Consumer Preferences for Fresh Citrus: Impacts of Demographic and Behavioral Characteristics

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Abstract

In the last twenty years, trends within fresh fruit consumption have shifted from consumption of fresh citrus to non-citrus fresh fruit. Within citrus, consumers are switching from the traditionally dominant fruit, oranges, to tangerines. Using survey results from three cities in the U.S. on consumer preferences for fresh citrus products, we demonstrate that freshness, flavor and appearance are the most important attributes of fresh citrus. Heterogeneous preferences exist among consumers and both demographic and behavioral variables have significant impacts on preferences. Results indicate there are no dominant best predictors of consumer preferences. However, it appears there is potential to develop specific marketing strategies based on demographics.

Keywords: Fresh citrus, consumer preference, attitude, cluster analysis, market segmentation

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Introduction

Increasing consumption of fruits and vegetables is encouraged as part of a healthy diet that will lead to lower personal and social health costs. The FAO has established increasing fruit and vegetable consumption as a global priority (FAO 2003). In the U.S., several campaigns and programs, such as Produce for Better Health Foundation (PBH) and the Nutrition Assistant Program administered by USDA, have continuously and extensively promoted vegetable and fruit consumption among U.S. consumers to reduce the risk of diseases such as stroke, cancer and diabetes (Stewart and Harris 2004;USDA-FNS 2008). Increased demand for fruits and vegetables has provided opportunities for several agricultural sectors. For instance, from 1990 to 2007 the per capita consumption for fresh berries (blueberry, cranberry and strawberry) doubled and the consumption of pineapple and papayas increased more than fivefold. However, per capita consumption of fresh citrus (orange, tangerine, lemon, lime and grapefruit) experienced a decline from 26.6 pounds in 1998 to 20.6 in 2008. Among citrus groups, the consumption and sales of the historically dominant citrus fruit, oranges, experienced a continuous decline, while tangerines experienced an increase in consumption. From 1990 to 2008, per capita consumption of fresh oranges decreased from 12.4 to 9.9 pounds and tangerines increased from 1.4 to 3.1 pounds (USDA-ERS 2009a; USDA-ERS 2009b).

Demand for fruits is expected to grow, from 164.5 pounds per capita in 2000 to 182.3 pounds by 2020 (Lin et al. 2003). The shift from consumption of fresh citrus to non-citrus fresh fruit, combined with a shift within fresh citrus from oranges to tangerines, and the projection for increases in demand for fresh fruits bring forward a critical question for the citrus industry – how to take advantage of the increasing demand for fresh fruit, and why consumers are shifting citrus consumption habits from the traditionally dominant oranges to tangerines? Developing an increased understanding of consumer preferences for fresh citrus may play a key role in aiding the biological scientists who need to understand what to focus on when developing new varieties in citrus breeding programs. Identifying the characteristics of citrus that play a key role in consumer fresh citrus choices is an important step in determining consumer preference for fresh citrus. Determining the importance of product attributes "…is of special relevance to public policymakers interested in understanding and perhaps influencing the information environment of the consumer as it relates to purchase decision-making" (Quelch 1979, p232).

Despite the importance of identifying the critical factors determining consumer preferences for fresh fruit, few studies are available that focus on citrus. The two most relevant studies are from Campbell et al. (2004) and Poole and Baron (1998). Campbell et al. use conjoint analysis to determine consumer preference for seven attributes that may affect consumer preferences for Satsuma mandarins. They also cluster consumers into three segments as no-blemish, price-sensitive and no-seed segment. Poole and Baron study the importance of ten citrus attributes, but they do not investigate the factors that may impact consumer preferences.

Other existing literature focuses on consumer preferences for specific fruit attributes such as pesticide use in apples (Baker 1999); organically, locally grown potatoes (Loureiro and Hine 2002); and locally grown fresh produce (Eastwood, Brooker and Orr 1987). Studies in food science focus on the comparison of sensory attributes of several products and consumer overall rating of those products to determine the best alternative among those being tested (e.g.

Campbell et al. 2004; Jaeger et al. 1998; Kühn and Thybo 2001). However, trying to elicit consumer preferences for a single attribute may not be enough to explain consumer choices of different fruits. Further, determining consumer choices of products directly after a taste test of selected sensory attributes may evoke respondents' attention to those characteristics being tasted, which may be ignored in a real world purchase (particularly when many sensory attributes are not experienced at the time of purchase). Therefore, the results from sensory taste tests may be misleading to predict consumer purchase behaviors. Perhaps the most famous example of this is Coca-Cola's introduction of a new formula in 1980s that was designed to beat their competition in a taste test, but did not succeed in the marketplace (Whyte 1991). A simple, but powerful, tool to identify consumer preferences may be to ask consumers to rank the importance of product attributes as suggested by Quelch (1979).

In addition, previous studies (Campbell, et al. 2004; Gao and Schroeder 2009) have shown that consumer preferences are heterogeneous, and as such, identification of specific consumer groups that have similar attitudes toward product attributes is critical. Both demographic and behavioral variables can be used to explain heterogeneous preferences, though neither is sufficient on their own. Consumer demographics are commonly believed to be poorly related to consumer behavior (Johns and Gyimothy 2002), however, consumer demographics are readily available. Although demographics are not likely to explain all of the variation in consumer preferences, some are often significantly related to preferences. For example, numerous studies have found location (city, region or country) to be an important factor in explaining heterogeneous consumer preferences (e.g. Fox 1995; Jaeger, et al. 1998). Psychographic characteristics are more reliable as a measure of consumer lifestyle and may serve as a better predictor for market segmentation; however these variables are lacking theoretical foundation, measurement reliability, and are difficult to access without a detailed survey designed for the specific problem (Lesser and Hughes 1986; Edris and Meidan 1989).

The purpose of this article is to (1) determine the importance of fresh citrus attributes; and (2) determine the impact of consumer demographics and behavioral variables on consumer preferences for key citrus attributes. By including both demographic and behavioral variables, we expect to be able to identify the most important factors in determining consumer preferences for citrus products and possibly shed a light on future studies on consumer preference for other fruits. Our paper differs from previous studies on consumer preference for citrus products in several aspects. First, we collected a long array of variables on consumer demographics and purchase behavior to identify the impacts of those variables on consumer preference and consumer grouping. This is significantly different from Poole and Baron (1996) who did not consider the potential heterogeneous preferences among consumers and from Campbell et al. (2004) who only included a few demographic and behavioral variables in their analysis. In addition, unlike Campbell et al., the attributes that are ranked in our study are for the broad concept of citrus (including orange, tangerine, grapefruit and pummelo etc.), instead of for one breed of mandarin. By focusing on citrus in general, we are more able to provide input for the biological scientist, who has the ability to develop products that mix attributes from various citrus fruits. This information will help breeders develop strong varieties of citrus fruits that may have multiple attributes from different varieties of citrus to best meet consumer demand.

Importance Rating of Fresh Citrus Attributes

Three consumer surveys on consumer preferences for fresh citrus attributes were conducted by Ipsos-Reid[1] in 2008 in Chicago, Illinois; Baltimore, Maryland; and Tampa, Florida, resulting in 223 usable responses. Respondents were randomly selected for mall intercept interviews and were asked to rate the importance of eight attributes in their purchase decisions for fresh citrus. The eight attributes include seven sensory attributes *Appearance, Freshness, Flavor, Fruit Size, Ease of Peeling, Seeds* (number of seeds in fruit), *Juiciness,* and, one extrinsic attribute, *Price.* The attributes investigated in this study are similar to those in Poole and Baron (1996) with the exception of *Packaging* which was the least important factor affecting consumer choice of citrus, and is difficult to evaluate as the types of packaging differ, making it unclear to what the consumer was referring. Consumer demographics such as age, household income, household size, etc., were collected and are summarized in Table 1 (see Appendix 1). Also summarized in Table 1 are the variables collected on purchase and consumption behavior. Consumption habits of citrus, as well as other fruits and drinks were collected as previous research has indicated other fruits may be substitutes or complements for citrus (Lee, Brown and Seale 1992).

More than 60% of respondents indicated each of four attributes were extremely important: *Freshness, Flavor, Appearance* and *Juiciness. Seeds, Ease of Peeling,* and *Fruit Size* were less important attributes with more than 30% of the respondents ranking these three attributes as "somewhat" or "not at all" important. These results are slightly different from Poole and Baron (1996), who found that more than 50% of the respondents rated *Juiciness, Skin Quality* (similar to our variable *Appearance*), *Sweetness* (similar to our variable Flavor) and *Texture* as the most important attributes. However, Poole and Baron (1996) did not include *Freshness* in their survey.

Consumers in the three cities had similar but slightly different preferences for fresh citrus attributes. Consumers in all three cities ranked *Freshness* and *Seeds* as the most and least important attributes, respectively (Table 2). Baltimore consumers considered *Appearance* and *Flavor* equally important. However, consumers in both Chicago and Tampa rated *Flavor* over *Appearance* as the second most important attribute (Table 2). People in Baltimore tend to be

Table 2. Importance of Fresh Citrus Attributes by City

	Baltimore				Chicago				Tampa			
	1	2	3	4	1	2	3	4	1	2	3	4
Freshness	0.0	1.4	12.5	86.1	0.0	2.7	16.4	80.8	0.0	0.0	16.7	83.3
Flavor	0.0	0.0	19.4	80.6	0.0	4.1	15.1	80.8	0.0	2.6	24.4	73.1
Appearance	0.0	1.4	18.1	80.6	1.4	6.9	31.5	60.3	1.3	5.1	33.3	60.3
Juiciness	0.0	4.2	22.2	73.6	2.7	5.5	23.3	68.5	1.3	6.4	44.9	47.4
Fruit Size	2.8	11.1	22.2	63.9	8.2	26	24.7	41.1	6.4	38.5	24.4	30.8
Price	2.8	16.7	22.2	58.3	1.4	19.2	24.7	54.8	9.0	25.6	28.2	37.2
Ease of Peeling	6.9	12.5	29.2	51.4	9.6	27.4	31.5	31.5	11.5	35.9	25.6	26.9
Seeds	8.3	9.7	30.6	51.4	19.2	20.6	23.3	40.0	32.1	19.2	19.2	29.5

Notes: 1 = not at all important; 2 = somewhat important; 3=very important; 4 = extremely important

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[1] Begun in 1975, Ipsos is a global company that focuses on survey-based market research.

more demanding for the quality of fresh citrus- even for the lowest rated attributes such as *Ease of Peeling* and *Seeds*. More than 50% of respondents in Baltimore rated *Ease of Peeling* and *Seeds* as the most important, while in Chicago and Baltimore, less than 40% respondents rated those two attributes as the most important.

Impacts of Demographic and Behavioral Variables on Consumer Preferences

Eight ordered probit models were estimated to identify the underlying determinants that explain the differences in consumer preferences. Because each respondent rates the importance of eight fresh citrus attributes, there may be correlation in the unobserved errors of the eight regression equations. Models that account for correlation in the errors for systems of equations may be more appropriate. However, because the regressors in the eight models are the same, models such as seemingly unrelated regression (SURE) result in the same estimates as ordinary least square (OLS) method that does not account for the correlation in the errors in a system of equations (Greene 2000). In this article an ordered probit model is used as the dependent variable is the respondents' ordinal rating of a certain level of importance (from 1 to 4). Estimating the ordered probit models may not account for correlation in the errors, but is more consistent with the nature of the dependent variables. As such, the observed rating of citrus attributes is:

(1)
$$y_i = j \text{ if } \mu_{j-1} \leq y_i^* \leq \mu_j, j=1,2,3,4 \quad ,$$

where y_i is the observed importance rating of citrus attributes, y_i^* is unobserved true importance rating of attributes an μ_js are threshold levels. With the assumption that $y_i^* = \beta'x + \varepsilon_i$ and ε_i is a random component with normal distribution, the probability that a respondent rates an attribute as importance level *j* is:

(2) $$Prob(y_i = j) = \Phi(\mu_j - \beta'x) - \Phi(\mu_{j-1} - \beta'x), \ j=1,2,3,4$$

where Φ is the cumulative distribution function of standard normal distribution, *βs* and μ_js are parameters being estimated and *x*s are independent demographic and behavioral variables[2].

The results of the ordered probit models are reported in Table 3[3] (See Appendix 2). Location and marital status are the most important demographic variables explaining the heterogeneous preferences among consumers. Consumers in Baltimore tend to consider *Appearance, Juiciness, Fruit Size, Price* and *Ease of Peeling* (five of eight attributes) as more important than Tampa consumers. Married consumers were statistically more likely to rate *Freshness, Appearance, Flavor, Fruit Size, Price* and *Ease of Peeling* (six of eight

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[2] It is very common to include behavior variables such as purchase behavior as regressors to explain consumer preferences. However, by including the purchase behavior variables as regressors, we are not arguing that purchase behavior determines consumer preferences. As in most regression analysis, we are not trying to establish a cause-effect relationship between the dependent and independent variables. Whether purchase behavior determines consumer preference or consumer preference determines consumer purchase behavior is not the focus of this paper.
[3] Marginal effects are not reported because the focus of this study is to determine the negative or positive impact of the regressors rather than the scale. In addition, reporting marginal effects will take more pages than reporting the estimates of the model (for each regressor there are four marginal effect estimates). The marginal effects estimated at the mean are available from the author per request.

attributes) more important than other consumers. Overall, education, employment status and ethnicity do not significant affect consumer rating of citrus attributes.

A number of the behavior variables significantly influenced consumer perceptions. For instance, consumers who did the majority of the household shopping (*Shopping Percent*) are significantly more likely to rate seven of the eight attributes higher than consumers who were not the primary shopper. In addition, consumers who have purchased oranges in the last 30 days rated *Size, Price, Ease of Peeling* and *Seeds* significantly less important than those who had not purchased oranges in the last 30 days. Consumption behavior of oranges also has a significant impact on consumer ratings for some of the fresh citrus attributes. For instance, people who consumed grapefruit in last month are more likely to rate *Appearance* and *Flavor* less important than those who did not, while people who consumed tangerine are more likely to rate *Ease of Peeling* and *Seeds* less important. Although this may seem counter-intuitive at first, it may be a result of the primary shopper being more discriminating than a person who consumes the fruit, but may or may not be the purchaser.

One interesting phenomenon demonstrated by the results is the opposite signs of coefficients of purchase and consumption behavioral variables. The results show that consumers who purchased oranges in the last 30 days were significantly less likely to rate *Ease of Peeling* and *Seeds* as more important than those who did not purchase oranges. However, consumers who consumed oranges in the last three months were significantly more likely to rate *Ease of Peeling* and *Seeds* as more important than those who did not consume oranges. The same phenomenon happens with the effects of purchase and consumption of grapefruit on consumer preferences for *Appearance* and *Flavor*. Those that purchased grapefruit were significantly more likely to rate *Appearance* and *Flavor* as more important, while those that consumed were less likely to rate these two factors as important. With tangerines, *Ease of Peeling* and *Seeds* were more important to purchasers and less likely to be important to consumers. Although at first this result seems incongruous, the pattern revealed is consistent with Poole and Baron (1996), who showed that there were mismatches between consumer purchases and stated preferences.

This finding is also consistent with literature on consumer attitude formation (Schiffman and Kanuk 2000). As consumer attitudes are often formed by unconditioned stimulus (past experience) and conditioned stimulus (experience with the use of products), it is reasonable that expectations before consumption (purchasers, not consumers) might differ from post-consumption beliefs. In our case, for example, consumers might not believe ease of peeling and seeds to be important attributes in oranges before consumption. However, after consumption, their opinion changes as a result of the experience they had with the orange. In this case, the indication is the consumption experience may have contained negative information related to seeds and peeling, thus making it more important for the next purchase opportunity. To take this a step further, the consumer might not expect seeds in oranges, therefore, they are surprised to find any seeds, and this becomes more important. For grapefruit, the relation may be easier to demonstrate. At the time of purchase, appearance is important, as it is one of the criteria that can be observed pre-consumption (unlike seeds). After consumption, the consumer may find no relationship between appearance and the consumption experience, hence appearance becomes less important.

Impacts of Demographic and Behavioral Variables on Consumer Segmentation

The results of the ordered probit models demonstrate that some variables, such as city, marital status, and shopping percent have a significant impact on consumer preference for several fresh citrus attributes. This implies that among the respondents being surveyed, some consumer groups were more critical on a number of the attributes of fresh citrus. As such, a cluster analysis was used to divide consumers into groups based on their rating scale of the eight citrus attributes in Table 2. Ward's hierarchical clustering method was implemented because this method performs better with uniform cluster size when the original clusters are poorly separated (SAS 2008).

Three clusters were identified and are reported in Table 4. One cluster of consumers rated all attributes more important than consumers in the other segments. For this reason, we refer to these consumers as Perfectionists. Another cluster rated all attributes except for price higher, thus are referred to as Pro-Quality consumers. The final segment includes the remaining consumers, who gave their focus on the price variable and are referred to as Pro-Price consumers. Consumers in the Pro-Quality cluster rate *Appearance, Freshness, Flavor, Juiciness* as significantly more important, and price as significantly less important than consumers in the Pro-Price cluster.

Table 4. Importance of Fresh Citrus Attributes by Consumer Cluster Segment

	Perfectionist	**Pro-Price**	**Pro-Quality**	**Overall Sample**
Freshness	3.99	3.34	3.88	3.82
Flavor	3.98	2.89	4.00	3.76
Appearance	3.85	3.13	3.55	3.61
Juiciness	3.87	2.89	3.47	3.55
Fruit Size	3.73	2.40	2.47	3.08
Price	3.83	2.79	2.45	3.20
Ease of Peeling	3.54	2.28	2.35	2.92
Seeds	3.40	2.17	2.32	2.82
# of Respondents	110	47	66	223

Numbers are reported on a scale from 1-4, with 4 representing extremely important and 1 representing least important.

Multinomial logit model are estimated to determine impact of the demographics and behavioral variables on consumer types. In the multinomial logit model, the probability that a consumer belongs to the *ith* consumer group is

$$(3) \quad P(y = i) = \frac{\exp(\beta_i' x)}{\sum_{j=1}^{3} \exp(\beta_j' x)}$$

In the estimation, one consumer group must be chosen as a comparison group and the log of the odds ratio of the probability that consumers belong to group *i* vs. group *j* is

$$(4) \quad \ln\left[\frac{P_i}{P_j}\right] = \beta_i' x$$

The sign of the parameter estimates indicate the impact of independent variables on the probability of consumers belonging to consumer group *i* as compared to group *j*(Greene 2000). Each of the three groups from the cluster analysis is used as a comparison group and three multinomial logit models were estimated[4].

By focusing on the significant variables from the results of multinomial logit models, we are able to examine the different make-up of each cluster (Table 5). The largest portion of consumers in the Perfectionist cluster is from Baltimore (40.0%), consumers from Chicago and Tampa account for 35.5% and 24.6% of the Perfectionist group. Tampa consumers led both the Pro-Price and Pro-Quality clusters (with 40.4% and 48.5% of the clusters, respectively). In the Pro-Price group, singles account for more than half of the consumers, while married people are more likely to be in the Perfectionist or Pro-Quality clusters. This result is consistent with a study on food behavior that showed married adults are more likely to follow the dietary guidelines, thus are more concerned with food quality than people who are single (Roos et al. 1998).

Number of children present was different by cluster. As over half of the respondents in our survey do not have children, it is not surprising that each cluster is more likely to have consumers without children. However, what is interesting is that consumers with children of different ages were likely to be in different clusters, which does not comply with Roos et al. (1998) who found that the age structure of children in families did not significantly affect parents' food behaviors. Considering the difference in nutrition intakes of children and the cost of raising children at different ages differ significantly (Lino and Carlson 2009;Ganji, Betts and Whitehead 1995), this result may reflect changing attitudes of parents with children at different ages towards fruit quality. Specifically, parents with children less than 2 years old are more likely to be in the Pro-Quality cluster over the Perfectionist group, which indicates parents of very young children are focused on food quality and less focused on price. Parents of children aged 6 to 12 were more likely to be in the Pro-Quality and Perfectionist group over Pro-Price, implying food quality has more impacts on the choice of fresh citrus for consumers with children than those without children.

Behavioral variables also impacted cluster membership. The Pro-Price group contained equal amounts of people that indicated they performed about half, more than half, and all of the family's shopping. However, the Perfectionist group was largely made up of those who did all of the shopping. Past purchases of grapefruit and tangerine were significant in determining cluster membership, but purchases of other fruits were not. Over 45% of Perfectionist had purchased grapefruit in the last 30 days, as compared to only 27% of those in the Pro-Quality group. In addition to purchasing habits, consumption habits influenced group membership. Nearly all respondents in Perfectionist and Pro-Quality consumer groups (90%) had consumed orange juice in the last 30 days, but those in the Pro-Price group were less likely to have had orange juice. There was a lower concentration of grapefruit consumers in the Pro-Quality cluster.

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[4] The results of the multinomial logit model are not reported because of the space limits. From the multinomial logit model we were able to identify the important factors that affect the clusters of consumer groups.

Table 5. Statistics of Consumer Profiles by Segment

	Perfectionist	**Pro-Price**	**Pro-Quality**
Demographics			
City			
Baltimore	40.0%	29.8%	21.2%
Chicago	35.5%	29.8%	30.3%
Tampa	24.5%	40.4%	48.5%
Marital Status			
Single	40.9%	51.1%	42.4%
Married	44.6%	27.7%	45.5%
Other	14.5%	21.3%	12.1%
Children Age Structure			
No Children	45.5%	61.7%	48.5%
Children Under 2	7.3%	4.3%	12.1%
Children 2 to 5	17.3%	4.3%	9.1%
Children 6 to 12	30.9%	10.6%	27.3%
Children 13 to 18	19.1%	23.4%	25.8%
Purchase Behavior			
Shopping Percent			
About Half of Shopping	14.6%	38.3%	28.8%
Almost All the Shopping	17.3%	25.5%	16.7%
All the Shopping	68.2%	36.2%	54.6%
Fruit Purchased			
Grapefruit	45.5%	36.2%	27.3%
Tangerine	63.6%	68.1%	50.0%
Consumption Behavior Food Consumed			
Orange Juice	93.6%	76.6%	92.4%
Grapefruit	46.4%	51.1%	36.4%
Tangerine	67.3%	72.3%	69.7%
Grape	80.9%	83.0%	71.2%

Notes: For City and Martial Status, the numbers across different category for each consumer segment add up to 100%. However, for other variables, those numbers does not add up to 100% because those categories are not exclusive.

In Pro-Price group, more than 50% of consumers have consumed grapefruit, while only 36% of this group had indicated they purchased grapefruit. This may again indicate the inconsistency between purchase and consumption, where consumers behave as a perfectionist, wanting all attributes before purchase, but post-consumption, they become more concerned with price. This could be explained by the experience they have when consuming grapefruit. If they purchase a poor quality fruit, they may regret the price they paid for the fruit. However, if they have a good experience, they may think they can obtain that same experience at a lower price (for example, they may think the good quality is a result of the correct season, thus assuming they can get good quality at a lower price). As price is an important welfare measure and quality indicator, consumers may use price as an indicator of quality at purchase. However, after consumption,

price loses its role as a quality cue, thus the consumer may change weighting of the importance of price in their decision.

Conclusions

Fruit and vegetable consumption is lower than recommended levels in the United States. Understanding the consumer decision making process with regard to fruits and vegetables is a vital step in successfully promoting fruit and vegetable consumption. Using survey results from three cities in the U.S. on consumer preferences for fresh citrus products, we demonstrated that freshness, flavor and appearance are the most important attributes of fresh citrus. However, heterogeneous preferences exist among consumers. Demographic variables such as city, marital status, age and presence of children in the household, and behavioral variables, such as share of shopping responsibility, purchase and consumption of fruits also have significant impacts on consumer preferences.

One of the most interesting results in this analysis is the reversed impacts of purchase and consumption behavior on consumer ratings of fresh citrus attributes. Although this is consistent with Poole and Baron's (1996) study on consumer preferences for citrus, it is still surprising as it may reflect poor performance of current labels in the market as indicators of product quality. Because of the difference between the expected quality (at purchase) and experience quality (after consumption), consumers alter their attitudes about the role of product attributes in their purchase decision. This demands the development of more efficient strategies to provide accurate information on quality of fresh citrus.

In addition to identifying the product attributes that most significantly determine consumer choice of fresh citrus, the ratings of these attributes were used to identify clusters of consumers. Both demographic and behavioral variables played important roles in identifying consumer preference for fresh citrus and can be effectively used to identify clusters of consumers. There is no dominant best predictor of consumer preferences. However, the finding that parents with children at different ages show different attitudes towards citrus attributes indicates the potential to develop specific marketing strategies based on the children's age structure in the household. The significant impact of purchase and consumption of tangerine and grapefruit on consumer preferences require further detailed study on those consumer groups. In addition, follow up research to identify the exact components of freshness, flavor, appearance and other citrus attributes is critical for producers to provide the right products, as well as for researchers to develop more favorable new products for consumers. Using focus groups to identify the key factors that may explain the disparity in consumer attitude toward fruit attributes before and after purchase also warrants future research.

Acknowledgements

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Appendix 1

Table 1. Demographic and Behavioral Variables of Survey Respondents

Variable	Description	Total	Baltimore	Chicago	Tampa
Demographic Variables					
City	City of residence	223	32%	33%	35%
Age	Age of respondent	38.4	38.7	38.4	38.0
Gender	Percent male respondents	48.0%	50.0%	48.0%	46.1%
Household Size	Number of residents in household	3.3	3.1	3.5	3.2
Household Income	Under $30,000	10.3%	8.3%	15.1%	7.7%
	$30-$49,999	48.9%	51.4%	46.6%	48.7%
	$50-$74,999	19.7%	23.6%	17.8%	18.0%
	$75-$99,999	11.7%	9.7%	8.2%	16.7%
	$100,000 and above	9.4%	6.9%	12.3%	9.0%
Marital Status	Single	43.5%	48.6%	46.6%	35.9%
	Married	41.3%	36.1%	34.3%	52.6%
	Other	15.2%	15.3%	19.1%	11.5%
Education	High school or lower	47.5%	51.4%	56.2%	56.2%
	Technical school or a university	30.0%	25.0%	31.5%	31.5%
	2-year college diploma	12.6%	16.7%	8.2%	8.2%
	Undergraduate or graduate degree	9.9%	6.9%	4.1%	4.1%
Employment	Employed, full-time	46.6%	72.2%	32.9%	35.9%
	Employed, part-time	16.6%	13.9%	16.4%	19.2%
	Homemaker	6.7%	5.6%	6.8%	7.7%
	Student	7.1%	2.8%	6.8%	11.5%
	Retired	3.6%	2.8%	5.5%	2.6%
	Unemployed	4.9%	1.4%	2.7%	10.3%
	Other	14.3%	1.4%	28.8%	12.8%
Ethnicity	White/Caucasian	58.7%	44.4%	64.4%	66.7%
	Black/African American	30.5%	48.6%	24.7%	19.2%
	Other	10.8%	7.0%	10.9%	14.1%
Age of Children in Home	No children	49.8%	44.4%	49.3%	55.1%
	Under age 2	8.1%	5.6%	11.0%	7.7%
	Ages 2 to 5	12.1%	9.7%	12.3%	14.1%
	Ages 6 to 12	25.6%	31.9%	27.4%	18.0%
	Ages 13 to 18	22.0%	25.0%	19.2%	21.8%

Table 1. *Continued*

Variable	Description	Total	Baltimore	Chicago	Tampa
Behavioral Variables:					
Shopping Percent	Approximately half	23.8%	25.0%	24.7%	21.8%
	More than half	18.8%	16.7%	19.2%	20.5%
	All (100%)	57.4%	58.3%	56.2%	57.7%
Purchased in last 30-days:					
Orange Juice		92.8%	94.4%	91.8%	92.3%
Grapefruit Juice		44.4%	51.4%	37.0%	44.9%
Oranges		94.2%	98.6%	98.6%	85.9%
Grapefruits		38.1%	52.8%	32.9%	29.5%
Tangerines		60.5%	77.8%	50.7%	53.9%
Apples		80.7%	81.9%	82.9%	78.2%
Grapes		81.6%	79.2%	83.6%	82.1%
Other Fruits		62.8%	58.3%	60.3%	69.2%
Consumed in last 3 months:					
Orange Juice		89.7%	91.7%	93.2%	84.6%
Grapefruit juice		41.7%	47.2%	34.3%	43.6%
Oranges		96.4%	97.2%	98.6%	93.6%
Tangerines		69.1%	77.8%	52.1%	76.9%
Apples		78.0%	79.2%	78.1%	76.9%
Grapes		78.5%	79.2%	80.8%	75.6%
Fresh Citrus Consumption					
Frequency:					
	Less than once per month	3.1%	1.0%	5.4%	3.8%
	Once a month	15.7%	16.7%	20.6%	10.3%
	Once every 2 or 3 weeks	31.4%	30.6%	27.4%	35.9%
	Once a week or more	49.8%	52.8%	46.6%	50.0%

Appendix 2

Table 3. Parameter Estimates of Ordered Probit Model of Fresh Citrus Attributes

	Freshness	Appearance	Flavor	Juiciness	Size	Price	Peeling	Seeds
Intercept	2.27	-1.06	1.35	0.03	-0.96	1.06	-2.50***	-1.62
Demographics								
Baltimore	0.30	0.86***	0.35	0.73***	0.95***	0.83***	0.80***	1.00
Chicago	-0.05	0.17	-0.03	0.51***	0.33	0.72***	0.25	0.53***
Age	-0.03**	-0.02***	-0.01	-0.01	-0.01	0.00	-0.01	0.00
Male	-0.06	0.30	-0.41	0.15	0.18	0.04	0.46***	0.17
Household Size	-0.10	0.07	-0.03	-0.15*	0.05	-0.04	0.01	0.03
Income Level (dropped category = $100,000 and above)								
1 <$30k	0.21	0.40	-0.04	1.06***	1.07***	0.16	0.74*	0.48
30K <= 2 < $50K	0.30	0.53	-0.56	0.61*	0.73**	0.01	0.46	0.37
50K <= 3 < $75K	0.00	0.51	-0.29	0.34	0.41	-0.42	-0.05	-0.11
$75K <= 4 < $100K	-0.64	0.50	-0.99*	0.19	0.41	-0.67*	0.11	0.27
Marital Status (dropped category = other)								
Single	0.03	0.27	0.18	-0.23	0.16	0.26	0.27	0.01
Married	1.22***	0.88***	0.78***	0.10	0.58***	0.52***	0.66***	0.37
Education Level (dropped category = High School degree or lower)								
Some University	0.21	0.24	0.06	0.06	0.12	-0.11	0.01	-0.05
2-year College Diploma	1.20	0.45	0.20	0.10	0.38	0.34	0.57*	0.76**
Undergraduate or Graduate Degree	0.05	0.28	-0.83*	-0.57	0.06	0.48	-0.11	-0.03
Employment Status (dropped category =other)								
Employed, Full Time	-0.12	0.08	-0.12	-0.25	-0.14	0.07	-0.29	0.55*
Employed, Part Time	-0.45	-0.06	-0.14	0.02	-0.02	0.25	-0.10	0.66***
Homemaker	0.98	0.22	0.50	1.02*	0.34	0.89***	0.12	1.10**
Student	-0.97	0.06	0.12	-0.32	0.29	0.19	0.23	0.87***
Retired	-0.58	0.02	-1.70**	-0.53	-0.27	0.04	-1.18**	-0.08
Unemployed	-0.14	1.52***	-0.25	0.09	-0.39	-0.35	-0.38	0.31
Ethnicity (dropped category = other)								
White/Caucasian	0.29	0.33	0.89***	0.30	0.08	-0.28	0.08	0.17
African American	-0.07	0.15	0.46	-0.19	0.21	-0.50	0.04	-0.23

Table 3. *Continued*

	Freshness	Appearance	Flavor	Juiciness	Size	Price	Peeling	Seeds
Intercept	2.27	-1.06	1.35	0.03	-0.96	1.06	-2.50***	-1.62

Age Structure of Children in Household (dropped category = no children)

Demographics

	Freshness	Appearance	Flavor	Juiciness	Size	Price	Peeling	Seeds
Children Under 2	0.58	-0.08	0.47	-0.16	-0.37	-0.31	-0.40	-0.25
Children 2 to 5	0.61	-0.13	1.02	1.07***	0.08	0.69***	0.14	0.43
Children 6 to 12	0.30	0.09	0.89***	0.14	-0.10	0.28	0.07	-0.36*
Children 13 to 18	-0.02	0.02	-0.54*	-0.10	-0.17	-0.29	-0.26	-0.09

Purchase Behavior

	Freshness	Appearance	Flavor	Juiciness	Size	Price	Peeling	Seeds
Shopping Percent	0.59***	0.37***	0.33**	0.14	0.36**	0.29***	0.45***	0.25**
Orange Juice	0.32	0.02	-0.05	1.21***	0.42	0.35	0.72***	0.48
Grapefruit Juice	1.06*	-0.11	0.49	0.28	0.20	-0.47	-0.43	-0.52*
Orange	-0.77	-0.54	-0.67	-0.55	-0.75*	-1.23**	-0.91***	-1.33**
Grapefruit	0.20	0.74***	0.88***	0.21	0.27	0.48*	0.32	0.36
Tangerine	-0.56	0.22	-0.47	0.21	0.23	0.03	0.43*	0.51***
Apple	0.82*	-0.41	0.10	-0.03	0.56*	0.24	0.14	0.14
Grape	-0.87	0.13	0.08	-1.13**	-0.32	0.10	-0.02	-0.63**

Consumption Behavior

	Freshness	Appearance	Flavor	Juiciness	Size	Price	Peeling	Seeds
Orange Juice	0.88	0.57	1.43**	0.25	0.21	-0.21	0.32	0.49
Grapefruit Juice	-0.10	0.25	0.40	-0.03	-0.01	0.69***	0.6*	0.53
Orange	-0.26	-0.16	-0.21	0.46	-0.25	0.04	0.85*	1.22**
Grapefruit	-0.80	-0.77***	-1.2*	0.15	0.06	-0.35	-0.34	-0.02
Tangerine	0.34	-0.41	0.01	-0.44	-0.34	-0.40	-0.51***	-0.71***
Apple	0.26	0.29	0.50	0.23	-0.04	-0.07	-0.24	-0.01
Grape	-0.87	-0.30	-1.36**	-0.17	-0.09	-0.04	-0.07	-0.01

Fresh Citrus Consumption

	Freshness	Appearance	Flavor	Juiciness	Size	Price	Peeling	Seeds
Frequency	0.09	-0.25***	-0.02	-0.25***	-0.03	-0.03	-0.09	0.04
Limit2	1.84***	0.99***	1.81***	0.95***	1.32**	1.27***	1.18**	0.63***
Limit3		2.45**		2.45	2.07**	2.09***	2.10**	1.42***
# of Obs	223	223	223	223	223	223	223	223
Log Likelihood	-77.51	-148.56	-92.77	-156.21	-236.15	-225.80	-247.09	-250.69