

Impact of Label Information on Consumer Assessment of Soy-enhanced Tomato Juice

C.D. GOERLITZ AND J.F. DELWICHE

ABSTRACT: The impact of label information on the liking and closeness to ideal of tomato juice beverages was examined by having 100 judges assess 3 tomato juice beverages (Campbell's tomato juice, V8 juice, and an experimental tomato juice enhanced with soy) either with or without labeling information. Judges rated overall liking of each product and then rated appropriateness of various attributes (saltiness, tomato flavor, thickness, texture, red color, orange color, and brown color) on 5-point just-right scales. Only half of the judges were presented with product-related label information during evaluation. Overall liking scores were analyzed using repeated-measures ANOVA, whereas different attribute ratings were analyzed using Thurstonian Ideal Point modeling and Chi-square. Product-associated label information did not significantly alter overall liking ratings ($P > 0.05$), although a significant difference in liking was found between products ($P < 0.05$). Similarly, the label information did not impact comparison of product attribute levels to ideal attribute levels. Both V8 and Campbell's were significantly different from the ideal for 3 of the attributes ($P < 0.05$). For the soy-enhanced tomato juice, all 7 attributes were significantly different from the ideal ($P < 0.05$). In this instance, labeling information had no notable impact on assessments.

Keywords: tomato juice, label information, overall liking, soy, Thurstonian Ideal Point modeling

Introduction

Isoflavones in soy and lycopene in tomato juice both have been shown to reduce the risk of various cancers (Rao and Agarwal 2000; Norman and others 2003). In addition, the isoflavones in soy have been shown to reduce cholesterol levels (Lichtenstein 1998; Erdman 2000). Reduced risk of heart disease is another health benefit of soy (Jenkins and others 2002; Sagara and others 2004) and lycopene in tomato juice (Agarwal and Rao 1998; Rao and Agarwal 2000; Rissanen and others 2002). In 1999, the U.S. Food and Drug Administration (USFDA) allowed food labels to include a health claim that stated a daily diet containing 25 g of soy protein, also low in saturated fat and cholesterol, may reduce the risk of heart disease (Henkel 2000). Foods must contain at least 6.25 g of soy protein per serving and be low in fat, cholesterol, and sodium to qualify for the health claim. However, the benefit of soy isoflavones is still unclear, which is why the USFDA has limited its health claim to foods containing soy protein (Henkel 2000). Regardless of current USFDA labeling restrictions, a soy-enhanced tomato juice could potentially deliver several health benefits, and it is possible that a synergistic effect arising from combining soy and lycopene could have even greater health benefits. However, these potential health benefits will be realized only if consumers are willing to drink the product.

Previous research has shown that label or nutritional information can impact consumer assessments of products. Solheim (1992) investigated consumer responses to sausages with varying fat content (12% and 20% fat); 347 consumers rated 2 sausages (2 different levels of fat from 1 of 2 different companies) from "dislike very much" to "like very much" under 2 different conditions. Half the consumers were given fat content information that was correct; the other half were given incorrect information. When the sensory quality was similar, labeling the 20%-fat sausages falsely as 12%-fat

increased the liking for them. However, the correct information on the fat content of the 12%-fat sausage decreased the liking.

Kahkonen and others (1996) examined the effect of nutritional information on acceptance and perceived sensory attributes of a low-fat, low-salt spread. Fifty consumers were given 4 fat spreads at varying levels of fat (low, high) and salt (low, high). The consumers rated pleasantness, intensity of saltiness, and melting rate in the mouth on 9-point category scales. Results indicated that information about fat level in the spreads can increase pleasantness ratings for low-fat spreads for consumers concerned with food and health but can decrease pleasantness ratings for consumers unconcerned with food and health (Kahkonen and others 1996). However, when Kahkonen and others (1997) did a similar study with fat-free strawberry yogurt, a parallel effect was not found. In this instance, 234 consumers were told they were assessing "strawberry yogurt," "fat-free strawberry yogurt," or "new tasty fat-free strawberry yogurt." The authors speculated that the lack of difference between conditions arose because yogurt is already seen as healthful. An alternate explanation is that these labels did not differentiate between different levels of fat.

The literature (Solheim 1992; Kahkonen and others 1996, 1997) suggests that nutritional information can, but does not always, influence consumer assessment. This study examined the impact of nutritional information on overall liking and closeness to ideal of an experimental soy-enhanced tomato juice and 2 commercially available tomato juice beverages.

Materials and Methods

Roughly 90 mL of each of the 3 refrigerated tomato juice products (Campbell's tomato juice [Campbell Soup Co., Camden, N.J., U.S.A.], 100% A-C-E Vitamin-rich V8 juice [Campbell Soup Co.], and an experimental soy-enhanced tomato juice [developed at the Ohio State Univ.]) were presented to each judge in 4-ounce plastic soufflé cups (Solo Plastic Soufflés, P400, Solo Cup Co., Baltimore, Md., U.S.A.) with computer-generated 3-digit random codes. Samples were presented in a randomized order, coun-

MS 20040295 Submitted 5/7/04, Revised 6/23/04, Accepted 8/30/04. The authors are with The Ohio State Univ., 2015 Fyffe Rd., Columbus, OH 43210. Direct inquiries to author Delwiche (E-mail: delwiche.1@osu.edu).

terbalanced across subjects. The Campbell's and V8 juices were chosen as benchmarks, both being commercially successful tomato beverages. The soy-enhanced tomato juice was developed for use in clinical trials investigating health benefits from the consumption of soy-enhanced tomato beverages. Development of the soy-enhanced tomato juice was under the control of collaborators located at the Ohio State Univ., and these assessments served as early-phase diagnostics in the project. One hundred untrained individuals, willing to assess tomato-based beverages, recruited from local student, staff, faculty, and visitors, assessed all 3 juices. All assessments were made at a centralized location in a controlled setting (10 booths equipped with an on-line data-collection system) on the Ohio State campus. Fifty of the judges were presented with product information for each sample and 50 were not. There was no significant difference in the age or gender of the participants in each group. The product information supplied for Campbell's tomato juice was "20 mg of antioxidant lycopene per 8 fl oz serving and 120% of the Recommended Daily Allowance of vitamin C." For V8 juice it read, "100% of the Recommended Daily Allowance of antioxidant vitamins A, C, and E." The soy-enhanced tomato juice's information read, "45 mg of heart healthy soy isoflavones and 30 mg of antioxidant lycopene per 6 fl oz serving." Responses were collected with on-line data-collection software (Compusense® 5, version 4.4, Compusense, Inc., Guelph, Ont., Canada). Consumers began by rating overall liking of each sample on the 9-point hedonic category scale (Lawless and Heymann 1998). Next, the consumers were asked to indicate the closeness to ideal of different attributes for each sample using a just-right scale (Ennis and Rousseau 2001). These attributes included saltiness, tomato flavor, thickness, pulpiness, red color, orange color, and brown color. An example of the just-right scale, with sample-associated information, is show in Figure 1. Retasting was allowed throughout the procedure. Overall liking, and all but the color at-

tributes, were assessed under red light to minimize the impact of the obvious color differences between samples.

The consumers also responded to several demographic questions. Specifically, they were asked to indicate gender, age category, and ethnicity, as well as consumption frequency of tomato-based beverages, consumption frequency of soy-containing foods, and frequency of seeking food products with health benefit claims. For these last 3 questions, assessments were made on a 10-point category scale (1 = 7 or more times per week, about 4 times per week, once per week, twice per month, once per month, once per 3 months, once per 6 months, once per year, rarely [less than once per year], and 10 = never). Finally, consumers were asked to indicate the level of interest in using food to prevent diseases and the level of concern with developing cancer on a semistructured 7-point category scale (extremely interested [7], neither interested nor disinterested [4], not at all interested [1], very concerned [7], neither concerned nor unconcerned [4], and not at all concerned [1]).

The demographics of 2 groups of subjects were compared with Chi-square to determine whether there were significant differences between the subject groups. The overall liking scores the 100 judges gave for each of the 3 juices were analyzed using repeated measures analysis of variance (ANOVA) and Scheffe's post hoc test (when appropriate), where the beverages were dependent variables and presence/absence of label information was the independent variable. The attribute assessments of the juices made on just-about-right (JAR) scales were analyzed using Thurstonian Ideal Point modeling (Ennis and Rousseau 2001) and Chi-square (O'Mahony 1986). The impact of demographics on liking was examined by repeated measures ANOVA and Scheffe's (when appropriate) where the beverages were dependent variables, presence/absence of label information was the independent variable, and each demographic was a covariate. In addition, the impact of demographics was examined on each label information group separately.

Please taste sample 832 and consider its health claim. Indicate the appropriateness of each attribute.
 (Click 'Display Instructions' if you wish to read the [health claim](#) again.)

	SALTINESS				
	not nearly salty enough	not quite salty enough	just right	slightly too salty	much too salty
Sample 832					
	TOMATO FLAVOR				
	not nearly enough tomato	not quite enough tomato	just right	slightly too much tomato	much too much tomato
Sample 832					
	THICKNESS				
	not nearly thick enough	not quite thick enough	just right	slightly too thick	much too thick
Sample 832					
	PULPINESS				
	not nearly pulpy enough	not quite pulpy enough	just right	slightly too pulpy	much too pulpy
Sample 832					

Review
Instructions

Question 1 of 2
Sample 1 of 3

Figure 1—An example of 1 product's just-about-right (JAR) scales for some of the attributes.

Results and Discussion

Comparison of the subject groups with Chi-square indicated that there was no significant difference between groups for gender, age, ethnicity, frequency of tomato beverage consumption, frequency of soy-containing food consumption, frequency of health-benefit seeking behavior, or interest in using foods to prevent disease ($P > 0.05$). There was a significant difference (Chi-square, $P = 0.01$) between groups in their level of concern with de-

veloping cancer. Those that were given label information regarding antioxidants and soy isoflavones reported being more concerned with developing cancer. It is likely that this label information primed this response and that it does not reflect a true difference between the subject groups.

There was a significant difference in the overall liking between the 3 products (ANOVA, $P < 0.0001$): the soy-enhanced tomato juice was liked significantly less than Campbell's tomato juice and the V8 juice (Scheffé's, $P < 0.05$), which did not differ significantly from each other (Scheffé's, $P > 0.99$). Whereas about 74% of the 100 judges liked the Campbell's and the V8 juices, only about 20% liked the soy-enhanced tomato juice (Figure 2). Label information did not significantly alter overall liking (ANOVA, $P = 0.41$), nor was there a significant interaction between the label information and products (ANOVA, $P = 0.42$). Similarly, label information did not alter the comparison of each product's attributes to the ideal product's attributes (as estimated by Thurstonian Ideal Point modeling). It is possible that, similar to Kahkonen and others (1997), the reason that the label information did not impact overall liking or attribute acceptability was because consumers already consider tomato juice to be a nutritional product.

Comparison of each product's attributes to the ideal product's attributes (as estimated by Thurstonian Ideal Point modeling) indicated that V8 and Campbell's were significantly different from the ideal product for 3 attributes—saltiness, red color, and brown color (Chi-square, $P < 0.05$). Soy-enhanced tomato juice was significantly different from the ideal product for all attributes assessed (Chi-square, $P < 0.05$). Consumers rated the soy-enhanced tomato juice as having too little tomato flavor, thickness, and red color. Some of the judges believed that the soy-enhanced tomato juice had too little salt and brown color and others believed that the juice had too much salt and brown color. Overall, the soy-enhanced tomato juice is further from the ideal than the commercially available products, and label information did not impact either these assessments or overall liking. Thurstonian Ideal Point modeling also estimated d' , which in this instance is a measure of the distance between the ideal attribute level and the product's attribute level in units of standard deviation (Figure 3).

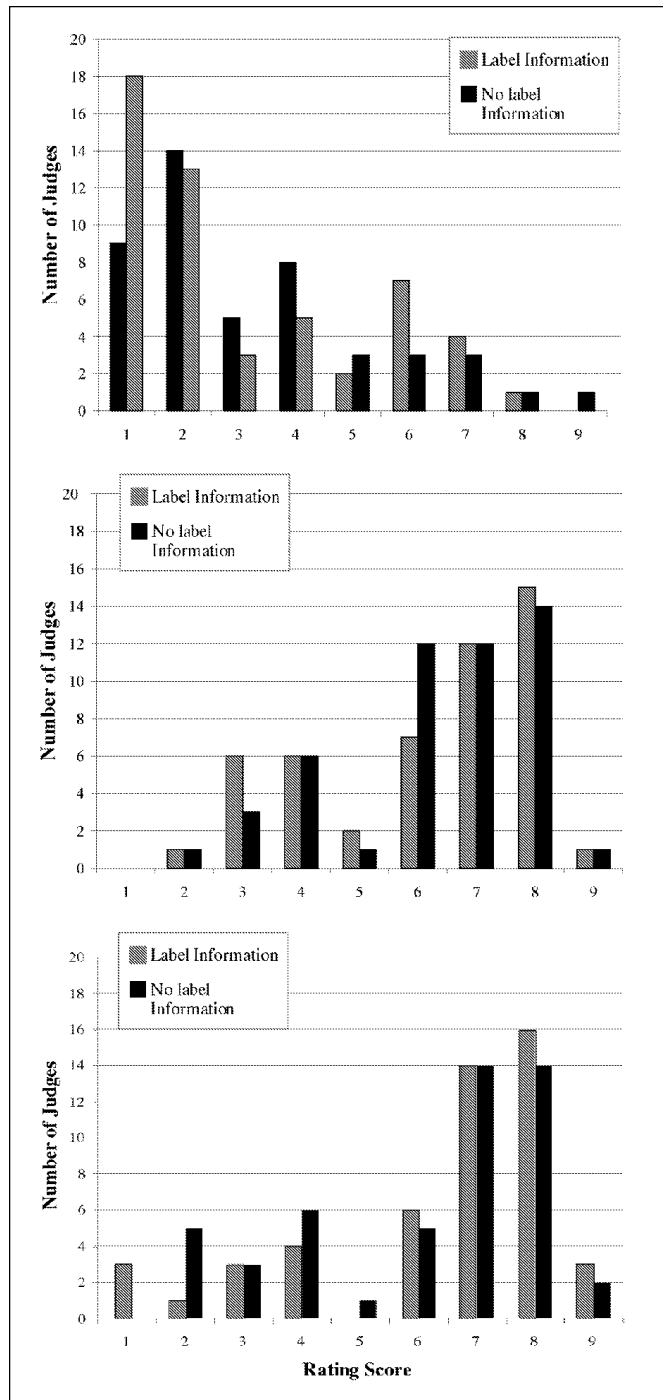


Figure 2—Frequency distribution of liking ratings for all 100 judges for soy-enhanced tomato juice (top), Campbell's tomato juice (middle), and V8 juice (bottom) (1 = dislike extremely and 9 = like extremely)

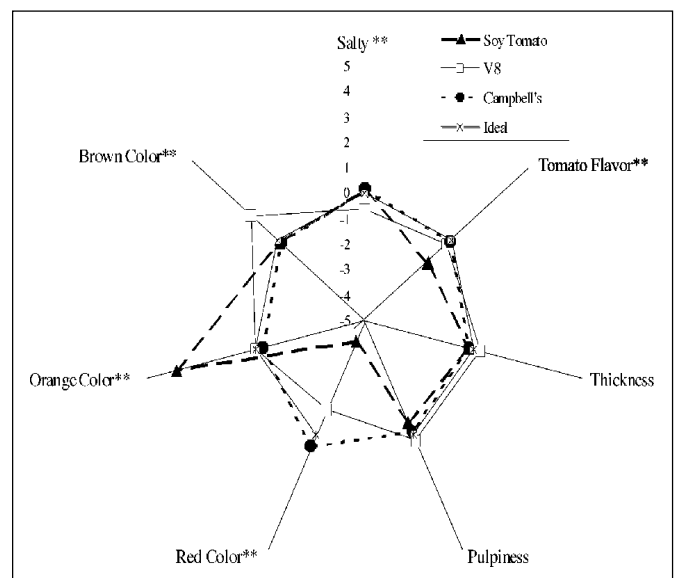
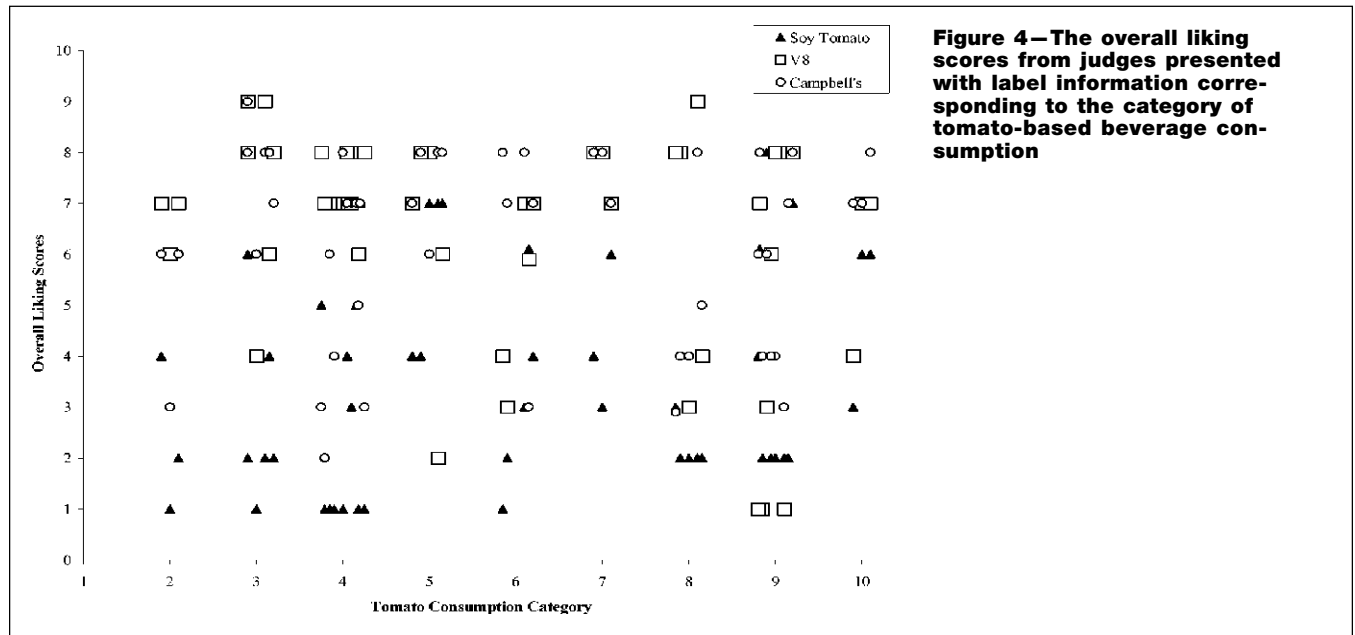


Figure 3—Radar plot with average d' values of products for absence and presence of label information (P value ≤ 0.01)**



These findings suggest that a tomato juice enhanced with 45 mg of soy isoflavones is unlikely to be a commercially successful product.

Generally, demographic groups did not differ in their liking ratings. No significant difference in overall liking was found between men and women, age groups, or ethnic groups (ANOVA, $P > 0.05$). In addition, no significant difference was found between individuals grouped by consumption frequency of soy-containing foods, frequency of seeking food products with health benefit claims, level of interest in using food to prevent diseases, or level of concern with developing cancer (ANOVA, $P > 0.05$). The only significant interaction found between the demographic factors and overall liking was frequency of tomato-based beverage consumption (ANOVA, $P = 0.02$). Consumers who were presented with the label information and who reported consuming tomato-based beverages often (1 to 4 times/wk) liked the soy-enhanced tomato juice less than those who reported consuming tomato-based beverages 1 time/mo to never (ANOVA, $P = 0.02$) (Figure 4). However, no difference was seen between high and low frequency tomato juice consumption groups when consumers were not presented with the label information (ANOVA, $P = 0.57$). There was also no significant difference found between the overall liking and the consumption of tomato-based beverages when all the data was analyzed (both presence and absence of label information) ($P = 0.39$).

Conclusions

Tomato juice product rich with soy and lycopene could bring many health benefits to those who consume it. However, providing nutritional information about the product does not increase its liking by consumers, nor does it make attribute levels more acceptable. Therefore, labeling a product with nutritional information does not guarantee that an inferior product will become more acceptable.

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