

Ingredient spotlight:

- [1] Berg, J.M., Tymoczko, J.L. and Stryer, L. (2002) *Biochemistry*. 5th edn. New York: W.H. Freeman.
- [2] Whitcomb, D.C. and Lowe, M.E. (2007) 'Human pancreatic digestive enzymes', *Digestive Diseases and Sciences*, 52(1), pp. 1-17. doi: 10.1007/s10620-006-9589-z.
- [3] Brzozowski, B., Stasiewicz, K., Ostolski, M. and Adamczak, M. (2020) 'Reducing Immunoreactivity of Gliadins and Coeliac-Toxic Peptides Using Peptidases from *L. acidophilus* 5e2 and *A. niger*', *Catalysts*, 10(8), p. 923. doi: 10.3390/CATAL10080923.
- [4] Vreeke, G.W., Vincken, J.P., Wierenga, P.A. and Gruppen, H. (2023) 'Quantitative peptide release kinetics to describe the effect of pH on pepsin preference', *Process Biochemistry*, 135, pp. 21-30. doi: 10.1016/j.procbio.2023.10.021.
- [5] Sathe, A., Freedman, T., Putman, L., Gallotto, S. and Clarkin, E. (2025) 'Results of a clinical trial of ANG003, a non-porcine pancreatic enzyme replacement therapy, in people with cystic fibrosis', *Journal of Cystic Fibrosis*, 24(1), pp. 107-114. doi: 10.1016/j.jcf.2025.07.008.
- [6] Paulussen, K.J.M., Askow, A.T., Deutz, M.T., McKenna, C.F. and Garvey, S.M. (2024) 'Acute microbial protease supplementation increases net postprandial plasma amino acid concentrations after pea protein ingestion in healthy adults: a randomized, double-blind, placebo-controlled trial', *The Journal of Nutrition*, 154(5), pp. 1509-1519. doi: 10.1016/j.tjnut.2024.03.009.
- [7] Townsend, J.R., Morimune, J.E., Jones, M.D., Beuning, C.N. and Haase, A.A. (2020) 'The Effect of ProHydrolase® on the Amino Acid and Intramuscular Anabolic Signaling Response to Resistance Exercise in Trained Males', *Sports*, 8(2), p. 13. doi: 10.3390/SPORTS8020013.
- [8] Rath, A., Gaonkar, T., Dhar, D., Kallapura, G. and Jadhav, S. (2024) 'Study of amino acids absorption and gut microbiome on consumption of pea protein blended with enzymes-probiotics supplement', *Frontiers in Nutrition*, 11, p. 1307734. doi: 10.3389/fnut.2024.1307734.
- [9] Minevich, J., Olson, M.A., Mannion, J.P., Boubertakh, B., Lefranc-Millot, C., Reeth, O. and Kluess, H.A. (2015) 'Digestive enzymes reduce quality differences between plant and animal proteins: a double-blind crossover study', *Journal of the International Society of Sports Nutrition*, 12(Suppl 1), p. P26. doi: 10.1186/1550-2783-12-S1-P26.
- [10] Sender, R., Fuchs, S. and Milo, R. (2016) 'Revised estimates for the number of human and bacteria cells in the body', *PLOS Biology*, 14(8), e1002533. doi: 10.1371/journal.pbio.1002533.
- [11] Cummings, J.H. and Macfarlane, G.T. (1997) 'Role of intestinal bacteria in nutrient metabolism', *Clinical Nutrition*, 16(1), pp. 3-11. doi: 10.1016/S0261-5614(97)80252-X.
- [12] Macfarlane, G.T. and Macfarlane, S. (2012) 'Bacteria, colonic fermentation, and gastrointestinal health', *Journal of AOAC International*, 95(1), pp. 50-60. doi: 10.5740/jaoacint.SGE_Macfarlane.
- [13] Pimentel, M., Saad, R.J., Long, M.D. and Rao, S.S.C. (2020) 'ACG Clinical Guideline: Small Intestinal Bacterial Overgrowth', *American Journal of Gastroenterology*, 115(2), pp. 165-178. doi: 10.14309/ajg.0000000000000501.

- [14] Russell, W.R., Gratz, S.W., Duncan, S.H., Holtrop, G., Ince, J., Scobbie, L., Duncan, G., Johnstone, A.M., Lobley, G.E., Wallace, R.J., Duthie, G.G. and Flint, H.J. (2011) 'High-protein, reduced-carbohydrate weight-loss diets promote metabolite profiles likely to be detrimental to colonic health', *American Journal of Clinical Nutrition*, 93(5), pp. 1062-1072. doi: 10.3945/ajcn.110.002188.
- [15] Koh, A., De Vadder, F., Kovatcheva-Datchary, P. and Bäckhed, F. (2016) 'From dietary fiber to host physiology: short-chain fatty acids as key bacterial metabolites', *Cell*, 165(6), pp. 1332-1345. doi: 10.1016/j.cell.2016.05.041.
- [16] De la Iglesia-García, D., Huang, W., Szatmary, P., Bastón-Rey, I., Gonzalez-Lopez, J., Prada-Ramallal, G., Mukherjee, R., Nunes, Q.M., Domínguez-Muñoz, J.E., Sutton, R. and NIHR Pancreas Biomedical Research Unit Patient Advisory Group (2017) 'Efficacy of pancreatic enzyme replacement therapy in chronic pancreatitis: systematic review and meta-analysis', *Gut*, 66(8), pp. 1354-1355. doi: 10.1136/GUTJNL-2016-312529.
- [17] de Vrese, M., Laue, C., Offick, B., Soeth, E., Repenning, F., Thoß, A. and Schrezenmeir, J. (2015) 'A combination of acid lactase from *Aspergillus oryzae* and yogurt bacteria improves lactose digestion in lactose maldigesters synergistically: A randomized, controlled, double-blind cross-over trial', *Clinical Nutrition*, 34(3), pp. 394-399. doi: 10.1016/j.clnu.2014.06.012.
- [18] Majeed, M., Majeed, S., Nagabhushanam, K., Arumugam, S., Pande, A., Paschapur, M. and Ali, F. (2018) 'Evaluation of the safety and efficacy of a multienzyme complex in patients with functional dyspepsia: a randomized, double-blind, placebo-controlled study', *Journal of Medicinal Food*, 21(11), pp. 1120-1128. doi: 10.1089/JMF.2017.4172.
- [19] Ullah, H., Arbab, S., Tian, Y., Liu, C.Q., Chen, Y., Qijie, L., Khan, M.I.U., Hassan, I.U., Li, K. (2023) 'Efficacy of digestive enzyme supplementation in functional dyspepsia: A monocentric, randomized, double-blind, placebo-controlled, clinical trial', *Biomedicine & Pharmacotherapy*, 167, p. 115858. doi: 10.1016/j.biopha.2023.115858.
- [20] Yoosuf, S., Hetta, A.K., Lincoln, A., Hustoft, T.N., Hausken, T. and Lied, G.A. (2023) 'Pancreatic enzyme supplementation versus placebo for improvement of gastrointestinal symptoms in non-responsive celiac disease: A cross-over randomized controlled trial', *Frontiers in Medicine*, 9, p. 1001879. doi: 10.3389/fmed.2022.1001879.
- [21] La Monica, M.B., Raub, B., Lopez, H.L. and Ziegenfuss, T.N. (2023) 'A probiotic amylase blend reduces gastrointestinal symptoms in a randomised clinical study', *Beneficial Microbes*, 14(4), pp. 331-341. doi: 10.1163/18762891-20230043.
- [22] Rathi, A., Gaonkar, T., Dhar, D., Kallapura, G. and Jadhav, S. (2024) 'Metabolomics and gut metagenomics profile of the healthy adults on consumption of whey protein supplemented with enzymes-probiotics blend', *Scientific Reports*, 14, p. 9234. doi: 10.1007/s42452-024-05815-3.
- [23] Retuerto, M., LaMonica, M., Ziegenfuss, T.N., Raub, B., McCormick, T.S. and Ghannoum, M.A. (2023) 'Probiotic supplementation of pea-derived protein alters the gut microbiome balance in favor of increased protein degradation, reflected in increased levels of essential amino acid in human plasma', *Gastroenterology & Hepatology*, 14(5), pp. 553-556. doi: 10.15406/ghoa.2023.14.00553.
- [24] Tuck, C.J., Taylor, K.M., Gibson, P.R., Barrett, J.S. and Muir, J.G. (2018) 'Increasing symptoms in irritable bowel symptoms with ingestion of galacto-oligosaccharides are mitigated by α -galactosidase treatment', *American Journal of Gastroenterology*, 113(1), pp. 124-134. doi: 10.1038/AJG.2017.245.

- [25] Martin-Biggers, J., Sarao, L.K., Figueroa, J., Koecher, K. and Maladecki, J. (2023) 'A digestive enzyme and herbal dietary supplement reduces bloating in a single use in healthy adults: A randomized, placebo-controlled, cross over study', Research Square [Preprint]. doi: 10.21203/rs.3.rs-3416887/v1.
- [26] Borowitz, D., Stevens, C., Brettman, L.R., Campion, M., Wilschanski, M. and Leitz, G. (2011) 'International phase III trial of liprotamase efficacy and safety in pancreatic-insufficient cystic fibrosis patients', *Journal of Cystic Fibrosis*, 10(6), pp. 443-452. doi: 10.1016/j.jcf.2011.07.001.
- [27] Heubi, J.E., Schaeffer, D., Ahrens, R., Sollo, N., Strausbaugh, S., Graff, G., Ahrens, R., Aitken, M.L., Borowitz, D., Freedman, S.D., Gelfond, D., Leung, D.H., Schwarzenberg, S.J., Stallings, V.A., Stevens, C., Zaman, M. and Ramsey, B.W. (2016) 'Safety and Efficacy of a Novel Microbial Lipase in Patients with Exocrine Pancreatic Insufficiency due to Cystic Fibrosis: A Randomized Controlled Clinical Trial', *The Journal of Pediatrics*, 176, pp. 156-161.e1. doi: 10.1016/j.jpeds.2016.05.049.
- [28] Untersmayr, E. and Jensen-Jarolim, E. (2008) 'The role of protein digestibility and antigenicity in allergy and autoimmunity', *Critical Reviews in Food Science and Nutrition*, 48(4), pp. 289-301. doi: 10.1080/10408390701425616.
- [29] Mowat, A.M. and Agace, W.W. (2014) 'Regional specialization within the intestinal immune system', *Nature Reviews Immunology*, 14(10), pp. 667-685. doi: 10.1038/nri3738.
- [30] Berin, M.C. and Sampson, H.A. (2013) 'Mucosal immunology of food allergy', *Current Biology*, 23(9), pp. R389-R400. doi: 10.1016/j.cub.2013.02.043.
- [31] Cornell, H.J., Czyzewska, A., Macrae, F.A., Rydzewska, G., Nasierowska-Gutmejer, A. and Bednarczyk, A. (2016) 'The effect of enzyme supplementation on symptoms and duodenal histology in celiac patients', *International Journal of Celiac Disease*, 4(2), pp. 40-47. doi: 10.12691/IJCD-4-2-2.
- [32] Liu, W., Liu, H., Wang, Y., Xu, M., Wang, H. and Chen, H. (2023) 'Mechanism of the Allergenicity Reduction of Ovalbumin by Microwave Pretreatment-Assisted Enzymolysis through Biological Mass Spectrometry', *Journal of Agricultural and Food Chemistry*, 71(37), pp. 13867-13877. doi: 10.1021/acs.jafc.3c04613.
- [33] Brzozowski, B., Stasiewicz, K., Ostolski, M. and Adamczak, M. (2020) 'Reducing Immunoreactivity of Gliadins and Coeliac-Toxic Peptides Using Peptidases from *L. acidophilus* 5e2 and *A. niger*', *Catalysts*, 10(8), p. 923. doi: 10.3390/CATAL10080923.
- [34] Samadi, N., Heiden, D., Klems, M., Salzmann, M., Rohrhofer, J., Eiwegger, T., Untersmayr, E. and Binder, C.J. (2021) 'Gastric Enzyme Supplementation Inhibits Food Allergy in a BALB/c Mouse Model', *Nutrients*, 13(3), p. 738. doi: 10.3390/NU13030738.
- [35] Lomer, M.C.E. (2015) 'Review article: the aetiology, diagnosis, mechanisms and clinical evidence for food intolerance', *Alimentary Pharmacology & Therapeutics*, 41(3), pp. 262-275. doi: 10.1111/apt.13041.
- [36] Misselwitz, B., Butter, M., Verbeke, K. and Fox, M.R. (2019) 'Update on lactose malabsorption and intolerance: pathogenesis, diagnosis and clinical management', *Gut*, 68(11), pp. 2080-2091. doi: 10.1136/gutjnl-2019-318404.
- [37] Ianaro, G., Pecere, S., Giorgio, V., Gasbarrini, A. and Cammarota, G. (2016) 'Digestive enzyme supplementation in gastrointestinal diseases', *Current Drug Metabolism*, 17(2), pp. 187-193. doi: 10.2174/138920021702160114150137.
- [38] de Vrese, M., Laue, C., Offick, B., Soeth, E., Repenning, F., Thoß, A. and Schrezenmeir, J. (2015) 'A combination of acid lactase from *Aspergillus oryzae* and

yogurt bacteria improves lactose digestion in lactose maldigesters synergistically: A randomized, controlled, double-blind cross-over trial', *Clinical Nutrition*, 34(3), pp. 394-399. doi: 10.1016/j.clnu.2014.06.012.

[39] Tuck, C.J., Taylor, K.M., Gibson, P.R., Barrett, J.S. and Muir, J.G. (2018)

'Increasing symptoms in irritable bowel symptoms with ingestion of galacto-oligosaccharides are mitigated by α -galactosidase treatment', *American Journal of Gastroenterology*, 113(1), pp. 124-134. doi: 10.1038/AJG.2017.245.

[40] Böhn, L., Störsrud, S., Törnblom, H., Bengtsson, U. and Simrén, M. (2013) 'Self-reported food-related gastrointestinal symptoms in IBS are common and associated with more severe symptoms and reduced quality of life', *American Journal of Gastroenterology*, 108(5), pp. 634-641. doi: 10.1038/ajg.2013.105.

[41] Majeed, M., Majeed, S., Nagabhushanam, K., Arumugam, S., Pande, A., Paschapur, M. and Ali, F. (2018) 'Evaluation of the safety and efficacy of a multienzyme complex in patients with functional dyspepsia: a randomized, double-blind, placebo-controlled study', *Journal of Medicinal Food*, 21(11), pp. 1120-1128. doi: 10.1089/JMF.2017.4172.

[42] Haderer, M., Neubert, P., Rinner, E., Scholtis, A., Broncy, L., Gschwendtner, H., Kilger, D., Kandulski, A., Gülow, K., Kunst, C. and Müller, M. (2021) 'Novel pathomechanism for spontaneous bacterial peritonitis: disruption of cell junctions by cellular and bacterial proteases', *Gut*, 70(7), pp. 1384-1393. doi: 10.1136/GUTJNL-2020-321663.

[43] Kriaa, A., Jablaoui, A., Rhimi, S., Soussou, S., Mkaouar, H., Mariaule, V., Hernandez, J., Korkmaz, B., Lesner, A., Maguin, E. and Rhimi, M. (2021) 'SP-1, a serine protease from the gut microbiota, influences colitis and drives intestinal dysbiosis in mice', *Cells*, 10(10), p. 2658. doi: 10.3390/CELLS10102658.

[44] Rondeau, L., Barbosa Da Luz, B., Santiago, A., Bermudez-Brito, M., Hann, A., Rousseau, F., Vergnolle, N., Alric, L., Dietrich, G. and Deraison, C. (2024) 'Proteolytic bacteria expansion during colitis amplifies inflammation through cleavage of the external domain of PAR2', *Gut Microbes*, 16(1), p. 2387857. doi: 10.1080/19490976.2024.2387857.

[45] Arias, L.S., Delbem, A.C.B., Fernandes, R.A., Barbosa, D.B., Monteiro, D.R. (2016) 'Activity of tyrosol against single and mixed-species oral biofilms', *Journal of Oral Microbiology*, 8, p. 32385. doi: 10.3402/jom.v8.32385.

[46] Caminero, A., Galipeau, H.J., Constante, M., Bermudez-Brito, M., Jury, J., Natividad, J.M., Verdu, E.F. and Bercik, P. (2023) 'The emerging roles of bacterial proteases in intestinal diseases', *Gut Microbes*, 15(1), p. 2181922. doi: 10.1080/19490976.2023.2181922.

[47] Rondeau, L., Barbosa Da Luz, B., Santiago, A., Bermudez-Brito, M., Hann, A., Rousseau, F., Vergnolle, N., Alric, L., Dietrich, G. and Deraison, C. (2024) 'Proteolytic bacteria expansion during colitis amplifies inflammation through cleavage of the external domain of PAR2', *Gut Microbes*, 16(1), p. 2387857. doi: 10.1080/19490976.2024.2387857.

[48] Paulussen, K.J.M., Askow, A.T., Deutz, M.T., McKenna, C.F. and Garvey, S.M. (2024) 'Acute microbial protease supplementation increases net postprandial plasma amino acid concentrations after pea protein ingestion in healthy adults: a randomized, double-blind, placebo-controlled trial', *The Journal of Nutrition*, 154(5), pp. 1509-1519. doi: 10.1016/j.tjnut.2024.03.009.

[49] Caminero, A., Galipeau, H.J., Constante, M., Bermudez-Brito, M., Jury, J., Natividad, J.M., Verdu, E.F. and Bercik, P. (2023) 'The emerging roles of bacterial

- proteases in intestinal diseases', *Gut Microbes*, 15(1), p. 2181922. doi: 10.1080/19490976.2023.2181922.
- [50] Yule, D.I. (2023) 'Ca²⁺ signals in pancreatic acinar cells in response to physiological stimulation in vivo', *The Journal of Physiology*, 601(11), pp. 2085-2099. doi: 10.1113/jp284469.
- [51] Sans, M.D., Sabbatini, M.E. and Williams, J.A. (2020) 'Regulation of Pancreatic Exocrine Function by Islet Hormones', *Pancreapedia: Exocrine Pancreas Knowledge Base*. doi: 10.3998/PANC.2020.01.
- [52] Steiner, J.M., Gomez, C.L., Jaffey, J.A., Derksen, F.J., Gaschen, F.P., Lascelles, B.D.X., Messenger, K.M., Messenger, K.M., Messenger, K.M., Messenger, K.M. and Messenger, K.M. (2020) 'The relationship between cholecystokinin secretion and pancreatic lipase immunoreactivity in dogs', *Annals of Nuclear Medicine*, 34(8), pp. 577-583. doi: 10.1007/s12149-020-01492-5.
- [53] Gilannejad, N., Martínez-Rodríguez, G., Yúfera, M., Moyano, F.J. and Alarcón, F.J. (2021) 'Daily rhythms of intestinal cholecystokinin and pancreatic proteases activity in Senegalese sole juveniles with diurnal and nocturnal feeding', *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, 253, p. 110868. doi: 10.1016/J.CBPA.2020.110868.
- [54] Ramos-Álvarez, I., Lee, L., Jensen, R.T. (2023) 'Cofilin activation in pancreatic acinar cells plays a pivotal convergent role for mediating CCK-stimulated enzyme secretion and growth', *Frontiers in Physiology*, 14, p. 1147572. doi: 10.3389/fphys.2023.1147572.
- [55] Layer, P., Jansen, J.B., Cherian, L., Lamers, C.B. and Goebell, H. (1990) 'Feedback regulation of human pancreatic secretion. Effects of protease inhibition on duodenal delivery and small intestinal transit of pancreatic enzymes', *Gastroenterology*, 98(5 Pt 1), pp. 1311-1319. doi: 10.1016/0016-5085(90)90349-6.
- [56] Barto, T.L., Kemp, S.F., Borowitz, D., Bowser, E.K., Zaman, M., Leitz, G., Stallings, V.A., Schwarzenberg, S.J., Gelfond, D., Freedman, S.D., Aitken, M.L., Ramsey, B.W. and Heubi, J.E. (2022) 'Intestinal Absorption of Lipids Using a Pancreatic Enzyme-Free Nutritional Supplement in Patients with Cystic Fibrosis: A Randomized, Double-Blind, Crossover Pilot Trial', *Nutrients*, 14(3), p. 680. doi: 10.3390/nu14030680.
- [57] Heubi, J.E., Schaeffer, D., Ahrens, R., Sollo, N., Strausbaugh, S., Graff, G., Aitken, M.L., Borowitz, D., Freedman, S.D., Gelfond, D., Leung, D.H., Schwarzenberg, S.J., Stallings, V.A., Stevens, C., Zaman, M. and Ramsey, B.W. (2016) 'Safety and efficacy of a novel microbial lipase in patients with exocrine pancreatic insufficiency due to cystic fibrosis: A randomized controlled clinical trial', *The Journal of Pediatrics*, 176, pp. 156–161. doi: 10.1016/j.jpeds.2016.05.049.

Elemental diet feature – Alice Bradshaw:

1. Cedars-Sinai Medical Center. New Cedars-Sinai Study Shows How Specialized Diet Can Improve Gut Disorders. 2025.
2. Cedars-Sinai. Elemental Diet and Stool Microbiome Profile. Clinical Trial NCT05978973. 2024.
3. Nasser J, Mehravar S, Pimentel M, et al. Elemental diet as a therapeutic modality: a comprehensive review. *Dig Dis Sci*. 2024.
4. Cedars-Sinai; Clin Gastroenterol Hepatol. Palatable elemental diet improves symptoms in SIBO/IMO. 2025.
5. O'Morain C, Segal AW, Levi AJ. Elemental diets in the treatment of acute Crohn's disease. *BMJ*. 1984.

6. Zachos M, Tondeur M, Griffiths A. Enteral nutritional therapy for Crohn's disease. *Cochrane Database Syst Rev*. 2007.
7. Yamamoto T, et al. Maintenance therapy with elemental diet in Crohn's disease. *Aliment Pharmacol Ther*. 2005.
8. Teahon K, et al. The effect of elemental diet on intestinal permeability and inflammation. *Gut*. 1990.
9. Lochs H, et al. ESPEN Guidelines on Enteral Nutrition: Gastroenterology. *Clin Nutr*. 2006.

Ask the experts:

Dr. Kristy Appelhans

1. Dietary Fiber: Essential for a Healthy Diet. *Mayo Clinic*. November 7, 2025. [Dietary fiber: Essential for a healthy diet - Mayo Clinic](#)
2. Recommended daily intake of fibre and fibre rich foods to help you achieve it. European Food Information Council (EUFIC). October 26, 2023. [recommended-daily-intake-of-fibre-and-fibre-rich-foods-to-help-you-achieve-it.pdf](#)
3. Dietary fibre in Europe: current state of knowledge on definitions, sources, recommendations, intakes and relationships to health. Cambridge University. July 5, 2017. [Dietary fibre in Europe: current state of knowledge on definitions, sources, recommendations, intakes and relationships to health | Nutrition Research Reviews | Cambridge Core](#)
4. Edelman M, Wang Q, Ahnen R, Slavin J. The Dose Response Effects of Partially Hydrolyzed Guar Gum on Gut Microbiome of Healthy Adults. *Applied Microbiology*. 2024; 4(2):720-730. <https://doi.org/10.3390/applmicrobiol4020049>
5. Furnari M, Bruzzzone L, Savarino E, Gemignani L, Moscatelli A, Bodini G, et al. Sa2058 Efficacy of partially hydrolyzed guar gum in reducing methane excretion and clinical manifestation of subjects suffering from irritable bowel syndrome. *Gastroenterology*. 2012 May;142(5):S-391. doi: 10.1016/S0016-5085(12)61484-X.
6. Furnari M, Parodi A, Gemignani L, et al. Clinical trial: the combination of rifaximin with partially hydrolysed guar gum is more effective than rifaximin alone in eradicating small intestinal bacterial overgrowth. *Aliment Pharmacol Ther*. 2010;32(8):1000-1006. doi:10.1111/j.1365-2036.2010.04436.x
7. Pi XE, Fu H, Yang XX, et al. Bacterial, short-chain fatty acid and gas profiles of partially hydrolyzed guar gum in vitro fermentation by human fecal microbiota. *Food Chem*. 2024;430:137006. doi:10.1016/j.foodchem.2023.137006
8. Polymeros D, Beintaris I, Gaglia A, et al. Partially hydrolyzed guar gum accelerates colonic transit time and improves symptoms in adults with chronic constipation. *Dig Dis Sci*. 2014;59(9):2207-2214. doi:10.1007/s10620-014-3135-1
9. Takahashi C, Kozawa M. The effect of partially hydrolyzed guar gum on preventing influenza infection. *Clin Nutr ESPEN*. 2021;42:148-152. doi:10.1016/j.clnesp.2020.11.030
10. Tupper, Lara MNutr; Terol, Monique MNutr; Utter, Jennifer PhD; Morley, Shannon BSND. The Role of Guar Fiber in Improving the Management of Irritable Bowel Syndrome, Functional Constipation, and Functional Diarrhea: A

Sophie Barrett:

1. Zhu JS, Halpern GM, Jones K. The scientific rediscovery of an ancient Chinese herbal medicine: *Cordyceps sinensis*. Journal of Alternative and Complementary Medicine. 1998.
2. Chen Y, et al. *Cordyceps sinensis* enhances steroidogenesis and estradiol production via regulation of aromatase activity. Phytotherapy Research. 2012.
3. Wong KL, et al. Effects of *Cordyceps* on sperm quality and testosterone production in experimental models. Andrologia. 2014.
4. Boh B, et al. *Ganoderma lucidum*: A potential medicinal mushroom. International Journal of Medicinal Mushrooms. 2007.
5. Wachtel-Galor S, Benzie IFF. *Ganoderma lucidum* (Lingzhi or Reishi). Herbal Medicine: Biomolecular and Clinical Aspects. 2011.
6. Kubo K, et al. Maitake mushroom extract improves ovulation and insulin sensitivity in women with PCOS. Journal of Alternative and Complementary Medicine. 2010.
7. Wasser SP. Medicinal mushroom science: History, current status, future trends, and unsolved problems. International Journal of Medicinal Mushrooms. 2010.

BANT feature – Claire Sambolino:

1. <https://www.nesta.org.uk/data-visualisation-and-interactive/silver-bullet-or-sticking-plaster-weight-loss-drugs-and-the-uks-obesity-crisis/>, accessed 08 December 2025
2. <https://www.kantar.com/uki/inspiration/fmcg/2025-wp-glp-1-agonists-the-next-big-disruptor-in-society>, accessed 08 Nov 2025
3. Han Wu, Wenjia Yang, Tong Guo, Xiaoling Cai and Linong Ji, Trajectory of the body weight after drug discontinuation in the treatment of anti-obesity medications, BMC medicine, 2025. Accessed 08 December - <https://link.springer.com/article/10.1186/s12916-025-04200-0>
4. <https://www.medscape.com/viewarticle/what-comes-back-when-stopping-glp-1s-2025a1000wtd> , accessed 08 December 2025
5. 1:26:48 Natural Alternatives to GLP-1 Drugs, DOAC Nov 24, 2025
6. <https://www.medscape.com/viewarticle/gps-urge-specialist-clinics-weight-loss-drug-use-2025a1000v3b> , accessed 08 December 2025

Skin health feature:

Keri Briggs:

- Andersen F, Andersen K, Kligman A. Xerotic skin of the elderly: A summer versus winter comparison based on biophysical measurements. *Exog Dermatol* 2004; 2: 190–194.
- Behera SS, Ray RC, Zdoiec N. *Lactobacillus plantarum* with Functional Properties: An Approach to Increase Safety and Shelf-Life of Fermented Foods. Biomed Res Int. 2018 May 28;2018:9361614
- Boyce S.T., Supp A.P., Swope V.B., Warden G.D. Vitamin C regulates keratinocyte viability, epidermal barrier, and basement membrane in vitro, and reduces wound contraction after grafting of cultured skin substitutes. *J. Investig. Dermatol.* 2002;118:565–572.

Brosche T, Platt D. Effect of borage oil consumption on fatty acid metabolism, transepidermal water loss and skin parameters in elderly people. *Arch Gerontol Geriatr*. 2000;30(2):139–150.

Chilton-Lopez null, Surette ME, Swan DD, Fonteh AN, Johnson MM, Chilton FH. Metabolism of gammalinolenic acid in human neutrophils. *J Immunol Baltim Md 1950*. 1996;156(8):2941–2947

Cravello B, Ferri A. Relationships between skin properties and environmental parameters. *Skin Res Technol* 2008; 14: 180–186.

Denda M, Hori J, Koyama J, et al. Stratum corneum sphingolipids and free amino acids in experimentally-induced scaly skin. *Arch Dermatol Res*. 1992; 284(6):363-7. 2

Dirschka T, Tronnier H, Folster-Holtz R. Epithelial barrier function and atopic diathesis in rosacea and perioral dermatitis. *Br J Dermatol*. 2004;150(6):1136- 1141.

Egawa M, Oguri M, Kuwahara T *et al*. Effect of exposure of human skin to a dry environment. *Skin Res Technol* 2002; 8: 212–218.

Elias PM. Epidermal lipids barrier function and desquamation. *J Invest Dermatol*. 1983;80(Suppl):44-49.

Engelbrechtsen, K., Johansen, J., Kezic, S., Linneberg, A. and Thyssen, J. (2016), The effect of environmental humidity and temperature on skin barrier function and dermatitis. *J Eur Acad Dermatol Venereol*, 30: 223-249

Erbagci Z, Ozgoztaosi O. The significance of *Demodex folliculorum* density in rosacea. *Int J Dermatol* 1998;37:421-425.

Forton FMN. Papulopustular rosacea, skin immunity and Demodex: pityriasis folliculorum as a missing link. *J Eur Acad Dermatol Venereol* 2012;26:19–28.

Gether, L., Overgaard, L.K., Egeberg, A. and Thyssen, J.P. (2018) Incidence and prevalence of rosacea: a systematic review and meta-analysis. *British Journal of Dermatology* 179(2), 282-289.

Grice EA, Segre JA. The skin microbiome. *Nat Rev Microbiol*. 2011;9:244-253.

Herrero-Fernandez, M.; Montero-Vilchez, T.; Diaz-Calvillo, P.; Romera-Vilchez, M.; Buendia-Eisman, A.; Arias-Santiago, S. Impact of Water Exposure and Temperature Changes on Skin Barrier Function. *J. Clin. Med*. 2022, 11, 298

Horii I, Nakayama Y, Obata M, et al. Stratum corneum hydration and amino acid content in xerotic skin. *Br J Dermatol*. 1989; 121(5):587-92.

Hughes-Formella B, Wunderlich O, Williams R. Anti-Inflammatory and skin-hydrating properties of a dietary supplement and topical formulations containing oligomeric proanthocyanidins. *Skin Pharmacol Physiol*. (2007) 20:43–9.

Iversen L, Fogh K, Bojesen G, Kragballe K. Linoleic acid and dihomogammalinolenic acid inhibit leukotriene B4 formation and stimulate the formation of their 15-lipoxygenase products by human neutrophils in vitro. Evidence of formation of antiinflammatory compounds. *Agents Actions*. 1991;33(3–4):286–291.

Jarmuda S, O'Reilly N, Zaba R, et al. Potential role of *Demodex* mites and bacteria in the induction of rosacea. *J Med Microbiol* 2012;61:1504-1510.

Kawamura A, Ooyama K, Kojima K, et al. Dietary supplementation of gamma-linolenic acid improves skin parameters in subjects with dry skin and mild atopic dermatitis. *J Oleo Sci*. 2011;60(12):597–607

Kishimoto Y., Saito N., Kurita K., Shimokado K., Maruyama N., Ishigami A. Ascorbic acid enhances the expression of type 1 and type 4 collagen and SVCT2 in cultured human skin fibroblasts. *Biochem. Biophys. Res. Commun*. 2013;430:579–584.

Lee DE, Huh C-S, Ra J, et al. Clinical evidence of effects of *Lactobacillus plantarum* hy7714 on skin aging: a randomized, double blind, placebo-controlled study. *J Microbiol Biotechnol*. 2015;25(12):2160–2168.

Li J, O'Reilly N, Sheha H, et al. Correlation between ocular *Demodex* infestation and serum immunoreactivity to *Bacillus* proteins in patients with facial rosacea. *Ophthalmology* 2010;117:870-877.

Marstein S, Jellum E, Eldjarn L. The concentration of pyroglutamic acid (2-pyrrolidone-5-carboxylic acid) in normal and psoriatic epidermis, determined on a microgram scale by gas chromatography. *Clin Chim Acta*. 1973; 49(3):389-95.

Muggli R. Systemic evening primrose oil improves the biophysical skin parameters of healthy adults. *Int J Cosmet Sci*. 2005;27(4):243–249

Nanashima N, Horie K, Maeda H, Tomisawa T, Kitajima M, Nakamura T. Blackcurrant Anthocyanins Increase the Levels of Collagen, Elastin, and Hyaluronic Acid in Human Skin Fibroblasts and Ovariectomized Rats. *Nutrients*. 2018 Apr 16;10(4):495. doi: 10.3390/nu10040495. PMID: 29659549; PMCID: PMC5946280.

Neukam K, De Spirt S, Stahl W, et al. Supplementation of flaxseed oil diminishes skin sensitivity and improves skin barrier function and condition. *Skin Pharmacol Physiol*. 2011;24(2):67–74.

Pajtók C, Veres-Székely A, Agócs R, Szebeni B, Dobosy P, Németh I, Veréb Z, Kemény L, Szabó AJ, Vannay Á, Tulassay T, Pap D. High salt diet impairs dermal tissue remodeling in a mouse model of IMQ induced dermatitis. *PLoS One*. 2021 Nov 1;16(11)

Raj N, Voegeli R, Rawlings AV, et al. A fundamental investigation into aspects of the physiology and biochemistry of the stratum corneum in subjects with sensitive skin. *Int J Cosmet Sci*. 2017;39(1):2–10

Rawlings AV, Harding CR. Moisturization and skin barrier function. *Dermatol Ther*. 2004; 17(suppl 1):43-8.

Savini I., Catani M.V., Rossi A., Duranti G., Melino G., Avigliano L. Characterization of keratinocyte differentiation induced by ascorbic acid: Protein kinase C involvement and vitamin C homeostasis. *J. Investig. Dermatol*. 2002;118:372–379.

Steinhoff M, Buddenkotte J, Aubert J, et al. Clinical, cellular and molecular aspects in the pathophysiology of rosacea. *J Invest Dermatol Symp Proc*. 2011;15(1):2-11.

Sugarman JL. The epidermal barrier in atopic dermatitis. *Semin Cutan Med Surg*. 2008;27(2):108–114.

Sun Qian, Wu Jingping, Qian Guofei, Cheng Hongbin. Effectiveness of Dietary Supplement for Skin Moisturizing in Healthy Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Frontiers in Nutrition* (2022) 9

Tan, Kahbing Jasmine et al. A Western Diet Alters Skin Ceramides and Compromises the Skin Barrier in Ears *Journal of Investigative Dermatology*, Volume 142, Issue 7, 2020 - 2023.

Tan, J., Schofer, H., Araviiskaia, E., et al. (2016) Prevalence of rosacea in the general population of Germany and Russia - the RISE study. *Journal of the European Academy of Dermatology and Venereology* 30(3), 428-434.

Thiboutot D, Del Rosso JQ. Acne vulgaris and the epidermal barrier. *J Clin Aesthet Dermatol*. 2013 Feb;6(2):18-24.

Tominaga K, Hongo N, Fujishita M, Takahashi Y and Adachi Y. Protective effects of astaxanthin on skin deterioration. *J Clin Biochem Nutr*. 2017. 61(1):33-39

Tominaga K, Hongo N, Karato M, Yamashita E. Cosmetic benefits of astaxanthin on humans subjects. *Acta Biochim Pol*. 2012;59(1):43-7.

Tsukahara K, Hotta M, Fujimura T *et al.* Effect of room humidity on the formation of fine wrinkles in the facial skin of Japanese. *Skin Res Technol* 2007; 13: 184–188.

Vocks E, Busch R, Frohlich C *et al.* Influence of weather and climate on subjective symptom intensity in atopic eczema. *Int J Biometeorol* 2001; 45: 27–33.

Williams HC, Dellavalle RP, Garner S. Acne vulgaris. *Lancet*. 2012 Jan 28;379(9813):361-72. doi: 10.1016/S0140-6736(11)60321-8. Epub 2011 Aug 29. Erratum in: *Lancet*. 2012 Jan 28;379(9813):314. PMID: 21880356.

Yao Q, Jia T, Qiao W, Gu H, Kaku K. Unsaturated fatty acid-enriched extract from Hippophae rhamnoides seed reduces skin dryness through up-regulating aquaporins 3 and hyaluronan synthetases 2 expressions. *J Cosmet Dermatol*. 2021 Jan;20(1):321-329. doi: 10.1111/jocd.13482. Epub 2020 Jul 8. PMID: 32638495; PMCID: PMC7818504.

Yokota M, Masaki H, Okano Y, Tokudome Y. Effect of glycation focusing on the process of epidermal lipid synthesis in a reconstructed skin model and membrane fluidity of stratum corneum lipids. *Dermatoendocrinol*. 2017 Oct 4;9(1)

Zhao H, Wu J, Wang N, Grether-Beck S, Krutmann J, Wei L: Oral Pycnogenol® Intake Benefits the Skin in Urban Chinese Outdoor Workers: A Randomized, Placebo-Controlled, Double-Blind, and Crossover Intervention Study. *Skin Pharmacol Physiol* 2021;34:135-145.

Hay fever feature:

Grace Kenworthy:

1. Overview: Hay fever - InformedHealth.org - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/books/NBK279488/>.
2. Effector mechanisms in allergic reactions - Immunobiology - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/sites/books/NBK27112/>.
3. Mizuguchi, H. *et al.* Preseasonal prophylactic treatment with antihistamines suppresses nasal symptoms and expression of histamine H₁ receptor mRNA in the nasal mucosa of patients with pollinosis. *Methods Find Exp Clin Pharmacol* 32, 745–748 (2010).
4. Kitamura, Y. *et al.* Preseasonal prophylactic treatment with antihistamines suppresses IL-5 but not IL-33 mRNA expression in the nasal mucosa of patients with seasonal allergic rhinitis caused by Japanese cedar pollen. *Acta Otolaryngol* 132, 434–438 (2012).
5. Vighi, G., Marcucci, F., Sensi, L., Di Cara, G. & Frati, F. Allergy and the gastrointestinal system. *Clin Exp Immunol* 153 Suppl 1, 3–6 (2008).
6. Yang, G., Liu, Z. Q. & Yang, P. C. Treatment of Allergic Rhinitis with Probiotics: An Alternative Approach. *N Am J Med Sci* 5, 465 (2013).
7. Liu, P. *et al.* Research Advances in the Treatment of Allergic Rhinitis by Probiotics. *J Asthma Allergy* 15, 1413 (2022).
8. Xiao, J. Z. *et al.* Probiotics in the treatment of Japanese cedar pollinosis: A double-blind placebo-controlled trial. *Clinical and Experimental Allergy* 36, 1425–1435 (2006).
9. Ried, K., Travica, N., Paye, Y. & Sali, A. Effects of a Probiotic Formulation on Seasonal Allergic Rhinitis in Adults—A Randomized Double-Blind Placebo-Controlled Trial: The Probiotics for Hay Fever Trial. *Front Nutr* 9, (2022).
10. Singh, A. *et al.* Immune-modulatory effect of probiotic Bifidobacterium lactis NCC2818 in individuals suffering from seasonal allergic rhinitis to grass pollen: an

exploratory, randomized, placebo-controlled clinical trial. *Eur J Clin Nutr* 67, 161–167 (2013).

11. Zajac, A. E., Adams, A. S. & Turner, J. H. A systematic review and meta-analysis of probiotics for the treatment of allergic rhinitis. *Int Forum Allergy Rhinol* 5, 524–532 (2015).

Keri Briggs:

de Batlle J, Garcia-Aymerich J, Barraza-Villarreal A, Antó JM, Romieu I. Mediterranean diet is associated with reduced asthma and rhinitis in Mexican children. *Allergy*. 2008 Oct;63(10):1310-6.

Blaiss, M.S. (2004) Allergic rhinitis and impairment issues in schoolchildren: a consensus report. *Curr Med Res Opin* 20: 1937–1952.

Bousquet, J., Demarteau, N., Mullol, J., van den Akker-van Marle, M.E., Van Ganse, E. and Bachert, C. (2005) Costs associated with persistent allergic rhinitis are reduced by levocetirizine. *Allergy* 60: 788–794.

Chatzi L, Apostolaki G, Bibakis I, Skypala I, Bibaki-Liakou V, Tzanakis N, Kogevinas M, Cullinan P. Protective effect of fruits, vegetables and the Mediterranean diet on asthma and allergies among children in Crete. *Thorax*. 2007 Aug;62(8):677-83.

Chatzi L, Kogevinas M. Prenatal and childhood Mediterranean diet and the development of asthma and allergies in children. *Public Health Nutr*. 2009 Sep;12(9A):1629-34.

Eniitnucl EM. Hayfever, a post-industrial revolution epidemic. *Clin Allergy* 1988; 18:295 304.

Greiner AN, Hellings PW, Rotiroti G, Scadding GK. Allergic rhinitis. *Lancet*. 2011 Dec 17;378(9809):2112-22.

Güvenç IA, Muluk NB, Mutlu FŞ, Eşki E, Altıntoprak N, Oktmer T, Cingi C. Do probiotics have a role in the treatment of allergic rhinitis? A comprehensive systematic review and meta-analysis. *Am J Rhinol Allergy*. 2016 Sep 1;30(5):157-175.

Kawamoto Y, Ueno Y, Nakahashi E, Obayashi M, Sugihara K, Qiao S, Iida M, Kumasaka MY, Yajima I, Goto Y, Ohgami N, Kato M, Takeda K. Prevention of allergic rhinitis by ginger and the molecular basis of immunosuppression by 6-gingerol through T cell inactivation. *J Nutr Biochem*. 2016 Jan;27:112-22.

Kurup VP, Barrios CS. Immunomodulatory effects of curcumin in allergy. *Mol Nutr Food Res*. 2008 Sep;52(9):1031-9.

Li J, Fang F, Mei M, Wu D. The gut microbiome and allergic rhinitis; refocusing on the role of probiotics as a treatment option. *Eur Arch Otorhinolaryngol*. 2023 Feb;280(2):511-517.

Lyons SA, Dijk AMV, Knulst AC, Alquati E, Le TM, Os-Medendorp HV. Dietary Interventions in Pollen-Related Food Allergy. *Nutrients*. 2018 Oct 16;10(10):1520.

Marshall, P.S. and Colon, E.A. (1993) Effects of allergy season on mood and cognitive function. *Ann Allergy* 71: 251–258

Mlcek J, Jurikova T, Skrovankova S, Sochor J. Quercetin and its antiallergic immune response. *Molecules* 2016; 21: 623

Ober C, Yao TC. The genetics of asthma and allergic disease: a 21st century perspective. *Immunol Rev*. 2011 Jul;242(1):10-30.

Ozdoganoglu T, Songu M, Inancli HM. Quality of life in allergic rhinitis. *Ther Adv Respir Dis*. 2012 Feb;6(1):25-39.

Pawankar, Ruby & Walter, Canonica & Holgate, S.T. & Lockey, R.F.. (2012). WAO, white book on allergy. 52. 55-58.

Santos, C.B., Pratt, E.L., Hanks, C., McCann, J. and Craig, T.J. (2006) Allergic rhinitis and its effect on sleep, fatigue, and daytime somnolence. *Ann Allergy Asthma Immunol* 97: 579–586.

Siddiqui ZA, Walker A, Pirwani MM, Tahiri M, Syed I. Allergic rhinitis: diagnosis and management. *Br J Hosp Med (Lond)*. 2022 Feb 2;83(2):1-9.

Stuck, B.A., Czajkowski, J., Hagner, A.E., Klimek, L., Verse, T., Hormann, K. et al. (2004) Changes in daytime sleepiness, quality of life, and objective sleep patterns in seasonal allergic rhinitis: a controlled clinical trial. *J Allergy Clin Immunol* 113: 663–668.

Sundberg, R., Toren, K., Hoglund, D., Aberg, N. and Brisman, J. (2007) Nasal symptoms are associated with school performance in adolescents. *J Adolesc Health* 40: 581–583.

Varney V. Hayfever in the United Kingdom. *Clin Exp Allergy*. 1991 Nov;21(6):757-62.

Vliagoftis H, Kouranos VD, Betsi GI, Falagas ME. Probiotics for the treatment of allergic rhinitis and asthma: systematic review of randomized controlled trials. *Ann Allergy Asthma Immunol*. 2008 Dec;101(6):570-9.

Walker, S., Khan-Wasti, S., Fletcher, M., Cullinan, P., Harris, J. and Sheikh, A. (2007) Seasonal allergic rhinitis is associated with a detrimental effect on examination performance in United Kingdom teenagers: case-control study. *J Allergy Clin Immunol* 120: 381–387.

Watts AM, West NP, Zhang P, Smith PK, Cripps AW, Cox AJ. The Gut Microbiome of Adults with Allergic Rhinitis Is Characterised by Reduced Diversity and an Altered Abundance of Key Microbial Taxa Compared to Controls. *Int Arch Allergy Immunol*. 2021;182(2):94-105.

Yamada S, Shirai M, Inaba Y, Takara T. Effects of repeated oral intake of a quercetin-containing supplement on allergic reaction: a randomized, placebo-controlled, double-blind parallel-group study

Catherine Gorman:

<https://www.allergyuk.org/about-allergy/statistics-and-figures/>
<https://pmc.ncbi.nlm.nih.gov/articles/PMC1661616/>
<https://www.nature.com/articles/s41598-023-30027-x>
<https://www.cdc.gov/nchs/fastats/allergies.htm>
<https://www.allergyuk.org/about-allergy/statistics-and-figures/>
<https://www.jmedsciences.com/abstractArticleContentBrowse/JMEDS/19030/JPJ/fullText>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8284864/>
<https://www.frontiersin.org/articles/10.3389/fimmu.2018.01873/full>
<https://pubmed.ncbi.nlm.nih.gov/19932941/>
<https://aacijournal.biomedcentral.com/articles/10.1186/s13223-020-00434-0>
<https://www.nature.com/articles/1602213>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8064452/>
<https://aaafa.org/allergies/allergy-facts/>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7575215/>
[https://www.ijidonline.com/article/S1201-9712\(21\)00751-7/fulltext](https://www.ijidonline.com/article/S1201-9712(21)00751-7/fulltext)
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9305273/>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6273625/>

<https://karger.com/iaa/article/182/2/94/168518/The-Gut-Microbiome-of-Adults-with-Allergic>
<https://pubmed.ncbi.nlm.nih.gov/18181730/>
<https://pmc.ncbi.nlm.nih.gov/articles/PMC4369152/>
<https://www.sciencedirect.com/science/article/abs/pii/S0006291X20317630>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3784923/>