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Mushrooms Add Important Nutrients When Included in the Typical Diet

First dietary modeling analysis of all three USDA Food Patterns investigates the effects of adding a serving of mushrooms

February 24, 2021 – The second study published in as many months has identified another reason to add more mushrooms to the recommended American diet. The new research¹, published in *Food & Nutrition Research* (February 2021), examined the addition of mushrooms to U.S. Department of Agriculture (USDA) Food Patterns resulting in the increase of several micronutrients including shortfall nutrients, while having a minimal to zero impact on overall calories, sodium or saturated fat.

Dr. Victor L. Fulgoni III and Dr. Sanjiv Agarwal looked at the nutritional effect of substituting a serving of various foods recommended to be moderated in the diet by the 2015-2020 U.S. Dietary Guidelines with an 84-gram serving of mushrooms on nutrient profiles in USDA's Healthy US style, Mediterranean-style and Vegetarian Eating Patterns. This is a similar approach that the USDA used for determining its Dietary Guidelines². For the mushroom serving, researchers looked at a composite of white, crimini and portabella mushrooms at a 1:1:1 ratio; one scenario including UV-light exposed mushrooms; and one scenario including oyster mushrooms.

“Simply adding an 84-gram serving, or what would be the equivalent of 5 medium white mushrooms, to USDA Food Patterns increased several shortfall nutrients including potassium as well as other B vitamins and minerals and had minimal to no impact on overall calories, sodium or saturated fat,” said Dr. Fulgoni.

Depending on the pattern type and calorie level, key findings include:

- The addition of a serving (84 g) of mushrooms to the diet resulted in an increase in potassium (8%-12%), copper (16%-26%), selenium (11%-23%), riboflavin (12%-18%) and niacin (11%-26%), but had no impact on calories, carbohydrate, fat or sodium.
- The addition of a serving (84 g) of oyster mushrooms increased vitamin D (8%-11%) and choline (10%-16%) in USDA Food Patterns.

¹ Agarwal, S., & Fulgoni III, V. L. (2021). Nutritional impact of adding a serving of mushrooms to USDA Food Patterns – a dietary modeling analysis. *Food & Nutrition Research*, 65. <https://doi.org/10.29219/fnr.v65.5618>

² U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at <http://health.gov/dietaryguidelines/2015/guidelines/>.

- Mushrooms exposed to UV-light to increase vitamin D levels to 200 IU/serving also increased vitamin D by 67%–90% in USDA Food Patterns.
- A composite of white, crimini and portabella mushrooms at a 1:1:1 ratio would be expected to add 2.24 mg ergothioneine and 3.53 mg glutathione, while oyster mushrooms would provide 24.0 mg ergothioneine and 12.3 mg glutathione. (*Note: the USDA Food Patterns as well as USDA FoodData Central do not include analytical data either of these antioxidants at this time.*)

Results Mirror Similar Modeling Study

Drs. Fulgoni and Agarwal also modeled the addition of mushrooms to National Health and Nutrition Examination Survey (NHANES) 2011-2016 dietary data looking at a composite of white, crimini and portabella mushrooms at a 1:1:1 ratio; one scenario including UV-light exposed mushrooms; and one scenario including oyster mushrooms for both 9-18 years and 19+ years of age based on an 84g or ½ cup equivalent serving³. Similar to the USDA Food Patterns, the NHANES data found the addition of a serving (84 g) of mushrooms to the diet resulted in an increase in dietary fiber (5%–6%), copper (24%–32%), phosphorus (6%), potassium (12%–14%), selenium (13%–14%), zinc (5%–6%), riboflavin (13%–15%), niacin (13%–14%), and choline (5%–6%) in both adolescents and adults; but had no impact on calories, carbohydrate, fat or sodium.

Looking specifically at vitamin D, the study shows that when commonly consumed mushrooms are exposed to UV-light to provide 5 mcg vitamin D per serving, vitamin D intake could meet and slightly exceed the recommended daily value (98% - 104%) for both the 9 -18 year and 19+ year groups as well as decrease inadequacy of this shortfall nutrient in the population. In addition, a serving of UV-light exposed commonly consumed mushrooms decreased population inadequacy for vitamin D from 95.3% to 52.8% for age group 9–18 years and from 94.9% to 63.6% for age group 19+ years.

Mushrooms Role in the Dietary Guidelines

Mushrooms are fungi - a member of the third food kingdom - biologically distinct from plant and animal-derived foods that comprise the USDA food patterns yet have a unique nutrient profile that provides nutrients common to both plant and animal foods.⁴ Although classified into food grouping systems by their use as a vegetable, mushrooms' increasing use in main entrees in plant-based diets is growing, supporting consumers' efforts to follow food-based dietary guidance recommendations to lower intake of calories, saturated fatty acids, and sodium while increasing intake of under-consumed nutrients including fiber, potassium and vitamin D.

When considering mushrooms' role in diet quality and helping consumers achieve healthy eating patterns, a previous analysis of NHANES 2001-2010 data discovered that mushroom intake was associated with higher intakes of several key nutrients and thus better diet quality⁵. However, intake was low - about 21g per day among mushroom consumers. Because of mushrooms' culinary versatility and unique nutrient profile, greater recognition of mushrooms in dietary guidance is an opportunity to improve diet quality, particularly to increase consumption of vegetables.

“Results from this current research on modeling the nutritional impact of mushrooms on USDA healthy eating patterns are now available for consideration by the 2025-2030 Dietary Guidelines Advisory

³ Fulgoni VL III, Agarwal S. Nutritional impact of adding a serving of mushrooms on usual intakes and nutrient adequacy using National Health and Nutrition Examination Survey 2011–2016 data. *Food Sci Nutr*. 2021;00:1–8. <https://doi.org/10.1002/fsn3.2120>

⁴ Feeney MJ, Mrydal Miller A, and Roupas P. Mushrooms – Biologically Distinct and Nutritionally Unique. *Nutr Today* 2014,49(6):301).

⁵ O'Neil CE, Nicklas TA, and Fulgoni VIII. Mushroom Intake is Associated with Better Nutrient Intake and Diet Quality: 2002-2010 National Health and Nutrition Examination Survey. *J Nutr Food Sci* 2013, 3(5):229.

Committee,” said Mary Jo Feeney, MS, RD, FADA and nutrition research coordinator to the Mushroom Council.

Mushrooms: A Nutrient Powerhouse

Often grouped with vegetables, mushrooms provide many of the nutrient attributes of produce, as well as attributes more commonly found in meat, beans or grains. According to the USDA’s FoodData Central⁶, one serving (5 medium/90g) of white, raw mushrooms contains 20 calories, 0g fat, 3g protein and is very low in sodium (0mg/<1% recommended daily value). Few foods naturally contain vitamin D, and mushrooms are unique in that they are the only food in the produce aisle that contain vitamin D. Specifically, one serving of raw, UV-exposed, white (90g) and crimini (80g) mushrooms contains 23.6mcg (118% RDA) and 25.52mcg (128% RDA) of vitamin D, respectively.

More Research from the Mushroom Council Still to Come

With mushrooms growing in awareness and consideration among consumers nationwide, in 2019, the Mushroom Council made a \$1.5 million multi-year investment in research to help broaden understanding of the food’s nutritional qualities and overall health benefits.

In addition to the analysis of mushrooms for bioactives/ergothioneine for inclusion in USDA FoodData Central database, additional research projects approved include:

- Health promoting effects of including mushrooms as part of a healthy eating pattern.
- Mushrooms’ relationship with cognitive health in older adults.

Since 2002, the Council has conducted research that supports greater mushroom demand by discovering nutrient and health benefits of mushrooms. Published results from these projects form the basis for communicating these benefits to consumers and health influencers.

For more nutrition information, recipes and links to other Mushroom Council-funded studies, visit mushroomcouncil.org.

About the Mushroom Council

The Mushroom Council is composed of fresh market producers or importers who average more than 500,000 pounds of mushrooms produced or imported annually. The mushroom program is authorized by the Mushroom Promotion, Research and Consumer Information Act of 1990 and is administered by the Mushroom Council under the supervision of the Agricultural Marketing Service. Research and promotion programs help to expand, maintain and develop markets for individual agricultural commodities in the United States and abroad. These industry self-help programs are requested and funded by the industry groups that they serve. For more information, visit mushroomcouncil.org.

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⁶ U.S. Department of Agriculture, Agricultural Research Service. FoodData Central, 2019. fdc.nal.usda.gov.