

## SCIENTIFIC COLLAGEN STUDIES

### COLLAGEN FOR JOINTS, BONES AND MUSCLES

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| Collagen | Osteoarthritis, joint disorders  | Bello AE, Oesser S. Collagen hydrolysate for the treatment of osteoarthritis and other joint disorders: a review of the literature. <i>Curr Med Res Opin.</i> 2006 Nov;22(11):2221-32. doi: 10.1185/030079906X148373. PMID: 17076983.   |
| Collagen | Collagen peptides in human blood after oral ingestion                            | Iwai K, Hasegawa T, Taguchi Y, Morimatsu F, Sato K, Nakamura Y, Higashi A, Kido Y, Nakabo Y, Ohtsuki K. Identification of food-derived collagen peptides in human blood after oral ingestion of gelatin hydrolysates. <i>J Agric Food Chem.</i> 2005 Aug 10;53(16):6531-6. doi: 10.1021/jf050206p. PMID: 16076145.  |
| Collagen | Joint pain   | Clark KL, Sebastianelli W, Flechsenhar KR, Aukermann DF, Meza F, Millard RL, Deitch JR, Sherbondy PS, Albert A. 24-Week study on the use of collagen hydrolysate as a dietary supplement in athletes with activity-related joint pain. <i>Curr Med Res Opin.</i> 2008 May;24(5):1485-96. doi: 10.1185/030079908x291967. Epub 2008 Apr 15. PMID: 18416885. |
| Collagen | Where collagen peptides accumulate in the body after ingestion (joints, in mice) | Oesser S, Adam M, Babel W, Seifert J. Oral administration of (14)C labeled gelatin hydrolysate leads to an accumulation of radioactivity in cartilage of mice (C57/BL). <i>J Nutr.</i> 1999 Oct;129(10):1891-5. doi: 10.1093/jn/129.10.1891. PMID: 10498764.  |
| Collagen | Bone metabolism in mice  | Guillermine F, Beaupied H, Fabien-Soulé V, Tomé D, Benhamou CL, Roux C, Blais A. Hydrolyzed collagen improves bone metabolism and biomechanical parameters in ovariectomized mice: an in vitro and in vivo study. <i>Bone.</i> 2010 Mar;46(3):827-34. doi: 10.1016/j.bone.2009.10.035. Epub 2009 Nov 4. PMID: 19895915.                                   |
| Protein  | Protein and bone health  | Ginty F. Dietary protein and bone health. <i>Proc Nutr Soc.</i> 2003 Nov;62(4):867-76. doi: 10.1079/PNS2003307. PMID: 15018487.   |
| Collagen | Bone mass increase together with running, in mice                                | Takeda, S., Park, JH., Kawashima, E. <i>et al.</i> Hydrolyzed collagen intake increases bone mass of growing rats trained with running exercise. <i>J Int Soc Sports Nutr</i> <b>10</b> , 35 (2013). <a href="https://doi.org/10.1186/1550-2783-10-35">https://doi.org/10.1186/1550-2783-10-35</a>  |
| Collagen | Osteoarthritis, osteoporosis   | Schrieber R, Dr. Gareis H. <i>Gelatine Handbook: Theory and Industrial Practice. Gelatine Handbook: Theory and Industrial Practice Chapter 4. The Role of Collagen Hydrolysate in the Prophylaxis of Osteoarthritis and Osteoporosis.</i> 2007  |
| Collagen | Reumathoid arthritis   | Trentham DE, Dynesius-Trentham RA, Orav EJ, Combitchi D, Lorenzo C, Sewell KL, Hafler DA, Weiner HL. Effects of oral administration of type II collagen on rheumatoid arthritis. <i>Science.</i> 1993 Sep 24;261(5129):1727-30. doi: 10.1126/science.8378772. PMID: 8378772.  |
| Collagen | Role of collagen hydrolysate in bone and joint disease                           | Moskowitz RW. Role of collagen hydrolysate in bone and joint disease. <i>Semin Arthritis Rheum.</i> 2000 Oct;30(2):87-99. doi: 10.1053/sarh.2000.9622. PMID: 11071580.  |
| Collagen | Collagen fibrils and glycosaminoglycans in Achilles tendon                       | Minaguchi J, Koyama Y, Meguri N, Hosaka Y, Ueda H, Kusubata M, Hirota A, Irie S, Mafune N, Takehana K. Effects of ingestion of collagen peptide on collagen fibrils and glycosaminoglycans in Achilles tendon. <i>J Nutr Sci Vitaminol (Tokyo).</i> 2005 Jun;51(3):169-74. doi: 10.3177/jnsv.51.169. PMID: 16161767.                                      |
| Collagen | Activity related joint pain  | Clark KL, Sebastianelli W, Flechsenhar KR, Aukermann DF, Meza F, Millard RL, Deitch JR, Sherbondy PS, Albert A. 24-Week study on the use of collagen hydrolysate as a dietary supplement in athletes with activity-related joint pain. <i>Curr Med Res Opin.</i> 2008 May;24(5):1485-96. doi: 10.1185/030079908x291967. Epub 2008 Apr 15.                 |

PMID: 18416885.

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| Collagen | Skin ageing, joints, bones  | Figueres Juher T, Basés Pérez E. REVISIÓN DE LOS EFECTOS BENEFICIOSOS DE LA INGESTA DE COLÁGENO HIDROLIZADO SOBRE LA SALUD OSTEOARTICULAR Y EL ENVEJECIMIENTO DÉRMICO [An overview of the beneficial effects of hydrolysed collagen intake on joint and bone health and on skin ageing]. <i>Nutr Hosp.</i> 2015 Jul 18;32 Suppl 1:62-6. Spanish. doi: 10.3305/nh.2015.32.sup1.9482. PMID: 26267777.                         |
| Collagen | Efficacy and safety of collagen, regarding joint pain                                     | Benito-Ruiz P, Camacho-Zambrano MM, Carrillo-Arcentales JN, Mestanza-Peralta MA, Vallejo-Flores CA, Vargas-López SV, Villacís-Tamayo RA, Zurita-Gavilanes LA. A randomized controlled trial on the efficacy and safety of a food ingredient, collagen hydrolysate, for improving joint comfort. <i>Int J Food Sci Nutr.</i> 2009;60 Suppl 2:99-113. doi: 10.1080/09637480802498820. Epub 2009 Feb 11. PMID: 19212858.       |
| Collagen | Complementary therapy for the prevention and treatment of osteoporosis and osteoarthritis | Porfírio, Elisângela & Fanaro, Gustavo. (2016). Collagen supplementation as a complementary therapy for the prevention and treatment of osteoporosis and osteoarthritis: a systematic review. <i>Revista Brasileira de Geriatria e Gerontologia.</i> 19. 153-164. 10.1590/1809-9823.2016.14145.   |
| Collagen | Athletes with Chronic Ankle Instability   | Dressler P, Gehring D, Zdzieblik D, Oesser S, Gollhofer A, König D. Improvement of Functional Ankle Properties Following Supplementation with Specific Collagen Peptides in Athletes with Chronic Ankle Instability. <i>J Sports Sci Med.</i> 2018 May 14;17(2):298-304. PMID: 29769831; PMCID: PMC5950747.   |
| Collagen | Bone Mineral Density and Bone Markers in Postmenopausal Women                             | König D, Oesser S, Scharla S, Zdzieblik D, Gollhofer A. Specific Collagen Peptides Improve Bone Mineral Density and Bone Markers in Postmenopausal Women-A Randomized Controlled Study. <i>Nutrients.</i> 2018 Jan 16;10(1):97. doi: 10.3390/nu10010097. PMID: 29337906; PMCID: PMC5793325.   |
| Collagen | Endurance training, in the performance of runners   | Elvira-Aranda, Carlos, De Castellar-Sansó, Roser, Gomis-Gomis, María José, Gómez-Paternina, Jaime Enrique, Pérez Turpin, José Antonio. Effects of the hydrolyzed collagen supplement Colnatur Sport® on endurance training and performance of runners. <i>Journal of Human Sport and Exercise.</i> 2023, 18(1), in press. <a href="https://doi.org/10.14198/jhse.2023.181.20">https://doi.org/10.14198/jhse.2023.181.20</a> |

## COLLAGEN FOR SKIN, HAIR AND NAILS

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| Collagen | Nail growth and brittleness   | Hexsel D, Zague V, Schunck M, Siega C, Camozzato FO, Oesser S. Oral supplementation with specific bioactive collagen peptides improves nail growth and reduces symptoms of brittle nails. <i>J Cosmet Dermatol.</i> 2017 Dec;16(4):520-526. doi: 10.1111/jocd.12393. Epub 2017 Aug 8. PMID: 28786550.                    |
| Collagen | Increase in skin collagen expression and decrease in collagen degrading enzymes | Vivian Zague, Vanessa de Freitas, Marina da Costa Rosa, Geórgia Álvares de Castro, Ruy G. Jaeger, and Gláucia M. Machado-Santelli. Collagen Hydrolysate Intake Increases Skin Collagen Expression and Suppresses Matrix Metalloproteinase 2 Activity. <i>Journal of Medicinal Food</i> 2011 14:6, 618-624                |
| Collagen | Hair thickness  | Oesser, S. (2020). The oral intake of specific Bioactive Collagen Peptides has a positive effect on hair thickness.  |
| Collagen | Skin elasticity   | Proksch E, Segger D, Degwert J, Schunck M, Zague V, Oesser S. Oral supplementation of specific collagen peptides has beneficial effects on human skin physiology: a double-blind, placebo-controlled study. <i>Skin Pharmacol Physiol.</i> 2014;27(1):47-55. doi: 10.1159/000351376. Epub 2013 Aug 14. PMID: 23949208.   |
| Collagen | Skin Hydration, Elasticity, and Wrinkling                                       | Kim DU, Chung HC, Choi J, Sakai Y, Lee BY. Oral Intake of Low-Molecular-Weight Collagen Peptide Improves Hydration, Elasticity, and Wrinkling in Human Skin: A Randomized, Double-Blind, Placebo-Controlled Study. <i>Nutrients.</i> 2018 Jun 26; 10(7):826. doi: 10.3390/nu10070826. PMID: 29949889; PMCID: PMC6073484. |

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| Collagen                             | Collagen as internal sun screen protecting from UV rays, in mice  | Tanaka M, Koyama Y, Nomura Y. Effects of collagen peptide ingestion on UV-B-induced skin damage. <i>Biosci Biotechnol Biochem</i> . 2009 Apr 23;73(4):930-2. doi: 10.1271/bbb.80649. Epub 2009 Apr 7. PMID: 19352014.  |
| Collagen                             | Ingestion of collagen peptide induces increased fibroblast density and enhances formation of collagen fibrils in the dermis | Matsuda N, Koyama Y, Hosaka Y, Ueda H, Watanabe T, Araya T, Irie S, Takehana K. Effects of ingestion of collagen peptide on collagen fibrils and glycosaminoglycans in the dermis. <i>J Nutr Sci Vitaminol (Tokyo)</i> . 2006 Jun;52(3):211-5. doi: 10.3177/jnsv.52.211. PMID: 16967766.   |
| Collagen                             | Skin ageing, joints, bones  | Figueres Juher T, Basés Pérez E. REVISIÓN DE LOS EFECTOS BENEFICIOSOS DE LA INGESTA DE COLÁGENO HIDROLIZADO SOBRE LA SALUD OSTEOARTICULAR Y EL ENVEJECIMIENTO DÉRMICO [An overview of the beneficial effects of hydrolysed collagen intake on joint and bone health and on skin ageing]. <i>Nutr Hosp</i> . 2015 Jul 18;32 Suppl 1:62-6. Spanish. doi: 10.3305/nh.2015.32.sup1.9482. PMID: 26267777. |
| Collagen supplement<br>Gold Collagen | Signs of ageing; reduction  | Borumand M, Sibilla S. Daily consumption of the collagen supplement Pure Gold Collagen® reduces visible signs of aging. <i>Clin Interv Aging</i> . 2014 Oct 13;9:1747-58. doi: 10.2147/CIA.S65939. Erratum in: <i>Clin Interv Aging</i> . 2020 Feb 04;15:131. PMID: 25342893; PMCID: PMC4206255.   |

## FISH COLLAGEN

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| Fish collagen   | Skin properties       | Matsumoto, H.; Ohara, H.; Itoh, K.; Nakamura, Y.; Takahashi, S. Clinical effect of fish type I collagen hydrolysate on skin properties. <i>ITE Lett</i> , 2006; 7: 386–390  |
| Collagen (fish) | Facial skin qualities | Chai HJ, Li JH, Huang HN, Li TL, Chan YL, Shiao CY, Wu CJ. Effects of sizes and conformations of fish-scale collagen peptides on facial skin qualities and transdermal penetration efficiency. <i>J Biomed Biotechnol</i> . 2010;2010:757301. doi: 10.1155/2010/757301. Epub 2010 Jun 8. PMID: 20625414; PMCID: PMC2896882. |

## COLLAGEN AND TRIPEPTIDE COLLAGEN

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| Collagen and tripeptide | Absorption and extraction                                     | Yamamoto S, Deguchi K, Onuma M, Numata N, Sakai Y. Absorption and Urinary Excretion of Peptides after Collagen Tripeptide Ingestion in Humans. <i>Biol Pharm Bull</i> . 2016;39(3):428-34. doi: 10.1248/bpb.b15-00624. PMID: 26934933.   |
| Collagen and tripeptide | Collagen peptides do in fact reach the skin via the blood     | Misato Yazaki, Yukihiro Ito, Masayoshi Yamada, Spyros Goulas, Sachiyo Teramoto, Masa-aki Nakaya, Shigeo Ohno, and Kohji Yamaguchi. Oral Ingestion of Collagen Hydrolysate Leads to the Transportation of Highly Concentrated Gly-Pro-Hyp and Its Hydrolyzed Form of Pro-Hyp into the Bloodstream and Skin. <i>Journal of Agricultural and Food Chemistry</i> 2017 65 (11), 2315-2322 |
| Tripeptide              | Anti-inflammatory effect of collagen tripeptide in skin       | Hakuta A, Yamaguchi Y, Okawa T, Yamamoto S, Sakai Y, Aihara M. Anti-inflammatory effect of collagen tripeptide in atopic dermatitis. <i>J Dermatol Sci</i> . 2017 Dec;88(3):357-364. doi: 10.1016/j.jdermsci.2017.09.002. Epub 2017 Sep 28. PMID: 29017796.  |
| Tripeptide              | Skin dryness  | Okawa T, Yamaguchi Y, Takada S, Sakai Y, Numata N, Nakamura F, Nagashima Y, Ikezawa Z, Aihara M. Oral administration of collagen tripeptide improves dryness and pruritus in the acetone-induced dry skin model. <i>J Dermatol Sci</i> . 2012 May;66(2):136-43. doi: 10.1016/j.jdermsci.2012.02.004. Epub 2012 Feb 19. PMID: 22410290.   |
| Tripeptide              | Collagen Tripeptide on Deep Wrinkling and Skin moisturization | Shin, Jin & Kim, Ae & Lee, Hyun & Kim, Jun & Lee, Hae. (2021). The Beneficial Effects of Collagen Tripeptide on Deep Wrinkling and Skin Moisturization: A Randomized Controlled Trial. <i>Journal of Food and Nutrition Research</i> . 9. 508-515. 10.12691/jfnr-9-10-2.   |

## INGREDIENTS

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|------------------------|---|--|
| Turmeric               | Treatment of Osteoarthritis                             | Perkins K, Sahy W, Beckett RD. Efficacy of Curcuma for Treatment of Osteoarthritis. <i>J Evid Based Complementary Altern Med.</i> 2017 Jan;22(1):156-165. doi: 10.1177/2156587216636747. Epub 2016 Mar 14. PMID: 26976085; PMCID: PMC5871206.  |
| Turmeric               | Omega 3's and turmeric reduce inflammation and migraine | Soveyd N, Abdolahi M, Djalali M, Hatami M, Tafakhori A, Sarraf P, Honarvar NM. The Combined Effects of $\omega$ -3 Fatty Acids and Nano-Curcumin Supplementation on Intercellular Adhesion Molecule-1 (ICAM-1) Gene Expression and Serum Levels in Migraine Patients. <i>CNS Neurol Disord Drug Targets.</i> 2018 Mar 13;16(10):1120-1126. doi: 10.2174/1871527317666171213154749. PMID: 29237386. |
| MSM                    | MSM: safety and efficacy/applications                   | Butawan M, Benjamin RL, Bloomer RJ. Methylsulfonylmethane: Applications and Safety of a Novel Dietary Supplement. <i>Nutrients.</i> 2017 Mar 16;9(3):290. doi: 10.3390/nu9030290. PMID: 28300758; PMCID: PMC5372953.   |
| Gelatine and Vitamin C | Before activity augments collagen synthesis             | Shaw G, Lee-Barthel A, Ross ML, Wang B, Baar K. Vitamin C-enriched gelatin supplementation before intermittent activity augments collagen synthesis. <i>Am J Clin Nutr.</i> 2017 Jan;105(1):136-143. doi: 10.3945/ajcn.116.138594. Epub 2016 Nov 16. PMID: 27852613; PMCID: PMC5183725.  |
| Hyaluronic acid        | Skin moisture, dry skin                                 | Kawada C, Yoshida T, Yoshida H, Matsuoka R, Sakamoto W, Odanaka W, Sato T, Yamasaki T, Kanemitsu T, Masuda Y, Urushibata O. Ingested hyaluronan moisturizes dry skin. <i>Nutr J.</i> 2014 Jul 11;13:70. doi: 10.1186/1475-2891-13-70. PMID: 25014997; PMCID: PMC4110621.   |
| Hyaluronic acid        | Knee osteoarthritis                                     | Tashiro T, Seino S, Sato T, Matsuoka R, Masuda Y, Fukui N. Oral administration of polymer hyaluronic acid alleviates symptoms of knee osteoarthritis: a double-blind, placebo-controlled study over a 12-month period. <i>ScientificWorldJournal.</i> 2012; 2012:167928. doi: 10.1100/2012/167928. Epub 2012 Nov 20. PMID: 23226979; PMCID: PMC3512263.  |