OBJECTIVE I

Sensory Characteristics and Consumer Acceptance of Mechanically-Harvested California Black Olives

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Fruit harvested by the improved DSE 008 canopy contact harvester in 2008 was either processed fresh, or stored and processed in early 2009 by both Bell Carter and Musco Olive Company. The field procedures for the 2008 harvesting the olives are detailed below.

Field Procedures: Location: Block 17W Rocky Hill Ranch, Exeter CA

- Planted 1998
- 6 rows, 83 trees per row, 'Manzanillo' olives with 'Sevillano' pollinators
- Spaced @ 12 X 26 feet, 139 trees per acre

29 – 20 September 2008

The six tree rows were divided into five 14-tree replications with 1 buffer tree at each row end, and two buffer trees between each 14-tree replication.

- 1 replication per row (six row total) was hand harvested as a control
- 1 replication per row (six row total) were harvested with the DSE 008 canopy contact head harvester
    - Dropped fruit were collected and weighed; but not combined with harvested fruit
    - Each tree was hand gleaned, and fruit weighed; but not combined with harvested fruit
- The six hand harvested replications and six machine harvested replications were maintained in separate bins
- The separate bins were reweighed at Musco receiving station to confirm field weight
- A COC sample grade was done for each bin/replication
    - A 40 pound sample of extra large/large fruit was collected for each replication by running the fruit over the sizer
    - The 40 pound sample was separated into two 20 pound samples each for Bell Carter and Musco
        - One sample was processed fresh
        - One sample was processed stored
        - The samples were sent to the two processors that night

2 (harvest methods) X 6 (14 tree replications) X 2 (processors) X 2 (processing methods) = 48 samples total

Table 1.1 gives the effect of harvest method on the percent cannable fruit and adjusted value per ton. As can be seen in this table, mechanically harvesting with a canopy contact head significantly lowered the percentage of cannable olives and the adjusted value per ton. However, the major factors causing these decreases were significant increases in the percentages of trash and culls in mechanically harvested fruit (data not shown). The high percentage of trash was the result of an inoperative blower. The higher percentage of culls was the result of overripe fruit.

Table 1.1. Average, and statistically analyzed, receiving station grades for the percentage of cannable fruit and adjusted value per ton for the hand and machine harvested olives.

Effect of Harvest Method on Olive Grade and Value		
Harvest Method	Percentage Cannable[a]	Adjusted price/ton ($) [a]
Mechanical	88.0***	1013.80***
Hand	96.2	1137.80

[a] Means separation within columns were performed with PROC TTEST procedure of SAS (SAS Institute Inc., Cary, NC); *, **, *** = 0.05, 0.01 and 0.001 level of significance

These were not factors generated by the harvester. Also, 88% cannable fruit valued at $1,113.80 per ton is well within acceptable ranges for processing California black ripe table olives.

The above data demonstrates that the canopy picking head can produce commercially acceptable quality fruit if receiving station grade and value are the final criterion. However, it is the sensory and consumer evaluations detailed in the report below that confirm these mechanically harvested olives can produce processed olives with sensory quality equal to that of hand harvested product and are acceptable to consumers.

Considering that these olives (**Table 1.1**) delivered to Lee and Guinard for evaluation had a significantly lower canning percentage and adjusted value per ton, it is even more impressive that their evaluation results definitively demonstrated there is little distinguishable difference between hand and mechanically harvested olives.

Sensory Characteristics and Consumer Acceptance of Mechanically-Harvested California Black Olives

OBJECTIVES of OBJECTIVE I

The main objective of the study was to compare the sensory properties and acceptability of hand-harvested and mechanically harvested table olives. Another objective was to examine the effects of storage before processing on the sensory quality of the olives. Also, two different commercial processors processed the experimental samples, and they were compared to commercial offerings from these processors.

PROCEDURES of OBJECTIVE I

The study examined the sensory properties and acceptability of 10 California black table olive samples that were produced according to the experimental design described below. The variables in the design were harvesting method—hand vs. mechanical; commercial processor—Musco vs. Bell-Carter; and processing method—olives processed fresh vs. olives processed after storage. We also added two commercial products to the design, one from each processor. The samples in the design and the two commercial products are shown in **Table 1.2** below.

Table 1.2. Table olive samples.

Sample abbreviation	Processor	Commercial	Harvesting method	Processing method
A_Comm	A	Commercial	-	-
A_Hand_F	A	-	Hand	Fresh olives
A_Hand_S	A	-	Hand	Stored olives
A_Mach_F	A	-	Machine	Fresh olives
A_Mach_S	A	-	Machine	Stored olives
B_Comm	B	Commercial	-	-
B_Hand_F	B	-	Hand	Fresh olives
B_Hand_S	B	-	Hand	Stored olives
B_Mach_F	B	-	Machine	Fresh olives
B_Mach_S	B	-	Machine	Stored olives

Descriptive analysis

The sensory properties of the olives were measured by descriptive analysis with a trained panel of eight judges. In descriptive analysis, the panel rates the intensity of the sensory attributes of the products. Using a method that combined elements of the Quantitative Descriptive Analysis and the Spectrum Method, the panel rated the intensities of 31 attributes of appearance, flavor (taste and smell), texture and mouth feel across the 10 samples (**Table 1.3**). Reference standards for the flavor attributes in the scorecard were prepared to ensure concept alignment among the judges. Group and individual training sessions were held until the panel was deemed ready to proceed with the actual descriptive analysis. All products were evaluated in triplicate following a randomized complete block design. Olives were presented sliced in half, at room temperature, in a spherical glass covered with a plastic lid (three olives per glass). The intensity of the attributes was rated on a category line scale anchored with 'low' and 'high' labels (except for the attribute 'glossy', which used the labels 'dull' and 'glossy').

Consumer testing

The olive samples were also evaluated by 100 consumers, on Picnic Day (UC Davis' annual open campus event on 18 April 2009) or during the summer of 2009 (between 25 June and 3 July). Consumers were recruited among Picnic Day visitors and Davis Farmer's Market customers. To qualify for the study, consumers had to be US Residents and users and likers of black table olives.

Each consumer was presented with 11 samples (the first one was a primer, used to eliminate the first-order effect typically encountered in consumer tests—the first sample receives a higher hedonic score than the subsequent samples in the serving order). The order of presentation of the samples was randomized across consumers. Consumers rated overall degree of liking of the samples on the 9-point hedonic scale, from 1='dislike extremely' to 9='like extremely', with 5='neither like nor dislike'. They also rated degree of liking of the appearance, flavor, and texture of the samples. Olives (two olives per cup, sliced in half) were served in plastic cups covered with lids at room temperature. Crackers and water were provided for rinsing and palate cleansing. Upon completion of the tasting, consumers filled an exit survey with demographic and olive usage information.

Table 1.3. Sensory attributes in the descriptive analysis scorecard.

	Attribute	Reference		Attribute	Reference
Smell (Aroma)	Painty	Correction fluid	Flavor	Sweetness	Sucrose solution
	Briny	Black olive brine		Saltiness	NaCl solution
	Ocean-like	Green seaweed + anchovy*		Umami	MSG +Brine
	Fermented	Sauerkraut*		Bitterness	Caffeine solution
	Canny	Keys, cans		Roasted	Roasted sunflower seeds
	Earthy	Potting soil*		Buttery	Melted butter +olive brine *
	Sautéed mushroom	Sautéed Mushroom*		Ripeness	Unripe --- Ripe
	Dried fruit	Dried Prune	Texture	Firmness	
	Floral	Chrysanthemum tea		Juicy/ Moist release	
Appearance	Size	Small --- Large		Crumbly	
	Oval	Round --- Oval		Fibrous	
	Surface roughness	Smooth --- Rough (wrinkles, cracks)	After taste/ mouthfeel	Mouth coating	
	Glossy	Dull --- Glossy		Briny after-taste	
	Skin brownness	Black --- Brown		Lasting flavor	
	Flesh Brownness	Black --- Brown		Astringent	
	Flesh greenness	Black --- Green			

* mixed with olives

Data analysis

The descriptive analysis data were analyzed using a combination of univariate and multivariate statistics. Analysis of variance was used to examine the effects of the variables in the design. Principal component analysis (PCA) was then applied to the matrix of mean intensity ratings across the samples to examine the similarities and differences among the products in the design.

Hedonic ratings by the consumers were analyzed by analysis of variance and the matrix of hedonic ratings across consumers was analyzed by preference mapping — a combination of factor analysis and classification methods designed to assess preference-based market segmentation and to identify drivers of liking for each uncovered segment.

Partial least square (PLS) regression was then used to examine the relation between the hedonic ratings by consumers and the sensory attributes measured by the trained panel.

RESULTS OF OBJECTIVE I

Descriptive analysis

There were no significant differences between mechanically- and hand-harvested olives for any of the sensory attributes in the descriptive profile except *surface roughness* (**Table 1.4**). There were, however, many significant differences across a range of appearance, flavor, and texture attributes between fresh-processed olives and olives that had been stored before processing. A number of attributes also differed between processors and even more between the two commercial products and the experimental samples in the design.

Because it is nearly impossible to visualize differences among products across so many sensory dimensions, we used principal component analysis to show the relationships among the sensory attributes and the products in a two-dimensional 'sensory map' of the products. The principal component biplot shows the relationships among the sensory attributes — attributes which are positively correlated tend to form small angles with each other or to be clustered together on the plot, whereas attributes which are negatively correlated are found at opposite ends of the plot. It also shows the main sensory features of each table olive sample — attributes located close to a given sample tend to be higher for that sample, whereas attributes which are found away from that sample tend to be lower. The biplot of PC2 vs. PC1 is shown in **Fig. 1.1** below.

Fig. 1.1 shows how close to each other the hand- and mechanically-harvested versions of each olive product are located. By contrast, the location of the fresh- and stored-processed olives is different and so is that of samples processed by processors A and B.

Consumer testing

There was no significant difference in acceptability between mechanically- and hand-harvested olives. This was true not only for overall degree of liking but also for degree of liking of appearance, flavor and texture of the olives (**Fig. 1.2** and **Tables 1.5** & **1.6**). There were, however, significant differences in liking between fresh-processed and stored-processed olives. Consumers liked the fresh-processed olives significantly more than the stored-processed olives, and that was true not only for overall degree of liking, but also for liking of flavor and to a lesser extent liking of texture (**Fig. 1.4** & **1.5**, and **Tables 1.4** & **1.5**). On average, the four fresh-processed olive samples were liked best by the consumer population that tested the olives.

Fig. 1.4 below shows the partitioning of the variance in the hedonic data. It is clear that the main source of variation in the data was whether the olives were processed fresh or after storage.

Correlation analysis of hedonic ratings

It is interesting to note that when we examine how liking for the various sensory modalities correlated with overall degree of liking, we find that there was a highly significant correlation between liking for flavor and overall degree of liking (**Fig. 1.4** and **Table 1.6**). This suggests that even in a texturally-relevant product like table olives, flavor characteristics appear to be driving liking for the product overall.

Table 1.4. F-values for partitioned product source of variation.

	Commercial vs. non-commercial	Harvesting method (hand vs. machine)	Processing method (Fresh vs. Stored)	Processors (A vs. B)	Harvesting method * Processing method	Harvesting method * Processor	Processing method * Processor
Painty	**4.84**	2.03	2.80	0.14	0.16	0.14	0.14
Briny	1.46	0.28	0.98	1.11	1.36	0.01	0.01
Ocean-like	**7.21**	2.65	1.64	**16.17**	**4.38**	0.18	1.71
Fermented	**6.48**	0.02	3.22	**5.03**	0.92	0.18	0.18
Canny	2.34	0.02	2.10	0.02	0.39	0.03	0.03
Earthy	0.02	0.00	**7.77**	0.04	1.20	0.00	0.40
Sautéed mushroom	**4.88**	1.54	**3.94**	**5.71**	0.27	2.42	0.06
Dried fruit	**3.89**	0.31	**6.36**	1.25	0.02	0.09	0.09
Floral	0.41	0.83	0.10	0.08	0.28	0.08	0.20
Size	**36.87**	0.16	**6.89**	1.78	0.13	2.26	0.02
Oval	**4.12**	0.46	0.01	**3.88**	0.16	0.01	1.91
Surface roughness	1.72	**4.75**	2.06	3.10	0.00	0.37	**4.29**
Glossy	**8.05**	0.96	0.46	**87.50**	0.58	0.14	**8.14**
Skin brownness	2.85	1.67	0.10	**57.50**	0.43	**7.62**	**7.62**
Flesh Brownness	**9.16**	0.00	2.73	**115.09**	0.20	1.74	1.74
Flesh greenness	**13.31**	0.02	**7.66**	**37.09**	0.10	2.94	2.94
Sweetness	**6.63**	0.29	2.66	0.55	1.57	0.44	0.12
Saltiness	**17.07**	0.65	**89.39**	3.69	2.33	**4.83**	**4.83**
Umami	**8.96**	0.08	**38.54**	**8.67**	1.14	0.88	1.02
Bitterness	**10.35**	0.73	1.24	1.61	0.08	2.09	2.09
Roasted	1.21	0.02	**6.01**	3.41	2.27	0.87	0.01
Buttery	**9.05**	0.43	**25.73**	**3.94**	0.85	0.04	0.69
Ripeness	**11.25**	0.00	**34.05**	**30.50**	0.05	0.03	**9.07**
Firmness	**4.46**	1.62	**9.31**	**23.47**	0.12	0.12	**17.12**
Juicy/ Moist release	**67.49**	0.37	**73.49**	**14.20**	0.22	0.17	3.16
Crumbly	0.06	0.18	1.81	0.32	0.00	0.15	0.15
Fibrous	2.44	0.36	**12.69**	**23.39**	0.21	1.65	**14.47**
Mouth coating	**3.85**	0.00	**23.08**	1.63	0.06	0.96	0.02
Briny after-taste	**16.48**	0.03	**140.08**	**22.45**	0.86	**27.75**	**27.75**
Lasting flavor	1.10	0.22	**73.17**	**18.25**	0.39	**4.14**	**12.66**
Astringent	0.63	0.12	2.90	0.15	0.20	0.96	0.96

*Bold means significant effect (P<0.05)

Table 1.5. F-values for partitioned product source of variation

	Commercial vs. non-commercial	Harvesting method (hand vs. machine)	Processing method (Fresh vs. Stored)	Processors (A vs. B)	Harvesting method * Processing method	Harvesting method * Processor	Processing method * Processor
Overall degree of liking	**62.68**	2.04	**58.72**	0.01	0.00	0.61	0.48
Appearance liking	1.75	0.07	0.05	0.13	0.38	1.17	3.44
Flavor liking	**86.02**	0.90	**79.38**	0.31	0.06	0.41	0.00
Texture liking	2.44	0.06	**8.53**	**5.38**	0.07	0.07	3.50

*Bold means significant effect (P<0.05)

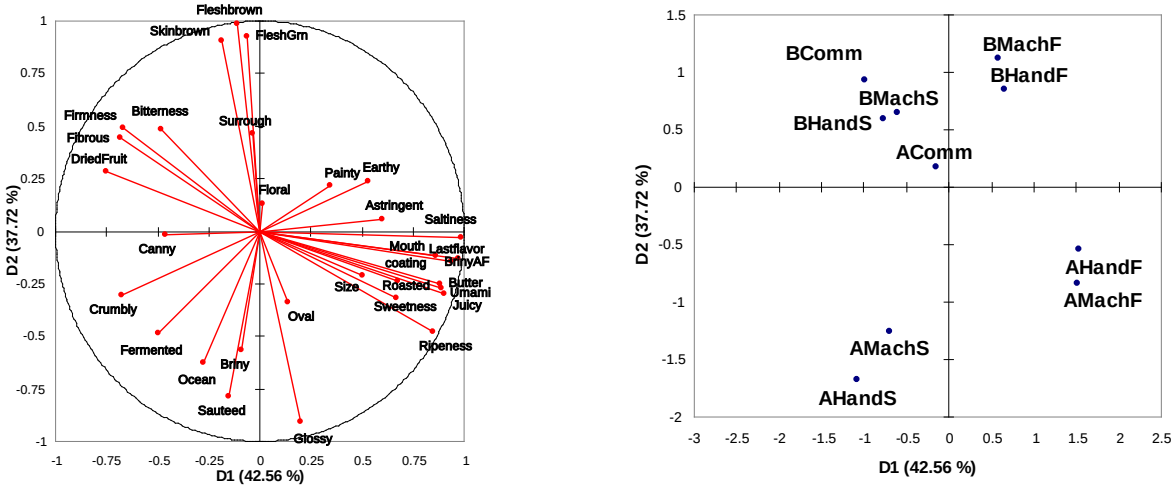


Fig 1.1. Principal component analysis of the descriptive analysis data showing the attributes and products.

Table 1.6. Mean hedonic ratings of the 10 olive samples for overall degree of liking, appearance liking, flavor liking and texture liking (N=100 consumers)

Products	Overall degree of liking	Appearance liking	Flavor liking	Texture liking
Acomm	4.57 ^{c}	6.07 ^{ab}	4.38 ^{c}	5.57 ^{c}
AHandF	6.01 ^{a}	5.91 ^{ab}	6.15 ^{a}	5.83 ^{bc}
AMachF	6.05 ^{a}	6.08 ^{ab}	6.13 ^{a}	5.66 ^{bc}
AHandS	4.98 ^{bc}	6.10 ^{ab}	4.90 ^{b}	5.55 ^{c}
AMachS	5.45 ^{b}	6.20 ^{a}	5.29 ^{b}	5.71 ^{bc}
Bcomm	4.60 ^{c}	5.74 ^{b}	4.35 ^{c}	5.67 ^{bc}
BHandF	5.96 ^{a}	6.13 ^{ab}	5.99 ^{a}	6.15 ^{ab}
BMachF	6.24 ^{a}	6.14 ^{ab}	6.17 ^{a}	6.31 ^{a}
BHandS	5.19 ^{b}	6.02 ^{ab}	5.08 ^{b}	5.70 ^{bc}
BMachS	5.06 ^{bc}	5.85 ^{ab}	4.97 ^{b}	5.67 ^{bc}

*Duncan's multiple range comparison test (alpha= 0.05) was used. Unshared same alphabets in the superscripts mean significant difference.

Legend: A and B = processors
Hand = hand-harvested; Mach = machine-harvested
S = stored then processed; F = fresh-processed

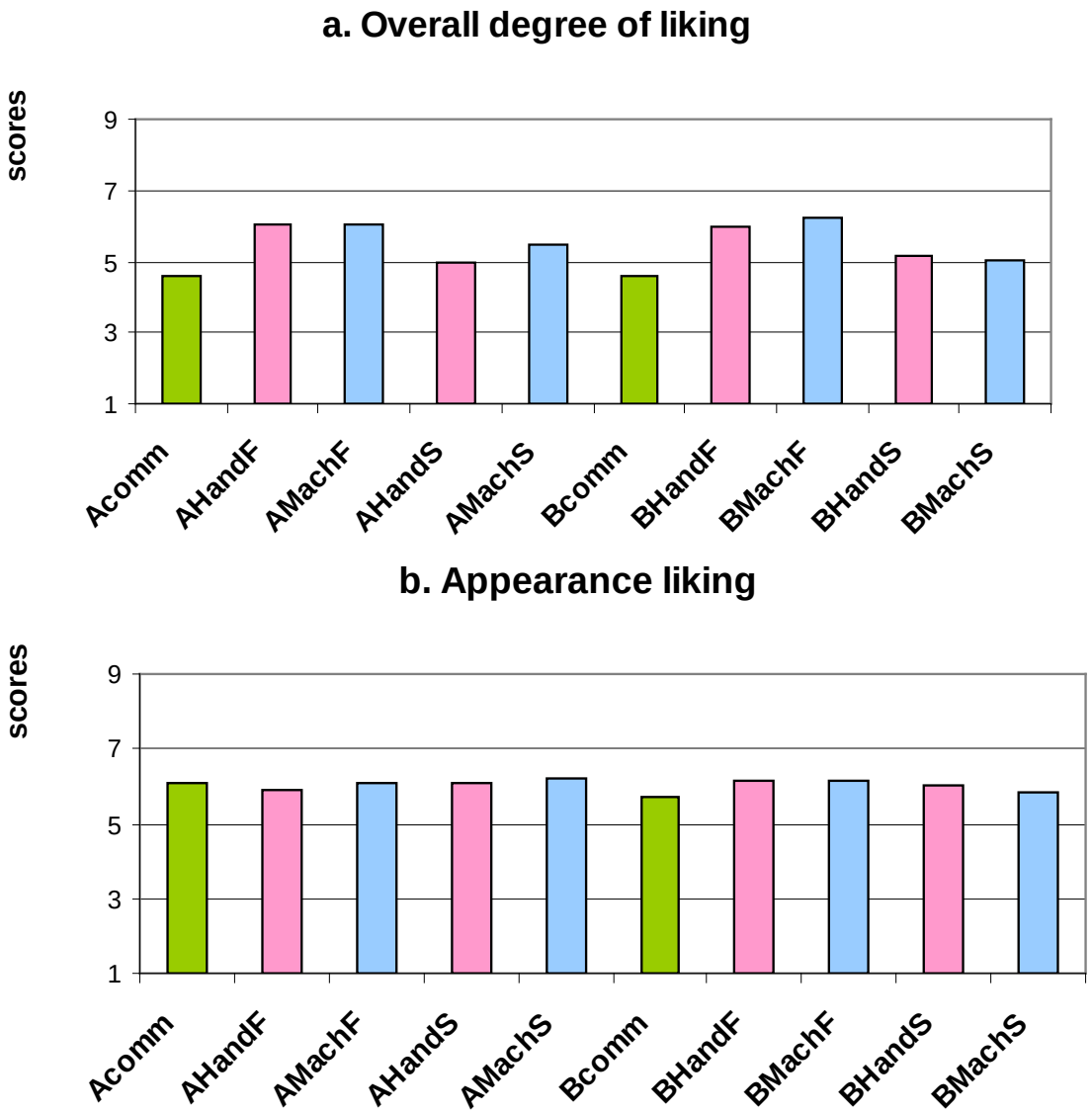


Fig 1.2. Mean hedonic ratings of the 10 olive samples for overall degree of liking and appearance liking (N=100 consumers).

Table 1.6. Pearson's correlation coefficients among hedonic ratings by consumers

Variables	Overall degree of liking	Appearance liking	Flavor liking	Texture liking
overall	**1**	0.415	**0.995**	**0.727**

*Values in bold are significantly different from 0 with a significance level alpha=0.05

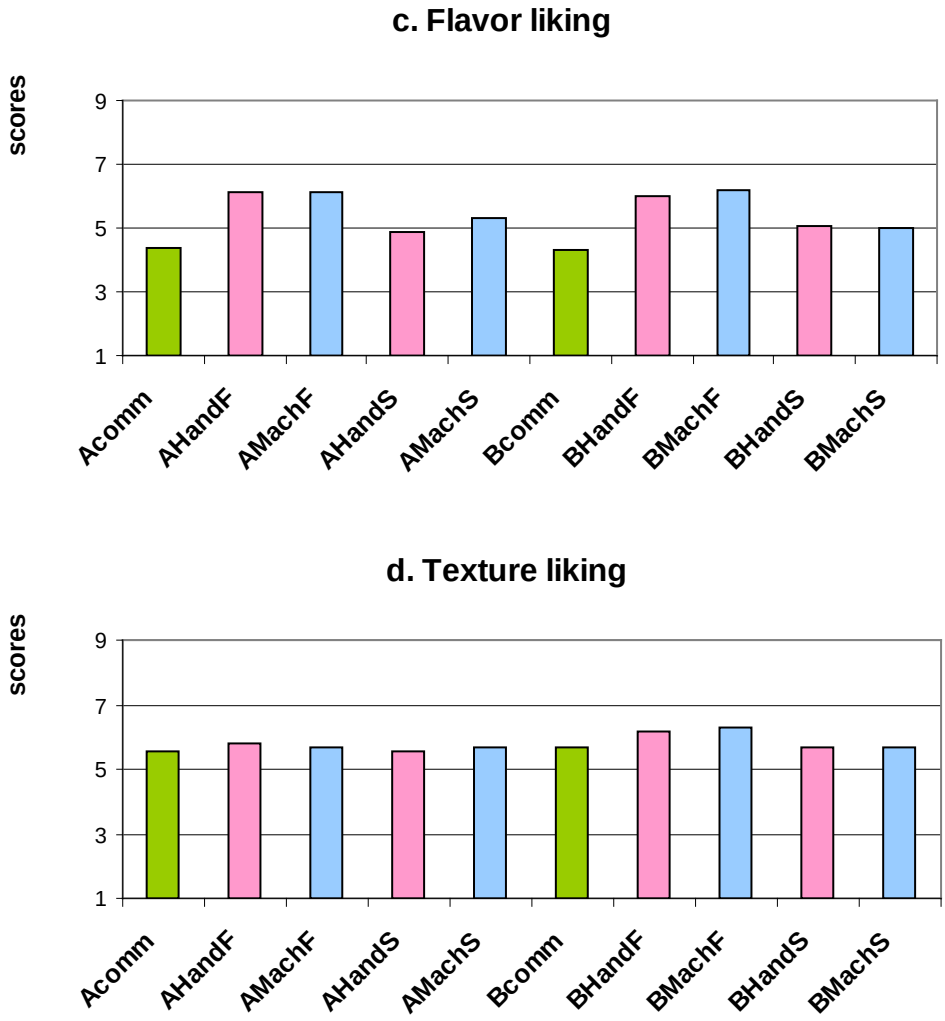


Fig 1.3. Mean hedonic ratings of the 10 olive samples for overall degree of flavor liking and texture liking (N=100 consumers).

Preference mapping

Fig. 1.7 shows the results of the preference mapping analysis as a biplot of the first two principal components, showing the consumer (**Fig. 1.7A**) and the olive samples (**Fig. 1.7B**). The preference map shows that most of the consumers are located on the right side of the plot (**Fig. 1.7A**), where the fresh-processed samples are located. This confirms the average data (for all consumers) presented above. It was also surprising to find that most consumers were concentrated away from the two commercial samples in the design, indicating most consumers liked those olives the least. Even though the consumers were fairly homogeneous in their liking patterns, with most of them concentrated on the right side of the biplot, close to the fresh-processed samples, there was some market segmentation that translated into two groups of consumers with slightly different preferences. The results of the preference clustering analysis are shown in **Fig. 1.8**, with a two-segment resolution. However, it should be noted that one cluster includes most of the consumers (n=86) and the other is rather small (n-13).

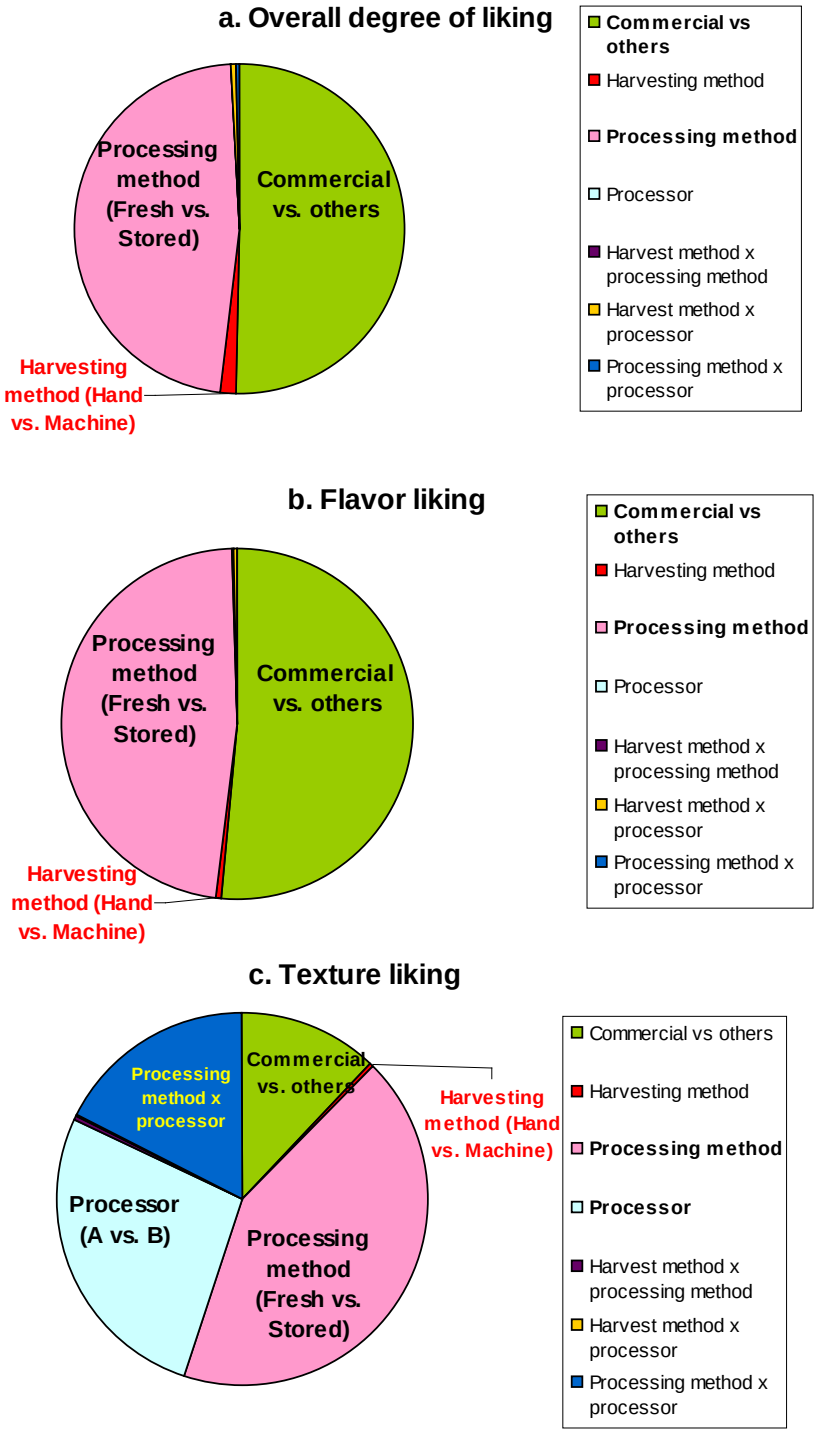


Fig 1.4. Partitioning of product source of variation for overall degree of liking, flavor liking and texture liking (appearance liking is not included since there was no significant effect).

A B C

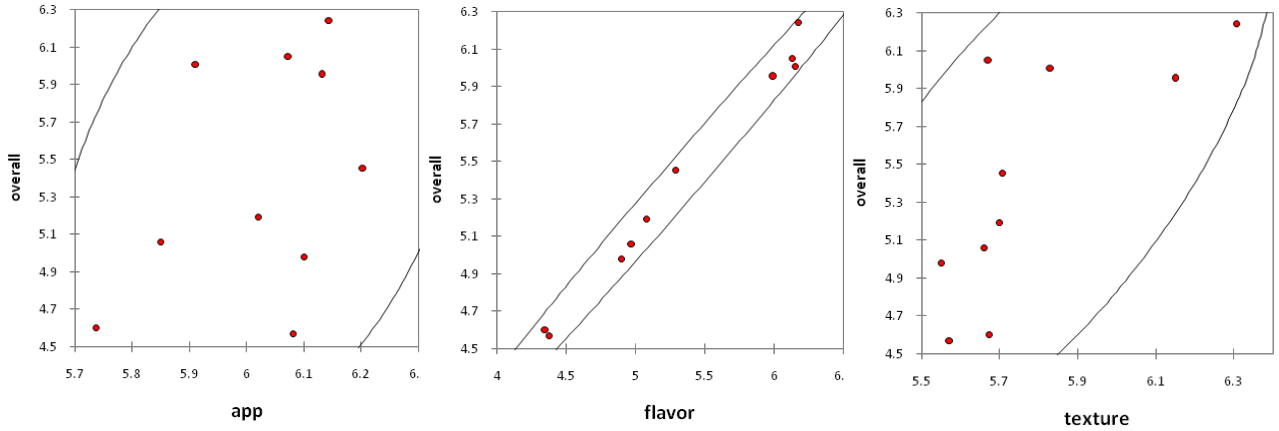


Fig 1.6. Scatter plots showing the relation between overall liking and liking for the specific sensory modalities of appearance (A), flavor (B), and texture (C) in the olives.

Another way to visualize the slight differences in liking patterns between the two segments is to plot the consumers on the PCA biplot (**Fig. 1.9**) according to their cluster affiliation (**Fig. 1.8**). It can be seen that the small cluster liked the olives that had been stored before processing best, likely because of familiarity with the profile that process generated. It is important to realize, however, that this cluster was very small, with only 13 consumers in it. The main cluster that includes the majority (86) of the consumers liked the fresh-processed samples best, and they are located on the right side of the biplot. The other way the two clusters differed was in the distribution of the sources of variation in the data (**Fig. 1.10**).

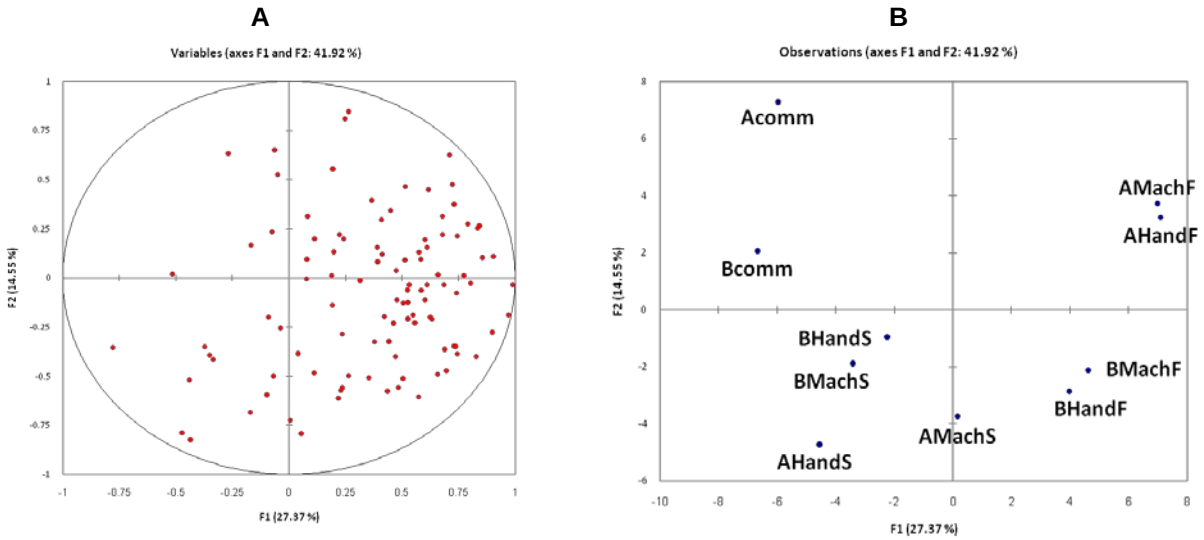


Fig. 1.7. Internal preference mapping showing the consumers (A) and the olive samples (B) (N=100)

Fig 1.8. Cluster analysis dendrogram of the 100 consumers

We then examined the sensory drivers of liking for the whole consumer population using PLS regression (**Figs. 1.11, 1.12 & 1.13**). This analysis shows which sensory attributes are associated with overall degree of liking by consumers (**Fig. 1.11**), and more specifically, which flavor attributes are associated with liking for flavor of the olives (**Fig. 1.12**) and which texture attributes are associated with liking for texture of the olives (**Fig. 1.13**).

Finally, we examined how the two preference clusters differed in their drivers of liking (**Fig. 1.14**). It is quite clear that they liked very different attributes in the olives, as indicated by the different set of attributes associated with each cluster's main direction of preference.

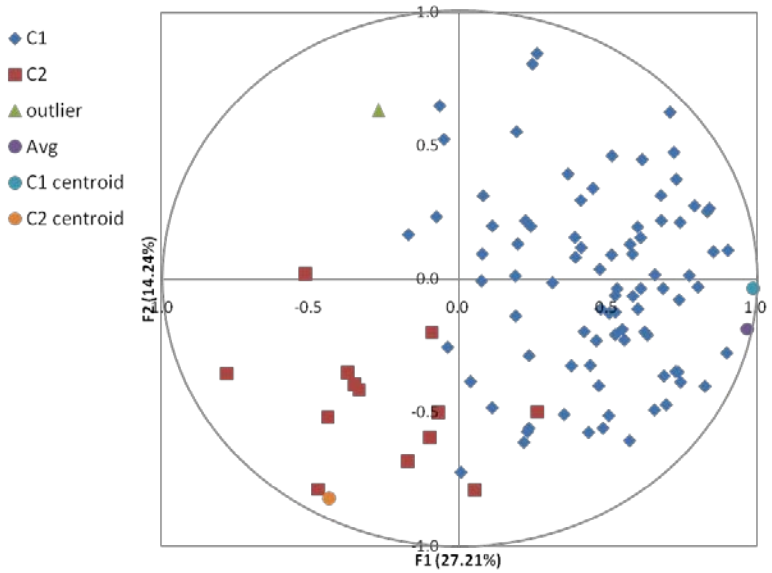
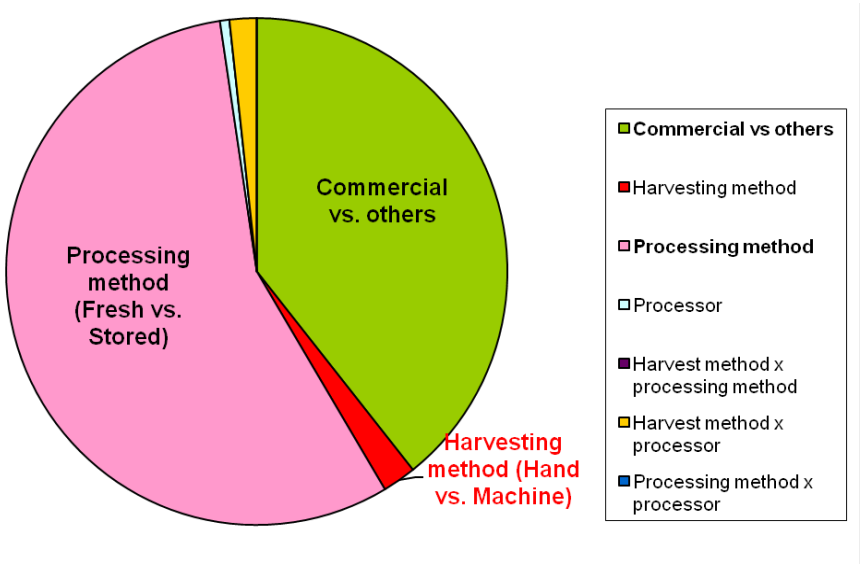
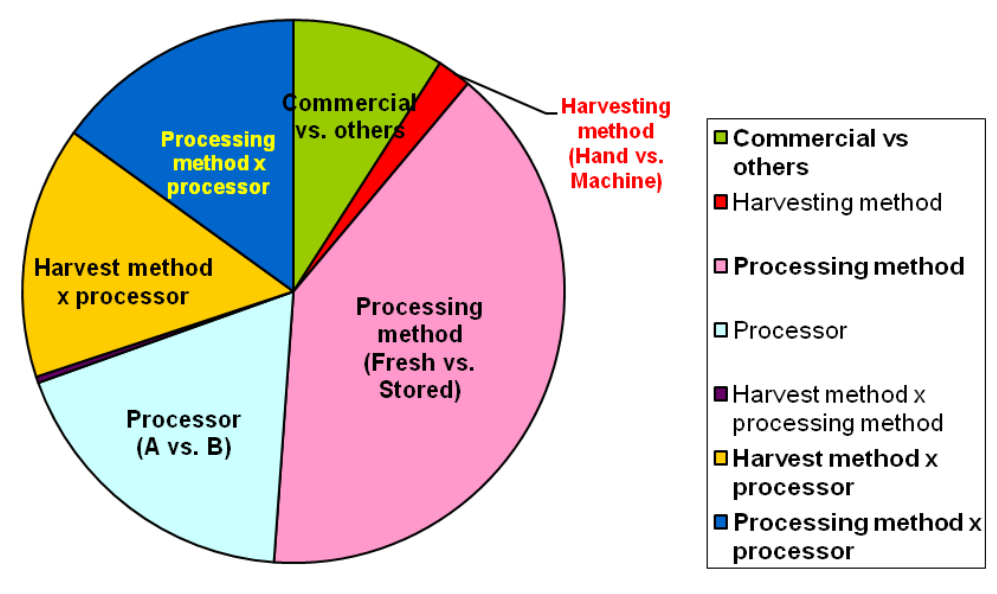


Fig. 1.9. Internal preference mapping with segmentation (G1=86, G2=13, 1 outlier with no group)



A. Partitioning of product source of variation on overall degree of liking for GP 1 (N=86)



B. Partitioning of product source of variation on overall degree of liking for GP 2 (N=13)

Fig 1.10. Partitioning of product source of variation on overall degree of liking for GP 1 (A) and GP 2 (B).

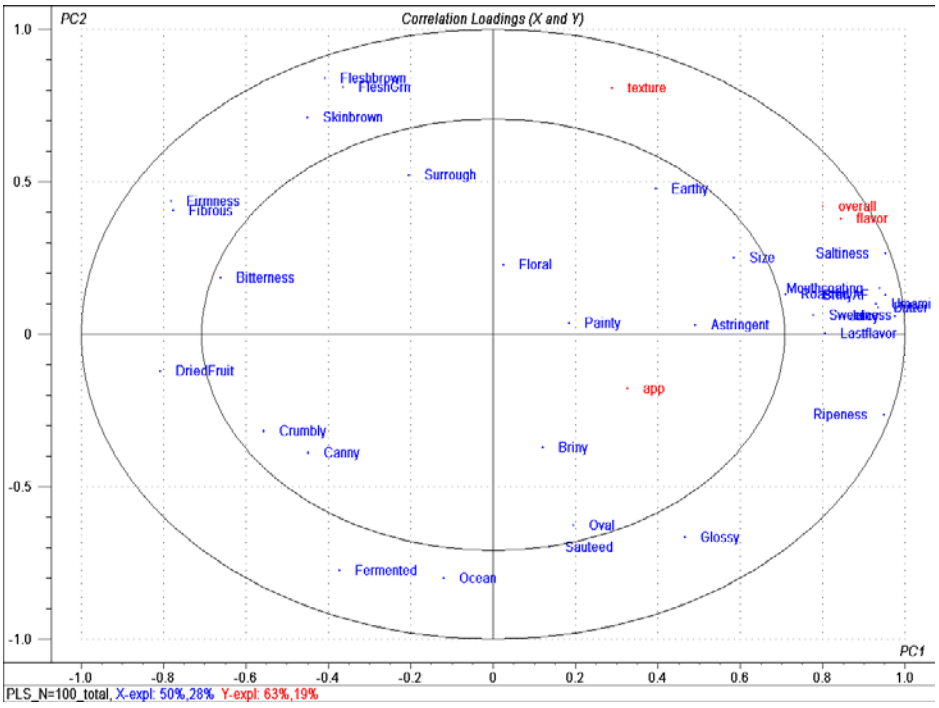


Fig. 1.11. PLS-Regression of the consumer hedonic ratings onto the sensory attributes from the descriptive analysis — overall degree of liking vs. all sensory attributes.
- X data; DA
- Y data; DOL, appearance liking, flavor liking, texture liking variables (N=100)

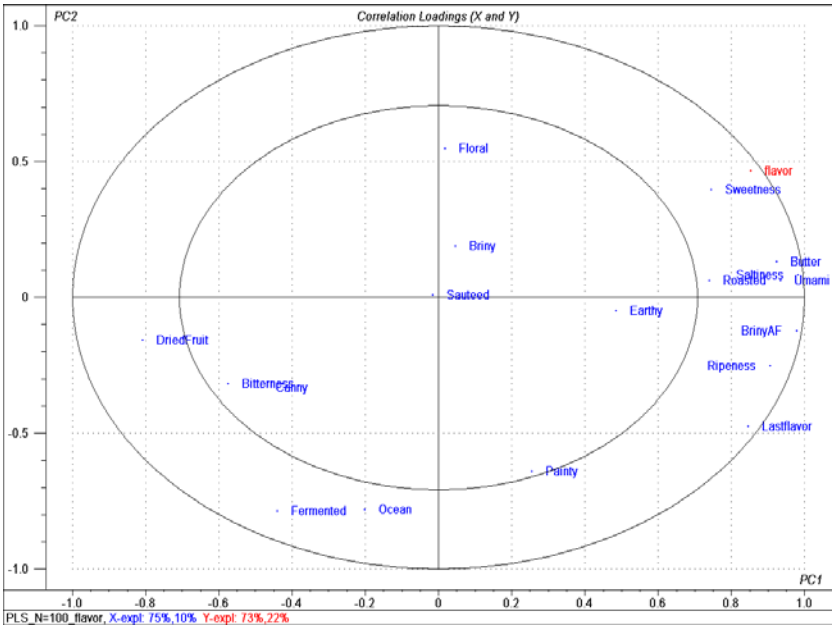


Fig. 1.12. PLS-Regression of the consumer hedonic ratings onto the sensory attributes from the descriptive analysis — degree of liking of flavor vs. flavor attributes.
- X data; DA – flavor (aroma + flavor + aftertaste)

- Y data; flavor liking (N=100)

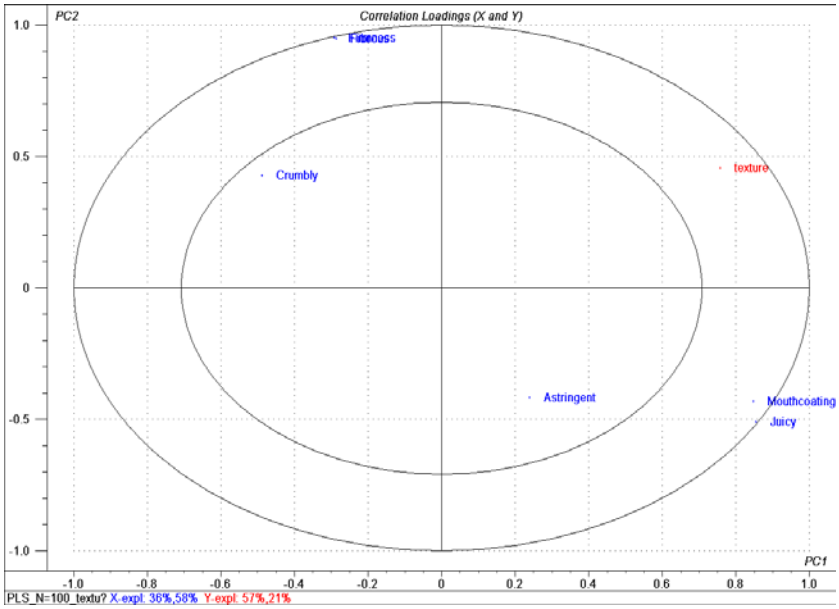


Fig. 1.13. PLS-Regression of the consumer hedonic ratings onto the sensory attributes from the descriptive analysis — degree of liking of texture vs. texture attributes.
- X data; DA – texture and mouth feel
- Y data; texture liking (N=100)

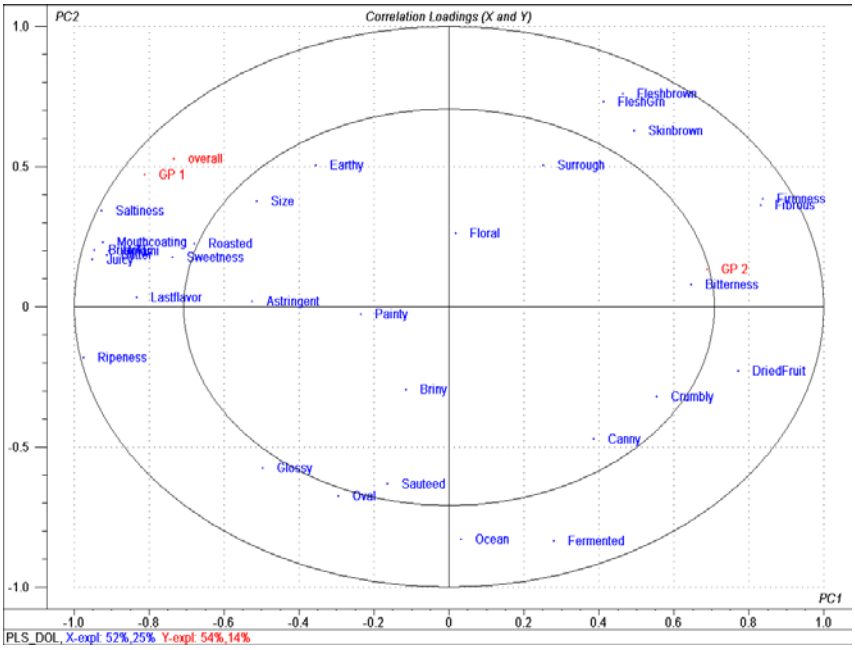


Fig. 1.14. PLS-Regression of the consumer hedonic ratings of the entire consumer population and of the two preference clusters (Group 1 and Group 2) onto the sensory attributes from the descriptive analysis — overall degree of liking vs. all sensory attributes.
- X data; DA

- Y data; DOL - total (N=100), GP 1 (N=86), GP2 (N=13)

Finally, we examined how the two preference clusters differed in their demographics and usage of table olives. **Table 1.7** below highlights the few significant differences that were found between the two segments.

Table 1.7. Exit survey results for all consumers, Group 1 (main cluster) and Group 2 (small cluster). Significant differences are highlighted in red.

- Chi-square test; checked whether the response pattern of GP 1 and 2 are significantly different
- Significant Qs; Age, Origin, 'organic product' influence on food & beverages (P<0.05)

<Demographic SAQs>

Q. Age

	TOTAL	GP 1	GP 2
-29	29.0	29.1	23.1
30-39	9.0	5.8	30.8
40-49	12.0	11.6	15.4
50-59	30.0	32.6	15.4
60-69	13.0	12.8	15.4
70-	5.0	5.8	0.0

Q. Origin

	TOTAL	GP 1	GP 2
CA	56.0	59.3	30.8
OTHER STATES IN US	29.0	24.4	61.5
ABROAD	11.0	11.6	7.7

Q. Ethnicity

	TOTAL	GP 1	GP 2
African	0.0	0.0	0.0
Asian	13.0	14.0	7.7
Caucasian	75.0	75.6	69.2
Hispanic/ Latino	6.0	4.7	15.4
Native American	0.0	0.0	0.0
Pacific islands	0.0	0.0	0.0
Mixed	4.0	3.5	7.7

Q. Gender

	TOTAL	GP 1	GP 2
MALE	39.0	41.9	23.1
FEMALE	59.0	55.8	76.9

Q. Self reported food neo-phobicity

	TOTAL	GP 1	GP 2
CONSERVATIVE (1)	2.0	2.3	0.0
2	2.0	2.3	0.0
NEITHER NOR	17.0	17.4	7.7
4	33.0	34.9	23.1
ADVENTUROUS (5)	43.0	39.5	69.2

Q. Education

	TOTAL	GP 1	GP 2
High school diploma/ GED	18.0	16.3	23.1
Bachelor's degree	39.0	39.5	38.5
Master's degree	18.0	16.3	30.8
PhD	14.0	15.1	7.7
Professional degree	6.0	7.0	0.0

Q. Family income

	TOTAL	GP 1	GP 2
Under $50,000	20.0	19.8	15.4
$50,000~$100,000	31.0	29.1	46.2
more than $100,000	30.0	31.4	23.1
Not to report	16.0	16.3	15.4

<Table olive usage SAQs>

Q. How often do you eat olives?

	TOTAL	GP 1	GP 2
2-3/ wk or more	24.0	23.3	23.1
1/wk	25.0	25.6	23.1
1/ 2wk	27.0	24.4	46.2
1/ month	14.0	15.1	7.7
less than 1/month	9.0	10.5	0.0
never	0.0	0.0	0.0

Q. Table olive in what food or beverages do you eat?

	TOTAL	GP 1	GP 2
canapé	20.0	18.6	23.1
pasta	60.0	58.1	76.9
pizza	78.0	75.6	92.3
salad	82.0	81.4	84.6
sandwich	37.0	40.7	15.4
cocktail	9.0	7.0	15.4
themselves	87.0	88.4	76.9

Q. From what source do you get your olives?

	TOTAL	GP 1	GP 2
can	89.4	87.8	91.7
deli	62.8	62.2	58.3
makes own	10.6	12.2	0.0

Q. How often do you buy olives?

	TOTAL	GP 1	GP 2
2-3/ wk or more	0.0	0.0	0.0
1/wk	10.6	9.8	8.3
1/ 2wk	17.0	17.1	16.7
1/ month	34.0	30.5	58.3
1/ 3 months	24.5	26.8	8.3
less than 1/ 3 months	11.7	13.4	0.0
never	2.1	1.2	8.3

Q. What type of olives do you buy?

	TOTAL	GP 1	GP 2
black whole	84.0	84.1	83.3
black sliced	44.7	41.5	58.3
green whole	73.4	69.5	91.7
green sliced	5.3	3.7	16.7
spiced black whole	39.4	40.2	25.0
spiced black sliced	5.3	6.1	0.0
spiced green whole	63.8	63.4	58.3
spiced green sliced	4.3	3.7	8.3
stuffed black whole	20.2	22.0	8.3
stuffed green whole	71.3	70.7	66.7

Q. How long do you store your olives?

	TOTAL	GP 1	GP 2
less than 1 wk	15.4	18.2	0.0
1wk ~ 1 month	46.2	42.4	57.1
1~3 months	20.5	18.2	28.6
3~6 months	17.9	18.2	14.3
more than 6 months	0.0	0.0	0.0

Q. What affects your olive purchase?

	TOTAL	GP 1	GP 2
type of olive	96.8	96.3	91.7
brand	31.9	31.7	25.0
country	25.5	25.6	25.0
package	17.0	18.3	8.3
price	79.8	80.5	66.7
nutrition	14.9	15.9	8.3

<Foods and Beverages in general>

Q. How much influenced by each factor?

Total (N=100)

	NOT AT ALL	SOMEWHAT	FAIRLY	HIGHLY
price	3.0	28.0	46.0	21.0
package	29.0	56.0	10.0	2.0
brand	22.0	51.0	19.0	5.0
nutrition	10.0	21.0	36.0	31.0
availability	9.0	27.0	35.0	27.0
organic	26.0	33.0	23.0	16.0

GP 1 (N=86)

	NOT AT ALL	SOMEWHAT	FAIRLY	HIGHLY
price	2.3	25.6	47.7	22.1
package	31.4	51.2	11.6	2.3
brand	22.1	52.3	17.4	4.7
nutrition	9.3	20.9	38.4	29.1
availability	10.5	26.7	36.0	24.4
organic	25.6	36.0	24.4	11.6

GP 2 (N=13)

	NOT AT ALL	SOMEWHAT	FAIRLY	HIGHLY
price	7.7	46.2	30.8	15.4
package	15.4	84.6	0.0	0.0
brand	23.1	38.5	30.8	7.7
nutrition	15.4	15.4	23.1	46.2
availability	0.0	30.8	30.8	38.5
organic	30.8	7.7	15.4	46.2

CONCLUSIONS of OBJECTIVE I

The main conclusion of this year's research is that there was no difference in sensory quality and acceptability between the hand- and mechanically-harvested olives. There were, however, differences in sensory quality and acceptability between the fresh- and stored-processed olives, with the fresh-processed olives showing better sensory quality and receiving higher liking scores. We found some segmentation among consumers in terms of their preferences, but the two-cluster solution was one with one very large cluster (86% of the consumers) and another with a very small cluster. So we can confidently conclude that the consumer population is fairly homogeneous in terms of their table olive preferences.