Characterizing the U.S. Melon Market

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Abstract. The domestic market for melons, *Cucumis melo* L., has not been well characterized. The 2011 cantaloupe-related foodborne illness outbreak reduced melon production by 32%, and per capita consumption of cantaloupe and honeydew melons has not recovered. Our objective was to profile and characterize consumer segments of individuals who purchased melons in the 3 months before the survey. Responses from 1718 participants were analyzed by consumption volume and subjected to cluster analysis based on importance of melon attributes. Heavy and moderate consumers preferred local melons over imported. The top four melon attributes were flavor, freshness, ripeness, and sweetness. As consumption increased, consumers placed more importance for their diets. The heaviest consumption group accounted for 22% of the market, and consumed nearly three times the melon servings per month compared with the moderate consumer, and nearly 10 times the servings of the light consumption group. Cluster analysis produced three distinct clusters. Cluster 1 was the most promelon in attitudes and consumption, as well as general health interest, craving sweet food, food pleasure, and variety seeking in foods. The largest segment was cluster 3 and was the ideal group for future targeting of marketing and advertising campaigns for increasing the melon market share with their intermediate consumption and promelon attitudes. Last, members of cluster 2 consumed the lowest amount of melons, spent the least on melons, and traveled the fewest number of miles to purchase them, relative to the other two segments.

The United States is one of the leading producers and consumers of melons in the world, with a 2016 production of 880,000 t (excluding watermelons). From 1992 to 2011, domestic production of melons was at an all-time high (USDA-ESMIS, 2018); yet, the 2011 cantaloupe-related foodborne illness outbreak, the deadliest outbreak in recent U.S. history (Garner and Kathariou, 2016), reduced melon production by 32% during the past decade (USDA-ESMIS, 2018). Since then, the melon industry has worked diligently to improve harvesting, handling, and shipping techniques, as well as making available sweeter hybrids with enhanced quality and eating experiences (Boriss et al., 2006) to help sales rebound.

U.S. consumers are demanding more fresh fruits than ever (Bentley, 2017). Among all

fruits, melons are one of the most consumed in the United States. The average American consumes ≈ 13 kg of melon each year (Agricultural Marketing Resource Center, 2018). More specifically, the 2017 per capita consumption of cantaloupe and honeydew melons was 3.1 and 0.75 kg, respectively (USDA-ESMIS, 2018). Greater melon consumption can be explained by increased consumer awareness of the health benefits of melons, improved year-round availability, creative marketing strategies, and improved cultivars (Lester, 2006). Despite these trends, per capita consumption of cantaloupe and honeydew melons has not recovered from the decline in the past decade (USDA-ESMIS, 2018). Because melons can be part of a healthy diet, factors influencing melon consumption heightens the importance of understanding consumer perceptions and preferences for melons, especially for introducing new cultivars.

Consumers can consider three types of product attributes when making a purchase: search, experience, and credence attributes (Beaulieu et al., 2004; Darby and Karni, 1973; Moser et al., 2011; Nelson, 1970). Search attributes are those the consumer can verify at the point of purchase (e.g., price, size, aroma), whereas experience attributes are validated after consumption (e.g., sweetness, flavor, texture). Credence attributes are difficult to ascertain directly by consumers either at the point of purchase or after consumption. Credence attributes typically command a price premium and are communicated

through labels (e.g., organically grown or locally produced). Understanding which melon attributes are valued is of interest to academics, growers, and retailers. This information can help industry stakeholders introduce new cultivars, increase melon sales and consumption, and convey key attributes and benefits to consumers.

Few published studies have investigated consumer preferences for fresh market melons. Lester and Shellie (1992) found that consumers highly favored melon attributes such as flavor, sweetness, and texture, and that these attributes contributed to repeat melon purchases. Fourteen years later, Lester (2006) reported that consumer preferences were highly distinct for specific sensory attributes. Melon attributes such as flavor coupled with fruit sweetness were most valued, followed closely by fruit texture; these attributes were correlated with overall fruit acceptability. Consumers indicated that high soluble solids content (sweetness) did not always indicate overall fruit quality was high. The best predictor of fruit quality, as defined by the consumer, was flavor (Lester and Shellie, 1992).

Heng and House (2018) reported a segmentation of international consumers (including $n = 995$ from the United States) based on consumption of 15 types of fruits including melons and (separately) watermelons. The “common fruit” consumer represented $\approx 40\%$ of the market and ate primarily apples, oranges, and bananas. The second cluster was a “high-frequency” consumer who ate the most different types of fruits but represented only $\approx 20\%$ of the market. The “low-frequency” consumer represented 40% of the sample while eating substantially less fruit compared with the other two clusters. Compared with the “low-frequency consumers,” both “common fruit” and “high-frequency” consumers found price, sweetness, ease of peeling, and trendiness less important, but placed greater importance on nutritional value, locally grown, quality appearance, in season, and recipe diversity (Heng and House, 2018).

Consumer attitudes and perceptions may influence purchase (Lusk, 2018). Thus, researchers have identified four key potential attitudes that may influence melon purchase: general health interest, craving sweet food, food pleasure, and variety seeking in foods. General health interest may indicate a predilection to consume fruits including melons. Given that sweetness as an attribute was a highly desirable attribute (Lester and Shellie, 1992), craving sweet foods may be related to melon consumption. Consuming foods that bring pleasure, as sweet foods and other foods with desirable characteristics may have, may also be related to melon consumption. Last, researchers considered that individuals who seek variety in their foods or diet may be more likely to be melon consumers and ideal targets for marketing messages about new cultivars. Previously published scales quantifying those constructs (Roininen, 2001; van Trijp and Steenkamp, 1991) could be helpful in characterizing the melon market.

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Country of origin labeling (COOL) is important for a wide variety of products, including meat, primarily beef (Lagerkvist et al., 2014; Lewis et al., 2016; Loureiro and Umberger, 2003, 2005), Italian olive oil (Van der Lans et al., 2001), Australian wine (McCutcheon et al., 2009), organic tomatoes and beans (Tobler et al., 2011), and possibly melons. There is a perception that domestically produced products are superior to imported products (Vanhonacker et al., 2016). Khachatryan et al. (2014) showed that domestically produced vegetable, herb, and flowering transplants were more highly valued compared with imported plants. In that study, individuals scoring high on a current-and-future-consequences scale were willing to pay a 15.3 cents premium for locally grown plants, compared with domestic (but not local) plants and discounted the amount they were willing to pay for imported plants (Khachatryan et al., 2014). Other studies have investigated consumer evaluation of locally grown food products, such as potatoes (Loureiro and Hine, 2002), tomatoes (Yue and Tong, 2009), and strawberries (Darby et al., 2008). Furthermore, Lewis and Grebitus (2016) concluded that highly ethnocentric consumers were more likely to buy domestic products.

Consumers can purchase melons in multiple forms (i.e., whole fruit, precut, frozen, and as part of fruit trays) and through different market outlets (i.e., grocery stores, farmers markets, independent stores). Although marketing strategies that helped increase melon consumption during the early 2000s focused on the single-serving market and smaller households (Lester, 2006), the availability of improved cultivars with novel search, experience, and credence attributes has brought new marketing opportunities for melon growers and sellers to access niche markets and obtain price premiums. To effectively market new types of melons, industry stakeholders should have an understanding of current consumer preferences for melon fruit quality attributes, as well as factors influencing their purchasing decision.

The goal of this study was to conduct a thorough assessment of the U.S. market for melons to better understand opportunities and challenges of introducing new melon cultivars to the market. This study collected information about consumer preferences for the key attributes associated with melon purchases and consumption. All melon types consumed in the United States belong to the Cucurbitaceae family, and the emphasis of this study was on *Cucumis melo* L. genotypes. Participants were guided to focus on any type or cultivar of *C. melo*, and researchers specifically excluded watermelons from our study. First, investigators assessed consumers' attitudes, consumption, and preferred melon attributes. Second, researchers categorized melon purchasers by consumption level and compared their demographic, consumption habits, and preferences for melon attributes. Third, investigators included several dimensions from previously published scales (Roininen,

2001; van Trijp and Steenkamp, 1991) that may potentially influence melon purchase and consumption: general health interest, cravings for sweet foods, food pleasure, and variety seeking in food. Last, researchers created consumer segments and profiled those groups to help academics, farmers, and retailers better serve the melon consumer. To the best of our knowledge, this was one of the first studies to estimate the key attributes of melons (excluding watermelons) valued by different types of consumers conducted online with a representative sample of the U.S. population.

Material and Methods

Investigators developed an online survey that was approved by the university committee on protection of human subjects in research to gain better understanding of the consumers' melon attitudes, purchases, and preferences (institutional review board protocol 1807020586). The questionnaire collected information on consumers' demographic characteristics, including age, gender, marital status, educational attainment, household income, and geographic location. Using region categorization from the Bureau of Labor Statistics, researchers grouped respondents in six geographic regions, such as Midwest, Western, Mountain Plains, Southwest, Mid-Atlantic, and New England.

Researchers asked respondents about their melon purchases and consumption. Throughout the questionnaire, participants were asked to focus on any type or cultivar of *C. melo*. For example, our screening criteria to participate in the survey was the purchasing of any melon in the past year, excluding watermelons. Investigators asked respondents about the number of miles they traveled to the primary outlet for purchasing melons, the form and variety of melons purchased, the number of dollars spent on all fruits, the average and most expensive prices paid for melons, and the primary outlet where they purchased most melons: chain stores, direct-to-consumer markets (DTC; e.g., farmers markets), or independent grocery stores. Researchers asked respondents their perceptions toward the importance of melons in their diet, the knowledge they had about melons, and their preferences toward locally and domestically grown melons. The questionnaire also asked respondents about the importance they placed on various melon attributes at the point of purchase using a 0 to 100 scale (0 = not at all important and 100 = extremely important). Melon attributes included search (i.e., size, aroma, appearance, varieties), experience (i.e., sweetness, flavor, freshness), and credence (i.e., organic and local) attributes.

The survey was distributed by LightSpeed GMI (Bridgewater, NJ) in Fall 2018 to potential respondents who were part of their proprietary opt-in panel of U.S. households. Investigators recruited respondents who were ≥ 18 years of age and had purchased melons at least once in the 12 weeks before the study. The sample of survey participants

was recruited to be representative of the U.S. population in terms of age, gender, and pretax income (based on 2017 census estimates). For example, the proportion of 18- to 34-year-olds in our sample was 30.0% compared with 30.4% in the 2017 American Community Survey (ACS). Similar comparison rates were achieved for respondents between 35 and 54 years old (33.1% vs. 33.9%), 55 and 64 years old (16.9% vs. 16.5%), and those 65 and older (20.0% vs. 19.0%). The proportion of women in our sample was 48% compared with 51% in the 2017 ACS. A total of 1718 (16% of those receiving an invitation) respondents who had purchased melons in the 3 months before the study completed the survey after eliminating potential respondents for a variety of reasons (e.g., failure to pass attention measures, incomplete responses, identical responses in a section).

To better understand melon consumption segments, researchers categorized respondents into four groups: noneater, light, moderate, and heavy consumer based the number of melon servings they had in the 3 months before the survey using the consumption distribution. The noneater group was composed of 20% of the sample ($N = 336$) and were those participants who reported purchasing but not consuming melons. Investigators followed a quantile distribution to categorize light, moderate, and heavy consumers. Light consumers ($N = 627$ or 37%) were those who consumed fewer than three servings of melon per month (1 serving = 1 cup of melon). Moderate consumers ($N = 371$ or 22%) were those who consumed between three and fewer than six servings of melon per month. Last, heavy consumers (384 or 22%) were those who consumed six or more servings of melon per month. This categorization is consistent with fresh fruit consumption patterns in developed countries (CDC, 2017).

Researchers considered melon consumption patterns as treatment effect for means comparisons across consumer demographics, consumption patterns, and melon attributes. Researchers made multiple comparisons among means in the analysis of variance (ANOVA) models using Tukey's honestly significant difference method at the 5% significance level. In the next section, investigators report results from the ANOVA and Tukey's significance tests, which were found to be similar to χ^2 tests. Investigators conducted analyses using Stata (release 15; StataCorp, College Station, TX).

To create richer consumer profiles, researchers included four established attitudinal scales in the survey: General Health Interest (GHI), Cravings for Sweet Foods (CSF), and Food Pleasure (FP). These were scales adapted from Roininen (2001). The fourth scale, Variety Seeking In Food (VSF) was adapted from van Trijp and Steenkamp (1991). Principal component factor analyses of the scales were generated using the MEANS, FACTOR, and CORR procedures of SAS software (SAS for Windows, v 9.4; SAS Institute Inc., Cary, NC). Last, investigators performed a k-means cluster analysis using the FASTCLUS procedure of

SAS software. Cluster analysis has been widely used to define consumer segments based on their preferences and attitudes toward foods (Heng and House, 2018).

Results and Discussion

Sample descriptive statistics. Individuals reported eating, on average, 4.58 servings (cups) of melon per month. The average consumer traveled a mean 6.2 miles to purchase melons, with no difference among consumption groups. In the following paragraphs, researchers examined the distribution of consumption volume of melons for the sample and created and compared four categories of melon consumers (i.e., noneater, and light, moderate, and heavy consumer). Overall, respondent age had a mean of 45.7 years, with heavy and moderate consumers being ≈ 5 years younger than light and nonconsumers (Table 1). Although almost half of the sample was female, moderate and heavy consumers had a lower proportion of female compared with light and nonconsumers. Most of our sample was composed of Caucasian/white Americans (77%). Researchers found some differences in the percentage of non-Caucasian individuals among the four groups, but with no clear trends. The average number of children per

household was less than one. There was no difference in the number of adults in the household but heavy and moderate consumers had a higher number of children in the home compared with light and nonconsumers.

Approximately half of the sample had a college education, with the heavy consumption group having a 5% to 6% higher percentage of college graduates compared with the other three groups. Fewer than half (45%) of this sample reported less than \$50,000 in annual household income, followed by 33% of respondents reporting between \$50,000 and \$100,000 in annual household income, and 22% of respondents earning more than \$100,000 in annual household income. Heavy consumers had a higher household income compared with the other three groups. Most of our respondents were located in the South (37%), followed by the West (25%), Midwest (19%), and Northeast (18%) regions. Investigators found no differences among the consumption groups for location of residence (e.g., Midwest, West, South, or Northeast United States), marital status, or residence in a metropolitan region.

The groups behaved similarly in that they purchased a similar amount of melons as whole melons while the nonconsumers purchased fewer whole melons (as opposed to precut melons) (Table 2). Heavy consumers purchased

most of their melons as cantaloupes with progressively fewer cantaloupes bought by the moderate, light, and nonconsumers. This result may suggest there is an opportunity to introduce new cantaloupe-like cultivars that appeal to heavy, and perhaps moderate, consumers. The average consumer traveled a mean 6.2 miles to purchase melons, with no difference among consumption groups.

Eighty-three percent of respondents reported they were the individual responsible for most fruit purchases in the household, and spent on average \$47.68 per month on all fruits (Table 2). This finding is not higher than the average weighted monthly fruit expenditures from the 2012 Consumer Expenditure Survey (\$27.88) (Sweitzer et al., 2017). There was a greater proportion of moderate and heavy consumers who reported being responsible for most fruit purchases in the household, when compared with nonconsumers and light consumers. The average price of melon paid by the respondents was \$3.41, whereas the most expensive melon they purchased was, on average, \$4.30. Although researchers found no difference on the average dollar expenditures on all fruits, investigators found that melon consumers had a higher average price paid per melon than noneaters. For example, moderate and heavy consumers paid on average \$3.65 and

Table 1. Descriptive statistics of demographic variables for 1718 U.S. consumers participating in an online survey about melons, for the full sample and categorized by melon consumption rate.

Variable	Mean (sd)				
	Full sample N = 1,718	Noneater N = 336	Light consumer N = 627	Moderate consumer N = 371	Heavy consumer N = 384
Age	45.7 (16.85)	49.85 (16.25)	44.69 (17.36)	44.72 (17.08)	44.66 (15.78)
Female ^z	0.47 (0.50)	0.49 (0.50)	0.55 (0.50)	0.41 (0.49)	0.39 (0.49)
Single ^z	0.37 (0.48)	0.35 (0.48)	0.41 (0.49)	0.33 (0.47)	0.37 (0.48)
Number children in HH	0.49 (0.91)	0.36 (0.82)	0.43 (0.89)	0.58 (0.99)	0.6 (0.92)
Caucasian ^z	0.77 (0.42)	0.83 (0.37)	0.77 (0.42)	0.73 (0.44)	0.78 (0.42)
College or beyond ^z	0.45 (0.50)	0.39 (0.49)	0.42 (0.49)	0.46 (0.50)	0.56 (0.50)
Live in metro area ^z	0.24 (0.43)	0.22 (0.42)	0.23 (0.42)	0.27 (0.44)	0.26 (0.44)
HH income <\$50K ^z	0.45 (0.50)	0.5 (0.50)	0.5 (0.50)	0.4 (0.49)	0.37 (0.48)
HH income \$50K–\$100K ^z	0.33 (0.47)	0.36 (0.48)	0.29 (0.45)	0.34 (0.47)	0.38 (0.48)
HH income >\$100K ^z	0.22 (0.41)	0.15 (0.35)	0.21 (0.41)	0.26 (0.44)	0.25 (0.44)
Live in Midwest ^z	0.19 (0.40)	0.22 (0.42)	0.20 (0.40)	0.18 (0.38)	0.18 (0.38)
Live in West ^z	0.15 (0.36)	0.16 (0.37)	0.14 (0.35)	0.18 (0.39)	0.13 (0.34)
Live in Plains	0.53 (0.22)	0.07 (0.25)	0.05 (0.22)	0.04 (0.20)	0.05 (0.21)
Live in Southwest ^z	0.10 (0.31)	0.11 (0.31)	0.10 (0.30)	0.10 (0.30)	0.13 (0.33)
Live in Southeast	0.22 (0.41)	0.21 (0.41)	0.24 (0.42)	0.21 (0.40)	0.20 (0.40)
Live in Mid-Atlantic	0.23 (0.42)	0.20 (0.40)	0.21 (0.41)	0.25 (0.43)	0.26 (0.44)
Live in Northeast ^z	0.04 (0.19)	0.04 (0.19)	0.04 (0.19)	0.02 (0.15)	0.05 (0.22)

^zThe mean is the percentage of respondents with that attribute.

Upper case letters show statistically significant differences across columns at $P < 0.05$ using Tukey's significant different tests. HH = household.

Table 2. Descriptive statistics of consumption variables for 1718 U.S. consumers participating in an online survey about melons, for the full sample and categorized by melon consumption rate.

Variable	Mean (SD)							
	Full sample	Noneater	Light consumer		Moderate consumer		Heavy consumer	
	N = 1,718	N = 336	N = 627		N = 371		N = 384	
Servings per month	4.58 (4.89)	0 0.00	1.32 (0.66)	C	3.89 (0.72)	B	10.56 (5.60)	A
Buy whole melon ^z	0.85 (0.36)	0.73 (0.45)	0.87 (0.33)	A	0.88 (0.32)	A	0.92 (0.27)	A
Buy cantaloupe ^z	0.55 (0.50)	0.23 (0.42)	0.67 (0.47)	B	0.76 (0.43)	AB	0.87 (0.34)	A
Responsible to purchase fruits ^z	0.83 (0.38)	0.77 (0.42)	0.79 (0.41)	B	0.87 (0.34)	A	0.91 (0.29)	A
Dollars in fruits per month	47.68 (73.67)	46.37 (54.15)	47.26 (77.39)		44.67 (95.86)		52.43 (55.32)	
Average price paid for melons	3.41 (1.74)	3.08 (1.64)	3.41 (1.62)	A	3.65 (1.95)	A	3.46 (1.75)	A
Number food miles	6.15 (9.95)	5.63 (6.98)	5.73 (8.94)		6.88 (12.07)		6.6 (11.35)	
Highest price paid for melons	4.3 (1.99)	3.74 (1.97)	4.21 (1.85)	B	4.63 (2.09)	A	4.63 (2.00)	A
Most purchases are in chain stores ^z	0.69 (0.46)	0.68 (0.47)	0.69 (0.46)		0.71 (0.45)		0.68 (0.47)	
Most purchases are in DTC ^z	0.11 (0.31)	0.08 (0.27)	0.1 (0.30)	B	0.09 (0.28)	B	0.16 (0.37)	A
Most purchases are in independent stores ^z	0.17 (0.37)	0.18 (0.38)	0.18 (0.39)		0.16 (0.37)		0.14 (0.35)	
Melons are important ^z	0.61 (0.49)	0.31 (0.46)	0.54 (0.50)	C	0.73 (0.44)	B	0.85 (0.36)	A
I know a lot about melons ^z	0.32 (0.47)	0.13 (0.34)	0.23 (0.42)	C	0.42 (0.49)	B	0.55 (0.50)	A
Local melons are better than regional melons ^z	0.44 (0.50)	0.31 (0.46)	0.38 (0.49)	B	0.52 (0.50)	A	0.55 (0.50)	A
Melons grown in the United States are better than imported melons ^z	0.35 (0.48)	0.27 (0.44)	0.29 (0.45)	B	0.44 (0.50)	A	0.46 (0.50)	A

^zThe mean is the percentage of respondents with that attribute.

Upper case letters show statistically significant differences across columns at $P < 0.05$ using Tukey's significant different tests. DTC = direct-to-consumer markets.

\$3.46 per melon, respectively, which was significantly different from \$3.08 paid for noneaters ($P = 0.05$). This finding may indicate that heavy and moderate consumers, who were responsible for fruit purchase, spent more of their fruit dollars on melons than their counterparts. In effect, melons seemed to be substitutes for other fruits, and not causing additional purchases that increase fruit expenditures.

Similar to average price paid per whole melon, heavy and moderate consumers reported a higher price paid (\$4.63) for the most expensive melon they purchased compared with light and nonconsumers ($P = 0.05$). This would indicate a willingness to spend more per melon by heavier consumers compared with light and nonconsumers. These findings have substantial marketing implications, as the melon industry aims to increase purchases and expenditures on melons.

More than two-thirds of respondents reported buying most melons at grocery stores or chains, warehouse or club stores, or through online pick up at a grocery store (Table 2). Only 11% of respondents reported buying most melons in DTC markets [e.g., farmers markets, at the farm, roadside stand, or through online orders or community-supported agriculture (CSAs)]. When comparing among groups, a similar percentage of all four consumer groups reported that most of their melon purchases were made from grocery stores (chains, warehouse, club, or online pick up at a store)

and independent or ethnic stores. However, a greater percentage of the heavy consumers, compared with the other consumption groups, reported buying most of their melons directly from a farmer at a roadside stand, CSA, or farmers markets. This result suggests that DTC markets are an effective outlet for farmers to reach heavy consumers of melons.

Approximately 61% of respondents perceived that melons were important for his or her diet, 44% agreed that local melons taste better than those coming from other regions, and a slightly lower percentage of respondents (35%) believed that melons grown in the United States taste better than imported melons (Table 2). Only a third of respondents believed that they knew a lot about melons. Attitudinally, a greater percentage of heavy consumers agreed that melons were important for their diet, that she or he knew a lot about melons, that local melons taste better compared with melons coming from other regions, and that domestic melons taste better compared with imported ones. The heavy and moderate consumption groups were similar on their attitudes about local and domestic melons but different from the light and nonconsumers.

Important search, experience, and credence melon attributes. Researchers asked study participants to rate the relative importance of 17 melon attributes using a 0 (not at all important) to 100 (extremely important) scale (Table 3). Search attributes included size (big and small), aroma, presence of bruises,

new types of melons, firmness, price, rind pattern (outer layer of melon), and rind color. Experience attributes included sweetness, flavor, ripeness, freshness, crispness, and flesh color. Robustness checks (i.e., means comparisons between eaters and noneaters and consistent clustering results after removing noneaters) indicated experience attributes should not be included for noneaters. Last, credence attributes were organic, local, and free of pesticides. The top five melon attributes were flavor (85% of importance), freshness (84%), ripeness (80%), sweetness (79%), and price (76%).

Search attributes ranked from the most to least important by all respondents were price, lack of bruises, firmness, rind color, aroma, size, rind pattern, and new type of melon. The only attribute for which investigators found no difference among the four groups was the importance of price. When comparing among groups, heavy and moderate consumers valued more firmness, rind color, aroma, size, rind pattern, and new types, when compared with light consumers and noneaters. Interestingly, lack of bruises was less important to heavy consumers than their counterparts. Because search attributes are evaluated at the point of purchase, this information can help marketers and sellers highlight the relevant search attributes valued by heavy and moderate consumers.

The most valued experience attributes for the full sample were flavor (85% of importance),

Table 3. Importance of melon attributes for online survey participants in total and by consumption segment.

	Full sample	Noneater		Light consumer		Moderate consumer		Heavy consumer	
	N = 1,718	N = 336		N = 627		N = 371		N = 384	
	Mean	Mean ^z		Mean		Mean		Mean	
Attribute	(SD)	(SD)		(SD)		(SD)		(SD)	
Search									
Price	75.93 (21.93)	76.27 (22.18)		77.04 (21.55)		74.19 (22.43)		75.51 (21.82)	
Ripeness	79.52 (18.69)	77.57 (19.58)	B	78.65 (18.94)	B	79.95 (18.36)	AB	82.23 (17.53)	A
No bruise	73.66 (22.59)	70.95 (23.18)	A	72.53 (22.87)	A	73.53 (22.36)	A	78.02 (21.28)	B
Firmness	65.03 (24.24)	61.52 (23.97)	C	62.92 (24.76)	BC	66.61 (23.85)	AB	70.04 (23.09)	A
Fragrant	56.65 (26.49)	50.35 (25.48)	B	55.09 (27.01)	B	59.98 (25.18)	A	61.52 (26.46)	A
Large size	52.06 (26.32)	46.14 (25.74)	B	48.85 (25.93)	B	55.61 (26.10)	A	59.04 (26.69)	A
Rind pattern	48.43 (31.00)	41.01 (29.69)	B	44.98 (30.81)	B	53.15 (30.48)	A	56.02 (30.68)	A
Rind color	57.13 (29.48)	51.53 (29.06)	B	54.06 (30.04)	B	60.32 (29.01)	A	63.94 (27.75)	A
New type	36.56 (30.21)	26.91 (26.02)	B	32.08 (28.39)	B	43.33 (31.42)	A	45.78 (31.38)	A
Experience ^z									
Flavor	84.47 (17.36)	—		84.52 (17.04)	B	84.7 (16.95)	AB	87.5 (15.60)	A
Freshness	83.68 (17.33)	—		83.4 (16.81)	B	83.27 (17.85)	B	86.77 (15.58)	A
Sweetness	78.63 (20.20)	—		78.6 (19.91)	B	78.97 (20.29)	B	83.43 (16.91)	A
Crispness	65.76 (26.81)	—		62.27 (27.59)	B	68.32 (26.34)	A	73.25 (23.61)	A
Flesh color	65.08	—		61.74 (26.97)	B	68.76 (24.02)	A	71.2 (25.14)	A
Credence									
Pesticide free	60.34 (31.85)	53.87 (33.01)	B	57.08 (32.05)	B	65.31 (29.83)	A	66.54 (30.63)	A
Local	52.98 (30.99)	43.32 (30.12)	B	49.81 (31.21)	B	58.00 (29.13)	A	61.78 (29.98)	A
Organic	44.01 (32.08)	34.08 (29.35)	B	40.58 (31.36)	B	50.11 (31.94)	A	52.41 (32.47)	A

^zMeans of experience attributes are not reported.Upper case letters show statistically significant differences across columns at $P < 0.05$ using Tukey's significant different tests.

freshness (84%), ripeness (80%), and sweetness (79%), followed by crispness (66%) and flesh color (65%). Heavy and moderate consumers reported a higher valuation of all experience attributes, when compared with light and nonconsumers. Important credence attributes for the full sample were free of pesticide (60%), local (53%), and organic (44%). Similar to experience attributes, credence attributes were more highly valued by heavy and moderate consumers than their counterparts.

Combined, these findings suggest that melon consumers place more value on experience attributes than search and credence attributes. An implication of this finding is the opportunity for retailers to signal experience and credence attributes through creative labeling and advertising programs. As suggested by Grolleau and Casswell (2006), if coupled with valued search attributes, reliable credence and experience attributes can be transformed into search attributes, motivating consumers to demand new types of melons and pay price premiums for them. Second, the similarities between noneaters and light consumers, in contrast to moderate

and heavy consumers, had compelling industry implications. It seems that those consuming more melons have higher quality standards and care less about the price compared with the other two segments based on consumption volume.

Attitudinal factors influencing melon consumption analysis. To assess attitudes that may influence melon consumption, researchers asked subjects to respond to questions from four previously published scales: GHI, CSF, and FP adapted from Roininen (2001) and VSF adapted from van Trijp and Steenkamp (1991). All items were measured using a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree). Tables 4 and 5 illustrate the results from the principal component factor analysis of each scale.

For the GHI component, the principal component analysis revealed all eight items had loadings >0.59 with acceptable fit statistics (Measure of Sampling Adequacy or MSA = 0.835, standardized Cronbach's α = 0.821). The variables combined as one component accounted for 45% of the variance. Means ranged from 3.0 to 3.9 on a 5-point Likert scale (Table 4). The moderate means

would indicate that participants had a preference toward healthy diets.

Only three of six items had sufficient loading to be retained for the CSF scale adapted from Roininen (2001) (Table 4). The three remaining items loaded well as a single component, accounted for $>70\%$ of the variance of the questions with acceptable fit statistics. Three items ("In my opinion, it is strange for some people to have cravings for sweets," "In my opinion, it is strange for some people to have cravings for chocolate," and "In my opinion, it is strange for some people to have cravings for ice cream") were omitted due to low loading coefficients. With mean item ratings ranging from 3.4 to 3.7, this sample of melon consumers had slightly above the scale midpoint for CSF.

Three items from the FP scale, adapted from Roninen (2001), were retained from the principal component analysis (Table 4). Two items omitted with low loading coefficients were "I prefer to eat food products I am used to" (0.4414) and "I am curious about food products I am not familiar with" (0.1948). The three remaining questions that accounted for 60.7% of the variance

Table 4. Principal component factor analysis results for six original items for General Health Interest, Cravings for Sweet Food, and Food Pleasure adapted from Roininen (2001), and Variety Seeking in Food scale adapted from van Trijp and Steenkamp (1991).

To what extent you agree or disagree with the following statements?	Factor Pattern	Final Communalities Estimates	Kaiser's MSA	Mean (sd)
General Health Interest				
I am very particular about the healthiness of food	0.70	0.50	0.81	3.5 (1.1)
I always follow a healthy and balanced diet	0.64	0.41	0.81	3.3 (1.1)
It is important for me that my daily diet contains a lot of vitamins and minerals	0.65	0.42	0.87	3.9 (0.9)
It is important for me that my diet is low in fat	0.59	0.35	0.86	3.3 (1.2)
I eat what I like and do not worry about the healthiness of food ^z	0.77	0.59	0.82	3.2 (1.3)
The healthiness of food has little impact on my food choices ^z	0.64	0.41	0.82	3.3 (1.3)
The healthiness of snacks makes no difference to me ^z	0.70	0.49	0.84	3.2 (1.3)
I do not avoid any foods even if they may rise my cholesterol ^z	0.66	0.44	0.87	3.0 (1.2)
Percent of Variance = 45.0%, MSA = 0.84, Variance Explained = 3.60, Cronbach Alpha: Raw = 0.82; Standardized = 0.82				
Cravings for Sweet Food Scale				
I often have cravings for sweets	0.87	0.75	0.67	3.7 (1.1)
I often have cravings for chocolate	0.84	0.71	0.70	3.6 (1.2)
I often have cravings for ice cream	0.82	0.66	0.74	3.4 (1.2)
Percent of Variance = 70.7%				
MSA = 0.70, Cronbach Alpha: Raw = 0.79, Variance Explained = 2.12, Standardized = 0.79				
Food Pleasure Scale				
When I eat, I concentrate on enjoying the taste of food	0.78	0.61	0.66	4.0 (0.9)
It is important for me to eat delicious foods on weekdays as well as weekends	0.79	0.62	0.659	4.0 (0.9)
An essential part of my weekend is eating delicious food	0.77	0.59	0.675	3.6 (1)
Percent of Variance = 60.7%, MSA = 0.67, Variance Explained = 1.82, Cronbach Alpha: Raw = 0.67; Standardized = 0.68				
Variety Seeking in Food Scale				
When I eat out, I like to try the most unusual items, even if I am not sure I would like them.	0.79	0.62	0.90	2.7 (1.3)
While preparing foods/snacks, I like to try out new recipes.	0.72	0.51	0.93	3.7 (1.1)
I think it is fun to try out food items one is not familiar with.	0.85	0.71	0.90	3.7 (1.1)
I am eager to know what kind of foods people from other countries eat.	0.82	0.67	0.90	3.4 (1.2)
I like to eat exotic foods.	0.85	0.72	0.88	3.1 (1.3)
Items on the menu that I am unfamiliar with make me curious.	0.83	0.69	0.91	3.5 (1.1)

^zReverse coded.

Percent of Variance = 65.5%, Measure of Sampling Adequacy (MSA) = 0.90, Variance Explained = 3.93, Cronbach Alpha: Raw = 0.89; Standardized = 0.89. Principal component analyses of the scales were generated using the MEANS, FACTOR (METHOD = p and PRIORS = one) and CORR procedures of SAS software (SAS for Windows, v 9.4, SAS Institute Inc.).

were the following: concentrate on enjoying the taste of food, important to eat delicious foods on weekdays and weekends, and eating delicious food on weekends. Mean scores for each item were above the midpoint of the scale, which would indicate these consumers had an interest in food pleasure.

Six of the eight items in the VSF scale were retained (Table 4), namely trying unusual items when eating out, trying new recipes when preparing foods, trying unfamiliar items is fun, eagerness to know foods from other countries, liking exotic foods, and curiosity toward unfamiliar items on a menu. Noting that the means for each item were above the midpoint of the scale, melon purchasers likely prioritize variety in foods.

Cluster analysis based on search, experience, and credence attributes. Researchers performed a k-means cluster analysis using individual ratings for melon attributes listed in Table 3. The solution resulted in three different clusters selected for Approximate Expected Overall R^2 , Pseudo F Statistic, Cubic Clustering Criterion, and the ratio of between-cluster variance to within-cluster variance (Table 5). Cluster 1 comprised 34.6% of the sample ($N = 595$), cluster 2 members included 20.6% of the sample ($N = 354$), and cluster 3 members had 44.7% of the sample ($N = 769$). Investigators next compared the clusters on their demographic characteristics and attitudes about GHI, CSF, FP, and VSG.

Melon purchasers in cluster 1 were younger, had more children in the household, and were more likely to live in a metropolitan area compared with the other clusters. Fewer purchasers from cluster 1 were Caucasian and lived in the Midwest region than their counterparts. Members of this market segment traveled 2 miles farther to purchase most fresh melons, spent the most per melon, and consumed more melons than the other two groups. Members of this cluster made most melon purchases in local markets and less through grocery chain stores. More members of this cluster agreed that "Melons are important for his/her diet" compared with the other two clusters. This cluster also reported greater knowledge about melons. Substantially more members of this group agreed that both local- and U.S.-grown melons taste better than other regions or imported melons. Furthermore, members of this cluster had the highest mean score for all the principal component factor scales including GHI, CSF, FP, and VSF. Based on their attitudinal, demographic, and consumption characteristics, researchers labeled this group "Local Melon Lovers."

Cluster 2 members were slightly older than cluster 1 members but were the same age as members of cluster 3. Clusters 2 and 3 had approximately the same number of children in the home. There were more consumers in cluster 2 who were white/Caucasian and lived in the Midwest region. Members of this

market segment consumed the lowest amount of melons, spent the least on melons, and traveled the fewest number of miles to purchase them, relative to the other two segments. Most of the melon purchases for consumers of this group were typically in grocery chain stores. Members of this cluster scored lowest on knowledge of melons, as well as reported a low preference for local or domestic melons. Members of this group on average scored lowest on GHI, FP, and VSF scales. They had a similar score on CSF scale as cluster 3 but lower compared with cluster 1. A higher percentage of cluster 2 members purchased melons from supermarket chain stores. Based on the demographic and consumption characteristics of this cluster, we labeled this group "The Convenient Shopper."

Cluster 3 members were similar in age and number of children to cluster 2 members as well as traveled a similar distance to purchase melons. Their mean score for CSF was also similar to cluster 2 and lower than cluster 1. Members of cluster 3 had mean score intermediate between cluster 1 and cluster 2. For example, their melon purchases and consumption levels were placed in-between the Local Melon Lover and the Convenient Shopper. Based on the demographic and consumption characteristics of this cluster, researchers labeled this group "Ripe-For-The-Picking Consumer."

Comparisons of respondents between consumption and cluster membership is illustrated

Table 5. Cluster proportion comparisons with the overall population for demographic and consumption categorical outcome variables.

Variable	Mean (sd)						P value
	Cluster 1		Cluster 2		Cluster 3		
	N = 595		N = 354		N = 769		
Age ^z	43.2 (16.2)	B	47.4 (17.2)	A	46.8 (17.0)	A	<0.0001
Female ^y	0.4 (0.4)	B	0.5 (0.5)	A	0.5 (0.5)	AB	0.0032
Single ^y	0.4 (0.5)		0.4 (0.5)		0.4 (0.5)		0.3726
Number children in HH ^z	0.7 (1.0)	A	0.4 (0.9)	B	0.4 (0.8)	B	<0.0001
Caucasian ^y	0.7 (0.5)	C	0.8 (0.4)	A	0.8 (0.4)	B	<0.0001
College or beyond ^y	0.4 (0.5)		0.5 (0.5)		0.5 (0.5)		0.0834
Live in metro area ^y	0.3 (0.5)	A	0.2 (0.4)	B	0.2 (0.4)	B	<0.0001
HH income <\$50K ^y	0.5 (0.5)		0.5 (0.5)		0.4 (0.5)		0.6639
HH income \$50K–\$100K ^y	0.3 (0.5)		0.3 (0.5)		0.4 (0.5)		0.2961
HH income >\$100K ^y	0.2 (0.4)		0.2 (0.4)		0.2 (0.4)		0.6429
Live in Midwest ^y	0.1 (0.3)	B	0.2 (0.4)	A	0.2 (0.4)	A	0.0005
Live in West ^y	0.1 (0.3)		0.1 (0.4)		0.2 (0.4)		0.1038
Live in Plains ^y	0.1 (0.2)		0.1 (0.2)		0.1 (0.2)		0.4976
Live in Southwest ^y	0.1 (0.3)		0.1 (0.3)		0.1 (0.3)		0.1208
Live in Southeast ^y	0.3 (0.4)	A	0.2 (0.4)	AB	0.2 (0.4)	B	0.0176
Live in Mid-Atlantic ^y	0.3 (0.4)		0.2 (0.4)		0.2 (0.4)		0.4205
Live in Northeast ^y	0.1 (0.2)		0.1 (0.2)		0.1 (0.2)		0.6380
Servings per month ^z	1.8 (1.0)	A	1.2 (1.0)	C	1.4 (1.0)	B	<0.0001
Number food miles ^z	7.9 (14.2)	A	5.2 (6.7)	B	5.3 (6.5)	B	<0.0001
Responsible to purchase fruits ^y	0.9 (0.3)	A	0.8 (0.4)	B	0.8 (0.4)	B	0.0100
Dollars in fruits per month ^z	51.5 (87.7)	A	44.2 (58.3)	A	46.3 (67.9)	A	0.2565
Average price paid for melons ^z	4.1 (2.2)	A	3.0 (1.3)	C	3.2 (1.3)	B	<0.0001
Highest price paid for melons ^z	5.1 (2.3)	A	3.7 (1.6)	C	4.1 (1.7)	B	<0.0001
Most purchases are in chain stores ^y	0.7 (0.5)	B	0.8 (0.4)	A	0.7 (0.4)	B	0.0043
Most purchases are in DTC ^y	0.2 (0.4)	A	0.1 (0.2)	B	0.1 (0.3)	AB	<0.0001
Most purchases are in independent stores ^y	0.2 (0.4)		0.2 (0.4)		0.2 (0.4)		0.5132
Melons are important ^z	0.8 (0.4)	A	0.4 (0.5)	C	0.6 (0.5)	B	<0.0001
I know a lot about melons ^z	0.5 (0.5)	A	0.1 (0.3)	C	0.3 (0.4)	B	<0.0001
Local melons are better than regional melons ^z	0.7 (0.5)	A	0.2 (0.4)	C	0.4 (0.5)	B	<0.0001
Melons grown in the United States are better than imported melons ^z	0.6 (0.5)	A	0.2 (0.4)	C	0.3 (0.4)	B	<0.0001
General Health Interest ^z	0.2 (0.9)	A	−0.3 (1.0)	C	−0.1 (1.0)	B	<0.0001
Craving For Sweet Food ^z	0.3 (0.9)	A	−0.2 (1.0)	B	−0.1 (0.9)	B	<0.0001
Food Pleasure ^z	0.4 (0.9)	A	−0.4 (1.0)	C	−0.1 (0.9)	B	<0.0001
Variety Seeking in Food ^z	0.4 (0.9)	A	−0.3 (0.9)	C	−0.1 (0.9)	B	<0.0001

^zData analyses were generated using the MEANS and GLIMMIX procedures of SAS software (SAS for Windows, v 9.4, SAS Institute Inc.).

^yData analyses were generated using the CHISQ and TESTP options in the TABLES statement of the FREQ procedure of SAS Software (SAS for Windows, v 9.4, SAS Institute Inc.).

Different letters across columns indicate significant differences of means at $P < 0.05$. Significant differences are shown in bold. DTC = direct-to-consumer; HH = household.

in Fig. 1. As expected, Local Melon Lovers (cluster 1) had a higher share of heavy consumers (30%) than Convenient Shoppers (cluster 2; 12%) and Ripe-For-The-Picking (cluster 3; 21%). Similarly Local Melon Lovers had a higher share of moderate consumers (27%) than Convenient Shoppers (18%) and Ripe-For-The-Picking (20%). The highest share of light and noneaters were in the cluster of Convenient Shoppers (43% and 27%), followed by Ripe-For-The-Picking (38% and 22%), and Local Melon Lovers (31% and 12%). Thus, both segmentation scenarios produced helpful and different information and both scenarios could effectively be incorporated into future marketing strategies to encourage melon consumption.

Conclusions

The main contribution of this study is the thorough assessment of the U.S. market for melons. Specifically, this study contributes to the literature by providing market segmentation scenarios and segment profiles within the U.S. melon market through the lens of consumer attitudes, preferences, and purchasing behavior. This study focused on *C. melo* L. genotypes, and excluded watermelons.

Categorizing the melon market by consumption rate (noneaters, light, moderate, and heavy consumers) provided some useful insights. Investigators found some demographic and attitudinal differences among melon consumers. For example, nonconsumers and light consumers were similar to each other but different from moderate and heavy consumers. Heavy and moderate consumers not only ate more melons, they preferred whole melons (relative to cut ones), spent more on average for melon purchases, and were willing to pay a higher price for melons. Both moderate and heavy consumers were also more likely to purchase melons from local markets, providing important avenues to reach this premium clientele. Heavy and moderate melon consumers placed a higher importance on melons in their diet, which may be because they value the nutritional benefits of melons.

Consistent with recent fresh fruit consumer trends, heavy and moderate consumers preferred local melons compared with melons imported from other states or countries. This credence attribute should produce a greater WTP compared with many search or experience attributes, which is consistent with the COOL literature. The top four attributes

(flavor, freshness, ripeness, and sweetness) were experience attributes and were similar across the segments, but the heavy consumers placed higher importance on those attributes, whereas price (a search attribute) remained similar in importance between the groups. Our findings are consistent with Lester and Shellie (1992), who found that consumers highly favored melon attributes such as flavor, sweetness, and texture, as well as Lester and Shellie (1992), who reported the best predictor of fruit quality was flavor.

As expected, melon importance and knowledge increased as consumption increased. Although the heaviest consumption group accounted for 22% of the market, they consumed nearly three times the melon servings per month compared with the moderate consumer and nearly 10 times the servings of the light consumption group. With a domestic population of 328 million consumers (Jordan, 2019), having each of the moderate consumers eat one more melon serving would increase consumption by 6.6 million melons (each yielding 18 half-cup servings). The fact that heavy and moderate consumers have higher quality standards and care less about the price paid for melons, relative to noneaters and light consumers, has important implications

Fig. 1. Comparison of consumption categories by cluster membership.

for researchers and industry stakeholders. Growers, distributors, and retailers should meet the needs of moderate and heavy consumers by making available new types of melons with distinct aroma and rind color.

Another useful segmentation provided by this study was on the basis of melon attribute importance. Results report three distinct clusters among individuals 18 years of age and older. Our findings are consistent in proportion and motivation to Heng and House (2018). Melon purchases in cluster 1 reflected 34.6% of the market and appeared to be the most promelon in attitudes, knowledge, and consumption, as well as GHI, SFC, FP, and VSF scales. This group, labeled Local Melon Lovers, would be the best target for new melon cultivars because of their high level of consumption and positive attitudes. Consumers in this cluster tend to be younger and have more children than the other two clusters. They are characterized by living in metropolitan areas, consuming more fruits in general, and spending more money on fresh fruits. Their preferred marketplace for melons are local markets (e.g., farmers markets) and tend to have vast knowledge about healthy diet. Marketing campaigns targeting this group should focus on the health and experience attributes of melons. Local

Melon Lovers might be willing to pay more for melons grown by local and small family farms.

The largest segment was cluster 3 and comprised 44.7% of the market, with attitudes, consumption, and factor scores intermediate to clusters 1 and 2. Given their demographic and consumption characteristics, the Ripe-For-Picking Consumer (cluster 3) appears to be the group of individuals that should be the target of marketing and advertising campaigns for increasing the melon market share. Given their higher consumption and intermediate GHI, FP, and VSF attitudes, marketing communications targeting this segment may be more fruitful compared with cluster 2. Because this group of consumers is likely to purchase fruits in local stores, marketing efforts to target this segment should emphasize melon attributes such as new types of melons, local foods, and information regarding melons and healthy diet. Last, cluster 2 was the least promelon with low mean scores reflecting attitudes about melons, and spending and consuming the least on melons. This group comprised only 20.6% of the market.

Limitations and further research. Online surveys and survey panels may have some biases but are generally accepted market research protocols that ensure accuracy and

data collection speed while reducing potential coding errors and mailing expense (Cobanoglu et al., 2001; Dillman et al., 2009). Our sample size was sufficiently large to overcome many of those potential biases. Future research should address the consumer willingness to pay for different melon attributes and understand how the place of purchase can influence consumption and preferences.

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