



Mushrooms and Health Global Initiative Bulletin

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Send Us YOUR Ideas and Comments

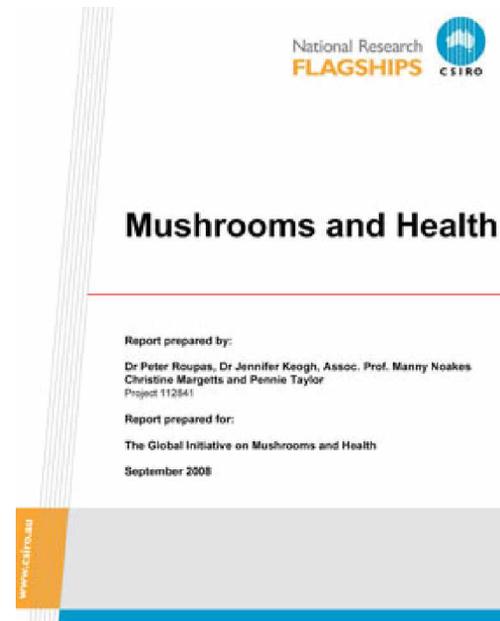
The Initiative Team (Team) welcomes comments about what's happening in your country in mushroom and health research and communication. Send examples of how you are using information in the *Bulletin* to the Editor, info@mushroomsandhealth.com. And don't forget, ISMS posts the *Bulletin* on its website so you can refer others to this important resource: <http://www.isms.biz/>.

Initiative Project Team

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Mushrooms and Health Scientific Report

The Team is pleased to announce the publication of *Mushrooms and Health* - a critical evaluation of scientifically-valid, published research linking mushroom consumption to human health.



Mushrooms and Health focuses primarily on *Agaricus bisporus* but includes other culinary specialty and nutraceutical specialty mushrooms. This resource document was prepared under the direction of Dr. Peter Roupas, FoodScience Australia (FSA), Australia's largest and most diversified food research organisation and a joint venture of the Commonwealth Scientific and Industrial Research Organisation (www.csiro.au).

An initial 11,000 published papers — including one citation from 1889 — identified through PubMed, SCOPUS, Web of Science, and AGRICOLA, were screened and 3,000 of the most relevant published works were evaluated in detail. The 160 page report includes over

300 references and compositional data from international food tables identifying key nutrients in many varieties of mushrooms. A summary of some of the key findings, presented by the authors at the Australian Mushroom Growers Association Annual Conference, included:

- Mushrooms are low in kilojoules and yet are a source of many nutrients, making them ideal for use in weight loss programs. One study (Cheskin *Appetite* 2008) has shown that substituting mushrooms for meat in recipes was an effective and acceptable method for reducing kilojoule intake. Whilst this highlights both the potential sensory and nutritional benefits, more studies in humans are needed to confirm this finding.
- Mushrooms are one of the very few foods that provide a natural source of vitamin D, providing 0.45 mcg/100g mushrooms and potentially higher levels on exposure to UV irradiation such as sunlight. This warrants significant attention due to the prevalence of inadequate vitamin D status in many populations. Further research to establish that mushrooms can improve vitamin D status in humans will add to the limited animal studies in this area.
- Mushrooms are a good source of minerals. They provide more than 10% RDI/100g of potassium, phosphorus, zinc, selenium and copper. (RDI Recommended Daily Intake)
- A 100g serving of mushrooms provides 29% of the RDI for vitamin B2 (riboflavin) and 27% of the RDI for vitamin B3 (niacin).
- The growing conditions are important in maintaining a healthy nutritional profile for mushrooms.
- Mushrooms are naturally low in sodium and high in the amino acid glutamate (a natural flavour enhancer), which makes them a potentially useful flavour addition to low sodium ingredients foods, meals and diets.

- Whilst extensive animal studies and various experimental approaches have attempted to characterise the potential health effects of mushrooms and their extracts, more human trials are required to confirm these findings. Possible health benefits requiring more extensive evaluation in human trials include:
 - anti-tumour effects
 - benefits for the immune system
 - anti-microbial properties
 - significant antioxidant activities

The Team will use this resource document to respond to inquiries regarding the science linking mushrooms and health and to prepare regular summaries and releases to key influencers including the media. In addition, a shorter review is planned to be submitted for publication in a peer reviewed journal as a ready reference for the scientific community. For additional information on *Mushrooms and Health*, contact Mary Jo Feeney, info@mushroomsandhealth.com.



New Research

The Australian Mushroom Growers Association (through Horticulture Australia Ltd) and the U.S. Mushroom Council have funded the following research projects.

Lawrence J. Cheskin, MD, FACP, Johns Hopkins School of Public Health, Baltimore, MD, will conduct a one-year clinical trial on the effectiveness of mushroom substitution for high energy density foods on weight loss, weight maintenance and health measures; such as oxidative stress, inflammation, and immune function. It is important to substantiate findings from the previous short term study ("Lack of energy compensation over 4 days when white button mushrooms are substituted for beef." *Appetite*, 2008,) and investigate whether the calorie savings persist.

Penny Kris-Etherton, PhD, RD and Robert Beelman, PhD, Pennsylvania State University, University Park, will conduct a small clinical trial to determine ergothioneine's bioavailability and effects on biomarkers of oxidative stress. Ergothioneine, primarily produced by fungi, is not synthesized by animals. Mushrooms are a major source of ergothioneine although its

bioavailability along with the absorption kinetics and metabolism from whole mushrooms or via supplementation has yet to be characterized in humans. In addition, the antioxidant potential of ergothioneine has not been determined by looking at effects of intake on biomarkers of oxidative stress.

Keith R. Martin, PhD, MTox, Arizona State University, Mesa, will investigate the beneficial effects of *Agaricus* and specialty mushrooms and the bioactive compound ergothioneine on events that occur early in the development of cardiovascular disease (CVD). CVD is considered an inflammatory condition so compounds that function as antioxidants (such as ergothioneine) might alter the process. CVD results from the build up of fatty plaque in the aorta until blood flow is completely stopped, or a clot is released as the body tries to repair atherogenic damage. If a dietary component could intercept this process, then the downstream events including stroke and heart attack could presumably be avoided.

Dayong Wu, MD, PhD, Nutritional Immunology Laboratory, United States Department of Agriculture Human Nutrition Research Center on Aging, Tufts University, Boston, MA is investigating the effect of mushroom supplementation on resistance to influenza infection. Results from Dr. Wu's previous work indicated that white button mushrooms can enhance both innate immune function (through enhanced natural killer (NK) cell activity) and a key process in the development of innate immunity (dendritic cell maturation). The speculated benefit of consuming mushrooms needs to be substantiated in an infection model before such claims can be made. ("Dietary supplementation with white button mushroom enhances natural killer cell activity in C57BL/6 mice." *The Journal of Nutrition* 2007 137: 1472–1477, 2007 and "White Button Mushroom Enhances Maturation of Bone Marrow-Derived Dendritic Cells and Their Antigen Presenting Function in Mice." *Journal of Nutrition* 138: 544–550, 2008).

Other Mushroom Research



"Vitamin D deficiency treated by consuming UVB-irradiated mushrooms." Ozzard, A, Heart G, Morrison G, and Hoskin K. *British Journal of General Practice* 2008;58:644-645. This report presents a 30-year old Indian male living

in south-east England who was deficient in vitamin D as identified by a serum 25(OH)D level of 17 nmol/l (25-120 nmol/L normal). A vegetarian for religious reasons, he did not consume dairy products. After doing his own research he decided to self-treat. He bought a UV-B bulb from a local hardware store and shone the light directly onto about 200 g of button mushrooms daily from a distance of about 15 cm. The report does not mention the length of time the mushrooms were exposed. The subject stir-fried the mushrooms before eating them and he repeated this routine daily for about 3 months, during the English winter. The subject claimed to make no other lifestyle changes. The repeat serum 25 (OH) D level was 39 nmol/L – and increase of 129%. The authors called for further randomized controlled trials to test the hypothesis that UV-B treated mushrooms provide a source of vitamin D for those whose diet, lifestyle and/or skin color place them at risk of deficiency.



Vitamin D and the Mushroom By Glenn Cardwell

Vitamin D is rapidly moving into the "Vitamin of the Decade" category. A recent paper suggested that adequate vitamin D protects women from breast cancer (Blackmore KM et al. *Am J Epidemiology* <http://aje.oxfordjournals.org/cgi/content/abstract/kwn198>) and a review by the American Academy of Pediatrics (*Pediatrics* 2008; 122: 1142-1152) recommends a doubling of the vitamin D recommended intakes from 5 mcg to 10 mcg per day (200 IU to 400 IU per day) for infants, children and adolescents.

A supplement to the *American Journal of Clinical Nutrition* in August 2008 was titled "Vitamin D and Health in the 21st Century: an Update" and gave a thorough account of the potential health benefits of adequate vitamin D. Adequate dietary vitamin D, or vitamin D supplementation, seems to lower the risk of multiple sclerosis, gum disease, tooth loss, bowel cancer, breast cancer, prostate cancer, rheumatoid arthritis, osteoarthritis, type 2 diabetes and even infectious disease like tuberculosis. Vitamin D, along with calcium, is important for bone mineral density, and muscle growth and function, with older people having less falls and better balance when having enough vitamin D.

A summary of the papers in the supplement (Brannon 2008) made it clear that there were still many questions to be answered about the role of vitamin D in health. There is good evidence that vitamin D is important for bone health, providing sufficient calcium is consumed. There is little research on vitamin D needs in people of differing ethnic backgrounds, skin pigmentation, body mass index and in children, adolescents and pregnancy. There still needs to be clarity on the ideal amount of vitamin D required, the ideal level of circulating vitamin D and the maximum amount of daily vitamin D that precludes any potential problems such as kidney stones.

Vitamin D enhanced mushrooms are now available in the United States from both Dole (<http://dolemushrooms.com/Vitamin%20D.htm>) and Monterey Mushrooms (<http://www.pr-inside.com/monterey-mushrooms-inc-launches-vitamin-r858831.htm>), and this may encourage other countries to launch similar products. Although vitamin D is naturally present in some animal foods, it is not found in plant foods. Mushrooms, which are not plant foods, are the only non-animal source of vitamin D as their ergosterol is converted to vitamin D via sunlight. Farmed mushrooms are generally low in vitamin D. Adding the equivalent to a burst of concentrated sunlight after harvesting is mimicking what would normally happen in nature.

Out in the wild, mushrooms get some sunlight every day. Looking at a range of wild mushrooms two studies found up to 20 mcg of D2/100g, well above the recommended dietary intake of vitamin D (Mattila 1994, 2002). Another study showed some wild mushrooms having 10-58 mcg D2/100g (Teichmann 2007).

It is quite normal for mushrooms to be a natural source of vitamin D. As humans have been eating mushrooms for thousands of years, they may have allowed humans to venture into parts of the world with very little sunlight. By boosting the vitamin D levels with a splash of sunlight, the mushroom will become a natural, viable way to get the day's needs of vitamin D.

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*The Value of Research:
Achieving "Superfood" Status*
By Heidi Gengler

Research is a valuable tool to reach not only consumers and the media, but also to reach and engage high profile health influencers – who can serve as advocates for mushrooms' nutrient and health benefits. Research is critical to provide the science to support statements positioning mushrooms as a "superfood." What makes a food "super?" According to media standards in the United States (U.S.), a "superfood" is a food that helps with top health issues, including the fight against cancer, weight management and immunity – all areas in which the mushroom industry has invested research dollars.

As a result of the mushroom industry's commitment to research and communications, mushrooms have seen an increased presence on U.S. "superfood" lists that inform consumers what they specifically should eat and why. From 2007 to 2008, media impressions resulting from the U.S. Mushroom Council-funded nutrition research increased 22 percent from 186 million to 226 million. Key coverage during 2008 in the U.S. included:

- Dr. Shiuan Chen's research (Beckman Research Institute, City of Hope, Duarte, CA) on mushrooms' potential breast and prostate cancer prevention benefits garnered media attention during 2008 when there were 275 "mushrooms and anti-cancer" stories totaling 213 million media impressions.

- Dr. Lawrence Cheskin's research (Johns Hopkins Bloomberg School of Public Health, Baltimore, MD) on substituting white button mushrooms for beef as a strategy for weight management resulted in 54 media placements and more than 108 million consumer impressions.
- Dr. Dayong Wu's research (Tuft's University, Boston, MA) on mushrooms' enhancing natural killer cell activity in mice is being highlighted in articles about boosting immunity during the cold season. As the U.S enters the cold and flu season, Dr. Wu's research will be distributed in an e-blast to more than 1,500 dietitians, health influencers and nutrition leaders.

Another way to reach health influencers is through exhibits at high profile national conventions and exhibitions. For example, the Mushroom Council recently sponsored an informational booth at the American Dietetic Association's Food and Nutrition Conference & Expo (FNCE). Thousands of dietitians and nutrition leaders were informed about the nutritional treasures of mushrooms, including the research on mushrooms as a weight-management strategy and cancer-fighting properties. Vitamin D continues to be the top concern among the nutrition community, and many dietitians expressed interest in mushrooms as a source of this important nutrient.

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