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Staff Paper

MARKET SEGMENTS IN THE FRESH BALATON TART CHERRY MARKET IN MICHIGAN

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Abstract

While many studies have focused on consumer preferences for specialty crops, few have focused on tart cherries. This article uses data collected from 134 Michigan tart cherry consumers to identify potential market segments through consumers' consumption frequency of fresh Balaton tart cherries. We use k-means cluster analysis to describe Balaton tart cherry market segments. Our analysis suggests that fresh and frozen tart cherry consumers do not commonly overlap and that fresh Balaton consumers are generally unique relative to other tart cherry consumers. Overall, this article provides a first step toward understanding consumer demographics for tart cherries.

JEL Codes: C38, L66, Q13

Market Segments in the Fresh Balaton Tart Cherry Market in Michigan

Demand for food in the United States has undergone significant structural changes in recent years. Consumer preferences have shifted rapidly towards healthier, fresher, more “natural” foods (McCluskey, 2015). Additionally, generational consumption patterns for have changed. For example, Conley et al. (2017) reported that relative to what would be expected by the consumption patterns from previous generations, Millennials (persons born between 1981 and 1996) have a higher demand for fresh and natural products and lower demand for that of processed food as well as for food away from home. Changes in consumer preferences are also compounded with a proliferation of food options, as consumers increasingly confront more options than they can cognitively process (Malone and Lusk, 2018; 2019). This new market environment suggests that specialty crop growers might benefit from reevaluating their target consumers.

Tart cherry producers represent one such industry likely to experience significant market adjustments (Thornsbury and Martinez, 2011). In an effort to respond to this burgeoning demand for fresh fruits, industry leaders collaborated with Michigan State University to develop a novel tart cherry that could be freshly consumed: the Balaton tart cherry. This article uses data from Balaton tart cherry consumers to explore market segments in the state of Michigan, as tart cherries are a specialty crop in the state of Michigan that is critical to the state’s collective identity (Malone and Flores Moreno, 2018). Michigan producers account for 75 percent of the total domestic production, making the state of Michigan the largest in the United States (Lagoudakis et al., 2019). It is four times higher than second-ranked Utah. Tart cherry production has shown an upward trend over the last decade with little evidence of demand growth, although consumption patterns have remained largely stable (ERS, 2017). In 2016, the consumption per person of cherries in general amounted to 2.2 pounds (ERS, 2017). This is a small number relative to other fruit crops

such as the 44 pounds of apples consumed by each American each year (U.S. Apple Association, 2014).

Extensive research has focused on the health benefits of tart cherries, which suggest that they contain antioxidants and anti-inflammatory ingredients. They also have been shown to contribute to muscle recovery as well as the regulation of “daily body rhythm” (Seeram et al, 2001; Connolly et al, 2006; Siddiq et al, 2011). Tart cherries include components that can reduce the risk of cancer, heart disease, and other chronic ailments (Ding and Lu, 2004). Hence, tart cherries are often marketed as “healthy,” although few studies have explored the effectiveness of these marketing strategies. More broadly, few peer-reviewed journal articles have been published that explore and analyze tart cherry consumers behavior in general. Instead, articles can be found that focus on substitute fruits such as peaches (Zhou et al., 2018) and sweet cherries (Kappel, Fisher-Fleming, and Hogue, 1996; Ross, Chauvin, and Whiting, 2010). The tart cherry literature that does exist focuses on producer decision-making for tart cherries, even though the vast majority of existing research seeks to identify the most attractive characteristics of tart cherries for consumers *through* producer opinions (Yue et al., 2014; 2017).

The overall objective of this article is to analyze existing tart cherry consumer data in order to provide a starting place for future tart cherry consumer marketing research. More specifically, we utilize k-means cluster analysis to identify market segments of fresh Balaton tart cherry consumers. The remainder of this article is organized as follows. First, we describe the data and the market segmentation methods. We then describe the results of our study, which suggest more educated, older consumers are most likely to consume fresh Balaton cherries. The final section concludes with a discussion of the study’s implications and recommends avenues for future research.

Data and Methods

The goal of our data analysis is to identify key market segments of Balaton tart cherry consumers. Data for this analysis was collected in Michigan grocery stores in 2004. A paper survey was attached to bags of fresh Balaton packaging. Balaton purchasers were asked to mail their survey responses back in an included envelope. There are three key benefits to this approach relative to a traditional online or mail-based survey. First, consumers were allowed to consume the tart cherries freely before they sent their survey back. This way, we can more confidently that they are in fact current tart cherry consumers. Second, we can also be more confident that they will more accurately describe how they used the tart cherries they purchased. Finally, this method allows us to be confident that they can respond to questions about their sensory perceptions of the product, which is not as easily conducted in a traditional hypothetical consumer survey.

The questionnaire was comprised of two sections.¹ First, we asked several descriptive multiple-choice questions about how frequently the participant consumed cherries. The second section asked about the consumer's socio-economic status. For the purposes of our analysis, we conducted k-means cluster analysis using the following four multiple-choice questions. First, we asked about each participant's weekly consumption of fresh and frozen tart cherries:

1. How often do you purchase fresh cherries (when they are available to buy in the store)? Please circle the letter of the response that most closely shows your response.
2. How often do you purchase frozen tart cherries? Please circle the letter of the response that most closely shows your response.

¹ A draft of the survey can be found in the Appendix.

For these two questions, participants were provided the option of selecting “Daily, 3-5 times per week, Once or twice per week, Less than once per week, or Never.” The third and fourth questions focused on annual consumption of Balaton tart cherries versus other varieties of tart cherries:

3. How many times have you purchased Balaton cherries this year?
4. How many times have you purchased other tart cherries this year?

Participants were provided the options of “1-3 times, 4-6 times, 7-12 times, or More than 12 times this year.” Consumers were asked to return the survey via an included envelope and stamp.

K-Means Cluster Analysis

To segment the consumer populations, we conduct k-means cluster analysis, which is a data reduction technique performed to group similar consumers in a dataset such that subjects in each group are similar to each other in terms of specific characteristics. (MacQueen, 1967). Cluster analysis is commonly used in the agricultural marketing literature to identify potential market segments for agricultural and food products such as craft beer (Malone and Lusk, 2018), chicken consumption (Innes and Cranfield, 2009), dairy (Schlecht and Spiller, 2012), and strawberries (Januszewska et al., 2006).

Cluster analysis groups observations by similarities across participants by minimizing Euclidean distances between them (Jain, 2010). “K-means” clustering randomly assigns k initial centers (k=3 in our case) by selecting k points from the observations to be used as initial centers. The iterative process assigns each observation to the nearest matching center. Subsequently, new centers are derived for every cluster. The whole process re-iterates (by k-means), assigning every single observation to the nearest center. There is a chance during that process that participants will change clusters. This process repeats until the last iteration re-assigns all observations to a cluster. The final cluster assignments constitute the clustering solution. K-means clustering requires an

ex-ante specification of the number of clusters, k . In our case, we chose the number of the clusters by visually examining the data.

Results

The sample size was 134, although only 123 participants completed the entire survey. The median age of our sample is 55 years old and our sample primarily consisted of women (81%). Similarly, 69% of our sample had an annual income above \$75,000, which suggests that our sample was significantly wealthier than the Michigan population, which had a median household income slightly above \$40,000 in that year. Table 1 shows the frequency of consumption of Balaton tart cherries during the year of the survey by age. Young adults aged 21–34 were the least likely to purchase tart cherries while older adults aged 55 years and older were the most likely to purchase the Balaton variety of tart cherries. The vast majority of our sample (86%) claimed to use the tart cherries as individual fruits without any processing.

[TABLES 1 AND 2]

Table 2 displays correlations between purchasing behaviors, which suggest that there is a negative relationship between consumers of fresh cherries and consumers of all other tart cherry metrics (frozen, Balaton, other). Table 3 displays the average consumption frequency for each of the three market segments.

[TABLE 3]

Three clusters were retained in the k -means cluster analysis. Consumers with a high purchasing frequency of cherries comprised 47.15% of our sample. On average, these consumers purchased fresh cherries more than twice per week but were less likely to purchase fresh Balaton tart cherries as they purchased fresh Balaton more than three times per year. These consumers were much less likely to purchase the frozen alternatives, suggesting that there is a small overlap between fresh

and frozen cherry consumers. The key Balaton consumer segment was the smallest market segment, as they comprised 19.51% of our sample. These consumers purchased fresh Balaton tart cherries almost monthly but were much less likely to consume fresh cherries. They were also least likely to purchase frozen tart cherries or other tart cherries relative to the other consumer segments. Finally, the frozen cherry market segment comprised 33.34% of the sample. This market segment consumed frozen cherries almost daily and opted for fresh Balaton cherries seven to twelve times a year.

Table 4 shows differences in demographic characteristics for the three consumer clusters. The frozen cherry and key Balaton market clusters tend to be less educated, with 55.3% of the frozen cherry and 57.1% of the key Balaton clusters having a four-year college education or less. The fresh cherry consumer segment was more educated, with 54.4% having a graduate degree. Fresh cherry consumers were also older as more than 82% of this cluster was older than 45 years. In comparison, more than 30% of the key Balaton and frozen cherry participants were under 45 years old. The frozen and key Balaton segments also had lower incomes, with approximately 75% of those clusters earning a household income of less than \$75,000, while almost 36% of the fresh cherry consumer segment earned over \$75,000.

[TABLE 4]

Conclusion

Tart cherry producers are likely to experience changing consumer demographics, and a key challenge for the industry is the identification of key market segments. Using k-means cluster analysis to identify three market segments for Balaton tart cherries, this paper links consumption frequency to consumer characteristics. For instance, we find that people with higher education

levels consume fresh cherries more frequently while lower income groups tend to gravitate toward frozen packaging. In addition, consumers who purchase more cherries tend to be older and wealthier.

While this study provides an insight into consumer segmentation in the tart cherry market, limitations remain. First, the data used for this study was collected in 2004. A contemporary sensory study with willingness to pay questions could identify relationships between taste perceptions and monetary evaluation of the product. Second, this study focuses only on consumers of the fresh Balaton variety, while the processed Montmorency variety is the most commonly consumed tart cherry. As such, future research might benefit from comparing results from this study with Montmorency. Third, this study focused on Michigan consumers. Given the geographic diversity of America's rosaceous fruit market, future research might explore geographical differences in consumer tastes. Fourth, this study grouped consumers based on their cherry consumption habits. Future research might evaluate price differences to examine likely substitution effects between tart cherry products and alternative rosaceous fruit options. Finally, the open-ended responses suggest that some consumers are concerned about the level of pesticides included in tart cherries. For example, one participant claimed, "I don't buy too many cherries because of the pesticide level. I do buy dried cherries though." One interesting study might be to explore this claim by testing the differences in consumer perceptions of pesticide levels for the same fruit when it is processed and fresh.

Despite these limitations, this study contains a few key insights for the tart cherry industry. By separating consumers into three consumer groups, we demonstrate that consumers are heterogeneous even in a very narrow segment of the tart cherry market method for targeted advertising in the tart cherry market. At least for fresh Balaton tart cherries, consumers tend to be

older, female, and more educated than the public. While this has been a key focus for the industry in past years, this article is the first to identify this group of consumers in an academic fashion. As such, our results represent a first step towards a better understanding of consumer heterogeneity in the tart cherry market and might constitute a basis for further analysis of fruits markets in the United States.

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Table 1. Balaton tart cherry consumption by age

Frequency of consumption	21-34 years	35-54 years	55 years or over	Total
1-3 times this year	2	11	19	33
4-6 times this year	6	13	18	37
7-12 times this year	2	14	16	32
More than 12 times this year	2	11	15	28
Total	12	49	68	130

Notes: Responses to the question, “How many times have you purchased Balaton cherries this year?”
Total number of observations = 130.

Table 2. Correlation matrix between cherry consumption frequencies

	Fresh Cherries¹	Frozen Tart Cherries²	Balaton Fresh Cherries³	Other Tart Cherries⁴
How often do you purchase fresh cherries (when they are available to buy in the store)? (FFC)	1	-0.05	-0.57	-0.17
How often do you purchase frozen tart cherries? (FFT)	--	1	0.02	-0.20
How many times have you purchased Balaton cherries this year? (PFC)	--	--	1	0.20
How many times have you purchased other tart cherries this year? (PTS)	--	--	--	1

¹How often do you purchase fresh cherries (when they are available to buy in the store)?

²How often do you purchase frozen tart cherries?

³How many times have you purchased Balaton cherries this year?

⁴How many times have you purchased other tart cherries this year?

Balaton Fresh and Other Tart Cherries are reverse coded.

Table 3. Average reported consumption for each market segment

Market Cluster	Fresh Cherries¹	Frozen Tart Cherries²	Balaton Fresh Cherries³	Other Tart Cherries⁴
Fresh cherry segment	2.40	1.53	1.55	1.07
Key Balaton segment	3.92	2.08	3.50	1.58
Frozen cherry segment	4.07	1.05	3.10	1.00
Total sample	3.27	1.48	2.42	1.15

¹How often do you purchase fresh cherries (when they are available to buy in the store)?

²How often do you purchase frozen tart cherries?

³How many times have you purchased Balaton cherries this year?

⁴How many times have you purchased other tart cherries this year?

Table 3. Demographic Composition of Tart Cherry Consumer Clusters

	General Sample	Frozen Cherry Segment	Key Balaton Segment	Fresh Cherry Segment	Michigan Population
Percent of Sample		33.34%	19.51%	47.15%	
		<i>Gender</i>			
Male	18.0%	13.0%	7.0%	26.0%	48.9%
Female	82.0%	87.0%	93.0%	74.0%	51.1%
		<i>Educational Attainment</i>			
High School/GED	15.3%	18.4%	21.4%	10.5%	44.4%
Some College/2-year College	9.2%	15.8%	3.6%	5.3%	31.0%
4-year College Degree	27.5%	21.1%	32.1%	29.8%	15.1%
Graduate degree	48.1%	44.7%	42.9%	54.4%	9.5%
		<i>Age</i>			
24 or younger	3.8%	2.6%	3.6%	3.5%	12.0%
25 to 34 years	5.3%	5.3%	10.7%	1.8%	17.1%
35 to 44 years	17.6%	23.7%	21.4%	12.3%	20.0%
45 to 54 years	20.6%	21.1%	14.3%	22.8%	20.3%
55 to 64 years	19.1%	13.2%	14.3%	28.1%	14.2%
65 or older	33.6%	34.2%	35.7%	31.6%	16.3%
		<i>Income</i>			
Higher than \$75,000	30.3%	21.9%	26.9%	35.7%	--
Lower than \$75,000	69.7%	78.1%	73.1%	64.3%	--

Note: Total number of observations = 131.

Michigan estimates from the 2005 American Community Survey (U.S. Census Bureau, 2005)

The median household income in Michigan in 2005 was \$67,144.

Survey Instrument

Dear potential survey participant: Several university researchers are investigating consumer perceptions of cherries. We would like you to take about 5 minutes (including the time you spend reading this) to answer some questions on cherry consumption and shopping behavior. You have received this survey and request to participate because you or someone in your household made a purchase of these new “Sweet” Tart Cherries named Balaton®. If you choose to respond to our study, your responses are confidential and we will protect your confidentiality to the full extent of the law. We ask that you complete your form and return it in the postage-paid envelope provided. You are free to not answer any question you choose, but please try to answer every question. If you have any questions regarding this study, please contact Dr. Bridget Behe at 517-355-5191 or at 238 Plant and Soil Sciences Building, Department of Horticulture, Michigan State University, East Lansing, MI 48824. If you have any questions about your right as a human subject please contact Dr. Peter Vasilenko, Ph.D., Chair, University Committee on Research Involving Human Subjects at 517-355-2180. Thank you.

1. How often do you purchase fresh cherries (when they are available to buy in the store)? Please circle the letter of the response that most closely shows your response.

A. Daily
B. 3-5 times per week
C. Once or twice per week
D. Less than once per week
E. Never

2. How often do you purchase frozen tart cherries? Please circle the letter of the response that most closely shows your response.

A. Daily
B. 3-5 times per week
C. Once or twice per week
D. Less than once per week
E. Never

3. How many times have you purchased Balaton cherries this year?

A. 1-3 times
B. 4-6 times
C. 7-12 times
D. More than 12 times this year

4. How many times have you purchased other tart cherries this year?

A. 1-3 times
B. 4-6 times
C. 7-12 times
D. More than 12 times this year

5. How did you eat the cherries you bought today? (Circle all that apply)

- A. As individual fruits without any preparation (washing does not count as preparation)
- B. Prepared in a fresh salad
- C. Prepared in a dessert
- D. Prepared or used in a main dish meal
- E. Other: _____

6. How would you rate the sweetness or tartness of the cherries you bought today?

Too Tart						Too Sweet	
1	2	3	4	5	6	7	

7. About how many cherries do you buy at one time?

_____ more than one pound _____ less than one pound

8. What color(s) or variety(s) do you buy? _____

9. How much (per pound) would you be willing to pay for the cherries that you purchased?

- \$0.99
- \$1.99
- \$2.99
- \$3.99
- \$4.99
- \$5.99

10. I prefer to eat locally grown produce:

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

11. Knowing where my food is grown is important to me.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

12. In what year were you born? _____ Year

13. Are you male or female? Male Female

14. How would you describe your ethnicity?
- White, non Hispanic
 - Black, African American
 - Hispanic
 - Asian Pacific Islander
 - Other

15. How many years of formal education (12=High School Graduate) have you completed?
_____ Years

16. How many people are living in the household who are older than 18 years of age? _____

17. Do they eat fresh cherries? Yes- all do Yes- some do No- none do

18. How many people are under the age of 18 in your household? _____

19. Do they eat fresh cherries? Yes-all do Yes-some do No-none do

20. What is the zip code of your mailing address? _____ Zip code

21. Was your 2003 household income higher before taxes higher or lower than \$75,000?

Higher

Lower