



## Can knowledge and product identity shift sensory perceptions and patronage intentions? The case of genetically modified wines



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### ABSTRACT

This study examines the influence of GM identity on wine's sensory evaluations (*i.e.*, appearance, aroma, taste) and consumer patronage using evaluative conditioning and halo effect as theoretical bases. We further inspect the role of knowledge in neutralizing these evaluation biases caused by the “negative halo” of involving gene technology in wine production. A sensory experiment involving 203 consumers suggests that wines primed as GM receive less desirable evaluations on appearance, aroma, and taste relative to conventional samples. Consumers educated with sufficient knowledge on GM wines, rate the wines more objectively such that sensory and overall quality evaluations of the two wine types are not significantly different. As such, educating consumers about the distinct nature of genetic modification technology used in wine making (using GM yeasts) seem to mitigate the negative halo caused by the GM identity.

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### 1. Introduction

The demand for low-calorie, nutritional, organic, local, and environment-friendly products has undergone a dramatic upsurge in recent years (*e.g.*, Howlett *et al.*, 2009; Poulston and Yiu, 2011; Irmak *et al.*, 2011; Kotler, 2011; Chrysochou and Grunert, 2014). As an antipode of these healthy consumption habits, genetically modified (GM) foods have become a topic of much attention and debate. The U.S. is a front-runner in adapting gene technology into food production, with as much as 40% of world's GM crops grown in the U.S. (*International Service for the Acquisition of Agri-biotech Applications*, 2013). Indeed, genetically modified organisms (GMO) are present in 80% of conventional processed foods in the U.S. (*The Grocery Manufacturers Association*, 2014). U.S. consumers' attitudes towards GM foods are increasingly objectionable mainly due to the perceived risks associated with them (Klerck and Sweeney,

2007). The recent approval of labeling laws of genetically modified (GM) products in Connecticut, Maine, and Vermont underscores the overwhelming concerns among U.S. residents who used to be somewhat receptive of GM products years ago (Chokshi, 2014; O'Fallon *et al.*, 2007).

Despite the heavy limelight on GM foods, consumer acceptance of such technology in the wine industry has not been researched extensively. Currently, commercial GM wines refer to wines fermented using genetically-modified yeasts. This process is inherently distinct from what's used in the case of most functional GM foods and is generally considered safer for winemaking, the environment, and the health of the consumers. Furthermore, GM yeast strains offer a number of benefits to consumers and the wine industry, but consumers suffer from a lack of awareness of these benefits. Without the necessary knowledge dissemination, it is difficult for GM wines to find their deserved level of endorsement.

Past studies suggest that a health related identity (*e.g.*, health cues) primed on products influences consumer evaluations (*e.g.*, Burton *et al.*, 2000; Chandon and Wansink, 2007; Chrysochou and Grunert, 2014; Kozup *et al.*, 2003). In the existing business and wine-related literature, little research has investigated consumer embracement of GM wines and how a GM identity can subjectively manipulate perceived sensory attributes. If product identity,

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signaled by a health prime, can bias subsequent sensory evaluations, how this bias could be attenuated remains a mystery. One of the major distinctions that separate wines from other food products is their highly experiential nature. Consumers obtain pleasure from wine consumption through appreciating the appearance, aroma, and taste that are uniquely bound to wines. Therefore, any biased judgment on these experiential attributes is likely to pose a significant hindrance to repeat purchases (Mueller et al., 2010).

This study examines the effect of GM identity and knowledge on sensory evaluations and purchase intentions. Through an experimental study, we examine how the GM identity, typically perceived as a negative cue, impacts wine sensory evaluations (i.e., appearance, aroma, and taste) and consumer patronage; and how this influence varies with knowledge exposure. It is anticipated that this study will aid policymakers in analyzing the viability of mandatory labelling GM related information in GM wines. Additionally, wine manufacturers, retailers, wineries, and wine tour providers will get to know the underlying consumer behavioral dynamics, which would help them in marketing such wines more effectively.

## 2. Background and hypotheses development

### 2.1. Healthier diets, GM foods, and GM wines

The U.S. is a world leader in organic dining and has developed promising markets to accommodate organic consumption (Global Industry Analysis, 2008). Craving for a healthier diet not only places organic and local foods with a competitive market position, but also incurs a surge of concerns or even condemnations of employing gene technology in food and beverage consumption (e.g., Costa-Font et al., 2008; O'Fallon et al., 2007; Subrahmanyam & Cheng, 2000). Genetic modification or genetic engineering refers to "certain methods that scientists use to introduce new traits or characteristics to an organism" (U.S. Food and Drug Administration, 2014). GM foods have been receiving enormous consumer backlash in numerous countries across the world (e.g., Klerck and Sweeney, 2007; Costa-Font et al., 2008). The mounting concerns with GM foods among U.S. consumers, in recent years, have triggered mandatory labeling laws of GM products (Chokshi, 2014). Currently, 65 active bills and ballot initiatives on labeling GM products are following across 26 states in the U.S. (Center for Food Safety, 2014). These apprehensions are mostly environmental, health- and ethical-related (Costa-Font et al., 2008). GM food acceptance is often viewed as contradictory to group norms, or societal and family values (Kleijnen et al., 2009). Although GM products provide considerable benefits for food supply (Azadi and Ho, 2010), consumers are likely to make a decision based on the latent risks that are mostly self-relevant.

Mass media interventions, often highly critical of GM technology, play a strong role in forming consumers' risk perceptions (Laros and Steenkamp, 2004). When consumers are not aware of the presence of GM products in the marketplace, knowing about this issue creates an element of shock among them. Due to the lack of labeling regulations and the corresponding lack of awareness, these consumers often feel cheated (Levy and Derby, 2000). These underlying consumer sentiments, through the social amplification of risk phenomenon (Frewer et al., 2002), create a much bigger impact on the society as negative risk perceptions pass through communication channels resulting in an augmented media and public attention (Kasperson et al., 1988). The wine industry has become a victim of such spillover effect and GM wines are often viewed in the same breath as functional GM foods in spite of the vastly different GM winemaking process from GM foods and the corresponding benefits of such wines.

Gene technology is applied to winemaking either by grape genomics or yeast genomics. In this study, we only consider wines that are produced using GM yeast as a fermentation agent, as GM grapes are not yet commercially allowed for wine making (Cummins, 2005). Genetic modification of plants employs illegitimate recombination such that GM crops involve alien genes to incompatible environment across various species (e.g., animal, plant, and virus). However, wine yeasts are a product of homologous recombination of genes (i.e., self-clone), which is a substance "generally recognized as safe (GRAS)" as per the U. S. Food and Drug Administration (Institute of Science in Society, 2007). The yeast cell is filtered out at the end of the winemaking process (Health Canada, 2013).

Despite the prevalent reservations regarding gene technology, GM yeasts could bring in ground-breaking benefits for the wine industry. GM yeast strains can expedite fermentation, raise yeast ethanol tolerance, enhance sensory aspects of wine, and avoid wine-related headaches (Husnik et al., 2007; Schuller and Casal, 2005; Pretorius, 2000). For the wine industry these benefits multiply in terms of reduced production times, lower costs, decreased spoilage, and better quality of the final product. The cons of applying such technology in winemaking are not perceived any differently from GM foods and normally comprise of ethical considerations, health risks, food safety, and environmental impact, including the danger of introducing modified organisms to the ecosystem. Some of these cons are speculations as their influence is often difficult to verify in the short run. However, the term "GM" may inevitably impose a "negative halo" to wines that are produced via GM yeasts.

To date, only four countries, USA, Canada, Moldova, and South Africa, have mandated the commercial use of GM yeasts (Organic Vineyard Alliance, 2013). Despite the numerous benefits of GM wines, consumer sentiments regarding such wines have mostly been negative. One of the main reasons behind these negative sentimentalities is the lack of awareness or knowledge regarding GM wines. Around 50% American consumers hold a nominal awareness and understanding of GM food (Hallman et al., 2013). This number would likely be considerably higher for GM wines considering the hedonic nature of wine—a product not typically considered a part of our staple diet. As a result of the deficiency in specific GM wine related knowledge, consumers tend to judge GM wines in the same way as they would judge functional GM foods.

### 2.2. Product label, taste, and the role of knowledge

Consumers rely on perceived attributes or cues to help them make a purchase decision (Crane and Clarke, 1988). Information regarding the perceived attributes is often gathered from product labels. For example, labeling products with health related cues has proven to be an effective marketing strategy. Consumers actively aggregate information provided by available intrinsic and extrinsic cues that guide their purchase decisions (Chandon and Wansink, 2007). However, research has shown that consumers make generalizations inappropriately based on product labels, which is explained by the "halo effect" (e.g., Chandon and Wansink, 2007). Halo effect refers to "an extrapolation from a general impression to unknown attributes" (Nisbett and Wilson, 1977, p. 250) that unconsciously alters individuals' judgments. For example, consumers significantly underestimate the calorie content of food from Subway as opposed to those from McDonald's (Chandon and Wansink, 2007). In the context of this study, labeling wines that are fermented with GM yeasts may assign a stigma that automatically drives consumers to perceive GM wines as unwholesome. This effect can be better explained by the evaluative conditioning theory. In essence, a person's evaluation of a certain stimulus may depend on, and will often change with, the pairing of that

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