CAN MUSHROOMS REALLY HELP LOWER **OUR CHOLESTEROL?**

By Paulette Baumgartl

For over 20 years, breakfasters around the world have enjoyed their daily oats, confident in the knowledge that their morning repast was doing them some good. But what about mushrooms?

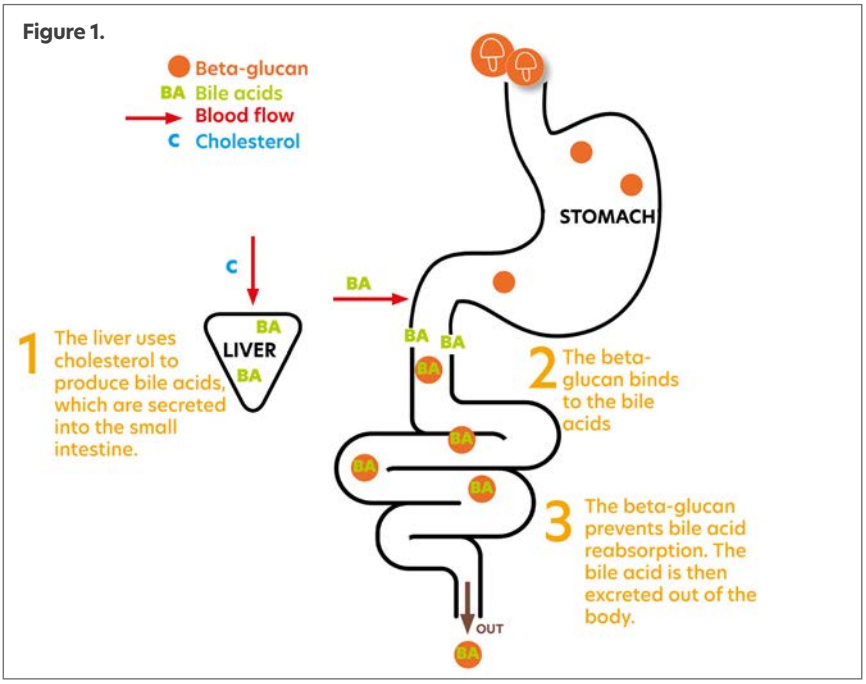
The well-documented cholesterol-lowering effect of oats has been certified by nutritional regulators globally since the late 1990s. Subsequent studies and clinical trials have shown consistent results that confirm, and even boost, the original claims. This high-level health claim has driven an increase in the consumption of oats globally[1].

Beta-glucan, the compound responsible for lowering cholesterol, is famously present in oat and barley grains. However, its presence in mushrooms is less well known.

The oats and barley health claim is currently authorised by Food Standards Australia New Zealand (FSANZ), the US Food and Drug Administration (FDA), and the European Food Safety Authority. To be eligible for the claim, FSANZ specifies that the food must contain at least 1 g of beta-glucan per serving and be consumed in the context of a diet containing 3 g of beta-glucan/day.

A key goal of the mushroom Strategic Investment Plan (SIP) is to support research that increases domestic consumption of mushrooms. Achieving a cholesterol-lowering high-level health claim would help achieve this aim. A levy-funded CSIRO project, *Mushrooms and their potential health benefits of lowering blood cholesterol (MU20001)* is now generating the evidence needed to pursue this claim.

Figure 1.



What is beta-glucan and how does it work?

Beta-glucan is a type of soluble dietary fibre that is present in the cell walls of some grains, yeasts, bacteria, fungi, and algae.

As illustrated in Figure 1, when beta-glucan enters the small intestine it can bind cholesterol-containing bile acids, preventing bile-acid reabsorption in the small intestine. It then passes into the large intestine where it is excreted from the body. Bile acids are important in aiding absorption of nutrients in the small intestine. As the body must then produce new bile acids in the liver using cholesterol, this results in reduced levels of cholesterol in the blood.

Beta-glucan and mushrooms

A small number of clinical trials have indicated that mushrooms could have cholesterol-lowering properties, but current evidence lacks the scientific rigor to support a health claim. While previous studies have established that mushrooms contain beta-glucan, the path to approval of a high-level health claim by FSANZ is long. It requires deeper knowledge of the type of beta-glucan, its functionality in the human intestinal tract, the likelihood of consumers achieving the serving size required to lower cholesterol levels, and evidence from human clinical trials.

Prior to undertaking a clinical trial, it was first necessary to establish the beta-glucan levels in a variety of mushrooms consumed in Australia, understand how these beta-glucan levels were affected by cooking and compare their bile acid binding capacity with oats.

For this project, beta-glucan content was determined for raw and cooked (boiled or fried) Australian *Agaricus bisporus* (button, cup, flat and brown mushroom) and *Pleurotus spp* (shimeji and oyster) mushrooms. This could then be compared to oats. A digestion simulation test was also used to evaluate the bile acid binding potential of different mushroom varieties.

	Preparation method	Serving (g) providing 1 g beta-glucan	Freeze dried powder (g) providing 1 g beta-glucan	Approx. number of mushrooms for 1 g beta-glucan[2]
Button (average weight 24 g)	Raw	150	12.4	7
	Boiling	100	7.5	
	Frying	80	13.0	
Brown (average weight 22 g)	Raw	150	13.2	7
	Boiling	90	8.8	
	Frying	90	13.8	
Cup (average weight 38 g)	Raw	200	15.7	6
	Boiling	150	12.4	
	Frying	120	14.4	
Flat (average weight 70 g)	Raw	300	22.1	5
	Boiling	200	13.9	
	Frying	170	21.9	
Oats	Raw	14	13.2	
	Cooked	100	20.4	

Table 1: Average serving sizes required to provide 1 g beta-glucan

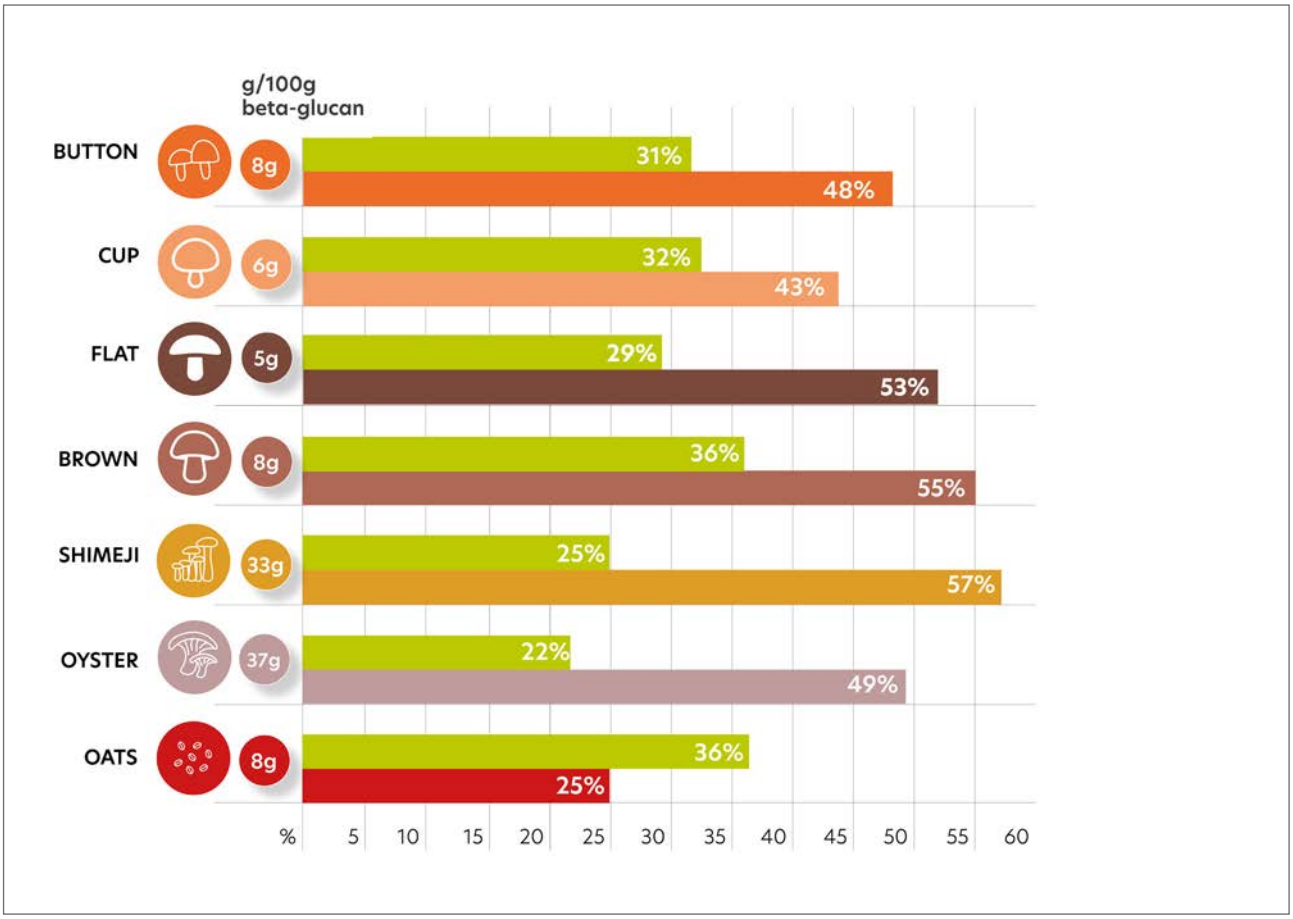


Figure 2. Total beta-glucan/100 g dried weight and percent bile acid binding capacity/500 mg of freeze dried boiled (coloured bars) and raw (green bars)

Beta-glucan content of raw and cooked mushrooms

Beta-glucan was a significant component in mushroom dry-matter. It was highest in oyster (37 g/100 g) and shimeji mushrooms (32.5 g/100 g), followed by button (8.1 g/100 g), brown (7.6 g/100 g), and cup (6.4 g/100 g), with flat mushrooms containing the lowest amounts (4.5 g/100 g). Freeze dried raw oats contained 7.6 g/100 g.

Although *Agaricus bisporus* contain similar levels of beta-glucan to oats, the high moisture content of mushrooms means the serving size needed to provide 1 g of beta-glucan is considerably higher (Table 1). Nevertheless, for most of the popular varieties, a handful of mushrooms is all it takes to provide the 1 g of beta-glucan.

Mushroom beta-glucan bile acid binding capacity compared to oats

To help determine the capacity of mushroom beta-glucan to bind bile acid, the CSIRO team compared *in vitro* binding of bile acids by mushrooms and oats using a simulated human digestive system. Data was reported as a percentage of bile acids bound per 500 mg of food (freeze dried weight).

The bile acid binding capacity of dried raw *Agaricus bisporus* mushroom varieties ranged from 29% to 36% which is comparable to raw oats (36%). Figure 2 illustrates the total acid-binding capacity for both raw and cooked versions of several varieties of mushrooms.

For all *Agaricus bisporus* varieties, cooking (boiling and frying) increased the bile acid binding capacity:

- Boiling increased capacity by 23% for flat, 19% for brown, 17% for button and 11% for cup.
- Frying increased capacity by 16% for flat, 9% for brown, 11% for button and 8% for cup.

Feasibility of lowering cholesterol by consuming mushrooms

This study showed that conventional *Agaricus bisporus* (button, cup, flat, brown) mushroom β-glucan had similar bile acid binding properties to oat β-glucan. However, as mushrooms are approximately 90% moisture, larger volumes of fresh *Agaricus* (150 g or more per day) are needed to achieve an intake of 1 g β-glucan per day.

However, this study also suggests that a lower level of daily mushroom intake could still be effective in lowering blood cholesterol levels if the mushrooms are cooked, as frying or boiling markedly increased bile acid binding. A follow up investigation is needed to confirm these findings.

Australian mushroom consumers currently eat an average of around 60 g mushrooms/day, equivalent to two large buttons or one small flat mushroom. They need to double this daily serve of fresh or cooked *Agaricus* – which is still only a handful of mushrooms each day – to consume 1 g of β-glucan. They could also increase β-glucan intake by eating mushrooms in a combination of different forms, including raw, cooked, and freeze-dried.

Based on these findings, the potential of lodging a health claim is currently being explored. This includes determining what further scientific evidence is required to support a high-level health claim.

KEY POINTS

- In a freeze-dried sample, common mushroom varieties contain a similar amount of beta-glucan to oats.
- Beta-glucan in button, cup, flat, and brown mushrooms have a similar bile acid binding capability (the primary cholesterol lowering mechanisms of beta-glucan) to oats.
- Cooking both concentrated the beta-glucan in mushrooms and improved its bile acid binding capacity.
- Consuming 1 g of beta-glucan may help to lower cholesterol within a diet containing 3 g of beta-glucan per day.
- Just seven button or five cup mushrooms daily can provide 1 g of beta-glucan.
- As mushrooms have high moisture content, the serving size needed to provide 1 g of beta-glucan is higher than average Australian consumption; *Australians with high blood cholesterol should eat more mushrooms! – Ed.*
- A clinical trial is needed to support these preliminary fundings and strengthen the case for a cholesterol lowering effect of beta-glucan from mushrooms.

This article has been based on:

Damien P Belobrajdic, Henri Brook, Paul Orchard, Genevieve James-Martin, Welma Stonehouse - Mushrooms and their potential health benefits of lowering blood cholesterol: Phase 1 beta-glucan content and activity of Australian mushrooms. Draft Report Version 1. Project code: MU20001, June 2022

References

1. The global oats market size stood at USD 5.18 billion in 2019 and is projected to reach USD 6.90 billion by 2027, exhibiting a CAGR of 3.8% during the forecast period (2020-2027). https://www.fortunebusinessinsights.com/industry-reports/oats-market-100199
2. https://www.foodstandards.gov.au/science/monitoringnutrients/ausnut/foodmeasures/Pages/fruits-and-vegetable-measures-program.aspx

Hort Innovation Strategic levy investment | MUSHROOM FUND

This project has been funded by Hort Innovation using the mushroom research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au