

THE WORLD'S FIRST SYSTEMATIC REVIEW ON *AGARICUS BISPORUS*

What's so special about
Australia's most popular fungi?



Read the full paper

Blumfield et al., J Nutr Biochem 2020;84:108453

Link: bit.ly/mushroomsresearch

 **NRAUS**
NUTRITION RESEARCH

Australian
MUSHROOMS

What you need to know about mushrooms



NOT A VEGETABLE
But contains:
resistant starch
phytonutrients
potassium



NOT AN ANIMAL
But contains:
vitamin B12
vitamin D



NOT A WHOLE GRAIN
But contains:
beta-glucans
prebiotics
riboflavin



NOT A NUT
But contains:
copper
selenium



What is *Agaricus bisporus*?



It's the world's most popular mushroom and includes^[1]:



FLAT



SWISS BROWN/CREMINI



CUP



BUTTON



PORTOBELLO

? FUN-gi FACT

Button, cup and flat mushrooms all come from the same mushroom, just grown for different lengths of time.

What's the research gap?

Over
300
reviews exist
on mushrooms

Yet
0
specifically on
Agaricus bisporus

What was done?

Nutrition Research Australia conducted the world's first systematic review on *Agaricus bisporus*, to investigate its key bioactive components and effects on health in humans.

5 databases searched
up to June 2019

Medline
Embase
Scopus
CINHAL
Cochrane Library

5,707
records found

1,037
full-text articles
screened

68
articles included
in the review

What was found?



53
articles on
bioactive
components

ANTIOXIDANTS
BETA-GLUCANS
CHITIN
D VITAMIN
ERGOTHIONEINE



15
articles on human
health effects

⬆️ Vitamin D status
⬇️ Inflammation
⬆️ Satiety
⬇️ Cancer risk & its metabolites
⬆️ Gut health
⬆️ Cardiometabolic health
⬆️ Immune function

What are the key bioactives in *Agaricus bisporus*?



What is it?

How much?

A

ANTIOXIDANTS

An array of antioxidants usually reported as flavonoids and polyphenols, including catechin, myricetin, quercetin & kaempferol^[2]. Mushrooms are one of the few non-plant foods that contain antioxidants.



Kaempferol in *Agaricus bisporus* vs. Strawberries (/100g wet weight)

B

BETA-GLUCANS

A soluble fibre, commonly found in oats, that has cholesterol lowering properties^[5].

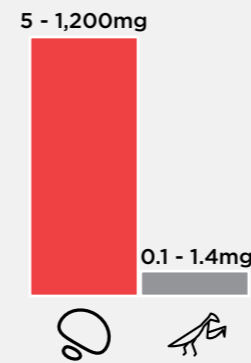


Beta-glucans in *Agaricus bisporus* vs. Oats (/100g dry weight)

C

CHITIN

A unique prebiotic polysaccharide that makes up the cell wall of fungi - it's like cellulose in plants^[7]. It's not found in any other foods, except for insects and yeasts.

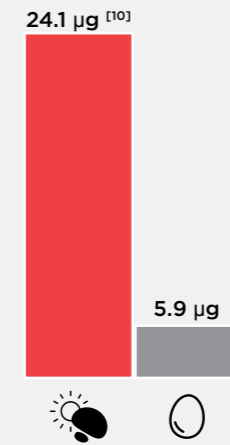


Chitin in *Agaricus bisporus* vs. Edible Insects (/100g wet weight)^[8]

D

VITAMIN D

The sunshine vitamin. Mushrooms naturally contain vitamin D2, with levels increased up to 10 times after the surface of the mushroom is exposed to UVB light (i.e. sunlight)^[10].



Vitamin D equivalents in UV-exposed *Agaricus bisporus* vs. Raw Eggs (/100g wet weight)^[11]

E

ERGOTHIONEINE

An antioxidant that can only be made by some fungi and bacteria^[13]. Mushrooms are the largest dietary source.



Ergothioneine in *Agaricus bisporus* vs. Tempeh (/100g dry weight)



How to maintain in cooking?

Cook for a shorter amount of time^[3, 4].

Not affected by cooking^[6].

Increases with cooking, regardless of whether the mushroom was fresh, frozen or canned^[9].

Using UV-exposed mushrooms, squeeze some lemon juice in the pan, cook at lower temperatures and for shorter times^[12].

Cook for a shorter amount of time^[3, 4].

WHICH TYPE IS BEST?

+ More vitamin D^[14]



Portobello

+ More ergothioneine^[16]



White Button

WHICH PART IS BEST?










28% more antioxidants in the cap (vs the stem)^[17, 18]

40% more beta-glucans in the stem (vs the cap)^[19]

FUN-gi FACT

The stem is a valuable source of bioactives. Don't waste it!

What is the evidence for *Agaricus bisporus* and human health?

	7 health outcomes	Reference	Study Type	Quality of Study*	Sample Size	Population	Intervention	Control	Result
	1 Vitamin D status	Stephensen et al. (2012) ^[20]	RCT	Higher	29	Healthy adults	88 g/day UV white button mushrooms for 6 wks	Non-UV white button	↑ serum 25(OH)D
		Keegan et al. (2013) ^[21]	RCT	Lower	25	Healthy adults	2000 IU vit D/day UV white button mushroom extract for 12 wks	Vitamin D supplement	↑ serum 25(OH)D (equivalent to a supplement)
		Urbain et al. (2011) ^[22]	RCT	Higher	26	Healthy adults	28 000 IU vit D/day UV white button mushrooms for 5 wks	Non-UV white button + placebo supplement	↑ serum 25(OH)D
		Shanely et al. (2014) ^[23]	RCT	Neutral	34	Athletes insufficient in vitamin D	600 IU vit D/day UV powdered portobello mushroom for 6 wks	Placebo	↑ serum 25(OH)D
	2 Inflammation	Calvo et al. (2016) ^[24]	RCT	Higher	37	Adults with metabolic syndrome	100 g/day UV white button mushrooms for 16 wks	Vitamin D supplement	↑ ergothioneine, ORAC, adiponectin ↓ oxidative stress factors
		Volman et al. (2010) ^[25]	RCT	Neutral	56	Adults with hypercholesterolemia	Juice with 5 g/day of α-glucans extracted from white button mushrooms for 5 wks	Juice without α-glucans extracted from white button	↓ TNFα ↔ IL-1b and IL-6
		Weigand-Heller et al. (2012) ^[26]	RCT	Neutral	20	Healthy adults	8 g and 16 g/day powdered mushroom over 3 days	Placebo	↓ oxygen radical absorbance capacity ↑ ergothioneine
	3 Satiety	Hess et al. (2017) ^[27]	RCT	Neutral	70	Healthy adults	226 g/day mushrooms for 10 days	Beef (kJ and protein matched)	↑ satiety ↔ energy intake
		Cheskin et al. (2008) ^[28]	RCT	Neutral	152	Healthy adults	1418 kJ/day white button mushrooms for 4 days	Beef (volume matched)	↓ energy intake ↔ satiety
	4 Cancer risk & its metabolites	Lee et al. (2013) ^[29]	Case-control	Higher	1000	Cases of ovarian cancer	N/A	Healthy adults (no ovarian cancer)	↓ ovarian cancer risk at intakes >2 g/day after 2 years
		Twardoski et al. (2015) ^[30]	Phase 1 trial	Higher	36	Adults with elevated prostate specific antigen	4-14 g/day powdered white button for 10 months	N/A	↓ prostate specific antigen
	5 Gut health	Hess et al. (2018) ^[31]	RCT	Neutral	70	Healthy adults	226 g/day mushrooms for 10 days	Beef (kJ matched)	↑ faecal weight and microbiota composition
		Nishihira et al. (2017) ^[32]	RCT	Lower	80	Adults with problematic halitosis, faecal or body odour	50 to 1000 mg/day mushroom extract for 4 weeks	Placebo	↓ odour and bowel strain
	6 Cardiometabolic markers	Abd-alwahad et al. (2018) ^[33]	Non-randomised trial	Lower	50	Not specified	2 g/kg body weight mushroom (in olive oil) /day for 30 days	Usual diet	↓ glucose, LDL cholesterol, triglycerides, body weight ↑ HDL cholesterol
		Weigand-Heller et al. (2018) ^[26]	RCT	Neutral	20	Healthy adults	8 or 16 g/day powdered mushrooms for 3 days	Placebo	↔ cholesterol and triglycerides
	7 Immune function	Jeong et al. (2018) ^[34]	RCT	Higher	20	Healthy adults	100 g/day white button mushrooms for 7 days	Usual diet	↑ salivary igA secretion

*Quality of study assessed using the Quality Criteria Checklist by the Academy of Nutrition and Dietetics.

Memorable mushroom messages

Bioactive Properties

1 Nutrition allrounder



Mushrooms provide nutrients found not only in vegetables, but in meat and whole grains too.

2 The special sterol



Mushrooms contain a unique sterol called ergosterol, that converts to vitamin D when exposed to light.

3 Beta-ful on the inside



The cell wall of mushrooms consists of the soluble fibre beta-glucan.

4 Unparalleled prebiotic



Mushrooms contain chitin, a unique prebiotic fibre that's not found in fruits, vegetables or grains.

5 First for ergothioneine



Mushrooms contain more ergothioneine (a unique antioxidant) than any other food.

Health Benefits

1 Fill up with fungi



Swapping beef for mushrooms has been shown to lower calorie intake, with no difference to satiety.

2 Nature's supplement



UV-exposed mushrooms can be as effective as a vitamin D supplement.

3 Healthy heart



Mushrooms cooked in extra virgin olive oil may help to improve markers of heart health.

4 Your gut bacteria loves them



Mushrooms contain special prebiotics which feed your gut bacteria.

5 Tan your mushrooms



Putting 1 cup in the sun for 15 mins can provide you with your daily vitamin D needs.

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Hort Innovation
Strategic levy investment

MUSHROOM FUND