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
What you need to know about mushrooms

Mushrooms are a fungus.
They are unique.

What is *Agaricus bisporus*?

1. It’s the world’s most popular mushroom and includes:
   - Flat
   - Swiss Brown/Crêmini
   - Cup
   - Button
   - Portobello

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.

Over 300 reviews exist on mushrooms
Yet 0 specifically on *Agaricus bisporus*

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
- 15 articles on human health effects

- Antioxidants
- Beta-glucans
- Chitin
- D vitamin
- Ergothioneine
- Vitamin D status
- Inflammation
- Satiety
- Cancer risk & its metabolites
- Gut health
- Cardiometabolic health
- Immune function

Button, cup and flat mushrooms all come from the same mushroom, just grown for different lengths of time.
What are the key bioactives in *Agaricus bisporus*?

**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.

**B) BETA-GLUCANS**
A soluble fibre, commonly found in oats, that has cholesterol lowering properties[5].

**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.

**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].

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

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**How to maintain in cooking?**

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

**B** Not affected by cooking[5].

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

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

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

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**WHICH TYPE IS BEST?**

- **Portobello**: + More ergothioneine[16]
- **White Button**: + More vitamin D[14]

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**WHICH PART IS BEST?**

- **Cap vs Stem**:
  - **Antioxidants**: 28% more in the cap (vs the stem)[17, 18]
  - **Beta-glucans**: 40% more in the stem (vs the cap)[19]

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

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

Bioactive Properties

<table>
<thead>
<tr>
<th>Number</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nutrition allrounder</td>
</tr>
<tr>
<td></td>
<td>Mushrooms provide nutrients found not only in vegetables, but in meat and whole grains too.</td>
</tr>
<tr>
<td>2</td>
<td>The special sterol</td>
</tr>
<tr>
<td></td>
<td>Mushrooms contain a unique sterol called ergosterol, that converts to vitamin D when exposed to light.</td>
</tr>
<tr>
<td>3</td>
<td>Beta-ful on the inside</td>
</tr>
<tr>
<td></td>
<td>The cell wall of mushrooms consists of the soluble fibre beta-glucan.</td>
</tr>
<tr>
<td>4</td>
<td>Unparalleled prebiotic</td>
</tr>
<tr>
<td></td>
<td>Mushrooms contain chitin, a unique prebiotic fibre that’s not found in fruits, vegetables or grains.</td>
</tr>
<tr>
<td>5</td>
<td>First for ergothioneine</td>
</tr>
<tr>
<td></td>
<td>Mushrooms contain more ergothioneine (a unique antioxidant) than any other food.</td>
</tr>
</tbody>
</table>

Health Benefits

<table>
<thead>
<tr>
<th>Number</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fill up with fungi</td>
</tr>
<tr>
<td></td>
<td>Swapping beef for mushrooms has been shown to lower calorie intake, with no difference to satiety.</td>
</tr>
<tr>
<td>2</td>
<td>Nature’s supplement</td>
</tr>
<tr>
<td></td>
<td>UV-exposed mushrooms can be as effective as a vitamin D supplement.</td>
</tr>
<tr>
<td>3</td>
<td>Healthy heart</td>
</tr>
<tr>
<td></td>
<td>Mushrooms cooked in extra virgin olive oil may help to improve markers of heart health.</td>
</tr>
<tr>
<td>4</td>
<td>Your gut bacteria loves them</td>
</tr>
<tr>
<td></td>
<td>Mushrooms contain special prebiotics which feed your gut bacteria.</td>
</tr>
<tr>
<td>5</td>
<td>Tan your mushrooms</td>
</tr>
<tr>
<td></td>
<td>Putting 1 cup in the sun for 15 mins can provide you with your daily vitamin D needs.</td>
</tr>
</tbody>
</table>

References


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