

DETERMINING CHILDREN'S PERCEPTIONS, OPINIONS AND ATTITUDES FOR SLICED SANDWICH BREADS

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ABSTRACT

The objective of this study was to determine the ideal whole grain bread product for children (8–17 years) using a survey and conjoint analysis. Focus groups (three focus groups, $n = 23$), emotional response and appearance liking surveys ($n = 172$), and an adaptive choice-based conjoint survey ($n = 173$) were conducted with children. Across elementary, middle and high school-aged children, children preferred bread with a light crumb (inside of the bread), a light crust and no topping or added textures or visual cues in the crumb. Children had generally negative feelings for breads with dark-colored crumb and crust, but had generally positive feelings for breads with light-colored crumb and crust. Breads with white crumb were liked more than bread with dark crumb, regardless of crumb particles, crust or crust topping. Crust color had no impact on overall appearance liking score. These results demonstrate that regardless of age, children like soft breads with light-colored crumb and crust with no fillings or toppings.

PRACTICAL APPLICATIONS

Increased consumption of whole grain breads is an effective technique in decreasing obesity in American children. Children's likings of bread products have an inverse relationship with whole grain versus refined grain content. This study demonstrated that development of a whole grain bread product that is desirable to children in both visual appearance and taste is an important step toward increased whole grain consumption by children and that images of attributes and a conjoint analysis in a survey format can be effectively utilized by children to measure their desires.

INTRODUCTION

Children consume only about one-third of the amount recommended of whole grains (Sadeghi 2008). Increased consumption of whole grains has been linked to lowered rates of obesity, cancers, cardiovascular disease and diabetes (Slavin *et al.* 2001). Recent studies that include whole wheat bread substitutions for refined grain bread products decreased the levels of obesity in children (Marcus *et al.* 2009). As such, increased consumption of whole grain bread products by children is a desirable outcome in terms of health.

One reason that whole grains are not consumed as frequently as refined grain products by children is the inverse relationship of whole grain content of a bread product to children's liking scores. Delk and Vickers (2007) reported

that in elementary school children, liking of bread rolls decreased as whole grain content of bread increased. In addition to overall liking, the appearance of bread is an important attribute that requires careful study. Appearance of a food product is a driver of food choices for children (Leon *et al.* 1999; Marshall *et al.* 2006). In an attempt to make whole wheat breads more desirable for both children and adults, white wheat breads have been introduced commercially. These breads mimic the appearance of a refined wheat bread, but can contain similar textures and flavors to darker whole wheat breads. There has been no research to suggest that the sensory attributes of white wheat breads are maximizing the drivers of liking for whole grain sliced sandwich breads, and the primary driver of children's liking of whole wheat sandwich breads has not been fully elucidated. In order to produce a whole wheat bread that

children will consume, it is important to examine what drives liking of breads in children so that manufacturers can confidently focus on research and improvements.

Conjoint analysis is used to measure the value and preferences of the various features of a food product. This approach involves the breakdown of a product into specific attributes and/or concepts that consumers then select in a series of choices to identify what attributes are most important (Orme 2010). Words or photos can be used to represent concepts or attributes, and Jervis *et al.* (2014) demonstrated that photos of bread attributes (crust and crumb attributes) could be effectively used in a conjoint analysis to determine ideal attributes in sandwich bread choices for adults. Conjoint analysis is also a reliable method of measuring children's food preferences and the importance of specific food product attributes. Olsen *et al.* (2012) demonstrated that using conjoint analysis with pictures of buns and juice yielded results consistent with visual hedonic preference measures and product choices in children. Guthrie *et al.* (2000) conducted a study with 3–5 year olds and reported that tasting a food resulted in the most reliable results ($r = 0.81$), followed closely by judging based on images on a computer screen ($r = 0.75$). Jarmillo *et al.* (2006), Calfas *et al.* (1991) and Vereecken *et al.* (2010) all demonstrated that testing food preferences of children using images in place of actual product was a reliable method as long as children were familiar with the foods.

The relationship between foods and the emotions that they elicit is particularly important as a way to distinguish between foods with similar liking scores. Cardello *et al.* (2012) determined that emotion analysis can be conducted either with the actual food product or with images of a food. Richins (1997) showed that an emotion questionnaire was reliable when surveying across a large number of products. The reliability of emotional responses to food was verified by Cardello *et al.* (2012) and was consistent with prior studies that verified the reliability of emotional responses to products other than food (Richins 1997; Chrea *et al.* 2009). Children's emotional responses to food images have yet to be researched in depth. The importance of children as consumers and decision makers in food purchase and consumption warrants further research into the emotional responses of children when presented with a visual stimulus of a food product.

The goal of this study was to determine the perceptions and attitudes of children toward a range of different bread composite images that represented possible whole grain bread products in order to guide future development of whole grain breads. Focus groups were conducted initially in order to develop an appropriate lexicon of emotions and responses of children toward various foods. An emotion and liking survey was used to assess children's emotional responses toward images of various sandwich breads.

Finally, adaptive choice-based conjoint (ACBC) was applied to determine what drives liking of bread in children and to create an ideal whole wheat bread with visual appeal. Pairing the results of a conjoint study of sliced sandwich breads, which can identify the attributes of a sandwich bread that children find important, and the emotional responses of children toward various bread products can help manufacturers produce a whole grain bread product that children will feel comfortable with and enjoy eating.

METHODS

Participants

All testing was conducted in compliance with North Carolina State University Institutional Review Board (NCSU IRB) regulations (protocol 2937). Parents of children ages 8–17 years were contacted using an online database of >5,000 consumers from the greater Raleigh/Durham/Chapel Hill, NC area maintained by the Sensory Service Center of NCSU. To qualify for any of the testing, their children had to be regular consumers of sliced sandwich breads. Twenty-four children, ages 8–13 years, were recruited to participate in one of the three focus groups. Children were assigned to one of the three focus groups to allow for an even distribution of ages and genders. These participants were also invited to participate in the conjoint and emotion surveys in the second part of this study. An additional 200 children, ages 8–17 years, were recruited through the same online database to participate in the emotion and conjoint surveys. The emotion survey and the conjoint survey were conducted in the same session, with an optional rest period for children in between surveys. Participants were compensated with a \$60 gift card. A total of 172 children participated in the emotion and ACBC surveys. The same respondents were used for both surveys to allow direct comparison of utility scores and emotional responses.

Focus Groups

A total of three 60-min focus groups were conducted. Each focus group was composed of 6–8 children ranging from 8 to 13 years old. These focus groups were conducted on the campus of NCSU and were led by a trained focus group moderator. Focus groups were audio and video recorded for later reference. Parents of participating children viewed the focus group through a closed circuit television system from an adjacent room. In the focus groups, children were first instructed in the use of appropriate emotional language and then practiced the use of emotion words to describe how various pictures made them feel. At first, the pictures that children responded to were of high-interest situations (a clown, a roller coaster, a beach). After children were com-



FIG. 1. IMAGES OF BREAD CRUST AND CRUMB CHARACTERISTICS WITH DESCRIPTORS USED IN EMOTION, LIKING AND ADAPTIVE CHOICE-BASED CONJOINT (ACBC) ANALYSIS

portable responding to images with emotions, they were shown pictures of various foods that were chosen to elicit a strong response from children. The foods shown were apple, bacon, broccoli, chocolate chip cookie, frosted doughnut, hamburger, strawberry ice cream cone, sliced peaches, sliced pineapple and a salad. After each picture, children were asked “How does this food make you feel?” and “How would you feel if your family served you this food for lunch/dinner?” After children were shown pictures of these foods, they were presented with pictures of a variety of breads and asked the same emotional response questions. Bread images were chosen to represent a wide variety of breads and bread attributes including different colors, shapes, toppings and fillings. Finally, children were given laminated pictures (approximately 3 in. × 5 in.) of various foods and asked to group the pictures based on their emotional responses to the foods. They were asked to give each group an emotional name. After the focus groups, emotion responses were tallied, consolidated in order to reduce redundancy and categorized as positive, neutral or negative. The highest frequency words were chosen to use in the conjoint and emotion surveys.

Picture Generation

Pictures representing selected bread attributes and their respective levels were created using methods developed by

Jervis *et al.* (2014). Composite bread pictures were created using the same procedures. These levels and composite breads are shown in Figs. 1 and 2 and fully detailed in Table 1.

Emotion and Liking Surveys

A check-all-that-apply (CATA) emotion and liking survey was created using SSI Web (Sawtooth Software version 8.0.22, Orem, UT). Children were asked if they attended elementary, middle or high school, and then presented with an explanation of the composite bread pictures prior to beginning the survey (Fig. 2). All 36 composite bread images were presented to each respondent in a monadic sequential randomized order (Fig. 3). For each image presented, children were asked to choose from a CATA selection of 12 emotional responses and how that image made them feel, and/or how they would feel if they were served a sandwich with that bread. Children could choose from the following emotional responses based on the words generated by the focus group participants: confused/bewildered/iffy, disappointed, disgusted, excited, happy, interested, satisfied, strange/awkward/weird, surprised, uninterested, upset and other. The 12 emotion words were presented in alphabetical order (King and Meiselman 2010). If the respondent chose other, they were to specify their emotional response.

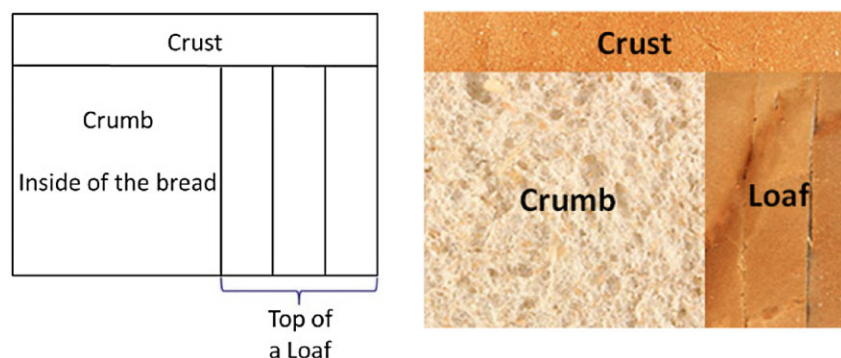


FIG. 2. THIRTY-SIX COMPOSITE BREAD IMAGES FOR EMOTIONS AND LIKING SURVEY

Children were then asked to evaluate their overall liking of the appearance of the composite bread product picture using a modified version of the Peryam–Kroll hedonic scale for children (Kroll 1990), where 1 = super bad and

7 = super good. Children took approximately 10–15 min to complete this survey. After evaluating all 36 pictures, children were presented with a screen with an affirmation message assuring them that they were doing well, and

Bread number	Crumb color	Crumb particles	Crust color	Crust topping
1	White	Seeds	Dark	None
2	White	Seeds	Dark	Oat-like
3	White	Seeds	Dark	Flake-like
4	White	Seeds	Light	None
5	White	Seeds	Light	Oat-like
6	White	Seeds	Light	Flake-like
7	White	Flakes	Dark	None
8	White	Flakes	Dark	Oat-like
9	White	Flakes	Dark	Flake-like
10	White	Flakes	Light	None
11	White	Flakes	Light	Oat-like
12	White	Flakes	Light	Flake-like
13	White	None	Dark	None
14	White	None	Dark	Oat-like
15	White	None	Dark	Flake-like
16	White	None	Light	None
17	White	None	Light	Oat-like
18	White	None	Light	Flake-like
19	Brown	Seeds	Dark	None
20	Brown	Seeds	Dark	Oat-like
21	Brown	Seeds	Dark	Flake-like
22	Brown	Seeds	Light	None
23	Brown	Seeds	Light	Oat-like
24	Brown	Seeds	Light	Flake-like
25	Brown	Flakes	Dark	None
26	Brown	Flakes	Dark	Oat-like
27	Brown	Flakes	Dark	Flake-like
28	Brown	Flakes	Light	None
29	Brown	Flakes	Light	Oat-like
30	Brown	Flakes	Light	Flake-like
31	Brown	None	Dark	None
32	Brown	None	Dark	Oat-like
33	Brown	None	Dark	Flake-like
34	Brown	None	Light	None
35	Brown	None	Light	Oat-like
36	Brown	None	Light	Flake-like

TABLE 1. DESCRIPTIONS OF BREAD COMPOSITE IMAGE ATTRIBUTES AND LEVELS

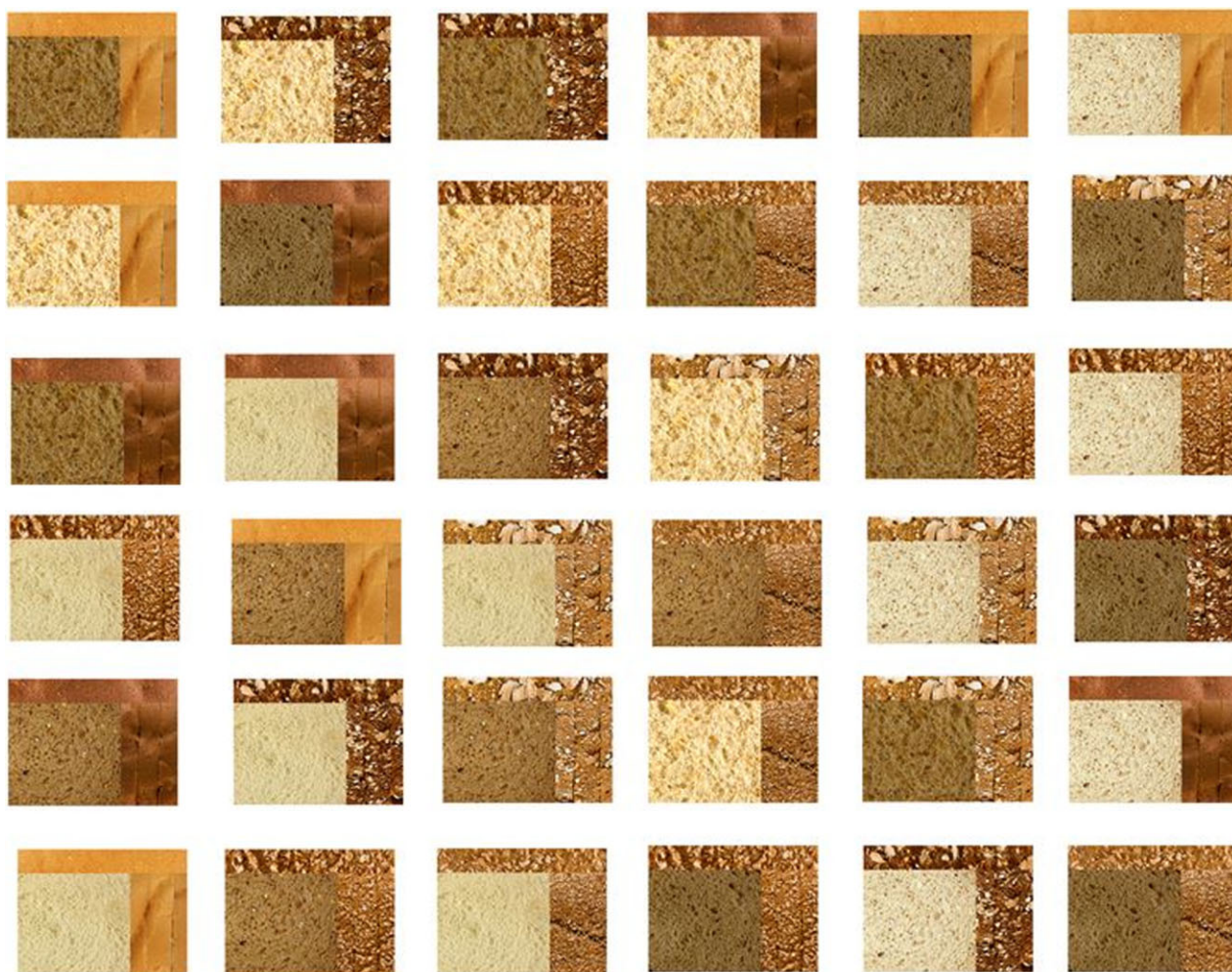


FIG. 3. ILLUSTRATIONS OF COMPOSITE IMAGES COMPOSED OF BREAD CRUST AND CRUMB CHARACTERISTICS USED TO EXPLAIN EMOTIONS AND LIKING SURVEY TO CHILDREN

allowed to take a 5-min break before proceeding to the conjoint survey.

Adaptive Choice-Based Conjoint

An ACBC survey was created using SSI Web (Sawtooth Software version 8.0.22). The survey included attributes of crust and crumb that were represented visually, as shown in Fig. 1. Nonvisual attributes were also identified for this study. These attributes included crust texture (hard or soft), middle of bread/crumb texture (moist, soft, chewy, smooth, squishy, grainy, dense or firm) and label claim (“tastes great,” “whole grain,” “tastes like mom made it,” “high fiber,” “soft,” “all natural,” or “no artificial ingredients or preservatives”). Levels for all attributes were derived from Jervis *et al.* (2014).

The ACBC study began with a build your own (BYO) activity where children were presented with each level of

each attribute and asked to build the best bread possible. Following the BYO section, children were presented with 10 screening tasks in which three product concepts were presented. Each product concept was created based on the responses to the BYO activity. Two or three attributes were permitted to vary from the BYO levels chosen for each product concept. For each product concept, one level for each attribute was displayed for each attribute, and pictures were used to represent the crust and middle of the bread (crumb) to create a composite bread product. Children responded to each product concept by choosing from the responses “I’d eat it” or “I would not eat it.” Throughout the survey, five questions were presented in which participants chose any unacceptable levels, and four questions were presented where children chose must have levels (Orme 2010; Jervis *et al.* 2012). Following the screening task, participants were presented with a tournament activity in which a maximum of 20 product concepts were used with a

minimum of three concepts for each choice task (Orme 2010; Jervis *et al.* 2012). At the conclusion of the survey, participants were thanked and received a \$60 gift card.

Statistical Analysis

Focus group emotional responses were analyzed using chi-square (XLSTAT). Emotional responses were analyzed using principal component analysis (PCA), using XLSTAT Addinsoft version 2010.5.02 (New York, NY). Overall appearance liking scores from the emotion and liking survey across and between school levels were analyzed using a two-way analysis of variance (ANOVA) with Fisher's least significant difference (LSD) as the post hoc test (XLSTAT).

Individual utility scores from the conjoint were extracted using hierarchical Bayesian estimation. The utility scores were rescaled using a zero-centered differences method (Orme 2010; Jervis *et al.* 2012). The zero-centered scores are used in order to facilitate comparisons and to standardize all of utility scores within any given attribute. The zero-centered utility scores were then analyzed across school age using two-way ANOVA using Fisher's LSD as the post hoc test (XLSTAT). Importance scores were determined by first calculating the range of utility scores for each attribute. The range was then divided by the total utility range and multiplied by 100 (Orme 2010). Importance scores across school age were compared using two-way ANOVA and Fisher's LSD as the post hoc test (XLSTAT). All statistical analysis was carried out at a 95% significance level.

RESULTS AND DISCUSSION

Focus Groups

A total of 254 emotion responses were recorded during the three focus groups. Responses were examined and words with identical or very similar meanings were condensed in order to reduce redundancy. This resulted in 51 unique responses. These responses were then categorized as positive, negative or neutral responses. The top 20 responses are shown in Table 2 along with their classification. Of all the responses given, 89 were positive, 59 were neutral and 105 were negative.

Reactions to unfamiliar bread and breads with toppings and/or fillings were often met with skepticism and strong reactions, both physical and verbal, from the children. Familiar white and whole wheat breads were met with a generally positive but subdued response. These results are consistent with the work of Olsen *et al.* (2012), in which children showed clear preferences for white breads in a conjoint study. One bread was reported to look "sweet" by 14 of the 23 children, which was attributed to an orange/carrot-colored crumb. This bread was met with positive reactions despite the crumb particles and unfamiliar appearance. These children were willing to overlook their neophobia of new and/or unfamiliar breads if they anticipated sweet tasting bread. Children based their perception of taste for unfamiliar breads on both past experiences and visual cues.

TABLE 2. DESCRIPTORS MOST FREQUENTLY (%) USED BY CHILDREN (AGES 8–13 YEARS) IN FOCUS GROUPS

	Descriptor	Percent of total responses	General emotional classification	
Words used in emotional survey	Disgusted	13.36% a	Negative	
	Happy	9.31% ab	Positive	
	Excited	6.88% bc	Positive	
	Bewildered/Confused/Iffy	6.88% bc	Neutral	
	Weird/Strange/Awkward	6.88% bcd	Negative	
	Upset	4.86% bcde	Negative	
	Uninterested	3.64% cdef	Neutral	
	Interested	3.64% cdef	Positive	
	Satisfied	3.24% cdef	Positive	
	Surprised	3.24% cdef	Neutral	
	OK	3.24% cdef	Neutral	
	Words not used in emotional survey	Sad	2.83% def	Negative
		Scared	2.83% def	Negative
Nauseated		2.83% def	Negative	
Crazy		2.43% ef	Neutral	
Good		2.43% ef	Positive	
Creepy/Creeped out		2.02% ef	Negative	
Chipper		2.02% ef	Positive	
Cheap		2.02% ef	Neutral	
Awesome	1.62% f	Positive		

Note: Different letters within a column are different ($P < 0.05$).

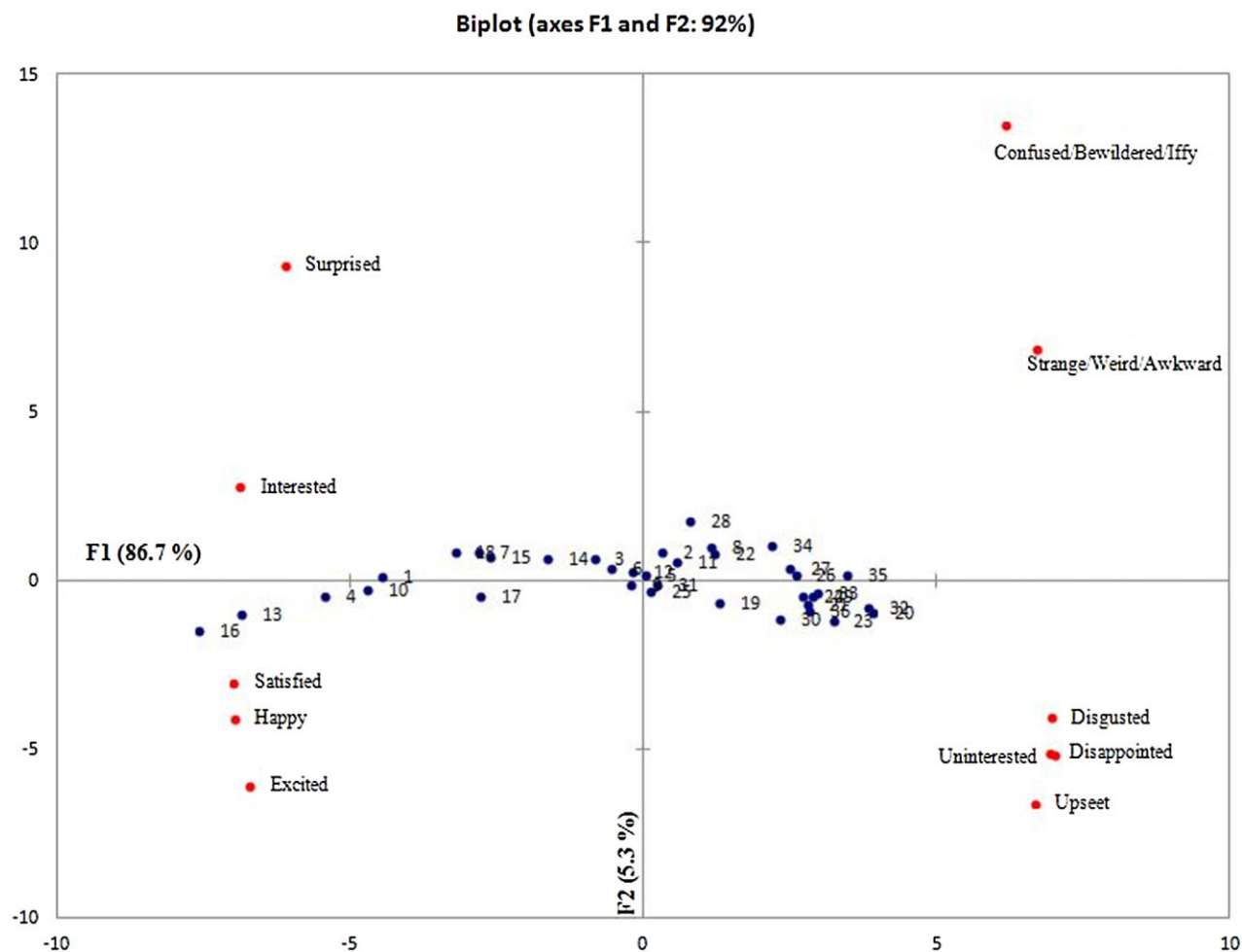


FIG. 4. PRINCIPAL COMPONENT BIPLLOT OF BREADS AND EMOTIONAL RESPONSES

Emotions Survey

Relationships between breads and emotional responses were analyzed using PCA. The PCA of bread images and emotional responses explained 92% of the variability within the set, with 86.7% loading on principal component (PC) 1 (Fig. 4). Generally positive emotional responses (surprised, interested, happy, satisfied, excited) loaded strongly on the negative axis of PC1, whereas generally negative emotional responses (confused/bewildered/iffy, strange/weird/awkward, disgusted, uninterested, disappointed, upset) loaded strongly on the positive axis of PC1. Bread image 16 (white crumb, dark crust, no crumb particles, no crust topping) and bread image 3 (white crumb, light crust, no crumb particles, no crumb toppings) were the most highly associated with positive emotional responses. The two bread images were composed of a white crumb, no crumb particles and no crust topping. Bread image 16 had a light crust, and bread image 13 had a dark crust. Children had

the strongest positive emotional responses to breads that were uniform and were free of added flakes, seeds or oats. This result is consistent with the results of the focus groups, in which children had positive responses to uniform appearance of sliced bread.

Gastón *et al.* (2010) used PCA to analyze CATA data in a study of chocolate milk desserts. In it, 18 terms were presented in a CATA block, which represented sensorial attributes relating to the sample. Significant differences were found in the frequency of word choices, and consumer perceptions could be differentiated using PCA. Use of a CATA survey is advantageous in that it is a natural and simple exercise for consumers as opposed to scaled evaluations and still allows for responses to be differentiated and analyzed. This method was chosen for our study as it was important to ensure that the response tasks were simple and natural for children who have a lower mental stamina compared to an adult, yet still allow for quantitative analysis.

Crumb color had the greatest impact on children's emotional response. White crumb (breads 1–18) was strongly associated with positive emotional responses and dark crumb (breads 18–36) was more strongly associated with negative emotional responses. This observation for crumb color was also affected by crumb particles and crust topping. Children overall had more positive responses to dark-colored crumb breads if they appeared uniform in composition as opposed to a lighter color bread that was not uniform. Breads 25 (brown crumb, dark crust, flake crumb particles, no crust topping) and 31 (dark crumb, dark crust, no crumb particles, no crust filling) were seen more positively than breads 2 (white crumb, dark crust, seed crumb particles, oat-like crust topping), 11 (white crumb, light crust, flake crumb particles, oat-like crust topping) and 8 (white crumb, dark crust, flake crumb particles, oat-like crust topping). These dark crumb breads shared the attributes of having no crust topping and no or flake crumb particles. These white crumb breads had oat-like crust topping, which was more negatively viewed than the other crust toppings. Breads with crumb particles and crust toppings were seen more negatively than breads with no particles and no topping. Seeds as a crumb particle and oat-like crust topping were the most negative levels in their respective attributes for both white crumb and brown crumb breads. Children had a more positive response to sliced sandwich bread that appeared uniform than one that did not regardless of crumb color; however, the preference was for a lighter color crumb. In order to create sliced sandwich bread that contains whole grains and is still appealing to children, the bread must appear uniform in crust and crumb and any particles added to the crumb or crust need to blend visually. Delk and Vickers (2007) showed that using blends of refined and whole wheat flour in breads could be used to increase consumption and acceptability of whole wheat bread products by children. They proposed that a series of 14 threshold steps, gradually increasing whole grain flour content, would be necessary to increase whole wheat percentages in a bread roll from 0 to 91%.

Liking Scores

Liking scores were consistent with results from emotion testing (Table 3). Breads with stronger positive emotional responses were liked more than breads associated with a stronger negative emotional response. Bread images 16 and 13 scored highest in liking ($P < 0.05$). These breads had white crumb, no crumb particles and no crust topping. Bread images 21, 33, 29, 27, 26, 36, 23, 20, 35 and 32 received the lowest liking scores ($P < 0.05$). These breads had dark crumb, both light and dark crust, flake or oat-like crust topping and a variety of crumb filling in no particular order. These results suggest that crumb particulate is not as

TABLE 3. CHILDREN'S LIKING SCORES (AGES 8–17 YEARS) FOR BREAD COMPOSITE IMAGES

Bread	Crumb	Filling	Crust	Toppings	Liking score mean
16	White	None	Light	None	5.84 a
13	White	None	Dark	None	5.62 a
4	White	Seeds	Light	None	5.27 b
10	White	Flakes	Light	None	5.01 bc
1	White	Seeds	Dark	None	4.82 cd
18	White	None	Light	Flakes	4.57 de
7	White	Flakes	Dark	None	4.51 e
17	White	None	Light	Oats	4.46 e
15	White	None	Dark	Flakes	4.44 e
14	White	None	Dark	Oats	4.34 ef
6	White	Seeds	Light	Flakes	4.12 fg
3	White	Seeds	Dark	Flakes	4.05 fgh
12	White	Flakes	Light	Flakes	3.98 ghi
9	White	Flakes	Dark	Flakes	3.97 ghi
5	White	Seeds	Light	Oats	3.94 ghi
25	Dark	Flakes	Dark	None	3.91 ghij
2	White	Seeds	Dark	Oats	3.80 hijk
28	Dark	Flakes	Light	None	3.78 hijk
31	Dark	None	Dark	None	3.71 ijkl
11	White	Flakes	Light	Oats	3.63 jklm
22	Dark	Seeds	Light	None	3.60 lkm
19	Dark	Seeds	Dark	None	3.53 klmn
8	White	Flakes	Dark	Oats	3.52 klmn
30	Dark	Flakes	Light	Flakes	3.48 lmno
34	Dark	None	Light	None	3.44 lmnop
24	Dark	Seeds	Light	Flakes	3.40 mnopq
21	Dark	Seeds	Dark	Flakes	3.39 mnopqr
33	Dark	None	Dark	Flakes	3.39 mnopqr
29	Dark	Flakes	Light	Oats	3.34 mnopqr
27	Dark	Flakes	Dark	Flakes	3.30 mnopqr
26	Dark	Flakes	Dark	Oats	3.29 nopqr
36	Dark	None	Light	Flakes	3.24 nopqr
23	Dark	Seeds	Light	Oats	3.22 opqr
20	Dark	Seeds	Dark	Oats	3.15 pqr
35	Dark	None	Light	Oats	3.13 qr
32	Dark	None	Dark	Oats	3.09 r

Note: Different letters within a column are different ($P < 0.05$).

Questions were answered on a 7-point feeling scale, where 1 = super bad, 4 = maybe good or maybe bad, and 7 = super good.

important as an attribute in dark crumb breads as in white crumb breads because a particulate in a dark crumb bread is more difficult to see than in a light crumb bread. In breads with white crumb, no topping was preferred ($P < 0.05$) in all but one circumstance. Bread 7 (white crumb, dark crust, flake crumb particles, no crust topping) scored at parity with breads 18, 17, 15 and 14 – each of which had either flakes or oats for crust topping. Following these breads, flakes as a crust topping were liked more so than an oat-like crust topping. In breads with dark crumb, crumb particulate and crust color did not impact liking scores and can be seen in all levels throughout the most and least liked dark crumb breads. Crust toppings did affect liking scores

TABLE 4. ATTRIBUTE IMPORTANCE SCORES OF POTENTIAL BREAD CONCEPTS TO ELEMENTARY, MIDDLE AND HIGH SCHOOL STUDENTS AS DETERMINED BY CONJOINT ANALYSIS

Attribute	Overall importance (ages 8–17 years)	Elementary school	Middle school	High school
Inside of bread appearance (crumb)	24.93 a	25.22 a	23.75 a	25.80 a
Outside of bread appearance (crust)	21.88 b	21.20 b	22.08 a	22.37 b
Flavor/Taste claim	18.86 c	18.37 c	19.59 b	18.60 c
Inside of bread texture (crumb)	15.12 d	15.31 d	15.60 c	14.44 d
Verbal description	11.16 e	11.05 e	11.44 d	10.98 e
Outside of bread texture (crust)	8.06 f	8.84 e	7.55 e	7.78 f

Note: Different letters within a column and within an attribute are different ($P < 0.05$).

similar to white crumb breads. No toppings were preferred to oat toppings ($P < 0.05$). Flakes as a crust topping were liked more than oats and liked less than no topping. These findings agree with responses from the emotions survey and are consistent with previous findings by Olsen *et al.* (2012) who found that images of white buns were far more popular among children than darker buns, and that the fewer toppings and fillings a bun had, the more popular it was.

Conjoint Survey

Importance scores reflect the importance of each attribute in the decision-making process of the respondents. Crumb picture was the most important attribute for children (Table 4). This result is consistent with the findings from the emotion survey, in which children had strong positive emotional reactions to white crumb breads and strong negative emotional reactions to dark crumb breads, and visual liking scores in which white crumb breads received higher liking scores than dark crumb breads. The next most important attribute was crust, followed by flavor/taste, crumb texture, label claim and, finally, crust texture. It is important to note that the two most important attributes were visual attributes.

There was no difference in attribute importance scores between grade levels ($P < 0.05$) for crumb, crust appearance, crumb appearance, crumb texture and label claim. Middle school children placed equal importance ($P < 0.05$) on crust appearance and flavor/taste. This is important to note due to concerns that respondents may overly rely on image importance and not place enough importance on the nonvisual attributes in their decision making (Jervis *et al.* 2014). Elementary school children placed equal importance ($P < 0.05$) on label claim and crust texture, although these two attributes were the lowest across all school-age groups.

A comparison of utility scores for visual assessment of crumb is shown in Table 5. A white, uniform crumb had the highest utility followed by white with flakes and then white with seeds. There was overall agreement that a white crumb was the most attractive crumb in sliced sandwich breads for

children 8–17 years old ($P < 0.05$). Comparing utility score distributions across school-age, middle school children ranked the three dark crumb attributes as equally desirable. A higher degree of separation between visual evaluations of crust levels was observed compared with crumb picture levels. Despite overall statistical separation between crusts with toppings, individual school-age groups showed variability in their preferences and tolerances for crusts with toppings. This may be attributed to the combination of color of the actual crust, and the appearance of the toppings included. Light crust with no topping and dark crust with no topping scored at parity across children of all ages. Crusts with topping were significantly less desirable across both light and dark crusts. Light crust with flakes was preferred to light crust with oats. Dark crusts with toppings were least desirable, but unlike white crusts, oats were preferred to flakes as a topping. This may be due to the oats disguising the dark crust and making it appear lighter overall. Overall, there was a clear preference for breads with no topping among school-age children. Jervis *et al.* (2014) reported adult preferences for the same crust and crumb pictured attributes to be higher for crusts with topping and crumbs with particulates of seeds followed by flakes. This is in antithesis to what is reported here for children demonstrating the need for sliced bread products that are focused toward children's preferences.

Utility score distribution of flavor/taste claim was the most important nonvisual attribute for children (Table 5). Across all school groups, the most attractive claim was that of no flavor/taste. If there is to be a flavor/taste attribute on the bread package, buttery was the most attractive followed by sweet or toasted, wheaty, mild, yeasty or earthy, with nutty being the least desirable ($P < 0.05$). For the crumb texture attribute, a soft crumb was the most attractive level, followed by smooth. High school children ranked soft and smooth at parity, but elementary and middle school children showed a preference for soft. The next most attractive crust texture was moist, followed by chewy, squishy, firm or grainy (at parity) and grainy or dense (at parity). The most attractive label claim was that of bread that "tastes great"

	Overall	Elementary	Middle	High
White crust	51.43 b	37.72 c	64.01 a	54.32 ab
Dark crust	44.37 bc	36.50 c	46.23 bc	52.13 ab
White crust with flakes	-9.14 d	-7.37 d	-13.07 de	-6.90 d
White crust with oats	-19.17 e	-15.44 de	-19.34 ef	-23.67 efgh
Dark crust with oats	-28.57 fgh	-19.96 efg	-33.11 ghi	-34.22 hi
Dark crust with flakes	-38.91 i	-31.45 fghi	-44.72 i	-41.66 i
White	64.49 ab	57.79 abc	70.53 a	66.04 ab
White with flakes	50.31 c	48.39 c	49.79 c	53.32 bc
White with seeds	8.67 d	8.25 d	13.78 d	3.38 d
Dark with flakes	-35.59 ef	-30.60 e	-39.81 efg	-37.05 ef
Dark	-37.60 ef	-37.84 ef	-42.63 efgh	-31.60 e
Dark with seeds	-50.28 gh	-45.99 fgh	-51.66 gh	-54.09 h
Soft	22.07 a	21.37 a	22.30 a	22.69 a
Hard	-22.07 b	-21.37 b	-22.30 b	-22.69 b
Soft	31.74 a	32.72 a	32.40 a	29.77 ab
Smooth	22.64 b	21.10 bc	21.67 bc	25.68 ab
Moist	12.20 d	13.83 cd	13.05 cd	9.19 de
Chewy	5.78 e	8.28 de	5.47 e	2.99 e
Squishy	-10.71 gh	-15.97 hij	-3.90 fg	-11.86 ghi
Firm	-17.41 ij	-17.30 hij	-19.83 ijk	-14.81 hij
Grainy	-20.70 jk	-19.16 ijk	-23.37 jk	-19.59 ijk
Dense	-23.54 k	-23.51 jk	-25.50 k	-21.37 jk
Tastes great	25.82 b	31.50 a	24.01 b	20.75 b
Tastes like mom made it	8.45 c	8.57 c	9.52 c	7.07 cd
Soft	5.10 cd	3.52 cde	8.73 c	2.94 cde
All natural	0.06 ef	-1.28 efg	0.15 def	1.65 def
Whole grain	-7.80 hi	-7.21 ghi	-11.50 ij	-4.35 fgh
High fiber	-14.33 jk	-15.60 jk	-16.10 k	-10.72 hij
No artificial ingredients or preservatives	-17.29 k	-19.50 k	-14.82 jk	-17.36 k
None	93.94 a	86.35 b	93.71 ab	103.72 a
Buttery	40.20 c	39.67 c	42.77 c	37.93 c
Sweet	21.70 d	23.07 d	20.23 de	21.66 de
Toasted	16.71 de	19.73 de	18.51 de	10.89 ef
Wheaty	4.14 fg	2.84 fgh	3.58 fgh	6.40 fg
Mild	-5.19 h	-3.18 gh	-5.59 hi	-7.27 hij
Yeasty	-16.69 jk	-17.61 jk	-16.40 ijk	-15.85 ijk
Earthy	-21.23 k	-22.15 k	-23.15 k	-17.90 jk
Nutty	-39.64 l	-42.36 l	-39.96 l	-35.86 l

Note: Different letters within an attribute are different ($P < 0.05$).

followed by bread that “tastes like mom made it,” at parity with bread that was “soft.” The remaining label claims were all health-conscious label claims. These label claims were less attractive to children than taste and texture label claims. The most attractive of these label claims was all natural, followed by whole grain and then high fiber and no artificial ingredients or preservatives, which scored at parity for the least attractive label claim. Children are less product-driven by health composition label claims than with label claims involving taste and texture. This result follows the individual attribute importance scores that ranked flavor/taste above all other nonvisual attributes. All age groups reported a soft crust texture to be more desirable than a hard crust texture.

CONCLUSIONS

This study demonstrated that surveys and conjoint analysis can be used to measure children's emotions and preferences for sliced sandwich breads. Children desire bread that is light in crust and crumb color, with no toppings and no crumb particles, and showed positive emotional responses to lighter breads with no toppings or fillings in the focus group and in the emotion survey. Liking scores were generally higher in these breads and conjoint analysis showed that visual attributes were more important than nonvisual cues. Of the visual attributes, white was preferred to dark crust and crumb. Children do not find flavor claims appealing but prefer a mild/low flavor bread that tastes great. Overall,

TABLE 5. ZERO-CENTERED UTILITY VALUES FOR ATTRIBUTES AND LEVELS OF EACH SEGMENT FROM CONJOINT ANALYSIS

children desire sliced sandwich bread that is light in color, uniform, soft and mild in flavor. Adding whole grains in such a way as to not be as noticeable to children visually and texturally will be a key to making acceptable sliced whole grain sandwich bread.

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