



Dr Flav's Fun Facts

Prepared for Hort Innovation
March 2020

Prepared by Nutrition Research Australia

Summary

During the research process for the systematic literature review, *'Examining the health effects and bioactive components in Agaricus bisporus mushrooms: A scoping literature review'*, NRAUS came across many fun facts that could be used in the communication messages to healthcare professionals and to support the consumer marketing campaign.

The NRAUS team reviewed all of the collated facts and prepared a Dr Flav's Fun Facts table for your consideration. Each fun fact is supported by a brief scientific description, any other information that should be considered with its use, and references. Fun facts that have been used to date in communication materials are marked with an asterisk (*).

Please note that these fun facts are not an extensive summary of that topic. They are provided as a source of information from which we can gather more evidence if requested for public use. Food regulations also need to be considered before any fact is communicated. The impact of food regulations often depends on the context of the claim (e.g. if communication is regarded as advertisement).

Table 1. Dr Flav's Fun Facts

Fun Fact	Scientific Description	Other Considerations	References
Nutrient composition			
100g of white button mushrooms (about 5) contain more potassium than a medium banana (98g).	Potassium is a mineral essential for cardiac function and maintenance of blood pressure. For prevention or management of hypertension (high blood pressure), individuals should aim for foods with a high ratio of potassium to sodium. 100g banana = 358mg potassium 100g white button mushrooms = 396mg potassium	Generally, a 25% difference is required for a comparison claim to consumers, but this message can still be used in general education messages	Australian Food Composition Database, 2019, Food Standards Australia and New Zealand Food Standards Code 1.2.7
Eating just 4 white button mushrooms counts as a serve of vegetables (about 75g)!	Fewer than 1 in 10 Australians eat the recommended 5 serves of vegetables each day. Adding just 4 white button mushrooms (75g) to the daily diet counts as one vegetable serve!		https://ncci.canceraustralia.gov.au/prevention/diet/vegetable-consumption Eat for Health Australian Dietary Guidelines
<i>Agaricus bisporus</i> mushrooms have healthy omega-6 fatty acids generally found only in meat or dairy.	Conjugated linoleic acid is a type of polyunsaturated, omega-6 fatty acid that is believed to have various health benefits. It is commonly found in meat and dairy, and may positively benefit body composition and cardiometabolic risk factors. Findings from the American Heart Association's scientific statement on omega-6 found that: <ul style="list-style-type: none"> • omega-6 fats are associated with a reduced risk of heart disease 		Chen S, Oh SR, Phung S, et al. Anti-aromatase activity of phytochemicals in white button mushrooms (<i>Agaricus bisporus</i>). <i>Cancer Res</i> 2006;66(24):12026-34. Lehnen TE, da Silva MR, Camacho A, et al. A review on effects of conjugated linoleic fatty acid (CLA) upon body composition and energetic metabolism. <i>J Int Soc Sports Nutr</i> 2015;12:36.

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	<ul style="list-style-type: none"> • omega-6 are not pro-inflammatory when consumed within existing health eating guidelines • replacing energy from saturated fat or carbohydrate with energy from linoleic acid was associated with a lower risk of coronary heart disease events and death. <p>Further, the Australian heart Foundation Position Statement on Dietary Fat and Heart Healthy Eating recommends including sources of Omega-6 PUFA, and that most Australian's have intakes of linoleic acid below recommended targets (4-10% total energy).</p> <p>If an imbalance between Omega-3 and Omega-6 is a concern, this can be addressed by including more food sources of Omega-3 PUFA.</p>		<p>Clifton P and Keogh J. Dietary fats and cardiovascular disease: an evidence check rapid review brokered by the Sax Institute for the National Heart Foundation of Australia. 2017.</p> <p>Harris WS, Mozaffarian D, Rimm E, Kris-Etherton P, Rudel LL, Appel LJ, et al. Omega-6 fatty acids and risk for cardiovascular disease: a science advisory from the American Heart Association Nutrition Subcommittee of the Council on Nutrition, Physical Activity, and Metabolism; Council on Cardiovascular Nursing; and Council on Epidemiology and Prevention. <i>Circulation</i>. 2009;119(6):902-7.</p> <p>https://www.heartfoundation.org.au/images/uploads/main/For_professionals/Dietary_Fats_Position_Statement_2017.pdf</p>
<p>*Nutrition allrounder: Mushrooms not only provide nutrients found in fruit and vegetables, but</p>	<p>Mushrooms can be a source of niacin (commonly found in meat and grains), pantothenic acid (meat and dairy), selenium (meat and grains) and copper (meat). Mushrooms are also an excellent source of riboflavin (meat, grains and dairy).</p>		<p>Jo Feeney M, Miller AM, Roupas P: Mushrooms-Biologically Distinct and Nutritionally Unique: Exploring a "Third Food Kingdom". <i>Nutrition today</i> 2014, 49:301-307.</p>

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also those found in meat and grains too.	Mushrooms are consumed in a similar way to plants, but have the some of the nutritional properties of animal derived foods. For example, mushrooms contain chitin (carbohydrate found in crustaceans and insects), ergosterol (rather than cholesterol found in mammals), and conjugated linoleic acids (commonly found in meat and dairy products)		U.S Department of Health and Human Services. National Institutes of Health. Dietary supplement fact sheets. https://ods.od.nih.gov/factsheets/list-all/
*A natural innovator: Unlike plants, mushrooms lack chlorophyll and obtain sustenance from complex organic materials of plants and animals.	Mushrooms are different to other vegetables as they don't have chlorophyll to make their own food through photosynthesis. They are fungi. Fungi have no chlorophyll and exist on decaying material in nature to grow and thrive.		Encyclopaedia Britannica https://www.britannica.com/science/fungus
Eat more edible mushrooms to add protein to any plant-based meal.	On average, edible mushrooms contain twice as many free amino acids (120.79 mg/g) compared to medicinal mushrooms (61.47 mg/g).	Mushrooms do not meet the required protein content for a nutrient content claim (5 grams per serve)	Kim MY, Lee SJ, Ahn, JK, et al. Comparison of free amino acid, carbohydrates concentrations in Korean edible and medicinal mushrooms. Food Chem 2009;113; 386–393.
<i>Prebiotics</i>			
Eating just 200g of cooked mushrooms for 10 days can act like a fertilizer to grow good bacteria in your gut.	Mushrooms contain non-digestible polysaccharides (a type of carbohydrate) which can act as food for our resident gastrointestinal microbiota. Measurable changes in faecal microbiota		Hess J, Wang Q, Gould T, et al. Impact of Agaricus bisporus Mushroom Consumption on Gut

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	composition have been reported in a study that compared the effect of ground beef (28g) vs mushroom (200g/day) consumption over 10 days. Greater abundance of Bacteroidetes (good bacteria) and lower abundance of Firmicutes (bad bacteria) were found. However, the clinical significance of the changes is not yet clear (if beneficial).		Health Markers in Healthy Adults. <i>Nutrients</i> 2018;10(10):1402.
Mushrooms contain special prebiotics that feed your 'good' gut bacteria to create a healthy gut microbiome.	Mushrooms contain several different types of carbohydrates that are not easily digested: low-digestible and non-digestible carbohydrates are those that you can't digest but that can feed your gut bacteria/microbiome. Mushrooms have quite a range of food options for our gut microbiota: chitin, B-glucans, raffinose, oligosaccharides, and resistant starch.		Hess J, Wang Q, Gould T, et al. Impact of <i>Agaricus bisporus</i> Mushroom Consumption on Gut Health Markers in Healthy Adults. <i>Nutrients</i> 2018;10(10):1402. Aida FMNA, Shuaimi M, Yazid M, et al. Mushroom as a potential source of prebiotics: a review. <i>Trends in Food Sci Tech</i> 2009;20(11-12):567-575.
Mushrooms: a little-known source of resistant starch in the diet.	Researchers found that ~15% of the fibre content of mushrooms is resistant starch. Resistant starches resist digestion in the small intestine, traveling to the colon where they can be fermented by resident bacteria to form short-chain fatty acids, particularly butyrate. Butyrate supports digestive health and disease prevention. While resistant starch from mushrooms has not been evaluated for its impact on gut health, studies on resistant starch from other sources show that it has		Hess J, Wang Q, Gould T, et al. Impact of <i>Agaricus bisporus</i> Mushroom Consumption on Gut Health Markers in Healthy Adults. <i>Nutrients</i> 2018;10(10):1402. Birt DF, Boylston T, Hendrich S, et al. Resistant starch: Promise for improving human health.

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	beneficial impacts on health, including improved insulin sensitivity, lower blood sugar levels, reduced appetite and improved gut health.		Advances in Nutrition 2013; 4(6):587-601.
<i>Glucans and Chitin</i>			
*Beta-ful on the inside: The cell wall of mushrooms consists of the soluble fibre beta-glucan.	Soluble and insoluble glucans form structural components of the cell wall.		Sari M, Prange A, Lelley JL, et al. Screening of beta-glucan contents in commercially cultivated and wild growing mushrooms. Food Chem 2017;216:41-51.
Mushroom contain up to four times more beta-glucans than oats.	Beta-glucans account for approximately 75% of total glucan concentrations in <i>Agaricus bisporus</i> mushrooms with a volume of 8-12g/100g dry weight, which is substantially higher than the 3-8g/100g dry weight found in oats, 1.3-2.7g/100g dry weight in rye, and 2-20g/100g dry weight in barley.		Sari M, Prange A, Lelley JL, et al. Screening of beta-glucan contents in commercially cultivated and wild growing mushrooms. Food Chem 2017;216:41-51. Autio K, Myllymaki O, Malkki Y. Flow properties of solutions of oat beta-glucans. J Food Sci 1987;52(5):1364-1366.
Don't remove the stalk when chopping your white button mushrooms. There's over 40% more beta-glucans in the stalk than the caps!	Beta-glucan is a soluble fibre found naturally in cereal grains, yeast, some mushrooms like <i>Agaricus bisporus</i> , and sold as a supplement. Beta-glucans are known to have anti-tumour, anti-inflammatory, anti-obesity, anti-allergic, anti-osteoporotic and immunomodulating properties. In white button mushrooms, beta-glucan concentration in the cap		Sari M, Prange A, Lelley JL, et al. Screening of beta-glucan contents in commercially cultivated and wild growing mushrooms. Food Chem 2017;216:41-51. Bashir KMI, Choi JS. Clinical and physiological perspectives of β -

Fun Fact	Scientific Description	Other Considerations	References
	was 8.6g/100g dry matter compared to 12.3g/100g dry matter in the stalk.		glucans: The past, present, and future. Int J Mol Sci 2017;18(9):1906.
Mushrooms contain chitin, a special fibre and prebiotic.	Along with b-glucans, chitin is the dominant component of the fungal cell wall, responsible for the rigidity and shape of the cell wall. It has an important role in the nutritional value of mushrooms.		Manzi P, Aguzzi A, Pizzoferrato L. Nutritional value of mushrooms widely consumed in Italy. Food Chem 2001;73:321-325.
*A true whole food: While the 'cap' of mushrooms is a richer source of antioxidants, its stem contains more of the soluble fibre beta-glucan.	Chitin is considered to promote diverse activities including antioxidant effects. Chitin level of the pileus (cap) is – in general – higher, than of stipes. These differences can be significant (for A. bisporus) or non-significant (for P. ostreatus and L. edodes). In white button mushrooms, beta-glucan concentration in the cap was 8.6g/100g dry matter compared to 12.3g/100g dry matter in the stalk. Similarly, in brown button mushrooms, beta-glucan concentration in the cap was 8.8g/100g dry matter compared to 10.1g/100g dry matter in the stalk.		Ngo DH, Kim Sk. Antioxidant effects of chitin, chitosan, and their derivatives. Adv Food Nutr Res 2014;73:15-31. Vetter J. Chitin content of cultivated mushrooms Agaricus bisporus, Pleurotus ostreatus and Lentinula edodes. Food Chem 2007;102(1):6-9. Sari M, Prange A, Lelley JL, et al. Screening of beta-glucan contents in commercially cultivated and wild growing mushrooms. Food Chem 2017;216:41-51.
<i>Ergothioneine</i>			
Mushrooms are the richest food source of an amino	Ergothioneine (ET), an amino acid uniquely synthesised by and found in relatively high		Weigand-Heller AJ, Kris-Etherton PM, Beelman RB. The

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acid or building block of protein called ergothioneine.	concentrations (0.1-1mg/g) in fungi/mushrooms, possess significant & efficacious antioxidant activities.		bioavailability of ergothioneine from mushrooms (<i>Agaricus bisporus</i>) and the acute effects on antioxidant capacity and biomarkers of inflammation. <i>Prev Med</i> 2012;54(Supp1):S75-8
Ergothioneine, found in mushrooms, is a powerful antioxidant!	<p>Unlike many antioxidants, very little ergothioneine is excreted from our bodies, showing just how important it is to get from our diet!</p> <p>OCTN1 receptors in the intestines are highly selective and specific for ergothioneine. OCTN1 also distributes ergothioneine to most body tissues. Expression of OCTN1 is concentrated at sites of tissue injury, and ergothioneine is highly retained with very little excreted through urine or faeces. The human body has no capacity for endogenous synthesis of ergothioneine</p>		Halliwell B, Cheah IK, Tang RMY. Ergothioneine – a diet-derived antioxidant with therapeutic potential. <i>FEBS Lett</i> 2018;592(20):3357-3366.
*Putting the one in ergothioneine: Mushrooms contain more ergothioneine: a unique sulphur-containing antioxidant - than any other food!	Ergothioneine is so important that our bodies have special receptors just for it, even though we can't make it in our body. Separate analyses of specific compounds in mushrooms including the sulfur-containing amino acid ergothioneine have been published. This sulfur-containing amino acid cannot be made by humans but has a unique transport system, implying it is important for human health.		<p>Grundemann D, Harlfinger S, Golz S, et al. Discovery of the ergothioneine transporter. <i>Proc Natl Acad Sci USA</i> 2005;102: 5256Y261.</p> <p>Kalaras MD, Richie JP, Calcagnotto A, et al. Mushrooms: A rich source of the antioxidants ergothioneine and glutathione. <i>Food Chem</i> 2017; 233:429-433.</p>

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<i>Ergosterol</i>			
*The special sterol: mushrooms contain a unique sterol called ergosterol, that converts to vitamin D when exposed to light.	Fungi contain a unique sterol, ergosterol, rather than cholesterol found in mammalian cells. Mushrooms exposed to ultraviolet light converts the naturally present ergosterol to ergocalciferol (vitamin D ₂).		Jo Feeney M, Miller AM, Roupas P: Mushrooms-Biologically Distinct and Nutritionally Unique: Exploring a "Third Food Kingdom". Nutrition today 2014;49:301-307.
<i>Agaricus bisporus</i> mushrooms have more ergosterol than many other edible mushrooms.	Ergosterol content was measured in <i>Agaricus bisporus</i> , Oyster mushrooms, and Enoki mushrooms. Ergosterol was highest in the <i>Agaricus bisporus</i> , and lowest in the Enoki mushrooms. However, oyster mushrooms had a better conversion of ergosterol to Vitamin D than the other edible mushrooms, but they all made some vitamin D with sun exposure.		Jasinghe VJ, Perera CO. Distribution of ergosterol in different tissues of mushrooms and its effect on the conversion of ergosterol to vitamin D2 by UV irradiation. Food Chem 2005;92(3):541-546.
<i>Polyphenols</i>			
Mushrooms contain polyphenols like quercetin and kaempferol which act as antioxidants.	Mushrooms are thought to contain phenolic acids such as hydroxybenzoic acid and hydroxycinnamic acid, and antioxidants such as quercetin, resveratrol and kaempferol.		Kozarski M, Klaus A, Jakovljevic D, et al. Antioxidants of edible mushrooms. Molecules 2015;20:19489-525
<i>Vitamin D</i>			
Sunbake your store-bought mushrooms to increase their vitamin D content.	Mushrooms are one of the only natural vegetarian food sources of vitamin D, which is produced by the conversion of ergosterol to ergocalciferol after exposure to ultraviolet (UV) light.		Cardwell G, Bornman JF, James AP, et al. A review of mushrooms as a potential source of dietary vitamin D. Nutrients 2018;10:1498.

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Tan your mushrooms, not your skin.	The sun's ultraviolet (UV) radiation is both a major cause of skin cancer and our best source of vitamin D. In Australia, almost all our vitamin D comes from the sun's UV radiation. However, at least 2 in 3 Australians will be diagnosed with some form of skin cancer before the age of 70 years. Placing mushrooms in sunlight will allow them to absorb vitamin D to meet your daily requirements without any risk to you skin.		Cardwell G, Bornman JF, James AP, et al. A review of mushrooms as a potential source of dietary vitamin D. <i>Nutrients</i> 2018;10:1498. Cancer Council. Skin cancer in Australia factsheet. https://actcancer.org/prevention/sunsmart/skin-cancer-in-australia/
Putting your mushrooms in the sun for 15mins can provide you with your daily vitamin D needs!	Placing mushrooms in the sun for 15 minutes will provide greater than 100% of the daily adequate intake of vitamin D (15µg/day).		Phillips KM, Rasor AS. A nutritionally meaningful increase in vitamin D in retail mushrooms is attainable by exposure to sunlight prior to consumption. <i>J Nutr Food Sci</i> 2013;3:236.
Sunlight-exposed mushrooms can be as effective as a vitamin D supplement.	Eating UV-exposed mushrooms enriched with vitamin D are as good as taking a vitamin pill at increasing serum 25(OH) concentrations in those with low serum Vitamin D	This is a health claim and so needs to be communicated as nutrition education only	Urbain P, Singler F, Ihorst G, et al. Bioavail-ability of vitamin D ₂ from UV-B-irradiated button mushrooms in healthy adults deficient in serum 25-hydroxyvitamin D: a randomized controlled trial. <i>Eur J Clin Nutr</i> 2011;65(8):965Y971.
Windows block UV-B, so place mushrooms outside to make vitamin D.	All types of glass block the majority of UV-B radiation. Therefore, mushrooms must be placed outside to create vitamin D. UV-B cannot be transmitted through window glass.		Almutawa F, Vandal R, Wang SQ et al. Current status of photoprotection by window glass, automobile glass, window films and sunglasses. <i>Photodermatol</i>

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			Photoimmunol Photomed 2013;29(2):65-72.
Place your mushrooms sunny side up! Face gills or the underside, to the sun or slice your mushrooms for maximum Vitamin D creation.	Increasing the surface area exposed to UVB light helps to increase the rate that ergosterol is converted to Vitamin D		Simon RR, Phillips KM, Horst RL, et al. Vitamin D mushrooms: comparison of the composition of button mushrooms (<i>Agaricus bisporus</i>) treated postharvest with UVB light or sunlight. J Agric Food Chem 2011;59:8724Y8732.
Sunlight-exposed mushrooms retain their vitamin D levels in the fridge for up to 8 days.	After cooking, vitamin D enriched mushrooms retain ~60 - 80% of their vitamin D content.		Roberts JS, Teichert A, McHugh TH. Vitamin D Formation from post-harvest UV-B treatment of mushrooms (<i>Agaricus bisporus</i>) and retention during storage. J Agric Food Chem 2008;56(12):4541-4544.
*Devoted to vitamin D: The vitamin D content of dried mushrooms is still 50% of its original value after 18 months.	Three types of mushroom (button, shiitake, and oyster) exposed to a UV-B lamp and then hot air-dried, had relatively good retention of vitamin D ₂ up to eight months when stored in dry, dark conditions at 20 °C in closed plastic containers. However, there was a steady loss of vitamin D ₂ during storage between 8 and 18 months. In the case of hot air-dried button mushrooms, vitamin D ₂ concentration decreased from 14.3 µg/g DM to 9.3 µg/g DM over eight months, then to 6.9 µg/g DM over the following 10 months.		Cardwell G, Bornman JF, James AP, et al. A review of mushrooms as a potential source of dietary vitamin D. Nutrients 2018;10:1498.

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<i>Metabolic markers</i>			
Mushrooms have been shown to improve adiponectin in people with metabolic syndrome – a key hormone for metabolic health.	<p>In a sample of adults with at least two features of the metabolic syndrome, adiponectin increased after daily consumption of 100g of cooked mushrooms over the 16-week intervention (7.9±3.2µg/mL baseline; 8.8±3.5µg/mL 16 weeks, p=0.03).</p> <p>Adiponectin, the most abundant anti-atherogenic and anti-inflammatory adipocytokine found in circulation, has direct effects on glucose and lipid metabolism and improves insulin sensitivity and central fat distribution (12, 13). A low level of adiponectin is associated with insulin resistance, obesity, metabolic syndrome and cardiovascular disease.</p>		<p>Calvo MS, Mehrotra A, Beelman RB, et al. A retrospective study in adults with metabolic syndrome: Diabetic risk factor response to daily consumption of Agaricus bisporus (white button mushrooms). <i>Plant Foods Hum Nutr</i> 2016;71:245-51.</p> <p>Yosae S, Khodadost M, Esteghamati A, et al. Adiponectin: An indicator for metabolic syndrome. <i>Iran J Public Health</i> 2019;48(6):1106-1115.</p>
<i>Immune system</i>			
Eating 100g of mushrooms for 7 days may help to support markers of immune function.	Compared to usual diet, eating 100g of cooked white button mushrooms for 7 days was associated with increased serum IgA osmolarity (p<.0001), secretion rate (p<.0005) and concentration (p<.0005), which are markers of immune function.		Jeong SC, Koyyalamudi SR, Pang G. Dietary intake of Agaricus bisporus white button mushroom accelerates salivary immunoglobulin A secretion in healthy volunteers. <i>Nutrition</i> 2012;28:527-31.
<i>Satiety</i>			

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Mushrooms have been shown to help reduce hunger and increase fullness, compared to a protein-matched beef meal.	In 35 young adults (age 23±4 years), eating mushrooms was associated with lower hunger (p=0.045), greater fullness (p=0.05) and a lower food intake during the rest of the day (p=0.03) compared with a protein-matched beef meal without mushrooms.		Hess JM, Wang Q, Kraft C, Slavin JL. Impact of Agaricus bisporus mushroom consumption on satiety and food intake. <i>Appetite</i> 2017;117:179-185.
<i>Cancer</i>			
Fungotherapy – mushrooms may be the new source of natural compounds for future cancer therapy.	<p>Medicinal mushrooms have been used throughout the history of mankind for treatment of various diseases including cancer.</p> <p>There has been a strong progress in the field of medicinal mushroom research in terms of anticancer drug development, but this work continues, and much more progress still awaits us, especially in the fields of molecular targets of the medicinal mushrooms and the complex synergistic interplay of their different components. Watch this space!</p>		Blagodatski A, Yatsunskaya M, Mikhailova V, et al. Medicinal mushrooms as an attractive new source of natural compounds for future cancer therapy. <i>Oncotarget</i> 2018;9(49):29259-29274.
Mushroom extract has been tested as a promising way to help manage prostate cancer in preliminary experimental trials.	In prostate cancer patients, mushroom extract at increased doses (4g to 14g extract daily; equivalent to 40g to 140g fresh WBM) was associated with decreased prostate specific antigen (PSA) levels in 36% of patients, with stable PSA levels or no effect in the remaining patients. Minimal side effects were reported and mostly limited to Grade 1 abdominal bloating. PSA levels are used by doctors		Twardowski P, Kanaya N, Frankel P, et al. A phase I trial of mushroom powder in patients with biochemically recurrent prostate cancer: Roles of cytokines and myeloid-derived suppressor cells for Agaricus bisporus-induced prostate-specific antigen

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	to help detect prostate cancer or other prostate abnormalities.		responses. Cancer 2015;121:2942-50.
<i>Patterns of consumption</i>			
When is mushroom season? All year-round! Interestingly though, winter is when online searches for mushroom recipes peak! That's great, because sun-exposed mushrooms in winter is a great way to help maintain your summer vitamin D levels though!	According to patterns seen in Google Trends, online searches for 'mushroom recipes' peaks annually in the winter months in both the southern and northern hemispheres.	Winter is the also the season where vitamin D levels drop - there could be an opportunity for a targeted message for dietary vitamin D	www.google.com
Love or hate mushrooms? It could be written in your genes.	Italian researchers have identified 17 genes which were associated with certain foods, including mushrooms. Interestingly, none of the genes were directly associated with taste or smell receptors.		European Society of Human Genetics (ESHG). "Revolutionizing diets, improving health with discovery of new genes involved in food preferences." ScienceDaily. ScienceDaily, 1 June 2014. <www.sciencedaily.com/releases/2014/06/140601201954.htm
Just 5 mushroom species accounts for 85% of global mushroom sales, even though over 2000 plus edible species have been	<i>Agaricus bisporus</i> , <i>Lentinus edodes</i> (shiitake mushroom), <i>Pleurotus Ostreatus</i> (oyster mushroom), <i>Auricularia polytricha</i> (black fungus mushroom), and <i>Flammulina velutipes</i> (enoki mushroom). Just five species account for 85% of		Royse DJ, editor A global perspective on the high five: Agaricus, Pleurotus, Lentinula, Auricularia & Flammulina2014.

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identified by scientists!	the global sales of edible mushrooms, with nearly half (40% from the humble <i>Agaricus bisporus</i> (white button mushroom).		
<i>Cooking</i>			
Cooking at high temperatures and for too long destroys antioxidants found in mushrooms. The greater the cooking time, the greater the loss. So cook your mushrooms at low temps until they are just cooked for your liking.	Cooking mushrooms reduces antioxidant concentrations. Antioxidant concentration for raw mushrooms was the highest across all studies.		<p>Ganguli A, Ghosh M, Singh N. Antioxidant activities and total phenolics of pickles produced from the Edible Mushroom, <i>Agaricus bisporus</i>. <i>J Culinary Sci Tech</i> 2006;5:131-142.</p> <p>Ng ZX, Tan WC. Impact of optimised cooking on the antioxidant activity in edible mushrooms. <i>J Food Sci Technol</i> 2017;54:4100-4111.</p>
Add lemon juice to mushrooms before cooking to help preserve more of their vitamin D content.	Adding lemon juice to the mushrooms before heating them helps retain their vitamin D during cooking. It could be explained by the antioxidant properties of ascorbic acid that is present in the lemon juice, but the reason is still unknown.		<p>Ložnjak P, Jakobsen J. Stability of vitamin D3 and vitamin D2 in oil, fish and mushrooms after household cooking. <i>Food Chem.</i> 2018;254:144-149.</p> <p>Hajimahmoodi M, Aliabadipoor M, Moghaddam G, et al. Evaluation of in vitro antioxidant activities of lemon juice for safety assessment. <i>Am J Food Technol</i> 2012;7(11):708-714.</p>

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<p>Cook your mushrooms at lower temperatures and for a shorter amount of time to preserve their vitamin D content!</p>	<p>Cooking method can impact the amount of vitamin D initially contained within a mushroom. Mushrooms will lose some vitamin D in the cooking process and higher heat will lead to a larger loss of vitamin D. To retain the maximum amount of vitamin D, use shorter cooking times at a lower heat.</p>		<p>Ložnjak P, Jakobsen J. Stability of vitamin D3 and vitamin D2 in oil, fish and mushrooms after household cooking. <i>Food Chem.</i> 2018;254:144-149.</p>
<i>Culinary applications</i>			
<p>Mushrooms: The way forward for creating plant-rich diets and sustainable food practices.</p>	<p>Mushrooms contain several important nutrients and at the same time, are low in kilojoules/calories and in sodium. Mushroom production can also be an energy efficient process and can help to improve soil quality.</p> <p>Cooking with mushrooms can also lower food costs. Based on a 2014 Northern California retail market price report, a 50:50 ground beef with button mushrooms taco blend saves 20% on the food cost, and if 80% of the beef is substituted with mushrooms, the food cost savings increase to 33%.</p>		<p>Jo Feeney M, Miller AM, Roupas P: Mushrooms-Biologically Distinct and Nutritionally Unique: Exploring a "Third Food Kingdom". <i>Nutrition today</i> 2014;49:301-307.</p> <p>Grimm D, Wosten HAB. Mushroom cultivation in the circular economy. <i>Appl Microbiol Biotechnol</i> 2018;102(18):7795-7803.</p>
<p>Blend your burger: beef-mushroom burgers are good for business.</p>	<p>Blended burgers represent an exciting sustainability opportunity for restaurants and food service operators, as beef accounts for a sizable portion of these companies' greenhouse gas emissions.</p> <p>Acceptance and satiety of a blended and all-beef burger are comparable.</p>		<p>Clune S, Crossin E, Verghese K. Systematic review of greenhouse gas emissions for different fresh food categories. <i>J Clean Prod</i> 2017;140(2):766-783.</p> <p>Summers AC, Ezike A, Smith P, et al. Acceptance of a mushroom-soy-</p>

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			beef blended burger among school aged children. Health Behav Policy Rev 2017;4(3):274-281.
Growing mushrooms can be a sustainable practice for the food supply.	Mushroom production relies on heat produced through composting. Therefore, it is an energy efficient process. The substrate it is grown in is also recycled to improve soil quality (i.e. soil amendment: the practice of improving mine soil quality in terms of its structure and biochemical function).		<p>Jo Feeney M, Miller AM, Roupas P: Mushrooms-Biologically Distinct and Nutritionally Unique: Exploring a "Third Food Kingdom". Nutrition today 2014;49:301-307.</p> <p>Lonie J, Phelps L. Sustainable production practices in mushroom farming. Mushroom News. 2011;59:4Y8.</p> <p>Grimm D, Wosten HAB. Mushroom cultivation in the circular economy. Appl Microbiol Biotechnol 2018;102(18):7795-7803.</p>
Mushrooms: the mighty meat alternative with all the flavour.	Based on findings of a sensory study, the flavour of dishes was reported to improve when mushrooms were partially substituted for minced meat e.g. in a beef taco. This is because of the characteristic <i>umami</i> -rich flavour profile of mushrooms.		<p>Myrdal Miller A, Mills K, Wong T, et al. Flavor-enhancing properties of mushrooms in meat-based dishes in which sodium has been reduced and meat has been partially substituted with mushrooms. J Food Sci 2014;79(9): S1795-804.</p> <p>Kurihara K: Umami the Fifth Basic Taste: History of Studies on</p>

Fun Fact	Scientific Description	Other Considerations	References
			Receptor Mechanisms and Role as a Food Flavor. Biomed Res Int 2015;2015:189402.
Replacing some of your meat with mushrooms can boost the flavour of your meal and help to increase your daily recommended serves of vegetables.	<p>Due to the spectrum of vitamins (e.g. Vit B and D) and minerals found in mushrooms, adding mushrooms to dishes increases its nutrient profile.</p> <p>Based on findings of a sensory study, flavour/texture of dishes was reported to improve when mushrooms are partially substituted for minced meat e.g. in a beef taco. This is likely due to the characteristic <i>umami</i>-rich flavour profile of mushrooms.</p>		<p>Jo Feeney M, Miller AM, Roupas P: Mushrooms-Biologically Distinct and Nutritionally Unique: Exploring a "Third Food Kingdom". Nutrition today 2014;49:301-307.</p> <p>Myrdal Miller A, Mills K, Wong T, et al. Flavor-enhancing properties of mushrooms in meat-based dishes in which sodium has been reduced and meat has been partially substituted with mushrooms. J Food Sci 2014;79(9):S1795-804.</p> <p>Kurihara K: Umami the Fifth Basic Taste: History of Studies on Receptor Mechanisms and Role as a Food Flavor. Biomed Res Int 2015;2015:189402.</p>
<i>Other</i>			
*World's top pick: <i>Agaricus bisporus</i> is the world's most commonly consumed mushroom.	Although more than 2000 varieties of mushrooms are edible, the white button mushroom in the <i>Agaricus bisporus</i> species is the most commonly consumed mushroom in the world.		Jo Feeney M, Miller AM, Roupas P: Mushrooms-Biologically Distinct and Nutritionally Unique: Exploring

Fun Fact	Scientific Description	Other Considerations	References
			a "Third Food Kingdom". Nutrition today 2014;49:301-307.
*Three of the same: Button, cup and flat mushrooms all come from the same mushroom, just left longer to grow!	Mushroom maturity is usually scored on a 7-point arbitrary developmental scale devised by Hammond & Nichols (1975), sometimes described as rate of veil opening. Stage 1 is the 'pinhead', stage 2 the 'button', stage 3 'closed cup', stage 4 'cup' veil break stage, stage 5 open 'cup', stage 6 the 'flat', stage 7 'flat' with an inverted cap. Although the scale is arbitrary, measurement of maturity during a postharvest period is linear using the scale.		Hammond JBW, Nichols R. Changes in respiration and soluble carbohydrates during the post-harvest storage of mushrooms (<i>Agaricus bisporus</i>). J Sci Fd Agric 1975;26(6):835-842.
Do the mushroom munch – a friendly fungi for a healthy gut.	Replacing meat with mushrooms can create a more beneficial gut microbiota profile (significantly more Bacteroidetes and less Firmicutes) and better laxation (increased stool weight) in adults. This is due to the unique carbohydrate profile present in mushrooms. Chewing mushrooms thoroughly will help enhance the digestion process by increasing availability of "low-digestible" carbohydrates which will in turn increase the production of beneficial metabolites such as short-chain fatty acids.		Hess JM, Wang Q, Kraft C, et al. Impact of <i>Agaricus bisporus</i> mushroom consumption on satiety and food intake. Appetite 2017;117:179–185. Manzi P, Pizzoferrato L. Beta-glucans in edible mushrooms. Food Chem 2000;68:315–318.
What's on your pizza? Mushrooms were ranked as Britain's #1 pizza topping in 2018, beating pepperoni for the top prize.	N/A		https://www.vouchercodes.co.uk/press/infographics/VoucherCodes-lifetime-of-pizza-full-results