

Ingredient spotlight:

1. Nishino T, Nishioka C, Ura H, Nagumo T. Isolation and partial characterization of a novel amino sugar-containing fucan sulfate from commercial *Fucus vesiculosus* fucoidan. *Carbohydr Res* 1994;255:213-224.
2. Patankar MS, Oehninger S, Barnett T, et al. A revised structure for fucoidan may explain some of its biological activities. *J Biol Chem* 1993;268:21770-21776.
3. Nishino T, Nishioka C, Ura H, Nagumo T. Isolation and partial characterization of a novel amino sugar-containing fucan sulfate from commercial *Fucus vesiculosus* fucoidan. *Carbohydr Res* 1994;255:213-224.
4. Wagner M, Wagner B. [Agglutinins in marine brown algae. Dedicated to Professor Dr. H. Knoll on his 65th birthday]. *Z Allg Mikrobiol* 1978;18:355-360. [Article in German]
5. Ferreiros CM, Criado MT. Purification and partial characterization of a *Fucus Vesiculosus* agglutinin. *Rev Esp Fisiol* 1983;39:51-59.
6. Rozkin Mla, Levina MN, Efimov VS, Usov AI. Comparative study of the anticoagulant activity of sulfated polysaccharides from marine brown algae. *Farmakol Toksikol* 1988;51:63-68. [Article in Russian]
7. Durig J, Bruhn T, Zurborn KH, et al. Anticoagulant fucoidan fractions from *Fucus vesiculosus* induce platelet activation in vitro. *Thromb Res* 1997;85:479-491.
8. Soeda S, Sakaguchi S, Shimeno H, Nagamatsu A. Fibrinolytic and anticoagulant activities of highly sulfated fucoidan. *Biochem Pharmacol* 1992;43:1853-1858.
9. Roberts DD, Ginsburg V. Sulfated glycolipids and cell adhesion. *Arch Biochem Biophys* 1988;267:405-415.
10. Soeda S, Ishida S, Shimeno H, Nagamatsu A. Inhibitory effect of oversulfated fucoidan on invasion through reconstituted basement membrane by murine Lewis lung carcinoma. *Jpn J Cancer Res* 1994;85:1144-1150.
11. Zhuang C, Itoh H, Mizuno T, Ito H. Antitumor active fucoidan from the brown seaweed, umitoranoo (*Sargassum thunbergii*). *Biosci Biotechnol Biochem* 1995;59:563-567.
12. Zapozhets TS, Besednova NN, Loenko luN. Antibacterial and immunomodulating activity of fucoidan. *Antibiot Khimioter* 1995;40:9-13. [Article in Russian]
13. Baba M, Snoeck R, Pauwels R, de Clercq E. Sulfated polysaccharides are potent and selective inhibitors of various enveloped viruses, including herpes simplex virus, cytomegalovirus, vesicular stomatitis virus, and human immunodeficiency virus. *Antimicrob Agents Chemother* 1988;32:1742-1745.
14. Criado MT, Ferreiros CM. Selective interaction of a *Fucus vesiculosus* lectin-like mucopolysaccharide with several *Candida* species. *Ann Microbiol (Paris)* 1983;134A:149-154.
15. Criado MT, Ferreiros CM. Toxicity of an algal mucopolysaccharide for *Escherichia coli* and *Neisseria meningitidis* strains. *Rev Esp Fisiol* 1984;40:227-230.
16. Zapozhets TS, Besednova NN, Loenko luN. Antibacterial and immunomodulating activity of fucoidan. *Antibiot Khimioter* 1995;40:9-13.

[Article in Russian]

17. Itoh H, Noda H, Amano H, et al. Antitumor activity and immunological properties of marine algal polysaccharides, especially fucoidan, prepared from *Sargassum thunbergii* of Phaeophyceae. *Anticancer Res* 1993;13:2045-2052.
18. Teixeira MM, Hellewell PG. The effect of the selectin binding polysaccharide fucoidin on eosinophil recruitment in vivo. *Br J Pharmacol* 1997;120:1059-1066.
19. Patankar MS, Oehninger S, Barnett T, et al. A revised structure for fucoidan may explain some of its biological activities. *J Biol Chem* 1993;268:21770-21776.
20. Hajela K, Kayestha R, Sumati. Carbohydrate induced modulation of cell membrane. IV: Interaction with mucin and fucoidan totally immobilizes the human platelet membrane. *Indian J Biochem Biophys* 1996;33:308-310.
21. Lynch G, Low L, Li S, et al. Sulfated polyanions prevent HIV infection of lymphocytes by disruption of the CD4-gp120 interaction, but do not inhibit monocyte infection. *J Leukoc Biol* 1994;56:266-272.
22. Beress A, Wassermann O, Tahhan S, et al. A new procedure for the isolation of anti-HIV compounds (polysaccharides and polyphenols) from the marine alga *Fucus vesiculosus*. *J Nat Prod* 1993;56:478-488. [published erratum appears in *J Nat Prod* 1996 May;59(5):552]
23. Pearce-Pratt R, Phillips DM. Sulfated polysaccharides inhibit lymphocyte-to-epithelial transmission of human immunodeficiency virus-1. *Biol Reprod* 1996;54:173-182.
24. Zaretzky FR, Pearce-Pratt R, Phillips DM. Sulfated polyanions block *Chlamydia trachomatis* infection of cervix-derived human epithelia. *Infect Immun* 1995;63:3520-3526.
25. D'Adamo P. *Eat Right 4 Your Type*. Putnam: 1997.
26. Boren T, Falk P, Roth KA, et al. Attachment of *Helicobacter pylori* to human gastric epithelium mediated by blood group antigens. *Science* 1993;262:1892-1895.
27. Stromqvist M, Falk P, Bergstrom S, et al. Human milk kappa-casein and inhibition of *Helicobacter pylori* adhesion to human gastric mucosa. *J Pediatr Gastroenterol Nutr* 1995;21:288-296.
28. Magner JA, Kane J, Chou ET. Intravenous thyrotropin (TSH)-releasing hormone releases human TSH that is structurally different from basal TSH. *J Clin Endocrinol Metab* 1992;74:1306-1311.
29. Overton K, Serif GS. Synthesis of L-fucose in thyroid tissue. *Biochim Biophys Acta* 1981;675:281-284.
30. Hotta T, Ishii I, Ishihara H, et al. Comparative study of the oligosaccharides of human thyroglobulins obtained from normal subjects and patients with various diseases. *J Appl Biochem* 1985;7:98-103.
31. Rowe A, Berendt AR, Marsh K, Newbold CI. *Plasmodium falciparum*: a family of sulphated glycoconjugates disrupts erythrocyte rosettes. *Exp Parasitol* 1994;79:506-516.
32. Clark DL, Su S, Davidson EA. Saccharide anions as inhibitors of the malaria parasite. *Glycoconj J* 1997;14:473-479.
33. Granert C, Raud J, Xie X, et al. Inhibition of leukocyte rolling with polysaccharide fucoidin prevents pleocytosis in experimental meningitis in the rabbit. *J Clin Invest* 1994;93:929-936.

34. Angstwurm K, Weber JR, Segert A, et al. Fucoidin, a polysaccharide inhibiting leukocyte rolling, attenuates inflammatory responses in experimental pneumococcal meningitis in rats. *Neurosci Lett* 1995;191:1-4.

Gut health feature:

Natalie Lamb:

1. National Institute for Health and Care Excellence. Irritable Bowel Syndrome in Adults: Diagnosis and Management Clinical Guideline. Available online: <https://www.nice.org.uk/guidance/cg61> (accessed on 28 December 2017).
2. Le Chatelier E, Nielsen T, Qin J, et al. Richness of human gut microbiome correlates with metabolic markers. *Nature* 2006; **500**(7464):541-6.
3. Vighi G, Marcucci F, Sensi L, Di Cara G, Frati F. Allergy and the gastrointestinal system. *Clin Exp Immunol* 2008;**153** Suppl 1:3-6.
4. Bravo-Blas A, Wessel H, Milling S. Microbiota and arthritis. *Curr Opin Rheumatol* 2016; **28**: 1.
5. McCabe LR, Irwin R, Schaefer L, Britton RA. Probiotic Use Decreases Intestinal Inflammation and Increases Bone Density in Healthy Male but not Female Mice. *J Cell Physiol* 2013;**228**(8):1793-8.
6. Uccello M, Malaguarnera G, Basile F, et al. Potential role of probiotics on colorectal cancer prevention. *BMC Surg* 2012.12 Suppl 1:S35.
7. Bassaganya-Riera J, Viladomiu M, Pedragosa M, De Simone C, Hontecillas R. Immunoregulatory mechanisms underlying prevention of colitis-associated colorectal cancer by probiotic bacteria. *PLoS One* 2012.**7**(4):e34676.
8. Salminen S, Nybom S, Meriluoto J, Collado MC, Vesterlund S, El-Nezami H. 2010. Interaction of probiotics and pathogens--benefits to human health? *Curr Opin Biotechnol*. Apr;**21**(2):157-67.
9. Chapman CM, Gibson GR, Rowland I. Health benefits of probiotics: are mixtures more effective than single strains? *Eur J Nutr* 2011;**50**(1):1-17.
10. Rennard BO, Ertl RF, Gossman GL, Robbins RA, Rennard SI. Chicken Soup Inhibits Neutrophil Chemotaxis In Vitro. *Chest* 2000; **118**: 1150-7.
11. Ibrahim F, Halttunen T, Tahvonon R, Salminen S. Probiotic bacteria as potential detoxification tools: assessing their heavy metal binding isotherms. *Can J Microbiol* 2006; **52**(9):877-85.
12. Kabeerdoss J, Devi RS, Mary RR, Ramakrishna BS. Faecal microbiota composition in vegetarians: comparison with omnivores in a cohort of young women in southern India. *Br J Nutr* 2012; **108**(6):953-7.
13. Gibson GR, Roberfroid MB. 1995. Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. *J Nutr*. Jun;**125**(6):1401-12.
14. Reddy BS, Weisburger JH, Wynder EL. Effects of high risk and low risk diets for colon carcinogenesis on fecal microflora and steroids in man. *J Nutr* 1975;**105**(7):878-84.
15. Yu Z, Zhang X, Li S, Li C, Li D, Yang Z. Evaluation of probiotic properties of *Lactobacillus plantarum* strains isolated from Chinese sauerkraut. *World J Microbiol Biotechnol* 2013; **29**(3):489-98.

Beth Morris:

¹ BBC Good Food Nation survey 2016: how we eat now. Available at: <https://www.bbcgoodfood.com/article/bbc-good-food-nation-survey-results>.

- ¹ Collins SM. Stress and the Gastrointestinal Tract IV. Modulation of intestinal inflammation by stress: basic mechanisms and clinical relevance. *Am J Physiol Gastrointest Liver Physiol*. 2001 Mar;280(3):G315-8.
- ¹ High-throughput sequencing reveals the incomplete, short-term recovery of infant gut microbiota following parenteral antibiotic treatment with ampicillin and gentamicin
- ¹ Lombardo L et al. Increased incidence of small intestinal bacterial overgrowth during proton-pump inhibitor therapy. *Clin Gastroenterol Hepatol*. 2010; 8(6): 504-8.
- ¹ Leclercq S et al. Intestinal permeability, gut-bacterial dysbiosis, and behavioral markers of alcohol-dependence severity. *Proceedings of the National Academy of Sciences of the United States of America*. 2014;111(42):E4485-E4493.
- ¹ Lerner A, Matthias T. Changes in intestinal tight junction permeability associated with industrial food additives explain the rising incidence of autoimmune disease. *Autoimmun Rev*. 2015;14(6): 479-89.
- ¹ Fasano A. Intestinal permeability and its regulation by zonulin: diagnostic and therapeutic implications. *Clin Gastroenterol Hepatol*. 2012; 10 (10): 1096-100.
- ¹ Roberts CL et al. Hypothesis: increased consumption of emulsifiers as an explanation for the rising incidence of Crohn's disease. *J Crohns Colitis*. 2013; 7(4):338-41.
- ¹ Hammons AJ, Fiese BH. Is frequency of shared family meals related to the nutritional health of children and adolescents? *Pediatrics*. 2011; 127(6): e1565–e1574.
- ¹ Dimidi E et al. Mechanisms of action of probiotics and the gastrointestinal microbiota on gut motility and constipation. *Adv Nutr*. 2017; 8 (3): 484-494.
- ¹ Yu T et al. Effects of prebiotics and synbiotics on functional constipation. *Am J Med Sci*. 2017; 353 (3): 282-292.
- ¹ Williams EA et al. Clinical trial: a multistrain probiotic preparation significantly reduces symptoms of irritable bowel syndrome in a double-blind placebo-controlled study. *Aliment Pharmacol Ther*. 2009; 29 (1): 97-103.

Joint health feature:

Michela Vagnini:

- 1) <https://www.arthritisresearchuk.org/arthritis-information/data-and-statistics/state-of-musculoskeletal-health.aspx>
- 2) [http://www.mineralresourcesint.co.uk/pdf/Mineral Depletion of Foods 1940 2002.pdf](http://www.mineralresourcesint.co.uk/pdf/Mineral%20Depletion%20of%20Foods%201940%202002.pdf)
- 3) <https://www.ncbi.nlm.nih.gov/pubmed/8865143>
- 4) <https://www.arthritisresearchuk.org/arthritis-information/conditions/osteoarthritis/causes.aspx>
- 5) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4394521/>
- 6) Henrotin Y., Deby-Dupont G., Deby C., de Bruyn M., Lamy M., Franchimont P. Production of active oxygen species by isolated human chondrocytes. *Br. J. Rheumatol*. 1993;32:562–567. doi: 10.1093/rheumatology/32.7.562
- 7) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5500215/>
- 8) <https://www.ncbi.nlm.nih.gov/pubmed/12480795>
- 9) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4625766/>
- 10) Harris SS, et al. Caffeine and bone loss in healthy postmenopausal women. *Am J Clin Nutr*. 1994;60(4):573–8.
- 11) <https://academic.oup.com/jcem/article/96/7/1911/2833671>
- 12) <https://www.ncbi.nlm.nih.gov/pubmed/8527213>

13) <https://www.naturalmedicinejournal.com/journal/2015-10/choosing-right-vitamin-k2-menaquinone-4-vs-menaquinone-7>

14) Reid IR, Bristow SM, Bolland MJ. Cardiovascular complications of calcium supplements. *J Cell Biochem.* 2015;**116**:494–501

15) Abelow BJ, et al. Cross-cultural association between dietary animal protein and hip fracture: a hypothesis. *Calcific Tissue Int.* 1992;50:14–18.

16) Hegsted DM. Calcium and Osteoporosis. *J Nutr.* 1986;116:2316–2319

Dr Elisabeth Phillips:

¹ <https://www.arthritisresearchuk.org/arthritis-information/data-and-statistics/state-of-musculoskeletal-health.aspx>

² Health and Safety Executive (HSE). Work –related Musculoskeletal Disorder related Musculoskeletal Disorder (WRMSDs) Statistics, Great Britain 2016

³ Poddubnyy D, Haibel H, Listing J et al. Baseline radiographic damage, elevated acute–phase reactant levels, and cigarette smoking status predict spinal radiographic progression in early axial spondylarthritis. *Arthritis Rheum.* 2012 May; 64(5):1388–98.

⁴ Zhang S, Li Y, Xu X, Feng X, Yang D, Lin G. Effect of cigarette smoking and alcohol consumption on disease activity and physical functioning in ankylosing spondylitis: a cross–sectional study. *International Journal of Clinical and Experimental Medicine.* 2015;8(8):13919–13927.

⁵ DeMarco MA et al. (2011). Obesity and younger age at gout onset in a community–based cohort. *Arthritis Care Res (Hoboken)* 63(8): 1108–1114.

^{6b} Silman AJ, Hochberg MC. *Epidemiology of the Rheumatic Diseases.* 2nd Ed. Oxford Medical Publications, (2001)

⁷ K. Ilberg H, Ding B, Padyukov L, Bengtsson C, R. nnelid J, Klareskog L, et al. EIRA Study Group.

Smoking is a major preventable risk factor for rheumatoid arthritis: estimations of risks after various exposures to cigarette smoke. *Ann Rheum Dis.* 2011;70:508–11.

⁸ Zheng, H., & Chen, C. (2015). Body mass index and risk of knee osteoarthritis: systematic review and meta–analysis of prospective studies. *BMJ Open*, 5(12). doi:10.1136/bmjopen–2014–007568.

¹ <https://www.arthritisresearchuk.org/arthritis-information/data-and-statistics/state-of-musculoskeletal-health.aspx>

⁹ Matcham F, Rayner L, Steer S, Hotopf M. The prevalence of depression in rheumatoid arthritis: a systematic review and meta–analysis. *Rheumatology (Oxford).* 2013;52:2136–48.

¹⁰ Michaud K. Co–morbidity in rheumatoid arthritis. *Clinical Rheumatology*, 2007; 21, 885–906.

¹¹ A. Young, G. Koduri, M. Batley, E. Kulinskaya, A. Gough, S. Norton, and J. Dixey. Mortality in rheumatoid arthritis. Increased in the early course of disease, in ischaemic heart disease and in pulmonary fibrosis. *Rheumatology (2007)* 46 (2): 350–357.

¹ Usha PR¹, Naidu MU. Randomised, Double-Blind, Parallel, Placebo-Controlled Study of Oral Glucosamine, Methylsulfonylmethane and their Combination in Osteoarthritis. *Clin Drug Investig.* 2004;24(6):353-63.

¹ Amalraj A, Pius A, Gopi S, et al. Biological activities of curcuminoids, other biomolecules from turmeric and their derivatives – A review. *J Tradit Complement Med.* 2016 Jun 15;7(2):205-233. PMID 28417091

¹ Daily JW, Yang M, Park S. Efficacy of Turmeric Extracts and Curcumin for Alleviating the Symptoms of Joint Arthritis: A Systematic Review and Meta-Analysis of Randomized Clinical Trials. *J Med Food*. 2016 Aug 1; 19(8): 717–729. PMID: PMC5003001

¹ Henrotin Y, Priem F, Mobasheri, A. Curcumin: A new paradigm and therapeutic opportunity for the treatment of osteoarthritis: Curcumin for osteoarthritis management. *SpringerPlus* 2013, 2, 56. PMID 23487030

Patrick Holford:

<https://academic.oup.com/jn/article/137/11/2507S/4664497>

¹ Nakagawa Y et al., Short-term effects of highly-bioavailable curcumin for treating knee osteoarthritis: a randomized, double-blind, placebo-controlled prospective study. *J Orthop Sci*. 2014 Nov;19(6):933-9

¹ Tanabe Y et al 'Attenuation of indirect markers of eccentric exercise-induced muscle damage by curcumin.' *Eur J Appl Physiol*. 2015 Sep;115(9):1949-57

1 Park C et al. Curcumin induces apoptosis and inhibits prostaglandin E(2) production in synovial fibroblasts of patients with rheumatoid arthritis. *Int J Mol Med* 2007; 20: 365-72

Medicinal mushrooms feature:

Jenny Logan:

- (1) Recent developments in mushrooms as anti-cancer therapeutics: a review; Seema Patel and Arun Goya; 3 *Biotech*; 2012 March, 2(1):1-15
- (2) Immune Modulation From Five Major Mushrooms: Application to Integrative Oncology; Alena G Guggenheim et al; *Integr Med (Encinitas)*. 2014 Feb; 13(1): 32–44
- (3) Maitake d Fraction; Sensuke Konno, *Alternative and Complementary Therapies*, April 2001
- (4) Michelle M Martinez-Montemayor et al; *Ganoderma lucidum (Reishi) Inhibits Cancer Cell Growth and Expression of Key Molecules in Inflammatory Breast Cancer*; *Nutr Cancer*. 2011 Oct; 63(7): 1085–1094
- (5) Mendel Freidman; *Mushroom Polysaccharides: Chemistry and Anti-obesity*; *Foods*. 2016 Dec; 5(4): 80.
- (6) Yuan Dong et al; *The Antidiabetic activities of Cordyceps*; *BioMed Research Int*; Vol 2014; 160980
- (7) Satorou Arata et al; *Continuous intake of the Chaga mushroom (Inonotus obliquus) aqueous extract suppresses cancer progression*; *Heliyon*. 2016 May; 2(5): e00111.
- (8) Cristina Lull et al; *Anti-inflammatory and Immunomodulating Properties of Fungal Metabolites*; *Mediators Inflamm*. 2005 Jun 9; 2005(2): 63–80.

Ask the experts:

Marianna Sulic:

Study reference:

1. <http://www.ncbi.nlm.nih.gov/pubmed/26753476>
2. <https://www.ncbi.nlm.nih.gov/pubmed/22721880>

Sheila Downes:

<https://www.nhs.uk/conditions/underactive-thyroid-hypothyroidism/>

The Medicinal Mushroom Agaricus blazei Murrill: Review of Literature and Pharmacotoxicological Problems

Immunomodulatory effects of blazei Murrill in Balb Agaricus / cByJ mice

An extract based on the medicinal mushroom Agaricus blazei Murrill Stimulates monocyte-derived dendritic cells to cytokine production in vitro and chemokine.

Tumor-specific cytotoxic and immunopotentiating effects of low-molecular weight relatively products derived from the basidiomycete, Agaricus blazei Murrill.

Effects of extracts from Brazilian sun-mushroom (Agaricus blazei) on the NK activity and lymphoproliferative responsiveness of Ehrlich tumor-bearing mice

Cell cycle progression and cytokine gene expression of human peripheral blood mononuclear cells by Agaricus modulated blaze

Tianyi He, Ruxing Zhao, Yiran Lu, et al., "Dual-Directional Immunomodulatory Effects of Corbrin Capsule on Autoimmune Thyroid Diseases," Evidence-Based Complementary and Alternative Medicine, vol. 2016, Article ID 1360386, 9 pages, 2016. doi:10.1155/2016/1360386