



Consumer acceptance of dishes in which beef has been partially substituted with mushrooms and sodium has been reduced



Jean-Xavier Guinard^{a,*}, Amy Myrdal Miller^{b,1}, Kelly Mills^b, Thomas Wong^b,
Soh Min Lee^{a,2}, Chirat Sirimuangmoon^{a,3}, Sarah E. Schaefer^c, Greg Drescher^b

^a Department of Food Science and Technology, University of California, Davis, 1 Shields Avenue, Davis, CA 95616, USA

^b The Culinary Institute of America at Greystone, 2555 Main St., St. Helena, CA 94574, USA

^c Foods for Health Institute, University of California, Davis, 1 Shields Avenue, Davis, CA 95616, USA

ARTICLE INFO

Article history:

Received 25 December 2015

Received in revised form

27 May 2016

Accepted 13 June 2016

Available online 16 June 2016

Keywords:

Consumer research

Mushrooms

Umami

Dietary guidance

Culinary strategies

ABSTRACT

We tested the hypothesis that because of their flavor-enhancing properties, mushrooms could be used as a healthy substitute for meat and a mitigating agent for sodium (salt) reduction without reduction in sensory appeal among consumers. In a fully-randomized design for each product, 147 consumers evaluated blind two carne asada and six taco blend recipes in which beef had been partially substituted with mushrooms and/or salt had been reduced by 25%, for overall liking, liking of appearance, flavor, texture and mouth feel on the 9-point hedonic scale, and adequacy of level of saltiness, spiciness and moistness on 5-point just-about-right (JAR) scales. Overall consumer acceptance of the carne asada, and liking for its appearance, flavor and texture/mouth feel decreased significantly when half the steak was substituted with mushrooms. The taco blend recipes with full sodium were also liked more overall than those with 25% less sodium. But there was no significant difference in overall liking among the three full-salt recipes, nor among the three reduced-salt recipes, indicating that across the consumer population we tested, acceptance of the mushroom-containing recipes was on par with that of the 100% beef recipe. The preference mapping analysis of the overall liking ratings of the taco blends uncovered four preference segments, two of which, representing a majority of the consumers, gave higher acceptance scores to the mushroom-substituted recipes. Furthermore, the largest preference segment liked the full- and reduced-sodium recipes equally, and another liked the reduced-sodium recipes significantly more. This research demonstrates that through their flavor enhancing properties, mushrooms can be used successfully to substitute for beef and even possibly mitigate sodium reduction without significant change in acceptance for a majority of consumers.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

In issuing the *2015 Dietary Guidelines for Americans*, the USDA and the USDHHS called for consumers to “consume a healthy eating

pattern that includes a variety of vegetables from all the subgroups—dark green, red and orange, legumes (beans and peas), starchy and other; fruits, especially whole fruits; grains, at least half of which are whole grains; and a variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds and soy products” (<http://health.gov/dietaryguidelines/2015/>). The Guidelines further called out the value of such largely plant-based dietary patterns as the traditional, healthy Mediterranean diet, which is associated with reduced rates of chronic diseases and increased life expectancy. The icon illustrating the messages of the *Dietary Guidelines, MyPlate*, represents an optimal American dinner plate on which half of the main area is filled with fruits and vegetables (<http://www.choosemyplate.gov/>). Unfortunately, there is ample evidence to suggest that for many of the foods that nutrition researchers are urging Americans to eat more

* Corresponding author.

E-mail addresses: jxguinard@ucdavis.edu (J.-X. Guinard), amy@farmersdaughterconsulting.com (A. Myrdal Miller), smlee@ewha.ac.kr (S.M. Lee), Chirat.sir@mfu.ac.th (C. Sirimuangmoon).

¹ Current address: Farmer's Daughter Consulting, LLC, 4925 Cameron Ranch Drive, Suite 100, Carmichael, CA 95608-8017, USA.

² Current address: Department of Food Science and Engineering, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul, 120-750, Republic of Korea.

³ Current address: School of Agro-Industry, Mae Fah Luang University, 333 Moo1 Thasud Muang Chiang Rai, 57100, Thailand.

of—especially produce, whole grains and legumes—liking, or sensory appeal, is low in comparison to other foods (Fabbri & Crosby, 2016; Poelman, Delahunty, & de Graaf, 2013). And by contrast, the foods that nutrition experts are urging consumers to avoid often have high sensory appeal because of their high sugar, high salt, and high fat content – all compounds for which we have an innate liking (Beauchamp & Engelman, 1991; Bowen et al., 2003; Drewnowski, 1997; Drewnowski, Mennella, Johnson, & Bellisle, 2012; Obbagy, Condrasky, Roe, Sharp, & Rolls, 2011). When devising culinary and sensory strategies to increase consumption of plant-based foods and fish, the culinary community is being asked to use less sodium, to reduce the use of ingredients with high levels of saturated fat like cheeses and meats, and to minimize the use of highly refined carbohydrate products. Clearly, the challenge of developing healthful foods with high consumer appeal underscores the need for integrated culinary, sensory, and consumer research in this area.

Nutritionally, mushrooms are low in energy, fat and sodium (5 mg/100 g of raw white), but high in protein, carbohydrate, and dietary fiber (USDA National Nutrient Database, 2011). They contain a variety of minerals and trace elements such as potassium and copper, and vitamins such as riboflavin, niacin, and folates. Bioactive secondary metabolites found in mushrooms include phenolic compounds, sterols and triterpenes, all with documented anti-tumor, antioxidant, antiviral, hypocholesterolemic and hypoglycemic effects (Cheung, 2008, 2010). What made mushrooms an attractive candidate for this proof-of-concept study, though, was the fact that they contain umami tastants glutamic acid, aspartic acid and 5'-ribonucleotides (Cheung, 2010; Liu, Vijayakumar, Hall, Hadley, & Wolf-Hall, 2005; Yang, Lin, & Mau, 2001; Zhang et al., 2013) which also have flavor enhancing properties (Fuji & Shimizu, 1993; Fuke & Ueda, 1996; Hong, Kwon, & Kim, 2012; Manabe, Ishizaki, Yoshioka, & Oginome, 2009; Zhang, Venkatasamy, Pan, & Wang, 2013).

Sodium improves the sensory quality of foods by increasing their saltiness and by enhancing other flavors (Keast & Breslin, 2003; Kemp & Beauchamp, 2006). In industrialized nations, about 75% of sodium in the diet comes from manufactured foods and foods eaten away from home (Liem, Miremadi, & Keast, 2011). Despite well documented negative health consequences and associated health care costs of high sodium consumption, most developed nations consume well above the recommended levels of sodium, thus making sodium reduction in the diet a public health priority (Cordain et al. 2005). Various strategies have been applied to reduce sodium in foods, with the 'stealth' approach of gradual sodium reduction and consumer habituation thereof showing the most promise (Liem et al. 2011).

Our hypothesis is that consumer acceptance of foods in which sodium has been reduced can be maintained by using healthy principles with flavor-enhancing properties. Specifically, we assessed whether mushrooms could be used as a healthy substitute for meat and a mitigating agent for sodium reduction because of their flavor-enhancing properties.

We first showed that because of their umami principles (Zhang et al. 2013), mushrooms can be used as a healthy substitute for meat and a mitigating agent for sodium reduction in meat-based dishes without loss of overall flavor (Myrdal Miller et al. 2014). We measured the effects of beef substitution with crimini or white mushrooms (*Agaricus bisporus*) on the flavor profiles of carne asada and beef taco blends with a descriptive analysis panel. Sensory mitigation of sodium reduction through the incorporation of mushrooms was also investigated in the taco blends. The substitution of beef with mushrooms in the carne asada did not alter the overall flavor strength of the dish, but the incorporation of 50 or 80% ground mushroom in the beef taco blend did enhance its

overall flavor as well as mushroom, veggie, onion, garlic and earthy flavors, and umami and sweet tastes. Overall flavor intensity of the 25% reduced-salt version of the 80% mushroom taco blend matched that of the full-salt versions of the 100% and 50% beef formulations, thus indicating that the substitution of 80% of the meat with mushrooms did mitigate the 25% sodium reduction in terms of the overall flavor impact of the dish, even if it did not quite compensate for the reduction in salty taste (Myrdal Miller et al. 2014).

We then tested the consumer acceptance component of our hypothesis. Could consumer acceptance of meat-based dishes in which meat had been substituted with mushrooms and sodium had been reduced be maintained? The outcomes of our consumer research are presented herein.

2. Materials and methods

2.1. Development, formulation and preparation of the carne asada and taco blend recipes

We first developed and bench-tested various recipes for carne asada and beef taco blends in which meat had been partially substituted with mushrooms and sodium reduced (Myrdal Miller et al. 2014). While CIA chefs preferred the intense meat flavor and texture developed through roasting, they recommended sautéing the mushrooms for both the taco blend and carne asada since it is a quicker cooking method (compared to roasting) that can be done in large batches in volume foodservice operations. Representatives from the Mushroom Council supported this recommendation due to lower moisture losses with this cooking method, losses that would impact food costs for the final dish, another important consideration for volume foodservice operations. The team agreed that the mushrooms for carne asada should be diced the same way the steak was. This distinction allowed us to compare the respective effects of the mushrooms, side-by-side or mixed within, on the flavor appeal of each dish. White mushrooms were selected for the taco blend due to cost. CIA chefs recommended using Crimini mushrooms for the carne asada because of their size, density, flavor and perceived value. Based on existing research that shows that few consumers can detect the first 20% reduction in sodium (Beauchamp, Bertino, Burke, & Engelman, 1990; Bolhuis et al., 2011), and on bench testing of various salt-reduced versions of the recipes as well as the potential umami flavor benefits of mushrooms, we elected to go with a 25% sodium reduction for the reduced-sodium versions of the dishes.

A total of six (6) beef taco blend recipes differing in added salt and meat/mushroom ratios and two (2) carne asada recipes differing in meat/mushroom ratios were formulated as shown in

Table 1
Recipe composition and codification.

Sample ID	Meat substitution level	Mushroom content	Steak content	
Carne asada				
100STEAK	0% (none)	0%	100%	
50ST/50MR	50%	50%	50%	
Sample ID	Salt reduction	Meat substitution level	Mushroom content	Beef content
Beef taco blend				
100B	None	0% (none)	0%	100%
100B/25LS	25%	0% (none)	0%	100%
50M50B	None	50%	50%	50%
50M50B/25LS	25%	50%	50%	50%
80M20B	None	80%	80%	20%
80M20M/25LS	25%	80%	80%	20%

Download English Version:

<https://daneshyari.com/en/article/7307134>

Download Persian Version:

<https://daneshyari.com/article/7307134>

[Daneshyari.com](https://daneshyari.com)