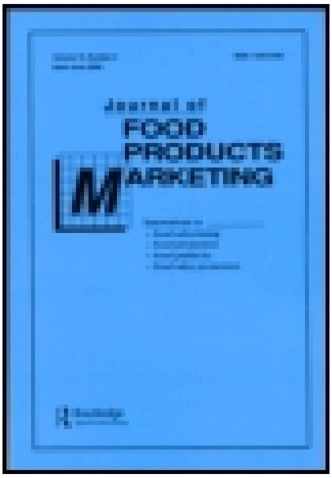

Journal of Food Products Marketing
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/wfpm20

The Effects of Food Color on Perceived Flavor: A Factorial Investigation in India

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Published online: 22 Jan 2015.

Journal of Food Products Marketing, 00:1–20, 2015

ISSN: 1045-4446 print/1540-4102 online
DOI: 10.1080/10454446.2014.885864

Routledge
Taylor & Francis Group

The Effects of Food Color on Perceived Flavor: A Factorial Investigation in India

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We extend research testing the effects of food color on flavor to a new cultural setting—India. We test color's effect at three levels: flavor identification, perception, and preference. One hundred twenty-two graduate students at an Indian business school enrolling students from all parts of India were assigned the task of tasting and evaluating an orange-flavored carbonated water. Color at two levels (purple and orange) and label information at two levels (told orange flavor, told grape) were manipulated in a full factorial, between-subjects design. Results confirm that food color affects the consumer's ability to correctly identify flavor as well as to form distinct flavor profiles and preferences. Food color dominates other flavor information including labeling and taste, though the strength of the effect is less pronounced in this setting. Strategic alternatives for the effective deployment of food color for promotional purposes are recommended.

KEYWORDS *food color, flavor, taste test, consumer choice, culture, India*

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INTRODUCTION

The primacy of food color in determining consumer response to flavor in color-associated foods has been repeatedly demonstrated in a number of studies (e.g., Spence, Levitan, Shankar, & Zampini, 2010) conducted in Western societies—referring to Europe and those countries whose predominant peoples, history, and culture stem from Europe, including the Americas and Australasia. We extend this research to India, whose consumers follow a different culinary tradition and whose sensibilities concerning the association between food color and flavor may have formed in a manner that may diverge from their Western counterparts. Would such differences result in different food color–flavor relationships?

Though human response to color is known to be universal and robust, colors' meanings—that is, the particular meanings attributed to specific colors—are geographically and culturally based (Wagner, 1988); therefore, people in different cultures around the globe perceive and evaluate colors differently (Schmitt & Simonson, 1997). This difference has been shown to hold for the evaluation of products across many categories (Akcay, Dalgin, & Bhatnagar, 2011), though we know of no concomitant research examining the cultural effects of food color. There is reason to believe, however, that culture does indeed impact food color. Consider, for example, the use of food color for decorative purposes, a common practice in India for occasions including festivals and marriages. This practice underscores the impact of culture on food color, whose interpretation may differ across cultures.

Though food scientists, psychologists, and chemical sense researchers have empirically examined various aspects of the effects of food color on flavor identity and perception, marketing research on the topic remains rather sparse; it is not theory-based, and, as a body, it is limited. Most prior food color research implicitly or explicitly treats food color as a direct sensory experience (Shankar et al., 2010). Some recent research points out, however, that there is a memory component to food color's effect, indicating that food color's effect is also cognitive (Shankar et al., 2010; Skrandies & Reuther, 2008), a function of expectations (Levitan, Zampini, Li, & Spence, 2008) and culture (Garber et al., 2001). The fact that culture mediates color–flavor interactions constitutes a limitation to prior research because the majority of prior empirical food color research to date originates from Western countries.

It is our purpose, therefore, to extend this research beyond the sphere of Western culture in order to test the universality or specificity of prior food color/flavor research (van Raaij, 1978). We do so by replicating the taste test experiment of Garber et al. (2001) in India, who, in the United States, tested the effects of beverage colors on flavor at three different phases of the process leading to consumer choice: identification, perception or meaning, and liking. This approach affords us a cross-cultural comparison at three levels.

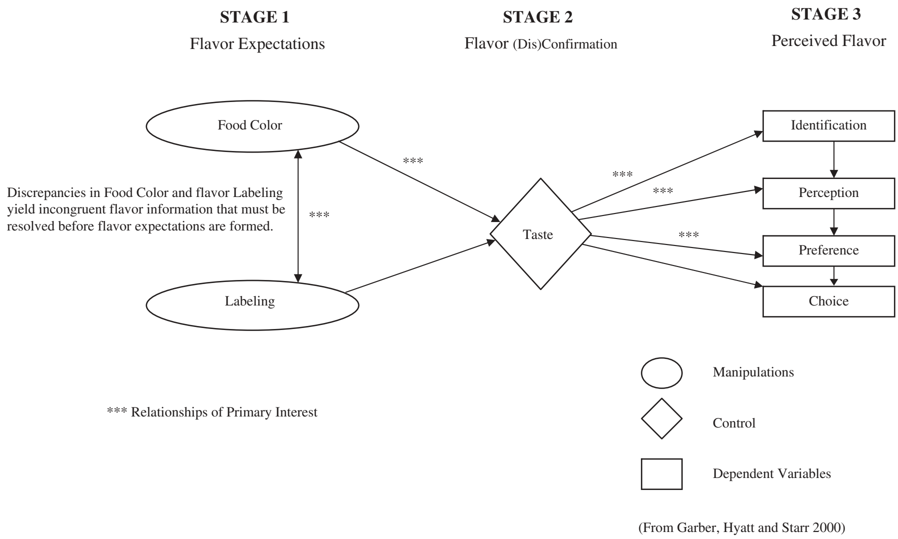

FIGURE 1 The relationship between the three forms of flavor information and their effects on stages of consumer choice. Reproduced with permission.

CONCEPTUAL DEVELOPMENT

Staged Models of Choice

We consider food color to affect the consumer at each of several stages in the choice process, as shown by the process model in Figure 1. There is much evidence that consumers go through a multistage decision process when making a purchase (Lussier & Olshavsky, 1979). Following Roberts (1989), we present individual-level choice as a phased process represented by a series of nested stages where behavior at each stage is conditioned by the events of previous stages. Food color and labeling are proposed to have main and interaction effects on flavor identification, flavor perception, and flavor preference formation, respectively.

The Effect of Uncharacteristic Food Color

Several studies from the food science and sensory literatures have demonstrated empirically, in a laboratory setting, that food color aids correct flavor identification by showing that recognition is diminished when the characteristic colors of food products are altered (cf. DuBose, Cardello, & Maller, 1980; Hyman, 1983; Stillman, 1993). These empirical results may be extended to a consumer setting. For example, Pepsi Gold, an amber-colored cola with a "hint of lemon" was introduced in India at the time of the 2007 World Cricket Championships, signifying the gold-colored World Cup Trophy. Its failure has been attributed to a lack of acceptance of a cola as anything but dark brown in color. We therefore propose the following main effect for food color on flavor identification:

H1a: Characteristic beverage color aids correct flavor identification.
H1b: Uncharacteristic beverage color degrades correct flavor identification.

The Interaction of Food Color and Taste as a Source of Flavor Information

Additionally, the aforementioned empirical results indicate the relative dominance of the food color stimulus over the taste stimulus by showing that, when presented with uncharacteristic food color, the tendency is to recognize a flavor that is typically associated with that color, rather than the correct flavor (Skrandies & Reuther, 2008; Wei, Ou, Luo, & Hutchings, 2012). We therefore posit the following effect of uncharacteristic color on (incorrect) flavor identification:

H2: Uncharacteristic beverage color is a flavor identification cue for a flavor that is normally associated with that color, rather than the correct flavor.

The Interaction of Food Color and Labeling as a Source of Flavor Information

Food color is typically not the only source of flavor information available to the consumer in the store. In particular, flavor information is provided as text on the label, particularly in product categories where there is more than one flavor. As indicated in Figure 1, we expect labeling to have main effects on flavor perception similar to food color, as well as an interaction effect with food color. Since the subject of our study is food color, we examine only labeling's interaction with food color, leaving the study of its main effects to future research.

Since we can expect that flavor information on labels is always correct, labeling and characteristic food color are always congruent, and they mutually reinforce specific flavor expectations in color-associated foods. Given label constancy, uncharacteristic food color presents the shopper with discrepant, or incongruent, flavor information in color-associated foods. Unlike the relationship between food color and taste, where we expect that relatively vivid and primary color sensations dominate the relatively hard to categorize and secondary taste sensations that discrepancies between the two will tend to go unnoticed, we believe that discrepancies between food color and labeling will be apparent, creating a tension that the shopper must then resolve in order to form satisfactory flavor expectations (Petty & Cacioppo, 1981).

With respect to food color and labeling, we predict that discrepancies are resolved in favor of food color for two reasons. First, color is the more vivid, affect-loaded, and memorable stimulus (Cheskin, 1957), which the consumer will therefore find more compelling. And, second, in a store setting, food color can be resolved at a greater physical distance than labeling and is therefore processed sooner—namely, as the shopper enters the grocery aisle and is still proceeding toward the target food product (Garber et al., 2001):

H3: When incongruent food color and labeling are presented, the discrepancy will be reconciled in favor of food color.

Effect on Flavor Perception

The aforementioned hypothesized dominance of food color as a source of flavor information over labeling and taste suggest that food color predominates in the formation of flavor perceptions. Therefore, we predict that flavor expectations are indicated by food color, even in the presence of discrepant labeling, and are confirmed by tasting, even if the flavor indicated by the food color is incorrect:

H4: Differently colored versions of otherwise identical foods will evoke distinct flavor profiles.

Effect on Flavor Preference

We propose that incongruent food color and labeling are unusual, blatantly discrepant stimuli when viewed by the consumer in a store context. As such, they would always be viewed as highly rather than slightly incongruent, as well as inconsistent and irrelevant in flavor meaning, and they would therefore tend to be unfavorably evaluated relative to foods presented with congruent food color and labeling.

With respect to uncharacteristic color, given food color's dominance over taste as a source of flavor information, we propose that congruent-uncharacteristic food color will be equally preferred to congruent-characteristic food color. We therefore predict that

H5: The flavors of foods presenting congruent food color and labeling are preferred to those presenting incongruent food color and labeling, regardless of whether the congruent flavor information is a correct or an incorrect signal of true flavor.

A TEST OF THE EFFECTS OF FOOD COLOR AND LABELING LEVELS ON FLAVOR IDENTIFICATION, PERCEPTION, AND PREFERENCE

Though several prior studies demonstrate the effect of food color on flavor, results vary significantly across studies, likely due to differences in the nature of the subject task (Oram, Laing, Hutchinson, Owen, Rose, Freeman, & Newell, 1995). For comparison purposes, we follow the procedure introduced by Garber et al. (2000), who, in the United States, tested the color–flavor association at each of three levels pertinent to the choice process: identification, meaning, and liking. We replicate their taste-test experiment. Specifically, beverage color is manipulated at two levels (orange represents characteristic color, and purple represents uncharacteristic color) and labeling at two levels (orange drink represents correct information, and grape drink represents incorrect information) in a between-subjects design. Flavor is not manipulated for control purposes and for parsimony. All beverage samples are orange-flavored.

Stimulus Development

We use fruit beverage in this empirical research for six reasons: (1) fruit beverage presents no issues concerning condition (i.e., color is not an important indicator of freshness, rancidness, spoilage); (2) it comes in many flavors; (3) fruit beverages are a ubiquitous and familiar product easily evaluated by most international consumers; (4) there is a simple and well-known relationship between fruit colors and the fruit flavors they represent; (5) fruit beverages are uniform in texture and mouthfeel across flavors; and (6) a clear form is commercially available.

The purple- and orange-colored beverages used in this research were created by adding flavorless food dyes to the clear base, according to instructions. To assure that the colors credibly portrayed the fruit drinks they were intended to represent, several subjects who did not participate in the experiment itself were shown samples of each color of the beverage, in plain white cups that neither identified nor characterized the beverages in any way, and were asked to identify them strictly by their appearance. Without exception, they identified the purple drinks as grape and the orange-colored drinks as orange.

The Experimental Setting

There are three critical elements replicated here that allow us to validly measure the effects of food color on perceived flavor perception in a consumer context. They are

- Flavor information typically comes to the consumer in three forms from the time the food or beverage product is first encountered in the store through preparation and consumption. They are food color, labeling, and taste. All three forms must be represented if a consumer context is to be properly presented.

- The three flavor information forms typically encountered by the consumer come in a particular temporal order. Food color and labeling are first encountered in the store, and tasting occurs sometime thereafter.
- To avoid demand artifacts, the subject cannot know that they are deliberately being presented with masked, atypically colored, and mismatched beverages. If they do deduce the real purpose of the experiment, they will then pursue the task of detecting the true flavor of the beverages they sample, rather than the task of evaluating beverages as true product candidates for market introduction.

Subjects and Procedure

In a 2 × 2 between-subjects design, color (correct [orange], incorrect [purple]) and label information (correct [told orange], incorrect [told grape]) were manipulated at two levels. Each subject in the study was assigned to one cell of the experiment, sampling just one of the four color/label treatment levels. Subjects tasted the same orange flavor in all cases.

The subject group represented a convenience sample, solicited from the student ranks of a graduate business school located in northern India, whose enrollment included students from all parts of the country. One hundred and twenty-two graduate students from an Indian business school that enrolls students from all parts of India (30% female and 70% male; 74% between 23 and 25 years of age; 100% between 20 and 28 years of age) were assigned the task of sampling and evaluating a flavored beverage. The drink used was orange-flavored Catch, a rather new yet popular Indian brand of fruit-flavored carbonated water, whose colorless aspect enabled the manipulation of its color for experimental purposes. Brand identity was not revealed. Rather, subjects were told that a New Zealand beverage brand was being launched in India, and the researchers wished to know what Indian consumers thought of it. Each subject was furnished with a 3-oz. white cup served uniformly at room temperature, a cracker to cleanse the palate before tasting, and a survey form to be filled out after tasting. Half of the respondents sampled beverages that were (correctly) labeled orange drink, and half sampled beverages that were (incorrectly) labeled grape drink. That the subjects took notice of the food color, and labeling stimuli was confirmed by posttest debriefing.

The pencil-and-paper survey consisted of five parts. Part A asked respondents about their knowledge and usage of fruit beverage products. Part B asked respondents to rate the drinks they sampled across 13 attitudinal statements (listed in Table 1) on a 5-point Likert-type scale, where 5 indicated strong agreement and 1 indicated strong disagreement. The attribute list was developed from focus groups conducted for this purpose. The list is designed to represent a comprehensive bundle of benefit attributes that collectively define a fruit beverage product, from which an individual beverage

TABLE 1 Flavor Performance Attribute Ratings Ranked by Mean Response Across All Subjects and Conditions[a]

		Mean Ratings[b]
1.	Has a lot of flavor	3.50***
2.	Is very good served with food	3.30***
3.	Has a very crisp taste	3.25***
4.	Has a very clean taste	3.26***
5.	Is very sweet	3.12*
6.	Is very thirst-quenching	3.12*
7.	Is very cooling	3.06
8.	Is very refreshing	3.05
9.	Is very tart	3.00
10.	Is inexpensive	2.90*
11.	Is very wholesome	2.88**
12.	Is very good for me	2.80***
13.	Contains all-natural ingredients	2.61***

[a]Rank ordered by mean rating.
[b]As measured on a 5-point scale, where 5 means *strongly agree*, 1 means *strongly disagree*, and 3 means *indifferent* or *don't know*.
***Significantly different from a mean rating of 3 at a level of .0005.
**Significantly different from a mean rating of 3 at a level of .005.
*Significantly different from a mean rating of 3 at a level of .05.

profile may be derived, according to the method prescribed by Wilkie and Pessemier (1973).

According to those mean ratings, respondents generally found the beverage they sampled to be very flavorful, to be good with food, have a crisp, clean taste, and to be rather sweet and thirst-quenching. They did not judge it to be natural, good for you, wholesome, and not inexpensive. This same general attribute profile applies across all respondent groups and manipulation levels, and it is similar to that obtained by Garber et al. (2001) for their U.S. student sample; who also found the orange beverage they sampled to be flavorful, crisp, clean, and sweet, but not natural, wholesome, or good for you. As a departure from their Indian counterparts, the U.S. respondents judged their beverage to be inexpensive, not tart, and not good served with food.

Part C asked respondents to evaluate their overall liking of the drink in and of itself, and their liking of the "particular flavor" of the drink, on respective 7-point valence scales ranging from +3 (*like it very much*) to –3 (*dislike it very much*), with a response of 0 indicating indifference or uncertainty. Part D asked subjects to identify the fruit flavor they tasted by checking the boxes associated with the correct answers from respective closed-form lists of 15 fruit flavor alternatives, including all the usual fruit flavors represented in the category plus "Mixed fruit flavors" and "Other." In a similar manner, subjects were asked in Part D what fruit flavor they expected prior to tasting. Part E asked subjects to supply demographic information.

RESULTS AND DISCUSSION

Incongruent flavor information is represented by two treatments, Purple-Orange and Orange-Grape, which present mismatched color–flavor combinations. Congruent flavor information is represented by the Purple-Grape and Orange-Orange treatments, which present matching color–flavor combinations. Table 2 reports the means for those dependent measures used to test flavor perception (information pertaining testing H3 and H4) and preference (pertaining to testing H5). The dependent variables used to test flavor identification (pertaining to testing H1a, H1b, H2, and H3) are binary in nature and therefore not reported in Table 2. Two covariates, gender and age, were also tested in preliminary analyses, but they were omitted from the final model specifications because they did not have significant effects on the outcomes.

Results for Flavor Identification

To test the effects of food color on the consumer's ability to correctly identify food flavor, we ran a series of two logistic regressions using the SAS CATMOD procedure (SAS Institute, 2004). The general model specification is

TABLE 2 Mean Ratings for Flavor Attributes and Preference

	Mean Flavor and Preference Ratings						
		Food Color		Labeling		Interaction	
Flavor Attributes[a] This fruit beverage sample is:	Total Sample	Purple	Orange	Grape	Orange	Mismatched Color and labeling	Matching Color and Labeling
Very good served with food:	3.34	3.70	3.00	3.20	3.47	3.17	3.51
Very good for me:	3.01	3.23	2.79	3.03	2.98	2.74	3.28
Very cooling:	3.14	3.33	2.98	3.13	3.15	2.90	3.41
Very clean taste:	3.30	3.50	3.11	3.28	3.37	3.21	3.39
Very refreshing:	3.05	3.25	2.92	3.05	3.10	2.79	3.39
Very crisp taste:	3.33	3.48	3.17	3.17	3.48	3.25	3.39
Has a lot of flavor:	3.60	3.83	3.55	3.72	3.65	3.62	3.75
Is inexpensive:	2.91	2.76	3.09	2.67	3.14	3.07	2.79
Contains all-natural ingredients:	2.74	2.82	2.65	2.83	2.65	2.74	2.74
Very wholesome:	2.93	3.00	2.85	2.82	3.04	2.84	3.00
Very tart:	2.94	3.00	2.89	2.90	2,98	2.87	3.02
Very sweet:	3.03	2.98	3.08	3.13	2.93	3.05	3.02
Is very thirst quenching	3.14	3.10	3.19	3.10	3.17	2.94	3.31
Liking[b]	4.86	5.17	4.56	4.70	5.01	4.51	5.20

[a]Each flavor attribute is rated on a 5-point scale, where a 5 indicates the highest level of agreement with the flavor attribute statements, as they pertain to oneself.
[b]Beverage liking is rated on a 7-point scale, where a +3 indicates *Like very much*, a -3 indicated *Do not like at all*, and a 0 indicates indifference or uncertainty.

$$Identification = \beta 1^{*}\,(Color) + \beta 2^{*}(Label)$$

where

- *Identification* = A binary dv in which a 1 indicates correct flavor identification.
- *Color* = A food color dummy in which a 1 indicates orange color, which is consonant with the actual flavor (orange), and a 0 indicates purple color, which is not consonant with the actual flavor.
- *Label* = A label information dummy with which flavor information is conveyed verbally. A 1 indicates orange flavor, which is correct, and a 0 indicates purple flavor, which is incorrect.

The response variable for one model is a binary measure that tests whether congruent color aids correct flavor identification (as a test of H1a), where a 1 indicates that a given subject has correctly identified the flavor of the sample beverage as orange. The other response variable is a binary measure that tests whether incongruent color: (1) degrades the ability of the consumer to correctly identify flavor (H1b); and (2) prompts the consumer to identify a flavor that one would normally associate with the color, incorrectly (H2). The inclusion of label information allows us to test the relative strength of food color in the formation of flavor expectations, relative to that other potential source of flavor information typically found in a packaging context.

Results in Table 3 show that consumers are more than 14 times as likely to correctly identify the orange flavor of the beverage sample when it is colored orange than when it is not (ORE = 14.65), in support of H1a; and that consumers are less than 1/20 as likely to incorrectly identify the orange flavor of the beverage sample when it is colored orange than when it is not (ORE = 0.049), in support of H1b. Conversely, we can interpret the reciprocal of the ORE for those who identified their sample as grape to indicate that consumers are more than 20 times as likely to identify the flavor of the beverage they sampled as grape, when it is purple in color, in support of H2.

It is not surprising when consumers identify an orange-colored drink as orange in flavor, particularly when it actually is orange in flavor and the ability of incongruent color to mislead consumers away from correct flavor identification has been demonstrated. We confirm these results in a new context. What is more interesting is a demonstration of the inclination of consumers to instead identify that flavor that is normally associated with an incongruent color, indicating that food color is a sufficiently robust flavor signal to dominate taste itself, in further support of H2.

TABLE 3 Logistic Regression Models Testing the Effects of Food Color and Label Information on Flavor Identification

Manipulations	dv's are binary variables where a "1" indicates those subjects who: identified flavor (correctly) as orange	identified flavor (incorrectly) as grape
Food Color		
Parameter	2.68	−3.01
Wald χ^2	21.05	21.63
p	<.0001	<.0001
Odds Ratio Estimate (ORE)	14.65[a]	0.049[b]
Label Information		
Parameter	1.37	−1.47
Wald χ^2	21.99	20.66
p	<.0001	<.0001
Odds Ratio Estimate (ORE)	3.94	.230
R^2	.368	.393
Max-Rescaled R^2	.493	.524

[a]May be interpreted as follows: the subject is more than 14 times as likely to identify the sample beverage as orange flavor when it is orange in color, as opposed to when it is purple.
[b]May be interpreted as follows: the subject is less than 1/20 as likely to identify the sample beverage as grape flavor when it is orange in color, as opposed to when it is purple.

To provide univariate results, we tested the significance of differences between proportions in the design using Kanji's Test #5, "Z-test for the equality between two proportions (binomial distribution)" (Kanji, 1993, p. 25). We further examine by a comparison of proportions, as shown in Table 3, testing the significance of their differences. We can again see that those who were exposed to the orange-colored beverage identified it as orange flavored a significantly greater proportion of the time than those exposed to the purple orange drink (83.9% to 10%, Z = 5.78, $p < .0001$), and that those exposed to the purple-colored drink identified it as grape significantly more often than those exposed to the orange-colored drink (33.3% vs. 0%, Z = 3.46, $p = .0003$). However, we can make further comparisons using Figure 2. We can see, for instance, as we would expect, that the proportion of subjects who identify the orange-colored beverage correctly as orange is significantly greater than those who identify the orange-colored beverage incorrectly as grape (83.9% vs. 0%, Z = 6.59, $p < .0001$). But, more interestingly, we see that the proportion of subjects exposed to the purple orange drink who identify it incorrectly as grape is significantly greater than the proportion who correctly identify the purple drink as orange (33.3% vs. 10%, Z = 2.19, $p = .0417$), indicating once again the relative strength of food color as a flavor signal over taste, and in further support of H1a, H1b, and H2.

As a test of H3, we compare the OREs for the mismatched food color and label manipulations in the two models of Table 3. When food color and labeling are mismatched, which does the consumer believe? In the first

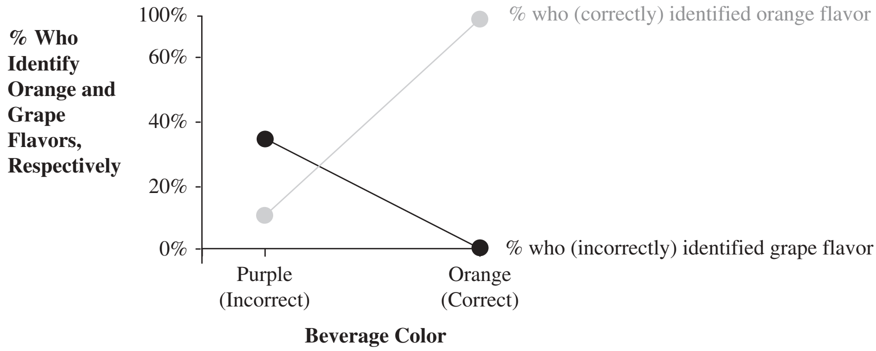

FIGURE 2 Flavor identification and expectation among those not told flavor, by beverage color.

model of Table 4, whose dv is correct identification of beverage flavor as orange, we see that the ORE for the food color manipulation is larger than the ORE for the labeling manipulation ($ORE_{color} = 14.65 > ORE_{label} = 3.94$), suggesting that the orange level of the food color manipulation is a more robust flavor signal than is labeling.

Conversely, the ORE for food color is smaller than that for labeling ($ORE_{color} = 0.049 < ORE_{label} = 0.230$), indicating that the purple level of the food color manipulation is a less robust signal of orange flavor than the grape level of the labeling manipulation, but a more robust signal of grape. Both results are in support of H3.

Results for Perception

The use of compensatory multi-attribute attitude models have long been used in marketing to profile competitor brands according to how they are perceived by the consumer (cf. Hauser & Koppelman, 1979). In this research, we take a similar decompositional approach to test H3 and H4, by comparing the flavor profiles of differently colored and labeled beverages across the flavor attributes.

We test the main and interaction effects of color and label information by fitting a series of 13 regressions with each of the 13 flavor attributes measured serving as dependent variables, respectively, using the SAS GLM procedure (SAS Institute, 2004). The model specification follows the same general form as that shown in the "Results for Identification" section above. Results are shown in Tables 4 and 2.

Food color has significant main effects on "Good with food," "Good for me," "Cooling," "Clean taste," "Very refreshing," and "Crisp taste," indicating that differently colored versions of identically flavored beverages evoke distinct flavor profiles, in support of H4. These results coupled with the

TABLE 4 ANOVA Models Testing the Effects of Food Color, Label Information, and Their Interaction on 13 Flavor Attributes, and on Liking

Dependent Variables[b]	Manipulations[a]			
This fruit beverage sample is:	Food Color	Labeling	Color × Label	R^2</T
Very good served with food:	16.12 (.0001)****	1.93 (.1678)	3.72 (.0561)	.160
very good for me:	7.21 (.0083)***	0.12 (.7256)	10.79 (.0013)***	.133
Very cooling:	4.28 (.0410)**	0.07 (.7856)	8.58 (.0041)***	.100
Very clean taste:	4.02 (.0473)**	0.06 (.8112)	0.86 (.3543)	.040
Very refreshing:	3.84 (.0524)*	0.00 (.9941)	11.58 (.0009)****	.116
Very crisp taste:	3.27 (.0731)*	3.02 (.0851)*	0.65 (.4212)	.055
Has a lot of flavor:	2.51 (.1162)	0.17 (.6837)	0.60 (.4413)	.027
Is inexpensive:	1.86 (.1769)	3.75 (.0550)*	1.44 (.2330)	.079
Contains all-natural ingredients:	0.78 (.3782)	0.99 (.3220)	0.00 (.9787)	.018
Very wholesome:	0.76 (.3846)	1.56 (.2149)	0.75 (.3887)	.027
Very tart:	0.49 (.4848)	0.22 (.6384)	0.82 (.3665)	.014
Very sweet:	.029 (5895)	1.19 (.2774)	0.08 (.8497)	.013
Is very thirst quenching	0.04 (.8383)	0.31 (.5815)	3.13 (.0798)	.033
Liking[c]	7.44 (.0073)***	1.70 (.1943)	9.57 (.00025)****	.138

[a]Cells contain *F* values. Probabilities are in parentheses.
[b]Ordered by strength of association with food color.
****$p < .001$. ***$p < .01$. **$p < .05$. *$p < .10$.

means shown in Table 2 indicate that the purple beverage is perceived by Indian consumers to be better with food, better for you, more cooling, have a cleaner taste, be more refreshing, and have a crisper taste, in support of H3.

Labeling has no significant main effects, indicating that labels indicating grape or orange flavor do not have distinct flavor profiles, further suggesting that food color as a flavor indicator is more robust than label information as such, in further support of H3.

An examination of the interaction of food color and labeling is, in effect, a comparison of matching color and label levels (i.e., purple-grape, orange-orange) versus mismatching color and label levels (i.e., purple-orange, grape-orange). This interaction has significant main effects for "Very refreshing," "Very good for me," and "Very cooling," indicating that matching colors and labels, whether they are purple-grape or orange-orange, are perceived to be more refreshing, better for you, and more cooling than mismatched levels, in further support of H3 and H4. These results are interesting because they show the congruent food color/labeling conditions to be perceived as significantly more natural and expensive than the incongruent food color/labeling conditions, regardless of whether the color of the congruent condition is characteristic or uncharacteristic, perhaps in further support of H3 and H4.

Results for Flavor Preference

To test the effects of food color and labeling on liking or preference, an ANCOVA was fitted to the data using the SAS GLM procedure (SAS Institute, 2004). Subjects rated their liking of the beverage they sampled on two separate liking scales, overall flavor liking and overall beverage liking. These proved to be highly correlated ($\rho = .797$), indicating that both questions measure the same underlying construct. Therefore, a composite liking measure was created by taking a simple mean of the two, which served as the dependent variable. Results are shown in the last row of Table 4, and in the last row of Table 2.

Food color has a significant main effect on liking. The direction of the effect indicates that subjects like the purple-colored drink better than the orange-colored drink—interesting, given that purple is the incongruent color—in support of H3 and H4. We speculate that this preference of incorrect color over correct color is due to these consumers' inherent preference for purple color over orange, independent of their roles as flavor signals. One indication of how these colors are perceived with distinct roles is suggested by the nature and prevalence of their respective use in decoration, where the color orange has played a larger role traditionally, and purple less so, though it is being used more often currently as people have begun experimenting with a broader range of colors. Perhaps purple's status as one of these "new" colors for decoration has made it an object of preference over the more traditional and therefore staid color orange in this context.

Label information is not significant, indicating that there is no difference between how labels at different treatment levels are liked. These results are not surprising: we know color to be an affect-loaded phenomenon to which consumers respond, but flavor information on a label is less likely to evoke such feelings.

The interaction of color and flavor has a significant main effect on liking, indicating that matching color and flavor information is preferred to mismatched color and flavor information. These results provide further support H5.

These results generally confirm results from Western countries, and in most all respects are surprisingly close to those reported by Garber et al. (2001). Food color appears in India, as it is in the West, to be a robust indicator of flavor, perception, and preference and to dominate other flavor information. Discrepant color is evaluated according to what flavor consumers would normally associate with that color, though with some differences that could be culturally based.

Two interesting discrepancies are noted. The first is that, though the proportion of Indian respondents who identified the purple drink as grape flavor was significantly greater than the proportion who correctly identified it as orange, this number was significantly smaller than the proportion who identified the orange-colored drink as orange flavor. The latter was not so for the Garber et al. (2001) study, who found that the proportion of U.S. respondents who incorrectly identified the purple drink as grape was not significantly different than that proportion who correctly identified the orange- colored drink as orange flavor. Therefore, though these Indian results are significant and directionally the same as the U.S. results, the effect of the wrong-colored drink is less robust. In other words, Indian respondents were fooled by the wrong color, but not fooled as often as were their U.S. counterparts.

We speculate that this may be due to the highly considered manner in which many of our Indian subjects tasted their beverage. This was evidenced by the time they took, their tendency to take many small sips rather than one drink and to take time in between sips to consider the experience, and their questions for the researchers during the taste test. Such careful deliberations may have affected their proclivity to be less deceived by the wrong color and would, as such, constitute a conservative test of this phenomenon.

A second discrepancy with U.S. results is that Indian respondents liked the incorrect purple-colored drink significantly more than the correct orange-colored drink, independently of label information. With the U.S. results, there was no significant difference between degree of liking between purple and orange-colored drinks.

MANAGERIAL IMPLICATIONS

These results support the notion that food color is inextricably linked to expected flavor in the minds of consumers, making the selection of uncharacteristic food color problematic. The results for India are actionable. In the following, we present three possible strategies for making the introduction of a novel food color viable for marketing communications purposes.

The first is to teach consumers to accept a novel color as characteristic, or emblematic, of a particular food, as brown is for cola. When the appearance of a food product is nondescript, then associating it with a new, more vibrant color can enhance its noticeability, its distinctiveness, and its appeal. Such as been the case with green for peppermint or yellow for Mountain Dew and all its me-too competition (a me-too color strategy). A problem with rendering a novel food color characteristic is that it will likely be a lengthy and expensive process, requiring as it does the conditioning of consumers to accept a new color as characteristic of a particular food product. Another obstacle is the sheer diversity and multiplicity of food products (and their packages) on display. This makes it hard for the marketer to find an empty visual niche, when compared to the days when peppermint was made green or cola was made brown. Another drawback to rendering a novel color no longer novel is that it loses its ability to surprise the consumer into attention, which was the prime reason for utilizing novel color in the first place.

The second strategy is to celebrate the very incongruity of a novel food color, to announce to the consumer that its novelty is there to surprise and delight, and the proper response is to have fun and enjoy it. This is done by featuring novel color and its very incongruence in the shelf presentation. The consumer therefore knows that the incongruence is intended, is meant to be amusing, and is therefore made to feel welcome to share in the fun. An example of this is Gatorade's Blue Raspberry drink, an uncharacteristically blue-colored beverage whose name calls attention to the incongruence of the drink's color and flavor.

The third strategy for the introduction of novel food color is to sever the food color and flavor expectations connection, making it impossible for the consumer to connect the two. If color and flavor are not connected, then novel food color cannot be incongruent. First, the natural tendency of the consumer to connect color and flavor must be deliberately blocked, to permit the introduction of other color themes and associations to distinguish and contrast the brand and to lend it meaning. The most straightforward means of unlinking food color and labeling is to mask food color. The focus of the product can then be shifted to a more thematic association. Several drink brands have elected this approach by packaging their drinks in opaque bottles or plastic labels that cover the outside of the package, thus hiding the view of the actual product. An Indian example of the masking of food color with an opaque package is Nescafe Iced Cappuccino Mix (to see, go to http://www.nestle.in/brands/beverages/nescafecappuccino), which comes in opaque boxes. The Vanilla Latte is blue and the Mocha purple; neither color is a coffee-flavor-associated color.

A more subtle approach to the disconnection of the food color/expected flavor relationship is the selection or creation of food colors and flavors that are not flavor- or color-associated. In denying the consumer the ability to readily categorize the flavor cues that food color and labeling present, the consumer may be induced into a mode of more elaborate information processing in order to understand and evaluate the product. This opens an opportunity for the presentation of promotional ideas, symbols, meanings, and associations through the medium of novel food color. Gatorade goes so far as to withhold specific flavor information in its "Nutritional Facts" label, citing only "natural flavors." The consumer is therefore blocked from falling back on old flavor habits and can have none of the usual flavor expectations prior to tasting. The consumer is therefore forced to consider and evaluate the Frost line of drinks in an entirely new context.

A related but somewhat different approach seeks an alternative appeal that is cognitive in nature. For example, Gatorade India offers a beverage line called "Blue Bolt" (to see package, go to http://www.gatorade.co.in/gatorade-sports-drink/index.html), whose color is an electric blue, not naturally or commonly associated with any fruit flavor, whose name and body text refer to energy and activity, an alert and excited bodily state, rather than to its flavor, and whose color is designed to be consistent with those themes rather than with flavor. Additionally, Pepsi India introduced an amber-colored form of Pepsi called Pepsi Gold, signifying the Cricket World Cup Gold Trophy (to see package, go to http://blogger-2006.blogspot.com/2007/07).

EXTENSIONS

Valuable future research would include generalizing on the results of this experiment by manipulating actual food flavor and food category along with food color and label information. With respect to food flavor, this research implicitly assumes that flavors differ purely on the basis of how well they are liked and may therefore be compared directly. However, flavors as complex multidimensional stimuli each have their own particular character. By replicating this study while manipulating flavor along with food color and label information, we may account for any flavor-specific effects. This effect could explain the fact that our Indian respondents liked the purple drink significantly better than the correctly orange-colored beverage; perhaps they simply liked purple better than orange color. Or perhaps there is a culture-specific meaning that caused purple to be preferable in this context, over and above its flavor associations. Further research is needed to test these possibilities. Similarly, food category may also be manipulated in order to account for any food-category-specific effects.

Additionally, it is not certain that food color affects all foods as it affects flavored water. Considering that flavored water is rather simple as a flavor stimulus, its flavor originating as it does only from an essential oil or natural/artificial components, these current findings may not generalize to foods whose flavors have a more complex origin—for example, processed meats, confectionary, or chocolate. Further studies are therefore required to either generalize these current results or to ascertain their limits.

In India, particularly, food color is known to play an important role in food decoration. This is a role for food color that is independent of its role as a flavor signal and can be highly meaningful and ritualistic, and, as such, it may have a significant confounding influence on flavor research such as this. Independent research on the role of color in decoration and the meanings that this may attribute to foods that are decorated bears examination. Outside of the Western sphere, only India has been tested. Further tests throughout the emerging world are needed both to confirm the indications of this research that the robust effects of food color on flavor are universal, and also to determine the specific effects of particular culture that this research also indicates may occur within the general effect of food color on flavor. Further, cross-cultural comparisons of all types are called for.

ACKNOWLEDGMENTS

We wish to gratefully acknowledge the generous assistance of Robert Aitken with the stimulus development portion of this research; Sailesh Agrawal, Sambhar Jain, Omkumar Krishnan, Shivan Merhotra, A. R. Mishra, and Varun Singh with survey administration; and the editor and anonymous reviewers. Authors are listed alphabetically. Each contributed equally.

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