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# Labeling of Vanilla Type Affects Consumer Perception of Vanilla Ice Cream

APRIL R. PARKER AND MARJORIE P. PENFIELD

**ABSTRACT:** The effects of labeling vanilla type on consumer liking of vanilla ice cream were evaluated. Three experiments with 144 to 150 panelists using 4 commercial ice creams were done where the samples were initially not labeled with the type of vanilla flavoring, then labeled, and finally labeled either correctly or incorrectly. Three experiments (116 to 150 panelists) then were conducted similarly for 3 laboratory-made ice creams. When the 4 commercial samples were not labeled, a natural vanilla-flavored sample was liked less ( $P < 0.05$ ) than mixed-flavored samples overall; when labeled, the naturally flavored and 1 of the mixed-flavor ice creams were liked equally overall ( $P > 0.05$ ). Products labeled "natural" (correctly or incorrectly) were liked more ( $P < 0.05$ ) overall than products with other labels. When laboratory-made ice creams (natural, artificial, mixed flavored) were evaluated, the labeled, naturally flavored sample was liked more than the unlabeled sample overall; when labeled, the artificially flavored ice cream was liked less than the unlabeled sample. Labeling was shown to affect consumer liking.

**Keywords:** ice cream, vanilla, labeling, preferences, consumers

## Introduction

Today, ice cream is a favorite comfort food of many people. It is a combination of milk, sweeteners, emulsifiers, stabilizers, and flavorings that are frozen to meet the Code of Federal Regulations (USFDA 2001). The effects of these ingredients have been studied and discussed (Guinard and others 1996, 1997; Marshall and Arbuckle 1996; Abd El-Rahman and others 1997; Baer and others 1997; Li and others 1997; Miller-Livney and Hartel 1997; Andreassen and Nielsen 1998; Ohmes and others 1998; Walstra and others 1999). Vanilla with its many variations is the most abundantly sold flavor of ice cream in the United States (Goff 2000). Each species of natural vanilla has unique characteristics that can be used to create individualized flavors. Synthetically made vanilla can also be added to food products to increase the variations available as well as lower the cost of production.

Labeling of products is a marketing tool that can affect consumer decisions to buy a product, whether it is a new product that the consumer wants to try or a product that the consumer believes to have added benefits. Labeling has been shown to influence the purchase of a variety of items by Rice (1995) and Light and others (1992). Jacoby and others (1971) found that extrinsic factors not intrinsic factors (taste, texture, and aroma) affect consumer product choices. In addition, Wansink and Park (2002) conducted a study to determine whether ingredient labels "contains soy protein" versus "contains protein" and health claims "may reduce heart disease" versus "no claim" could influence consumer perception of a nutrition bar that did not contain soy. They concluded that labeling can influence consumer perception, but labels do not influence all consumers equally. Alternatively, Bower and Turner (2001) found that liking had more effect on purchase intent than brand, price, or both when dealing with economy and brand name crisp snack foods.

While using "all natural" on product labels is an excellent market-

ing tool, it is of interest to see which type of flavoring (natural, artificial, or a mixture) is liked best by consumers and if labeling can affect consumer perception. Therefore, the goals of this research were to (1) determine which of 4 commercial ice creams containing different types of vanilla flavoring is liked best by consumers, (2) ascertain whether consumer perception of commercial ice cream can be affected by labeling (correctly or incorrectly) the type of vanilla used in the product, (3) investigate the type of vanilla flavoring liked best by consumers in laboratory-produced ice cream adjusted for the effect of other ingredients on flavor, and (4) discover the effect of labeling (correctly or incorrectly) on vanilla ice cream made with the same base mix but with different vanilla flavorings.

## Materials and Methods

### Experiments with commercial ice cream

Three experiments were conducted using 4 regional, commercial vanilla-flavored ice creams to determine which was liked best by consumers and to evaluate whether labeling of vanilla type affects consumer perception. One ice cream contained natural vanilla, one contained artificial vanilla, and the other 2 contained a mixture of natural and artificial flavorings. The 2 mixed-flavor ice creams represented low-priced and high-priced ice creams. The ice cream was bought in a local grocery store, and samples were scooped into individual 59-mL clear plastic cups (Georgia-Pacific) using a nr 30 metal scooper and kept in the freezer overnight until the day of panel. Hedonic testing (degree of liking) of the ice creams was conducted with 9-point scales that ranged from dislike extremely to like extremely for the following attributes: overall, appearance, color, flavor, vanilla flavor, and sweetness. Two 9-point segmented-line scales were used to determine the perceived strengths of vanilla flavor (1 = extremely weak; 9 = extremely strong) and sweetness (1 = not at all sweet; 9 = extremely sweet). In experiments IA and IB, a scorecard was given to the panelists to establish their "ideal" strengths of vanilla flavor and sweetness. This technique was adapted from Szczesniak and others (1975). In their method, panelists were given a scorecard and no product. They were asked to indicate the values

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they would assign to their “ideal” product. This provides a basis for determining how well products meet consumer expectations. Panelists also were asked age and gender as well as how often they ate ice cream and vanilla ice cream.

Student, staff, and faculty from the entire university campus were used as panelists for all experiments. Approximately 66% of the panelists were female for all the panels, with 58% of the panelists being between age 20 and 29 y. The majority (90% to 91%) of the panelists reported eating ice cream at least once a month or more often with 89% to 92% of them eating vanilla ice cream once every 2 to 3 mo or more often. In The Univ. of Tennessee Sensory Laboratory, samples were individually presented under cool white fluorescent lighting. For experiments A, B, and C, each panelist was presented with a tray containing a glass of water, a spoon, and paper scorecards. For all experiments, the samples were served individually to each panelist.

### Experiment IA—no labeling of vanilla type

Seventy-two panelists each received all 4 samples of commercial ice cream in balanced order to create a complete balanced design. This experiment was replicated several months later, and data were combined for analysis. Panelists were asked to identify the type of vanilla in each sample.

### Experiment IB—labeling of vanilla type

Seventy-two panelists were used to create a balanced design. The same 4 commercial ice creams were used again with each sample being labeled with the type of vanilla—natural, artificial, or a mixture of natural and artificial. Each panelist received all 4 samples of ice cream in balanced order. This experiment was replicated several weeks later, and data were combined for analysis.

### Experiment IC—labeling (correctly or incorrectly) of vanilla type

For Experiment IC, an incomplete block design was used with 150 panelists over a 2-d period using the same 4 commercial ice creams. The ice cream was labeled (either correctly or incorrectly) with the type of vanilla—natural, artificial, or a mixture of artificial and natural—for a total of 12 treatments. Each panelist received 4 samples of ice cream individually to evaluate.

### Data analyses

For each experiment, the data were entered in SAS version 8.02 for statistical analysis (SAS Inst., Cary, N.C., U.S.A.). The General Linear Models procedure (PROC GLM), analysis of variance (ANOVA), mean separation by least significant differences (LSD), and frequency techniques were used for data analyses. Experiments IA and IB both had panels conducted in separate months; therefore, the month was considered a fixed effect with month, flavor system, and their interaction being evaluated for significance using PROC GLM. For experiment IC, flavor system, labeling condition (correct or incorrect) and their interactions were analyzed. Additionally, data from experiments IA and IB were combined to directly answer questions about the effect of labeling on consumer liking. PROC GLM was used for analysis with the (PDIFF) option used for mean separation. The model for this analysis included flavor system, labeling condition, and their interaction. For experiment IC product, label, product  $\times$  label, and judge were included in the model to determine the effects of correctly or incorrectly labeling the products.

### Experiments with ice cream made with the same base ingredients

A base mix was used for further experimentation to adjust for the

effect of other ingredients on flavor. A standard 14% fat ice cream mix that did not contain any flavoring was obtained from Purity Dairies (Dean Foods, Nashville, Tenn., U.S.A.) and used to make ice cream. Artificial and/or pure vanilla extract (2-fold) obtained from Van Labs (Rochester, N.Y., U.S.A.) were added to the ice cream mix. Ice cream was made from the mix 1 d before the sensory panel using an ice cream maker (Cuisinart model Ice 20, East Windsor, N.J., U.S.A.). Amounts of vanilla used were determined in a series of ranking tests (Parker 2003). To make the ice cream, 750 mL of the base mix were put into the ice cream maker with 10 mL of artificial or natural flavoring or 5 mL of each. The mixer was run 20 min. The ice cream was scooped using a nr 40 plastic scooper, put into 59-mL clear plastic cups with lids that were labeled with random 3-digit numbers, placed into plastic boxes, and then hardened in a freezer at  $-19^{\circ}\text{C}$ . The average overrun across all the ice creams was 23%. Each panelist was presented with a tray containing a glass of water and a spoon. Computer scorecards (Biosystemes 2002) asked the same questions as described for experiment I.

There were slightly more females than males on the panels. The largest age group was 20 to 29 for all the panels. Most (88% to 93%) of the panelists reported eating ice cream once a month or more often. Vanilla ice cream was eaten once every 2 to 3 mo or more often by 86% to 93% of the panelists.

### Experiment IIA—no labeling of vanilla type

The experiment had a balanced design with 60 panelists getting each of the 3 samples. Each panelist completed an ideal scorecard and then evaluated each of the 3 samples individually. A repetition of this experiment was performed and the data were combined for analysis.

### Experiment IIB—labeling of vanilla type

Experiment IIB was a balanced design with 60 panelists where the panelists received each of the 3 samples of ice cream that were labeled with the type of vanilla used. The samples were served and evaluated individually. An ideal scorecard was also completed. A repetition of this experiment was performed, and the data were combined for analysis.

### Experiment IIC—labeling (correctly or incorrectly) of vanilla type

Experiment IIC was an incomplete block design conducted during a 2-d period. Each of 150 panelists received 3 samples. The ice creams were labeled (correctly or incorrectly) with the type of vanilla flavoring for a total of 9 treatments (3 flavors  $\times$  3 labels). The samples were individually served.

### Data analyses

Data for experiments IIA, IIB, and IIC were exported from FIZZ (Biosystemes 2002) to an Excel file and then transferred to SAS version 8.02 for analysis. PROC GLM with the PDIFF option was used for determination of main effects, their interaction, and mean separation. Differences were deemed significant at  $P < 0.05$ . As with experiments IA and IB, data from experiments IIA and IIB were combined for further analysis.

## Results and Discussion

### Experiments with commercial ice cream

**Experiment IA—no labeling of vanilla type.** Two panels were conducted in May and October 2001 with the same brands of ice creams being used for each test. There were significant interactions between month and flavor system for appearance, color, and flavor.

Appearance and color of the mixed flavored sample 2 was liked more in October (7.5) than in May (6.9). Hedonic color scores for mixed flavor 2 were higher in October (7.5) than in May (7.1). The flavor of the naturally flavored ice cream was liked more in May than October. The ingredient list and nutrition label information did not differ between months for the 4 commercial ice creams; therefore, the differences in hedonic scores between the month could be explained by production differences and/or differences in panel composition.

As shown in Table 1 with no product  $\times$  time interactions, the combination of data from May and October resulted in the overall liking mean value for both mixed flavored ice creams and the artificial ice cream being close to "liked moderately." From these panels, the results show that the naturally flavored ice cream was liked less overall than the ice creams containing a mixture of flavorings. There were no differences in the overall likeability between the artificial and natural flavored ice creams. The naturally flavored ice cream was liked less for vanilla flavoring than the other 3 samples. This may reflect a dislike for the underlying rummy notes associated with the flavor of bourbon vanilla used in the commercial ice cream (Webster 1995). There were no differences in hedonic scores for sweetness.

The ideal strength of vanilla flavor (6.5) as indicated by the panelists was not met by any of the commercial ice creams (4.8 to 5.8). This suggests that the manufacturer may want to increase the level of vanilla flavor in their products. For strength of sweetness, both the artificial (5.7) and mixed ice cream 1 (5.9) did not differ from the ideal with all 3 being sweeter than the other 2 products (5.1). There was a time difference ( $P < 0.05$ ) for strength of vanilla flavor with October (5.7) having a higher overall mean across all products than May (5.3).

Only 17% of the panelists correctly identified the naturally flavored ice cream. In contrast, 56% of the panelists correctly identified the artificially flavored ice cream. This may reflect the fact that the intensities of vanilla in these products were not as high as premium ice creams with natural vanilla flavor or panelists may associate the alcohol (medicinal) flavor of natural vanilla with an artificial flavor. Forty-seven percent of the panelists identified the naturally flavored ice cream as containing artificial flavoring and approximately 50% of the panelists called the mixed flavored ice creams artificial.

**Experiment IB—labeling of vanilla type.** As shown in Table 2, the addition of the label altered the results when compared with Experiment IA results. No month  $\times$  product interactions or month differences occurred ( $P > 0.05$ ). Like patterns of difference for overall, flavor, and sweetness hedonic scores are seen. Both mixed-flavored ice creams were liked more than the artificially flavored ice cream. The naturally flavored ice cream and mix 2 were liked the same, and the naturally flavored ice cream was liked the same as the artificially flavored ice cream. There were no differences among the samples for appearance and color. For vanilla flavor, mixed-flavored ice cream 1 was liked more than all the other ice creams. The natural and mixed 2 ice creams were liked the same for vanilla flavor, and the naturally flavored ice cream was liked the same as the artificially flavored one.

As in Experiment IA, the perceived ideal (6.8) was stronger in vanilla flavor than any of the commercial ice creams (4.9 to 6.4), indicating that the consumer's expectations were not met. The ideal was not different from mixed-flavored ice cream 1 for strength of sweetness but differed from the other 3 ice creams. The ideal (6.2) and mix 1 (5.9) were sweeter than the other 3 ice creams (5.2 to 5.5).

**Combined data—Experiments IA and IB.** Results from the analysis of the combined data from the 2 experiments are shown in Table

**Table 1—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 4 unlabeled, commercial vanilla ice creams evaluated by consumer panels in May and October 2001 (Experiment IA,  $n = 144$ )**

	Type of vanilla used in ice cream			
	Natural	Artificial	Artificial/ natural mix 1	Artificial/ natural mix 2
Overall	6.2b	6.6ab	6.8a	6.7a
Vanilla flavor	5.9b	6.4a	6.6a	6.5a
Sweetness	6.3a	6.4a	6.6a	6.6a

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values in the same row with like letters are not significantly different at  $P > 0.05$ .

**Table 2—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 4 labeled, commercial vanilla ice creams evaluated by consumer panelists (Experiment IB,  $n = 144$ )**

	Type of vanilla used in ice cream and indicated on label			
	Natural	Artificial	Artificial/ natural mix 1	Artificial/ natural mix 2
Overall	6.8bc	6.5c	7.3a	7.0ab
Appearance	7.6a	7.4a	7.5a	7.3a
Color	7.4a	7.3a	7.5a	7.4a
Flavor	6.7bc	6.4c	7.2a	6.9ab
Vanilla flavor	6.5bc	6.1c	7.2a	6.8b
Sweetness	6.7bc	6.4c	7.1a	6.9ab

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values within the same attribute with like letters are not significantly different at  $P > 0.05$ .

**Table 3—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 4 commercial vanilla ice creams unlabeled and labeled with vanilla type as evaluated by consumer panelists (Experiment IA and IB,  $n = 144$ )**

Attribute	Label Condition	Type of vanilla used in ice cream			
		Natural	Artificial	Artificial/ natural mix 1	Artificial/ natural mix 2
Overall	No label	6.2d	6.6cd	6.8bc	6.7bc
	Labeled	6.8bc	6.5d	7.3a	7ab
Flavor	No label	7.2bc	7.1c	7.4abc	7.2bc
	Labeled	7.6a	7.4abc	7.5ab	7.3bc
Vanilla flavor	No label	5.9d	6.4bc	6.7b	6.5b
	Labeled	6.5bc	6.1cd	7.2a	6.7b

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values within the same attribute with like letters are not significantly different at  $P > 0.05$ .

3. Interaction means for which there were significant differences are reported. With labeling, overall liking scores increased for the naturally flavored product and for mixture 1. Scores did not change for the other 2 products. A similar pattern was seen for the liking of the vanilla flavor. Hedonic scores for naturally flavored product increased but did not change for the other products. These data clearly indicate the effects of labeling on the liking of ice creams with various vanilla types.



**Table 4—Least-squares mean hedonic and intensity values<sup>a</sup> for several sensory characteristics of vanilla ice cream labeled correctly and incorrectly with a type of flavoring across 4 ice creams as evaluated by 150 consumer panelists (Experiment IC)**

	Label assigned to ice cream		
	Natural <sup>b</sup>	Artificial <sup>b</sup>	Both artificial and natural <sup>b</sup>
Overall <sup>c</sup>	7.1a	6.5b	6.8b
Appearance <sup>c</sup>	7.3a	6.9b	7.2a
Color <sup>c</sup>	7.2a	6.9b	7.1ab
Flavor <sup>c</sup>	7.0a	6.5b	6.7ab
Vanilla flavor <sup>c</sup>	6.9a	6.2b	6.5b
Sweetness <sup>c</sup>	6.8a	6.5a	6.6a
Strength of vanilla flavor <sup>d</sup>	5.4a	5.0b	5.4a
Strength of sweetness <sup>e</sup>	5.5a	5.4a	5.5a

<sup>a</sup>Values within the same attribute with like letters are not significantly different at  $P > 0.05$ .

<sup>b</sup> $n = 150$  for natural and artificial and 300 for both artificial and natural.

<sup>c</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>d</sup>Scale ranged from 1 = extremely weak to 9 = extremely strong.

<sup>e</sup>Scale ranged from 1 = not at all sweet 9 = extremely sweet.

**Table 6—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 3 labeled, laboratory-produced vanilla ice creams labeled with type of vanilla as evaluated by consumer panelists (Experiment IIB,  $n = 120$ )**

	Label assigned to ice cream		
	Natural <sup>b</sup>	Artificial <sup>b</sup>	Both artificial and natural <sup>b</sup>
Overall	7.1a	6.3b	7.0a
Appearance	7.0a	7.0a	7.2a
Color	7.0a	7.1a	7.1a
Flavor	6.9a	6.2b	6.9a
Vanilla flavor	6.7a	6.1b	6.8a
Sweetness	6.7a	6.4a	6.7a

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values within the same attribute with like letters are not significantly different at  $P > 0.05$ .

#### Experiment IC—labeling (correctly or incorrectly) of vanilla type.

No product  $\times$  label interaction was found for any of the attributes. Across labels, no differences in hedonic scores occurred among the products overall, or for flavor, vanilla flavor, and sweetness. For appearance, the artificially and naturally flavored ice creams were liked more than the mixed-flavored samples. For color, the artificially and naturally flavored samples were liked equally and more than the other 2 samples. For strength of vanilla flavor, the naturally flavored and the mixed flavor 1 products were perceived as stronger than the other samples. For sweetness, the naturally flavored and mixed-flavored 1 products were perceived as sweeter than the artificially flavored product.

When looking at the effect of labeling independent of product type, ice cream labeled “natural” was liked more overall and for vanilla flavor than the ice creams labeled “artificial” or “both artificial and natural” (Table 4). Ice creams labeled as containing “both artificial and natural” flavorings did not differ overall or for vanilla flavor from the ice cream labeled “artificial.” For appearance, the ice creams labeled “natural” and “both artificial and natural” were liked the same and more than the ice cream labeled “artificial.” For color and flavor, ice creams labeled “natural” were liked the same as the ice cream labeled as having “both artificial and natural” flavorings. The ice creams labeled “artificial” and “both artificial and natural”

**Table 5—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 3 unlabeled, laboratory-produced vanilla ice creams as evaluated by consumer panelists (Experiment IIA,  $n = 116$ )**

	Type of vanilla used in ice cream		
	Natural <sup>b</sup>	Artificial <sup>b</sup>	Both artificial and natural <sup>b</sup>
Overall	6.1b	6.7a	6.8a
Color	6.7b	7.3a	7.2a
Flavor	5.9b	6.6a	6.7a
Vanilla flavor	5.8b	6.5a	6.5a
Sweetness	6.0b	6.6a	6.5a

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values within the same attribute with like letters are not significantly different at  $P > 0.05$ .

were liked the same for color and flavor. No matter which label was applied, all products were liked the same for sweetness and perceived as equal in strength of sweetness. For strength of vanilla flavor, there was no perceived difference between the ice creams labeled “natural” or “both artificial and natural” but the ice cream labeled “artificial” was perceived to have a weaker vanilla flavor than the other 2 samples.

#### Experiments with ice cream made with the same base ingredients

**Experiment IIA—no labeling of vanilla type.** There was a product  $\times$  d interaction for appearance ( $P < 0.05$ ). The naturally flavored sample on day 2 (6.4) was liked more than the others (7.0 to 7.2). As shown in Table 5, across days, the naturally flavored ice cream was liked less than the other 2 products overall and for all attributes. The other 2 products did not differ significantly for these attributes. There were no differences among the samples and the ideal for strength of vanilla flavor or strength of sweetness, reflecting selection of levels of vanilla to give equal intensity and use of the same base.

**Experiment IIB—labeling of vanilla type.** There were no day or day  $\times$  system interactions. As shown in Table 6, for appearance, color, and sweetness there were no differences among the 3 samples. Overall and for flavor and vanilla flavor, the naturally flavored ice cream was liked the same as the mixed-flavored ice cream, and both were liked more than the artificially flavored ice cream.

The ideal did not differ from the naturally flavored ice cream or the mixed flavored ice cream for strength of vanilla flavor. The artificially flavored ice cream (5.9) was not as strong as the ideal (6.5) for strength of vanilla flavor. Labeling thus may influence perception of flavor strength. The ideal did not differ from any of the products for strength of sweetness. There was a day difference for strength of sweetness with day 1 having a higher mean average (6.2) than day 2 (5.8).

**Combined data—Experiments IIA and IIB.** When the data for these 2 experiments were combined (Table 7), hedonic scores for all attributes of the naturally flavored ice cream increased when the products were labeled with vanilla type. For the artificially flavored product, overall and flavor scores decreased when the product was labeled. Labeling did not affect hedonic scores for the mixed flavor system samples.

**Experiment IIC—labeling (correctly or incorrectly) of vanilla type.** There were no interactions between label and vanilla type. As shown in Table 8, the ice cream labeled natural was not liked as much as the other 2 samples overall, for flavor, or for vanilla flavor.

**Table 7—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 3 laboratory-produced vanilla ice creams unlabeled and labeled with vanilla type as evaluated by consumer panelists (Experiment IIA, *n* = 120; Experiment IIB, *n* = 116)**

Attribute	Label condition	Type of vanilla used in ice cream		
		Natural <sup>b</sup>	Artificial <sup>b</sup>	Both artificial and natural <sup>b</sup>
Overall	No label	6.1b	6.7a	6.9a
	Labeled	7.1a	6.3b	7.0a
Color	No label	6.7d	7.3ab	7.3ab
	Labeled	7.1c	7.1bc	7.1abc
Flavor	No label	6.2bc	6.0bc	6.2bc
	Labeled	6.6a	5.9c	6.3a
Vanilla flavor	No label	5.8b	6.5a	6.8a
	Labeled	6.7a	6.0b	6.6a
Sweetness	No label	6.0c	6.9ab	6.5ab
	Labeled	6.7a	6.4bc	6.7a

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values within the same attribute with like letters are not significantly different at *P* > 0.05.

For appearance and sweetness, the ice creams labeled artificially and mixed flavored did not differ significantly. For those attributes, the ice cream labeled natural was not liked as much as the one labeled mixed, but did not differ from the one labeled artificially flavored. For color, the ice cream labeled artificially flavored did not differ from the samples labeled mixed flavored, but was liked more than the ice cream labeled natural. The samples labeled mixed and naturally flavored did not differ from the naturally flavored did not differ. There were no significant differences among the ice cream samples, separated by label, for strength of vanilla flavor or for strength of sweetness.

### Conclusions

Based on this study, labeling of the type of vanilla flavoring used in ice cream can have an effect on consumer perception of ice cream. Like trends were seen for commercial ice creams and the laboratory-produced ice creams where no label was applied to the samples and the experiments where an accurate label was applied. Without any label present on the commercial or laboratory-produced samples, the naturally flavored ice cream was not liked as much as the other ice creams; yet, when the ice cream was labeled, the naturally flavored ice cream was liked as well as or better overall than the other samples.

It is up to the manufacture to decide if the advantages of 1 type of flavoring outweigh the disadvantages. Should the price of natural vanilla continue to rise and/or manufacturers no longer find it cost-effective, further research may be needed in the market place to determine if it is the label, the taste likeability, the price, or other factor that most strongly affects consumer purchasing of vanilla ice cream.

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**Table 8—Least-squares mean hedonic values<sup>ab</sup> for several sensory characteristics of 3 labeled, laboratory-produced vanilla ice creams (across 3 types-artificial, natural, and both artificial and natural flavor) evaluated by consumer panelists (Experiment IIIC, *n* = 150)**

	Label on ice cream		
	Natural <sup>b</sup>	Artificial <sup>b</sup>	Artificial and natural mix
Overall	6.1b	6.9a	6.9a
Appearance	6.9b	7.1ab	7.2a
Color	6.9b	7.2a	7.0ab
Flavor	5.8b	6.7a	6.8a
Vanilla flavor	5.8b	6.7a	6.8a
Sweetness	6.2b	6.5ab	6.7a

<sup>a</sup>Scale ranged from 1 = extremely dislike; 2 = dislike very much; 3 = dislike moderately; 4 = dislike slightly; 5 = neither like nor dislike; 6 = like slightly; 7 = dislike moderately; 8 = like very much; 9 = extremely like.

<sup>b</sup>Values within the same attribute with like letters are not significantly different at *P* > 0.05.

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