

Mushroom Council Nutrition Research Update

October – December 2005

Quarterly updates provide Mushroom Council members, industry and the Nutrition Research Advisory Panel with the latest information on the status of Mushroom Council funded nutrition research. For additional information or clarification, contact Mary Jo Feeney, MS, RD, FADA, Nutrition Consultant, mj.feeney@earthlink.net.

Chen, Shiuan PhD. Department of Surgical Research, Beckman Research Institute of the City of Hope, Duarte, CA.

See July-September Report for a list of Dr. Chen's abstracts published in the Proceedings of the April 2005 meeting of the American Association for Cancer research and statements Dr. Chen has approved for the Council's use regarding his research to date. Dr. Chen's work also was published in the *International Journal of Medicinal Mushrooms*, 2005; Vol. 7. No.3: 342-44 "Chemopreventive properties of mushrooms against breast cancer and prostate cancer."

Compounds in mushrooms that can inhibit aromatase and 5 alpha-reductase include the fatty acid linoleic acid and/or other fatty acid derivatives. Analytical work at Ohio State University to identify, verify and quantify these fatty acids and/or derivatives is ongoing at this time.

Cheskin, Lawrence J. MD Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

Does Substitution of Meat Products With White Button Mushrooms Have Potential For Weight Reduction? Studies of the Level of Short and Intermediate-Term Caloric Compensation, Satiety, and Dietary Satisfaction Among Lean and Obese Men and Women. Estimated completion early 2006.

Dr. Cheskin's research remains in progress.

Mark Kern, PhD, RD, San Diego State University, San Diego, CA.

Role Of Mushrooms Included in a Low Carbohydrate Diet on Weight Loss, Blood Lipids and Satiety. Estimated completion of the 18 month study is mid 2006.

The investigators provided the following updated report and preliminary data as of December 12, 2005. The feeding and sample collection portion of the research are completed and the process of analyzing samples, analyzing data, and submitting portions of the research for presentation and publication are underway. Three abstracts have been submitted to the Federation of American Societies for Experimental Biology for presentation at Experimental Biology 2006 in San Francisco, CA in April. The titles of these abstracts are:

- Blood lipid responses to consumption of two different very low carbohydrate diets versus a lower fat diet

- Postprandial serum triglyceride responses following four weeks of consuming two different very low carbohydrate diets versus a lower fat diet
- Body weight and composition changes after consumption of two different very low carbohydrate diets versus a lower fat diet

The general findings thus far, as described in the abstracts, include:

- Consumption of both the plant/mushroom-based very low carbohydrate diet and the animal-based low carbohydrate diet resulted in significantly lower serum triglycerides.
- All diets lowered total cholesterol significantly. Although there was no statistical difference in cholesterol-lowering among the diets, the plant/mushroom based diet lowered cholesterol by the greatest percent (15.6%).
- HDL-cholesterol (which is considered “good” cholesterol) was not lowered when consuming either of the low carbohydrate diets, but was significantly decreased when consuming the high carbohydrate/low fat diet.
- At the end of each trial, a meal challenge was provided to the subjects to determine their triglyceride responses for 4 hours after eating. The results suggested that consuming the plant/mushroom-based and animal-based very low carbohydrate diets blunted the increase in serum triglyceride concentrations despite consumption of a higher triglyceride load.
- All diets produced significant weight loss but the plant/mushroom-based diet produced greatest loss of fat tissue. More lean tissue was lost when consuming the plant/mushroom-based diet; however, that may be explained by a significantly greater loss in body water.

The primary data that have not yet been analyzed include blood pressure responses and appetite differences.

David B. Haytowitz, U.S. Department of Agriculture, Beltsville Human Nutrition Research Center, Nutrient Data Laboratory, Beltsville, MD.

Nutrient Analysis Of Mushrooms.

Nutrient information on white button raw, stir-fried and microwaved; oyster raw; shiitake stir-fried; crimini raw; portabella raw and grilled; and enoki raw appear in U.S. Dept. of Agriculture, Agricultural Research Service. 2005. USDA National Nutrient Database for Standard Reference, Release 18. Nutrient Data Laboratory Home Page, <http://www.nal.usda.gov/fnic/foodcomp>.

Immunity Research

- “*Effect of mushroom supplementation on innate immune response,*” Dayong Wu, PhD, USDA Human Nutrition Research Center on Aging at Tufts University. Immune cells from mice fed different doses of mushroom powder will be isolated for determination of innate immune responses such as macrophage function, NK cell count and activity and dendritic cell function. Dr. Wu is working on the proper methods to prepare freeze dried mushroom powder for the study. Franklin Farms provided the mushrooms for the study.
- “*Modulation of biomarkers of inflammation by mushrooms commonly consumed in the United States*” Keith R. Martin, PhD, Penn State University. This study seeks to determine if mushrooms commonly consumed in the U.S (white, crimini, portabella,

shiitake, oyster, king oyster, maitake and enoki). exhibit anti-inflammatory action in an *in vitro* macrophage model; beneficially alter *in vivo* pro-inflammatory status; and affect pro-inflammatory macrophage function. Dr. Martin has conducted *in vitro* pilot studies and discovered that all mushrooms tested stimulated the immune system by increasing tumor necrotizing factor (TNF) -alpha production in macrophages. He is replicating this observation prior to beginning the animal feeding studies.

- “*Modulation of defensin production by mushroom extracts in human cell lines*. Solo Kuvibidila, Ph.D, Louisiana State University. The Council approved seed money to support Dr. Kuvibidila’s proposal to look specifically at the possible effects of mushrooms on defensin production. This is an *in vitro* (cell culture study) only. Positive results could help her secure additional funding from other sources to conduct the full scope of her original proposal.

Pilot Study on Vitamin D2

The Council conducted a pilot study to determine the production feasibility of exposing mushrooms to UVB light to convert ergosterol to vitamin D2. This step was necessary prior to proceeding with a proposal from Mona Calvo, PhD, FDA Center for Food Safety and Applied Nutrition to investigate the effect of mushrooms optimized with D2 on increased disease resistance to microorganisms and mammary tumor growth in an animal model.

Drs. Beelman and Beyer, Penn State University, prepared samples exposed to UVB light in the growing room pre-harvest. Monterey Mushrooms prepared samples of white and ports exposed to UVB light post harvest. Preliminary analysis of vitamin D2 was conducted by Sylvan Inc under direction of Mark Wach. Subsequently, 10 samples including controls were sent to Pirjo Mattila, PhD, Agrifood Research Finland, for analysis verification. The D2 content of the samples ranged from 233% of the Daily Value (DV) for white mushrooms exposed 1 hour pre-harvest to 869% top side exposed for 5 minutes post harvest (Table 1). The Daily Value (DV) for vitamin D for labeling purposes is 400 International Units (IU) or 10 micrograms.

Table 1: Vitamin D2 and Percent Daily Value (DV) in Selected Mushrooms

| Sample | D2 per 84 g Nutrition Facts Serving) | %Daily Value |
|-------------------------------|--------------------------------------|--------------|
| White button control | 0.378 | 3.8 |
| White button top side 5 min. | 86.94 | 869.4 |
| White button top side 15 min | 81.27 | 812.7 |
| Portabella control | 0.315 | 3.2 |
| Portabella gill side 5 min | 47.25 | 472.5 |
| Portabella gill side 15 min | 78.12 | 781.2 |
| White button control | 0.441 | 4.4 |
| White button 1 hr pre-harvest | 23.31 | 233.1 |
| White button 3 hr pre-harvest | 39.06 | 360.6 |
| White button 6 hr pre-harvest | 55.44 | 554.5 |

Nutrition Research Information Activities

Nutrition research information activities center on attending and participating in various professional symposia, conferences and meetings and preparing Research Report summaries for distribution to health professionals. During 2005, Council representatives attended meetings and prepared reports from the following conferences:

- Institute of Food Technologists
- American Institute for Cancer Research
- Society for Nutrition Education
- Food and Nutrition Conference, American Dietetic Association
- Agricultural Outlook Forum
- Federation of American Societies of Experimental Biology (FASEB or EB, Experimental Biology)
- National Institute’s of Health Meeting, Assessing the Health Effects of Bioactive Food Components
- Produce for Better Health Foundation
- RMI Robert Mondavi Institute for Wine and Food Science UC Davis Groundbreaking

Quarterly reports similar to this industry report have been prepared for health professionals and sent electronically to a proprietary list developed through surveys and other inquiries

Mushroom Coverage in the Press

This table represents press coverage prepared from Stephanie Grunenfelder’s weekly web reports since the July-September update. These website links are provided as a convenience to you. The Mushroom Council is not responsible for the accuracy, quality, safety, or nature of the content of the linked sites. Some of the links may not be active at this time. .

| Week | Article/Link |
|-------------|--|
| Sept. 5-9 | Maitake mushroom may boost immunity against cancer and HIV http://www.latimes.com/features/health/la-he-supp5sep05.1.2292759.story?coll=la-headlines-health |
| Sept. 19-23 | Mushrooms add unique flavor http://www.herald-dispatch.com/apps/pbcs.dll/article?AID=/20050923/NEWS06/509230326/1001/NEWS |
| Sept. | Mushrooms deliver an antioxidant boost |

| Week | Article/Link |
|----------------|--|
| 26-30 | http://www.macleans.ca/topstories/health/article.jsp?content=20050926_161259_5300 The USDA approved an assessment increase under the Mushroom Promotion, Research, and Consumer Information Program http://www.freshplaza.com/2005/30sep/2_us_mushroomlevy.htm |
| Oct. 10-14 | Mushroom Yields First Of New Class Of Antibiotics http://www.medpagetoday.com/Pulmonary/Pneumonia/tb/1928 |
| Oct. 17-21 | Mushroom found to contain powerful antibiotic http://www.medindia.net/news/view_news_main.asp?x=5284 |
| Nov. 29-Dec. 2 | Shiitake mushrooms' secret may benefit earth-friendly fuels http://www.ars.usda.gov/is/pr/2005/051129.htm?pf=1 |
| Dec. 12-16 | HEART SMART: Mushrooms are good source of B vitamins http://www.freep.com/apps/pbcs.dll/article?AID=/20051214/FEATURES02/512140344/1027/FEATURES02 |
| | |

Ergothioneine Coverage

See July-September report for a list of publications carrying the ergothioneine story. It is estimated that upwards of 3,370,000 consumers saw the press release on mushrooms and ergothioneine in the United States.