magnesium concentrations in cells [46-48].

Deficiency is reflected in weakness, tiredness, anxiety, apathy, depression, insomnia, irritability, heart problems, predisposition to stress, as well as problems with muscle contraction. Possible deficiencies of this mineral are more

frequent in older people and in women during the premenstrual period. Magnesium deficiency is associated with premenstrual syndrome. Studies have shown that magnesium intake reduces nervousness, breast tenderness, weight gain, tiredness and headaches during PMS [46,49].

It has a positive effect on stress states and has a calming action. It improves heart muscle activity and regulates fats and glucose in the blood [47,50].

Copper: is necessary for the structure of collagen and elastin in the bone matrix [51,52]. Copper's role in bone metabolism is linked to the copper-dependent enzyme lysyl oxidase, for which it acts as a cofactor. The lysyl oxidase enzyme is required for the formation of lysine-derived cross-links in collagen and elastin [53]. Animal studies have shown that the activity of this enzyme increases in response to increased copper intake [54]. It also plays a key role in inhibiting bone resorption [55].

In the skin, copper stimulates the proliferation of dermal fibroblasts [56]; regulates the production of collagen (types I, II and V) and elastin components [57]; stabilises the extracellular matrix of the skin once formed, as there is increased cross-linking of collagen and elastin matrices in a copper dose-dependent manner [58]; serves as a cofactor for superoxide dismutase, an antioxidant enzyme present in the skin, important for protection against free radicals [59]; serves as a cofactor for tyrosinase, an enzyme essential for melanin biosynthesis responsible for skin and hair pigmentation [60].

Silica: silica accelerates the repair of connective tissue, providing strength and elasticity. A population-based study to determine the association between silica and bone health concluded that an increased intake of silicon may have healthy effects on bone tissue because silicon stimulates osteoblast production, neutralises hydroxyl radicals and participates in the formation of type I collagen and promotes its structural stability [61-65].

In the skin, silicon is important for optimal collagen synthesis and for activating hydroxylation enzymes, improving skin strength and elasticity. Physiological concentrations of orthosilicic acid have been shown to stimulate fibroblasts to secrete type I collagen [66]. In the case of hair, it is suggested that a higher silicon content in the hair fibre results in a lower rate of hair loss and increased shine. Nails are also affected by the presence of silicon, as this is the predominant mineral in their composition [67,68]. Collagen combined with silicon significantly improves skin firmness and elasticity, reducing facial wrinkles [69].

Boron: is essential in the metabolism of calcium, phosphorus, magnesium and vitamin D3. It influences mineral metabolism by improving calcium absorption and reducing urinary excretion. It also appears to act on collagen turnover, as boron intake increases collagen synthesis, and this may contribute to bone formation [70-72].

Malic acid: is the weak acid found in some fruits, such as apples and pears. Traditional medicine used apple cider vinegar both topically and internally for painful rheumatism. Malic acid or malate is the base that initiates the Krebs cycle, the key to energy production. Studies have shown that malic acid supplementation increases the amount of malate in the mitochondria and therefore increases the energy-producing capacity of the cell, reducing fatigue and improving exercise tolerance [73,74].

Devil's Claw (*Harpagophytum procumbens*): has analgesic and anti-inflammatory properties attributed to its high concentration of iridoid glycosides (harpagosides), whose main function is to inhibit the release of cell signalling proteins (cytokines such as IL1-β, TNF-α) that contribute to the inflammatory process [76]. By inhibiting the release of these mediators, devil's claw inhibits the catabolic processes that lead to joint cartilage degradation, thus restoring the balance between catabolic and anabolic processes of the extracellular matrix in the joint [75,76].

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