Consumer Preferences for Peanut Butter (Mamba) Products in Haiti: A Conjoint Analysis

R.G. Nelson[1]*, C.M. Jolly[1], M.J. Hinds[2], Y. Donis[3], and E. Prophete[3]

ABSTRACT

Haitian consumers were surveyed to determine their preferences for three attributes of peanut butter: *form* (spicy, sweet, plain), *origin* (Haiti, U.S.), and *price* (lowest, most common, highest). Conjoint analysis was used to calculate relative importance and strengths of preferences for these attributes, which showed that price had more than twice the importance in the buying decision as either of the other attributes. Cluster analysis was used to identify market segments of like preferences, such as those strongly favoring Haitian products, or strongly disliking the plain form, or strongly sensitive to price. A multinomial logit model was used to evaluate the effect of various demographic variables on the probability of membership in a segment. A market share simulation determined that a new, sweet peanut butter product would increase domestic revenues most if priced at the highest level because a segment of the population would purchase the product and increase total peanut consumption.

Key Words: International sales, marketing.

Peanuts are considered a minor crop in Haiti in terms of area cultivated and total production, but contribute significantly to farm household income. Yields received from peanuts are relatively low at about 300 kg per ha, due to low soil fertility, periodic drought, and poor quality seeds (Jolly and Prophete, 2001). However, because of their higher value, peanuts compete well with other farm enterprises for land, one of Haiti's most limiting resources. The contribution of the crop to rural household income is enhanced even more by processing into value-added products such as peanut butter and roasted peanuts.

In seeking ways to increase household income in Haiti, the United States Agency for International Development (USAID) has been funding an ongoing Collaborative Research Support Program to conduct research on peanut production, marketing, and consumption in Haiti. The overall goal of this project is to improve the welfare of rural peanut producing and consuming households in Haiti. Included among the specific objectives of the project are to (a) identify alternative strategies available to farm families for marketing peanuts and peanut products; (b) evaluate the effect of product pricing on consumer acceptance of value-added peanut products in local markets; and (c) evaluate consumer reaction to newly-developed peanut products in Haiti. This study addresses objectives (b) and (c) explicitly, and provides results of importance to achieving objective (a).

Peanut butter (called "mamba" locally) is one of the value-added products with potential for increasing rural farm household income. Processing is done by small businesses in rural and urban areas by using the peanuts grown in neighboring communities. Such local industry generates income for the rural populace and supplies products that appeal to the tastes of domestic consumers.

Mambas are a common item in the diet of many Haitians, especially in the spicy form that is flavored with pimiento peppers (*Capsicum annuum* L.). A sweet form, flavored with sugar, and a plain, unflavored form are new domestic products, but the plain form is available in peanut butters imported from the U.S. Other attributes considered to be influential in the peanut butter buying decision were origin (made in Haiti or the U.S.) and price.

The purpose of this study was to determine Haitian consumers' relative preferences for these attributes in local and imported peanut butters. The information will be useful in helping the Haitian peanut industry provide products that are better suited to the preferences of Haitian consumers. Other recent studies on the production or consumption of peanut products in less-developed countries include Moon *et al.* (1999) in Bulgaria, Baidu-Forson *et al.* (1997) in Niger, and Hinds *et al.* (1995) in Belize.

Materials and Methods

Survey Design and Implementation. Respondents were recruited from three districts in the Port-au-Prince area: 45 from Kenscoff (an above-average income town about 20 miles from the capital); 90 from Canape Vert (a lower income urban community on the outskirts of the capital); and 64 from Pernier (an average income commu-

nity close to the city center). Five interpreters, fluent in English and the Haitian Creole dialect, helped explain the instructions to survey participants. Participants first completed a separate sensory evaluation in which they tasted four peanut butter products: sweet, spicy, and plain local brands of mambas; and a U.S. brand plain peanut butter (Hinds et al., 2002). After completing the sensory evaluation, participants progressed to the visual preference evaluation of these product forms, to which the attributes of origin and price were added, as described below.

A complete 3 x 2 x 3 main effects design was used to construct all possible product profiles for the three flavors (spicy, sweet, or plain), the two origins (Haiti or U.S.), and three prices (H$5, 7, or 11 per 1-lb container), giving 18 profiles in all. However, one of the U.S. product profiles was inadvertently omitted from the first evaluation session at Kenscoff, so only 17 profiles were used in the subsequent analysis.

With respect to form, sweet, spicy, and plain local brands of mamba were compared to a U.S. brand of plain peanut butter. Sweet and plain mambas were new to the Haitian marketplace. The principal imported peanut butter found in grocery stores is the plain variety from the U.S.

Prices for domestic brands found in Port-au-Prince grocery stores ranged from H$6.19 to H$7.50 per lb., so H$7 was chosen as the most common price and H$5 as the lowest price. Imported brands ranged from H$9.60 to H$10.58 per lb., so H$11 was chosen as the highest price to allow for subsequent market share simulations beyond the range of observed prices. At the time of the study, one U.S. dollar was equivalent to four Haitian dollars.

The 17 peanut butter products were each displayed in 1-lb cylindrical plastic tubs (similar to those sold in local grocery stores) with form, price, and origin displayed on an attached label constructed by the researchers. Participants visually evaluated each product profile and then rated each sample on a 5-point hedonic scale with 5 representing "Definitely would buy product," 1 representing "Definitely would NOT buy product," 3 representing "May or may not buy product," and 2 and 4 representing intermediate responses.

After rating the peanut butter samples, the participants were asked to provide demographic information including age, gender, education, household size, and income, as well as behavioral information including purchase frequency and amount, forms bought, how used, where bought, who buys, family peanut allergies, and companion foods.

Conjoint Analysis. According to Green et al. (2001, p. S57), "conjoint analysis is, by far, the most used marketing research method for analyzing consumer trade-offs." A variety of studies have used conjoint analysis to examine consumer preferences for novel food items, including Gillespie et al. (1998) on ostrich meat, Harrison et al. (1998) on minced crawfish, and Huang and Fu (1995) on Chinese sausage.

Consumers' preference ratings were analyzed using Bretton-Clark's Conjoint Analyzer software (Bretton-Clark, 1992). This program has the advantage of generating preference estimates for each participant rather than aggregating all participants and obtaining average preferences. This "individual-level" approach reduces bias in results when researchers have reason to believe that there are different segments of respondents with markedly different preferences (Bretton-Clark, 1992).

Before estimating the conjoint model, functional forms were specified for each attribute. A dummy variable, or "part-worth," functional form was selected for all three attributes. For form and origin, the choice was obvious because these are qualitative variables for which we had no prior expectations regarding the shape of the preference function. Price could have been represented more parsimoniously with a linear model, but since our design gave us ample degrees of freedom, we opted for the flexibility of a dummy variable form for price.

The following functional form of the model was estimated with ordinary least squares regression:

$$R = \alpha + \beta_1 F_1 + \beta_2 F_2 + \beta_3 O_1 + \beta_4 P_1 + \beta_5 P_2 + e \quad \text{[Eq. 1]}$$

where R was the rating assigned by a respondent to a particular product profile; F_1 and F_2 represented two of the three forms, designated by effects-coded indicator variables (Cohen and Cohen, 1983; Hardy, 1993); O_1 represented one of the two origins; P_1 and P_{119} represented two of the three prices (also designated by effects-coded indicator variables); and e represented a normally-distributed random error term. To facilitate interpretation of part-worths, the coefficient for the omitted form variable was calculated as the negative sum of the included form coefficients. The same procedure was used to calculate the omitted price variable. Since there were only two origin variables, the coefficient for the omitted origin variable was calculated as the negative of the included origin coefficient. Since each of the 199 respondents rated 17 tubs of peanut butter, there were 17 observations available to estimate each respondent's preference model, and a total of 199 such models were estimated. The means of all the part-worths and relative importances were tested against the null hypothesis that they were not significantly different from zero in a two-tailed t-test.

Cluster Analysis. The procedure for the cluster analysis was taken from examples in the SAS/STAT User's Guide (SAS Institute, 1990). The part-worth coefficients from the conjoint analysis were read in to a FASTCLUS procedure allowing for up to 30 clusters, in order to identify outliers. Clusters with less than six observations were omitted. The means of the remaining clusters were used as seeds for a second FASTCLUS procedure where clusters of size two to six were examined using a CANDISC procedure to generate plots of the various clusters in two dimensions (representing the first and second canonical variables). From visual comparisons, we determined that a three-cluster model had the least overlap of cluster membership. A third FASTCLUS procedure was used to assign the earlier outliers to clusters, the results were output to a file in which each respondent was assigned membership in one of the three clusters, and this file was merged with the demographic data for each respondent. Finally, the means of the demographic variables for each cluster were compared to the overall sample using a two-

tailed t-test.

Multinomial Logit Analysis. A comparison of cluster means to overall sample means is useful for characterizing the demographic profile of a cluster, but it gives little indication of which demographic variables are most important in determining cluster membership. A more precise approach is to construct a multinomial logit model to measure the relative impact of each variable on the probability of membership in each cluster; specifically, how much a given change in an independent variable changes the probability of membership in a given cluster. Frank *et al.* (2001) detail the steps in constructing a multinomial logit model using LIMDEP (Greene, 1995) and argue that the analysis of marginal effects provides a more practical interpretation of the results than the coefficients from the multinomial logit model itself.

Results and Discussion

Relative Importance and Strengths of Preferences in the Overall Sample. The rightmost column of Table 1 shows the means of the conjoint analysis of the 199 respondents in the overall sample. Price was overwhelmingly the most important attribute in the sample's buying decision, with a relative importance of 57%. Form was the next most important attribute, with 24%, while origin was least important with 19%. The mean adjusted R^2 of 0.55 indicated that the model explained a substantial amount of the variation in the data. The results were similar to other studies. For example, Behe *et al.* (1999) reported a mean adjusted R^2 of 0.48 in their study of preferences for geraniums and Frank *et al.* (2001) reported 0.49 in their study of preferences for bell peppers.

Although sweet mamba was a relatively new product on the market, on average it was moderately preferred over the spicy and plain forms as shown by its positive part-worth (0.13 in Table 1). However, conclusions based on averages alone can be misleading. A more revealing analysis of the distribution of preferred levels (not shown in Table 1) was conducted to assess the degree of heterogeneity in preferences among the 199 respondents. This analysis showed that, holding other attributes constant, 42% of the respondents preferred the sweet form, 35% preferred the spicy form, and 23% preferred the plain form. The data suggest that opportunities exist for segmentation based on form. Products of Haitian origin showed a much higher part-worth than those of U.S. origin (0.19 vs. -0.19 in Table 1) and were preferred by 62% of the overall sample. Not surprisingly, the lowest price was strongly preferred to higher prices (0.88 vs. 0.15 vs. -1.03 in Table 1), with 75% of the sample favoring the lowest price of H$5, 20% preferring the middle price, and 5% preferring the highest price.

Despite the apparently unequivocal preferences shown in the overall sample means, the distribution of preferred levels suggested that there were opportunities for segmentation within each attribute, and possibly across attributes, e.g., the consumers who preferred plain mamba could also be the same ones who preferred products of U.S. origin. These considerations were investigated using cluster analysis and the prospects for further seg-

Table 1. Mean relative importance, part-worths, adjusted R^2, and demographic variables for Haitian consumer segments based on preferences for mamba attributes.

	Segment I	Segment II	Segment III	Overall
No. Participating	93	44	62	199
% of Sample	46.7%	22.1%	31.2%	100.0%
Constant	3.36	2.99*	3.18	3.22
Form:				
Relative importance (%)	30.84*	25.40	13.27*	24.17
Sweet	0.06	0.34†*	0.06	0.13†
Spicy	-0.03	0.18†*	-0.07	0.00
Plain	-0.04*	-0.52†*	0.01*	-0.13†
Origin:				
Relative importance (%)	27.38*	15.44*	9.12*	19.05
Haiti	0.31†*	0.11†	0.05*	0.19†
U.S.	-0.31†*	-0.11†	-0.05*	-0.19†
Price:				
Relative importance (%)	41.78*	59.16	77.61*	56.78
H$5	0.28†*	1.29†*	1.49†*	0.88†
H$7	0.08†*	-0.17†*	0.48†*	0.15†
H$11	-0.36†*	-1.13†*	-1.98†*	-1.03†
Adjusted R^2	0.341*	0.520	0.777*	0.550
Peanut purchases (kg/wk)	1.56	1.21	1.85	1.57
Mamba purchases (kg/wk)	1.11	3.22	0.85*	1.50
Family member allergic (%)	20.43	13.64	17.74	18.09
Age (yr)	31.87	30.11	32.10	31.55
Gender (% male)	51.61	70.45*	35.48*	50.75
Education (yr)	7.54	6.71	6.91	7.16
Household size (persons)	6.37	6.35	6.39	6.37
Income (US$/mo)	47.20	40.68	42.58	44.32
Time to nut store (min)	21.63	18.11	31.49	23.92
Time to mamba store (min)	22.67	15.89*	26.99	22.51
Buys own peanuts (%)	61.29	68.18	70.97	65.83
Buys own mamba (%)	58.06	68.18	59.68	60.80
Surveyed in Kenscoff (%)	33.33*	27.27	3.23*	22.61
Surveyed in Canape Vert (%)	41.94	31.82	59.68*	45.23
Surveyed in Pernier (%)	24.73	40.91	37.10	32.16

*Significantly different from "Overall" at the 0.10 level in a two-tail t or Z test.
†Significantly different from zero at the 0.10 level in a two-tail t test (part-worths only).

mentation on the basis of observable demographic variables were analyzed with multinomial logit.

Segments Identified by Cluster Analysis and Characterized by Multinomial Logit Analysis. Table 1 lists the preference data for three segments identified by cluster analysis, along with the means of the demographic variables associated with each segment. Table 2 shows the effect of each demographic variable on the marginal probability of a respondent being in a particular segment. Interpreted together, the two tables give a profile of the average customer in each segment.

Segment I was the largest segment in the sample, representing 47% of the respondents, and was characterized by its strong preference for products of Haitian origin and its relative insensitivity to price compared to the other two segments. The tendency toward lexicographic prefer-

Table 2. Marginal probabilities by consumer segment with respect to the vector of demographic variables (computed at the means).[a]

Variable	Marginal Probabilities		
	Prob[Y=I]	Prob[Y=II]	Prob[Y=III]
Constant	0.44000*	0.10808	-0.54808*
Peanut purchases (kg/wk)	0.01384	-0.01391	0.00007
Mamba purchases (kg/wk)	-0.00596	0.00622	-0.00026
Family member allergic (1=yes)	0.09199	-0.07062	-0.02136
Age (yr)	0.00148	-0.00338	0.00190
Gender (1=male)	-0.01438	0.17253*	-0.15816*
Education (yr)	0.02013*	-0.01715*	-0.00298
Household size (persons)	-0.00317	-0.00794	0.01112
Income (US$/mo)	0.00027	-0.00026	-0.00001
Time to nut store (min)	-0.00037	-0.00003	0.00040
Time to mamba store (min)	0.00068	-0.00133	0.00065
Buys own peanuts (1=yes)	-0.09467	-0.01371	0.10838
Buys own mamba (1=yes)	-0.06032	0.13045	-0.07014
Surveyed in Canape Vert (1=yes)	-0.42317*	-0.07307	0.49624*
Surveyed in Pernier (1=yes)	-0.51834*	0.00743	0.51091*

[a]Multinomial logit model significant at P = 0.01.
*Significantly different from zero at P = 0.10.

ences for origin had been noted by our team of interpreters, who had described such respondents as "patriots." The average model fit (R^2 = 0.341) was the lowest of the three segments. Table 2 indicates that years of education contributed significantly and positively to the probability of being in this segment. The interpretation of this coefficient (0.02013) is that an increase of 1 yr in the average number of years of education in the overall sample would increase the probability of membership in Segment I by 2%. Respondents from Kenscoff were much more likely to be in Segment I, as revealed by the large negative coefficients for the other two communities.

At 22% of the sample, Segment II was the smallest segment. It was characterized as strongly preferring both the sweet and spicy forms but not the plain form, moderately preferring products of Haitian origin, and sensitive to price. Gender of this segment was overwhelmingly male (71% vs. 51% in the overall sample). The influence of gender on probability of segment membership was significantly positive, such that knowing a respondent was male would increase the probability of membership in Segment II by 17.3%. Conversely, an increase of 1 yr of education would decrease the probability of membership in Segment II by 1.7%.

Members of Segment III represented 31% of the sample and were characterized by their extreme sensitivity to price (which also rated highest in relative importance) and their moderate indifference to form or origin. This segment had the highest proportion of women (64.5% vs. 49.3% in the overall sample), which was also reflected in the significant negative relationship of male gender to the probability of membership in this segment. Respondents from Canape Vert and Pernier, respectively, were 49.6% and 51.1% more likely to be members of Segment III.

Market Share Simulation. One of the objectives of the project was to investigate the impact of introducing

new peanut butter products in the Haitian marketplace. Specifically, the question we asked was: "What would be the domestic market share and revenue impact of introducing a Haitian-made sweet mamba to Haitian consumers?" Accordingly, we simulated the sweet form of Haitian mamba as a new product entering a market with three established products: spicy Haitian mamba at H$7 per pound, plain Haitian mamba at H$7 per pound, and plain U.S. peanut butter at H$10 per pound.

Conjoint analysis enables such an investigation by predicting how many of the respondents would select each of a given set of products as their first choice. From this we can construct a table of pre-introduction market shares (Table 3) and then let the shares vary in response to the introduction of a new product offered at various prices. Because we wished to vary the price of sweet mamba continuously over its range, for this analysis we used a functional form with price as a continuous linear variable (rather than as a dummy variable as shown in Equation 1 and Table 1).

The results of the simulation (Table 3) indicated that if sweet mamba was introduced at the same price as the other two domestic mambas (H$7 per pound), almost all of its 39% market share would come from cannibalizing the incumbent Haitian products, which would fall from a combined market share of 93% to 55%. Nevertheless, the effect on gross revenues of domestic producers as a whole was slightly positive, rising from 651 to 654 index points, as shown in the last line of Table 3. Various other prices for the new sweet mamba product (from H$7 to 12.10 per pound) were simulated to determine their effects on domestic revenues while holding constant the prices of the other products. As the price of the new product approached and exceeded that of the imported U.S. product, less of the market share was taken from the other two domestic products. Consequently, domestic revenues rose, peaking at the price of H$12 per pound for the new sweet mamba and providing an increase in domestic revenues about 8% higher than without the new product.

Conclusions

Potential exists for new peanut butter products in Haiti—indeed, some of these products began appearing on the shelves of grocery stores in Port-au-Prince shortly after they were identified as prospective new formulations (i.e., between the conception and the implementation of the study). The sweet form was particularly well-received by survey respondents. As expected in a low-income country, the survey population as a whole, as well as all three segments, placed the highest relative importance on price. However, preferences for other attributes were by no means homogeneous, and segments were identified that placed more or less emphasis on form and country of origin. While demographic characteristics were not strong influences, perhaps due to the small sample size and its variability, two of the segments appeared to be related to gender, two to education, and two to community. Market share analysis indicated that the new sweet product should be introduced at a premium price in order to maximize revenues to Haitian peanut producers.

Table 3. Simulating the market impact of a new, sweet mamba product from Haiti: effect of varying price on market share and gross revenue.

Form	Origin	Price	Base[a]	H$7.00	H$9.00	H$11.00	H$12.00
		H$					
				Market share (%)			
Plain	U.S.	10.00	7.0	6.5	5.0	4.5	4.0
Spicy	Haiti	7.00	52.5	32.3	46.4	49.9	50.7
Plain	Haiti	7.00	40.5	22.3	35.3	37.9	38.9
(New) sweet	Haiti	variable	–	38.9	13.2	7.7	6.5
				Index of gross revenue (unitless)			
Plain	U.S.	10.00	70	65	50	45	40
Spicy	Haiti	7.00	368	226	325	349	355
Plain	Haiti	7.00	283	156	247	265	272
(New) sweet	Haiti	variable	0	272	119	85	77
Sum of three Haitian products			651	654	691	699	704

Price of new, sweet mamba product from Haiti

[a]Baseline market share before introduction of new product.

Further research should evaluate the potential for additional value-added peanut products such as other flavors of peanut butters, roasted peanuts, and snack mixes. Continued expansion of consumer markets depends critically on providing a wider selection of product attributes and marketing benefits.

Acknowledgments

Literature Cited

Baidu-Forson, J., B.R. Ntare, and F. Waliyar. 1997. Utilizing conjoint analysis to design modern crop varieties: Empirical example for groundnut in Niger. Agric. Econ. 16:219-226.

Behe, B., R. Nelson, S. Barton, C. Hall, C.D. Safley, and S. Turner. 1999. Consumer preferences for geranium flower color, leaf variegation, and price. HortScience 34:740-742.

Bretton-Clark. 1992. Conjoint Analyzer, Version 3. Bretton-Clark, Morristown, NJ.

Cohen, J., and P. Cohen. 1983. Applied Multiple Regression, 2nd ed. Lawrence Erlbaum, NJ.

Frank, C.A., R.G. Nelson, E.H. Simonne, B.K. Behe, and A.H. Simonne. 2001. Consumer preferences for color, price, and vitamin C content of bell peppers. HortScience 36:795-800.

Gillespie, J., G. Taylor, A. Schupp, and F. Wirth. 1998. Opinions of professional buyers toward a new, alternative red meat: Ostrich. Agribusiness: An Int. J. 14:247-256.

Green, P.E., A.M. Krieger, and Y. Wind. 2001. Thirty years of conjoint analysis: Reflections and prospects. Interfaces 31:S56-S73.

Greene, W.H. 1995. LIMDEP, Version 7.0: User's Manual. Econometric Software, Plainview, NY.

Hardy, M.A. 1993. Regression with dummy variables. Sage University Paper series on Quantitative Applications in the Social Sciences, 07-093. SAGE Publications, Newbury Park, CA.

Harrison, R.W., A. Ozayan, and S.P. Meyers. 1998. A conjoint analysis of new food products processed from underutilized small crawfish. J. Agric. and Applied Econ. 30:257-265.

Hinds, M.J., M.S. Chinnan, and L.R. Beuchat. 1995. Acceptance and purchase intent of peanut butter by Belizean consumers. Book of Abstracts of the 56th Annual Meeting of the Institute of Food Technologists, 81A-2:230.

Hinds, M.J., C.M. Jolly, R.G. Nelson, Y. Donis, and E. Prophete. 2002. Consumer acceptability and physicochemical properties of Haitian peanut butter-type products (mambas) compared with U.S. peanut butter. Peanut Sci. 29:102-109.

Huang, C.L., and J. Fu. 1995. Conjoint analysis of consumer preferences and evaluations of a processed meat. J. Int. Food & Agribusiness Marketing 7:35-53.

Jolly, C.M., and E. Prophete. 2001. Peanut production: An environmental dilemma for Haitian rural communities, pp. 195-207. In C.A. Pemberton (ed.) Rural Development Challenges in the Next Century. Proc. VI Latin Amer. and Caribbean Agric. Econ. Conference. Dept. Agric. Econ. and Ext., Univ. West Indies, St. Augustine, Trinidad.

Moon, W., W.J. Florkowski, L.R. Beuchat, A.V.A. Resurreccion, M.S. Chinnan, P. Paraskova, and J. Jordanov. 1999. Effects of product attributes and consumer characteristics on attitude and behavior: The case of peanuts in a transition economy. Agribusiness 15:411-425.

SAS Inst. 1990. SAS/STAT User's Guide, Ver. 6, 4th Ed., Vol. 1. SAS Inst., Inc., Cary, NC, pp. 835-849.