CONSUMERS' EVALUATION OF APPLE QUALITY

Anna Marin
Food Innovation Center
1207 NW Naito Pkwy, suite 154
Portland, OR 97209
anna.marin@oregonstate.edu

RESEARCH OBJECTIVES

The overall objectives of this research are to relate apple physical measures to measures of consumer liking and acceptance. The hope is that the resulting data will provide information required to establish criteria for apple sorting and for apple eating quality standards. In order to measure consumers' degree of apple liking, the test design was to present consumers with a wide range of apple qualities for one apple variety at a time. Results presented here are for the first tests on Gala apples. The different apple quality classes were defined by non-destructive sorting methods followed by destructive sampling methods. This study also compares destructive and non-destructive sorting measures of apple quality and how they relate to consumer liking measures.

APPLE SORTING AND TREATMENT

The sorting objective for this study was to obtain a full range of fruit from low to high quality for consumer evaluations. Apples used in this study were 2001 season Gala apples obtained from 10 different lines from Stemilt Fruit Co. in mid-October. Treatment was to hold half of all the fruit in cold storage and the other half at room temperature for 10 days. Apples were then sorted in to 8 quality classes for consumer testing using the following methods:

Non-destructive:
1. NIR for soluble solids (NIR)
2. Firmalon for Acoustic Firmness Index (FI)

Destructive:
3. Magness-Taylor penetrometer (FTA)

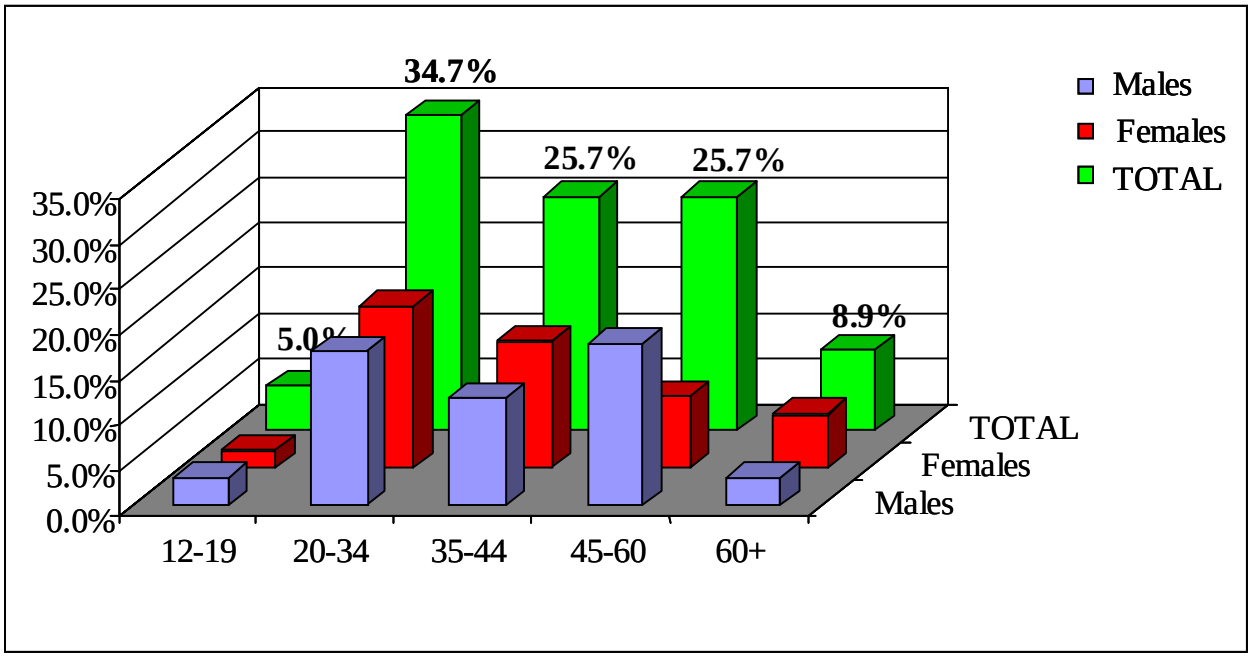
Non-destructive sorting methods were used prior to the consumer test and the destructive method was used on the day of consumer testing just prior to serving to consumers. The sorting methods resulted in eight quality classes of fruit (A through H) as described in the table to the right. Other physical measurements were taken on each fruit on the half portion left after the fruit was cut in half for serving to consumers. These other measures were based on analysis of the juice extracted from the half apple: initial pH, titratable acidity and total soluble solids.

Apple Class	Sort Method		
	NIR	FI	FTA
A	L	L	
B	M	L	
C	H	L	
D	L	H	
E	M	H	
F	H	H	
G	M	M	L
H	M	M	H

CONSUMER TASTE TEST DESIGN

Consumers for the taste tests were Portland, OR residents who eat apples at least once a month.

Age and gender distribution for 101 consumers is given in the following figure:



The 101 consumers were tested over 2 days with up to 10 panelists tested per one-hour session. Apple samples were served monadically, one at a time, with 9 apples total evaluated by all consumers: the 8 apple quality classes, plus a first sample as a warm up sample taken from apple class M M. The presentation order of all the other 8 classes was randomized across all consumers. Consumers were served ½ apple cut just before serving; the other ½ apple was used for other the fruit measurements described above. Consumer evaluation sessions were scheduled for 1 hour with a 5-minute break after each 3-apple evaluation; 2 breaks per session.

CONSUMER APPLE QUESTIONNAIRE

For each apple sample, consumers answered questions on overall liking, apple quality characteristics and on acceptability and purchase intent. Questions and examples of the scales used are given below:

A. Rating Questions Based on 10 cm **Liking** Scale:

1. Looking at the outside of the apple, how much do you EXPECT to like eating this apple?
2. After taking at least 2 bites, how much do you LIKE the APPLE OVERALL?
3. How much do you like the OVERALL TEXTURE?
4. How much do you like the OVERALL FLAVOR?

Dislike extremely — **Neither like nor dislike** — **Like extremely**

B. Rating Questions based on "**Just-About-Right**" scale:

5. SWEETNESS
6. SOURNESS

Not sweet enough — **Just about right** — **Much too sweet**

C. **Yes/No Questions:**

7. Is this apple ACCEPTABLE to you?
8. Would you consider BUYING this apple?

RESULTS: DESTRUCTIVE VS. NON-DESTRUCTIVE MEASURES

The following figures graphically display the relationship between non-destructive and destructive measures for the Gala apples used in this test. Figure A shows the relationship between the non-destructive test measure, NIR, and the destructive measure, % soluble solids. Figure B shows the relationship between the non-destructive firmness test measure, FI, and the destructive measure, FTA (firmness in lbs). The relationship between NIR and % soluble solids is fairly linear and predictable, as has been reported by other researchers, while the relationship between FI and FTA is not as good, as also reported by other researchers.

Figure A. NIR vs. % soluble solids

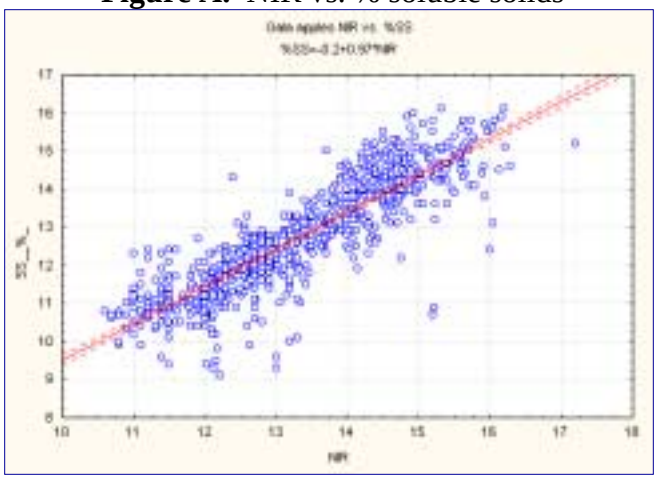
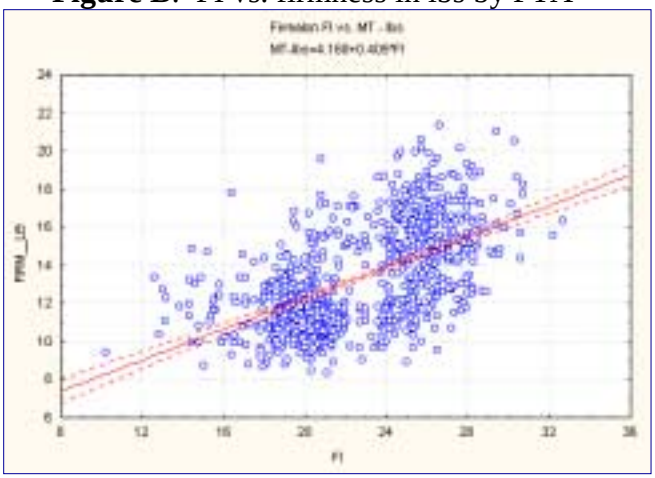


Figure B. FI vs. firmness in lbs by FTA



RESULTS: APPLE APPEARANCE, EXPECTANCY, OVERALL LIKING, FLAVOR AND TEXTURE.

The average scores across all consumers' for how much they expected to like the apples, based on appearance, are given in the following table. Consumers scored all the apple classes similarly with relatively high expectation that the apples would taste good (scores 6.05 to 6.39 on a 10-point scale). However, after tasting the apples, overall liking scores for the different quality apples were different, ranging from 4.58 to 6.41. Liking scores with different colors were significantly different. Consumer's scores for flavor were similar to the order of apple classes

for overall liking. Flavor scores ranged from 4.41 to 6.25 and texture scores ranged from 4.03 to 6.41.

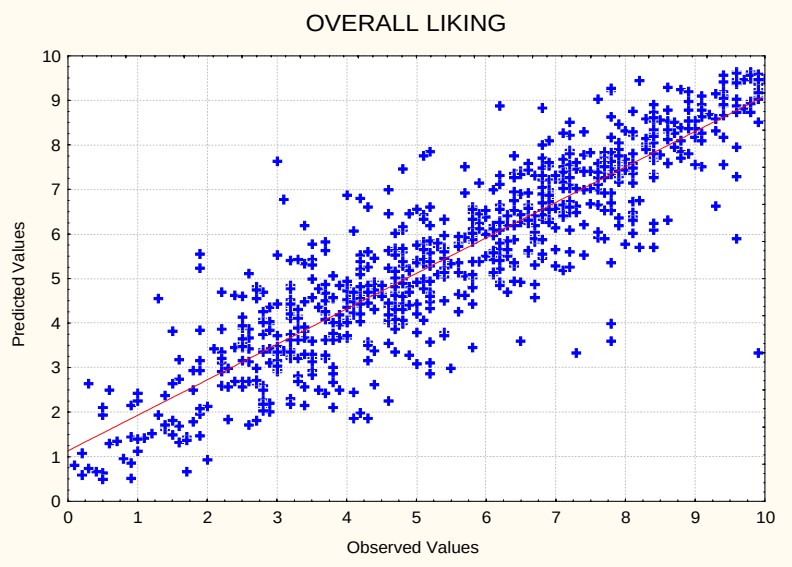
Apple Class	NIR	FI	MT	Liking Expectancy	Liking Score
H	M	M	H	6.19	6.41
E	H	M		6.19	6.04
D	L	H		6.19	5.97
F	H	H		6.39	5.46
C	H	L		6.10	5.68
G	M	M	L	6.21	5.11
A	L	L		6.05	4.90
B	M	L		6.18	4.58

RESULTS: SENSORY CHARACTERISTICS RELATED TO OVERALL LIKING

The relative contribution of the different apple qualities to overall liking is expressed in the following figure and linear model: OVERALL LIKING can be predicted well as a function of TEXTURE, FLAVOR, SWEETNESS and SOURNESS. All the qualities were significant to the model. The coefficients of each quality show that FLAVOR has the greatest effect on OVERALL LIKING followed by TEXTURE, with minor contributions, equally, by SWEETNESS and SOURNESS.

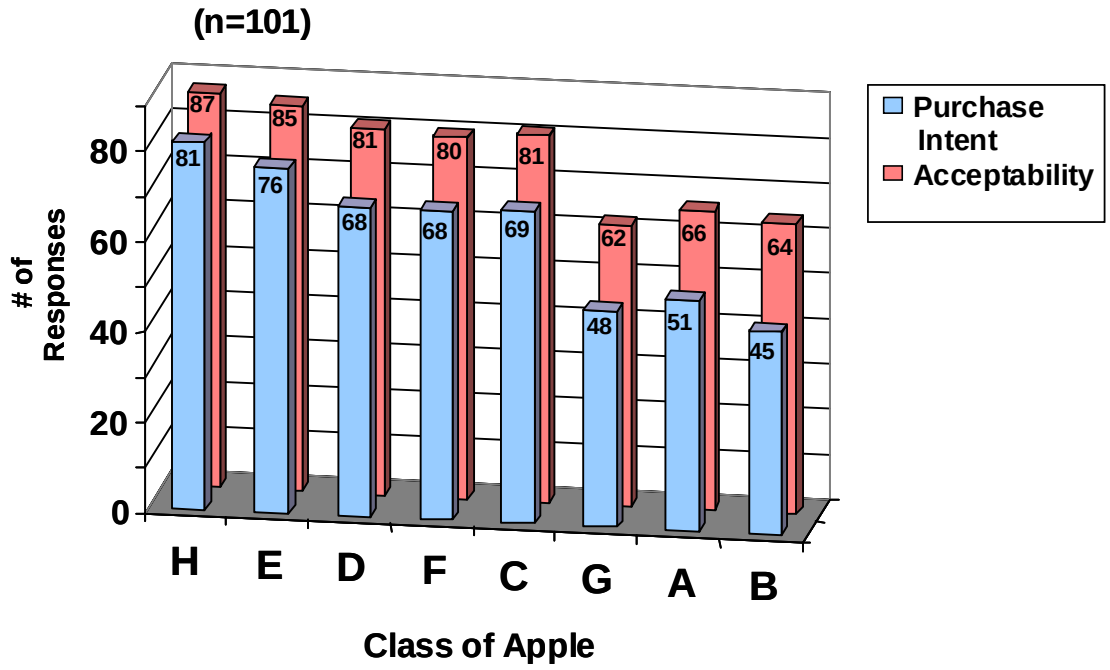
MODEL:

OVERALL LIKING = 0.341 + 0.2991(TEXTURE) + 0.5602(FLAVOR) + 0.0404(SWEETNESS) + 0.0398(SOURNESS)



ACCEPTABILITY AND PURCHASE INTENT FOR GALA APPLES

Consumer response for apple acceptability and purchase intent is summarized in the following figure as the percent of consumers responding positively to ACCEPTABILITY and BUYING for each apple quality class. The quality classes A through H are as described previously. As for OVERALL LIKING, FLAVOR and TEXTURE scores, ACCEPTABILITY and BUYING are most likely for classes H, E and D and are lowest for classes G, A and B.



PRELIMINARY CONCLUSIONS

This report summarizes the results for the first experimental trial where consumers tasted and rated a wide quality range of Gala apples that were sorted based on non-destructive and destructive methods. Results show that consumers can distinguish low and high quality apples and show varying degrees of preference for different qualities of apples. Also, results show that OVERALL LIKING is a function of consumers' ratings for four apple qualities, FLAVOR, TEXTURE, SWEETNESS and SOURNESS, with FLAVOR and TEXTURE having the most influence on OVERALL LIKING scores. Consumers also responded favorably to accepting and buying Gala apples that were firm and of moderate to high sweetness, but acceptability and buying both decreased if apples were not as firm or sweet.