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University Honors College

The Acute Effects of Shiitake and White Button Mushroom Intake on Postprandial Lipemia and Lipid Oxidation Following a High-Fat Meal

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Background

- Mushroom consumption is known to have an impact on post prandial cholesterol clearance and oxidative stress. The cholesterol effect is likely because they contain sterol-like compounds and the antioxidants in mushrooms may reduce the oxidative stress
- The current trend of rising obesity levels and poor dietary choices have led to an increase in the incidence of chronic diseases in the United States, including cardiovascular disease (CVD) and dyslipidemia.

Figure 1. Whole Shiitake Mushrooms (Lentinula edodes) cited as having high levels of a strong antioxidant, ergothioneine.

- Mushrooms contain high levels of fungisterols which are thought to be the primary mechanism for improved cholesterol clearance and oxidation.
- However, there have not been studies considering the varying impacts of different varieties of mushrooms on cholesterol clearance or oxidative stress.
- Important bioactive compounds currently being extracted from these mushrooms which are thought to have lipid lowering properties are B-glucans, Eritadenine, Lentinan, and Ergosterol.
- Ergothioneine, an anti-oxidant in mushrooms, may have a role in reductions of post prandial lipid oxidation.
- White button mushrooms (WB) have 0.21 mg/g dry weight, compared to Shiitake mushrooms (S) 1.98 mg/g dry weight.

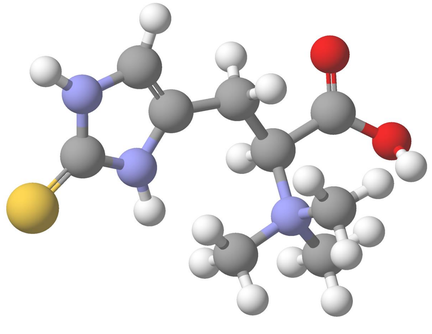

Figure 2. Ergothioneine Molecule. Strong antioxidant found in mushrooms.

Objectives

1. Consumption of S and WB with a high fat meal may acutely affect circulating cholesterol levels.
2. Consumption of S and WB with a high fat meal may acutely affect circulating lipid levels.
3. Consumption of S and WB with a high fat meal may acutely affect lipid oxidation of circulating lipids following a high fat meal.

Methods

All subjects will receive a meal with only meat to serve as a control to test for a 'normal' lipemic response.

Participants will then be randomized into receiving either WB then S (Group 1) or S then WB (Group 2) treatments for their second and third lab visits. Subjects will maintain normal dietary habits (no caffeine or alcohol) the day before. 12 hours prior, participants cannot eat or participate in vigorous activity.

Group 1	Group 2
1. Mushroom Absent	1. Mushroom Absent
2. White Button	2. Shiitake
3. Shiitake	3. White Button

Figure 3. Each participant will be randomly assigned to one of these two groups

At each visit, a participant will consume a high-fat meal (8 oz cooked 80/20 ground beef) with a bun high in carbohydrates within 10 minutes. This will be considered time zero. From there, a blood sample will be taken every 2 hours including hour zero until hour 6 (when the visit concludes).

Figure 4. Uncooked burgers being prepared. Precooked weight approx. 13oz which yields only 8oz cooked weight (required for experiment parameters).

We will look at total cholesterol, LDL, HDL, Triglyceride, and Glucose levels for each blood sample.

$\Delta TC = TC_{Hour\ 0} - TC_{Hour\ 2}$

$\Delta TRG = TRG_{Hour\ 0} - TRG_{Hour\ 2}$

During the first visit (control burger), change in total cholesterol and triglyceride levels will be immediately calculated at hour 2. This will help determine whether or not a subject demonstrates a lipemic response required for measuring experimental effects.

Anticipated Results

5 - Lipemic Response After Various Diets

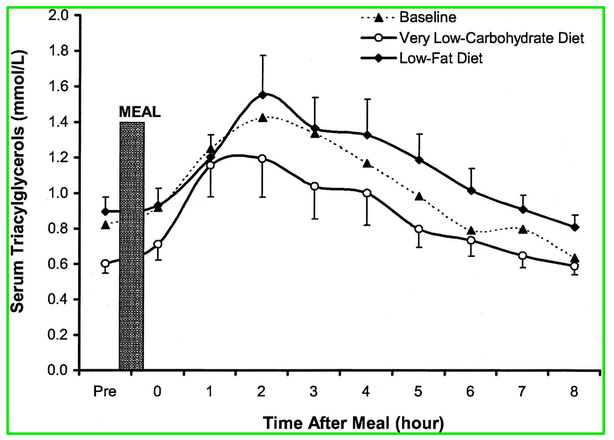

Figure 5. Lipemic Response Serum triacylglycerol concentrations after ingestion of a high fat meal at baseline and after 4 weeks of consuming very low carbohydrate and low fat diets in normal-weight women.

During the first visit between hour zero and hour 2 we expect to see a normal lipemic response as demonstrated above. This will vary among participants. However, subjects will be compared against themselves so that variation between subjects should not affect any results.

We anticipate noticing a change in each participants triglyceride levels as well as total cholesterol between the control burger and the S/WB burgers. Similar effects have been shown from consuming mushrooms in general. Our study seeks to understand possible different effects from different mushroom species; specifically S and WB which are vastly different.

6 - Triglyceride Response to Three Different Mushroom Treatments

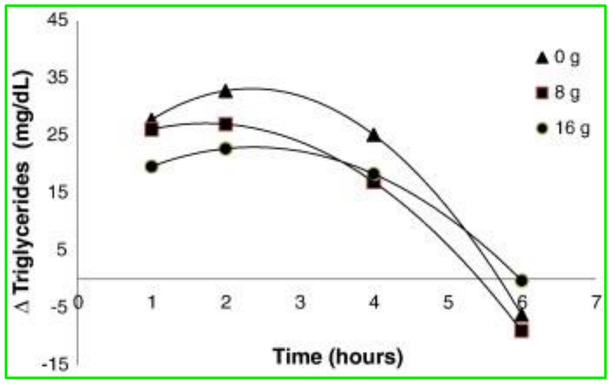

Figure 6. Postprandial Triglyceride Response 'Blunted' effect of triglyceride levels with increased levels of mushroom consumption.

As previous studies have indicated, we expect to see similar curves for S/WB treatments to be lower than baseline non-mushroom burgers.

This improved response is the goal of this research – to see if consuming S and WB with the high fat meal affects lipid absorption into the blood stream.

Since this is where a gap exists in the literature, this is where we focus our data collection and analysis.

7 - Glucose Response To Three Different Mushroom Treatments

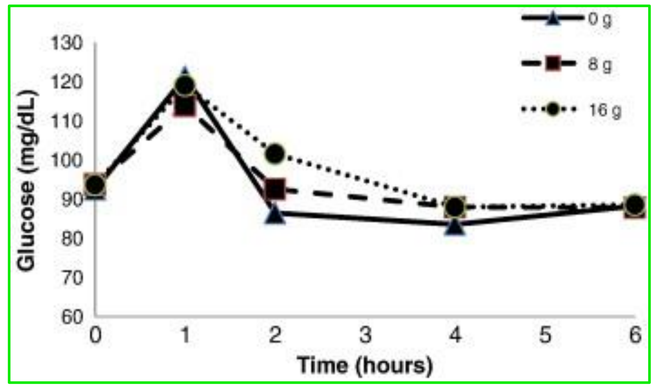

Figure 7. Glucose response (mg/dL) over the time course of 6 h with mushroom treatments of 0 g, 8 g, and 16 g. Pennsylvania State University 2009.

The results of the Glucose responses values are expected to be similar to previous studies. The bun that all three burgers will be served on has a large amount of carbohydrates and should be a sufficient enough supply therefore to demonstrate a changes in glucose response, if any are present.

Discussion

If mushrooms are consumed with a high fat meal (hamburger), there should be a beneficial change in post meal fat and cholesterol absorption as well as fat oxidation.

If the results of this study align with our expectations based on previous research, then we will have a better understanding of which mushrooms can be used to maximize this effect. Depending on how significant the change is for each mushroom, S and WB, we can draw different conclusions accordingly. There is a possibility that this study could yield results not concurrent with previous data but either way further study is required and our experiment should help provide a direction for that continuing research.

The information obtained from this study could help influence decisions on healthy eating and have further implications on how food recommendations are made.

Funding

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References

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