Ulster University

Descriptive Sensory Testing

Three Breeds of Lamb at the
Food and Consumer Testing Suite (FACTS),
Ulster University.

PROJECT: SENSORY TASTING REPORT

DATE: 30th May to 1st June 2018

INVESTIGATOR: DR A BURNS

Course Director for the BSc Consumer Management and Food Innovation programme
Director of the Food and Consumer Testing Suite (FACTS)

Suffolk Sheep Society Report – Sensory Tasting Exercise

Investigator: Dr Amy Burns

Location: University of Ulster, Food & Consumer Testing Suite (FACTS), Coleraine, N Ireland

Project Outline: Descriptive sensory testing of three breeds of lamb at the Food and Consumer Testing Suite (FACTS), Ulster University. (See FACTS description at https://www.ulster.ac.uk/faculties/ulster-university-business-school/departments/hospitality-and-tourism-management/fact-suite and Appendix 1 for photos).

Testing Period: Testing was conducted over three days (30th May to 1st June) between 12.30 and 2pm.

Panellists Inclusion Criteria:

The following criteria was used to select panellists:
- Regular Lamb Consumers.
- Females and males.
- Not on a weight reduction diet.
- non-smokers.
- Panellists attended FACTS between 12.30-2pm on each day.
- Panellists were requested to have a mid-morning snack two hours before their testing time and not to consume any other food or drink except water before testing (to ensure panellists were not hungry or full).

Sample Size: n = 81.

Product Testing:

Regarding product testing:
- Suffolk cross lamb was tested against Charollais cross and Texel cross lamb.
- Products were supplied by Linden Foods Ltd.
- Products were cooked and tested in the sensory kitchens and lab of the food and consumer testing suite (FACTS).
- All lamb joints were approximately 2kg in weight before cooking.
- Joints were cooked at 180oC for approx. 2.5 hours and left to rest for 15 minutes.
- Lamb was served on white plates coded with a 3 digit code.
- The order of testing was randomized to insure no order effect occurred (ie attribute levels diminishing as testing proceeded).
- 81 panellists completed the testing over 3 days.
- Panellists were instructed to taste the products in the order presented to them and to sip water in between tastings.
- Panellists were instructed to take as much time as they wanted whilst tasting the products on each occasion.

16th June 2018

<u>**Output:**</u>

Regarding output:
- The attributes measured were:
  - Appearance
  - Aroma
  - Taste
  - Texture
  - Overall Flavour
  - Succulence
  - Tenderness
- All products were tested using a 9-point Hedonic Likert scale.
- Scores ranged from 1-9 (1 = dislike extremely... 9 = Like extremely) for each measured attribute
- All joints of meat scored exceptional high on the Likert Hedonic scales.
- All joints of meat scored above 7 on the 9-point scale for all attributes measured. The results clearly demonstrate very positive feedback on all products.

<u>**Key Findings**</u>

The Suffolk Cross Lamb

- **Was chosen as the preferred choice by 70%** of the sample (See Figure 1).
- **Scored highest for all attributes and statistically significantly (P<0.05) higher** for appearance, aroma, taste, texture, flavour. (See Figure 2) This would confirm from the testing period that the Suffolk cross lamb had a better appearance, aroma, taste, texture and overall flavour than the Charollais or Texel cross lamb.

Figure 1 Preference

Figure 2: Sensory Attributes

Legend:
- Suffolk
- Charollais
- Texel

Scores (Appearance, Aroma, Taste, Texture, Flavour, Succulence, Tenderness):
- Appearance: 7.77, 7.47, 7.43
- Aroma: 7.77, 7.44, 7.51
- Taste: 7.83, 7.56, 7.35
- Texture: 7.75, 7.54, 7.38
- Flavour: 7.88, 7.56, 7.42
- Succulence: 7.67, 7.59, 7.47
- Tenderness: 7.75, 7.65, 7.51

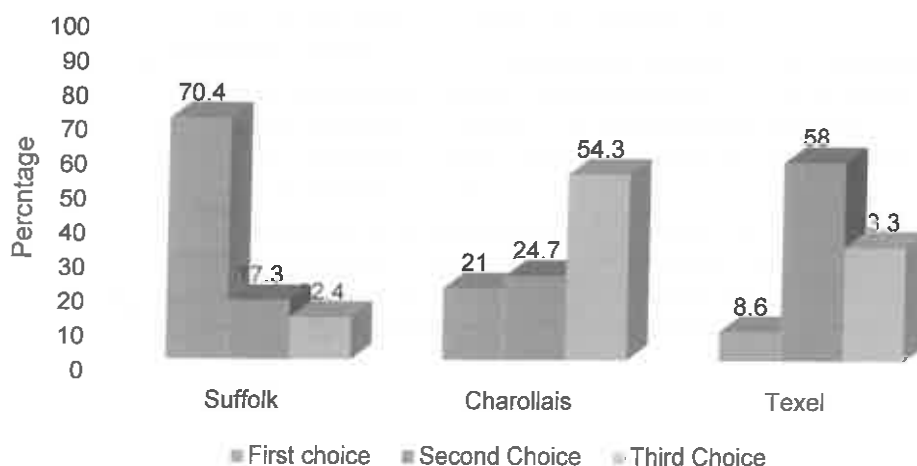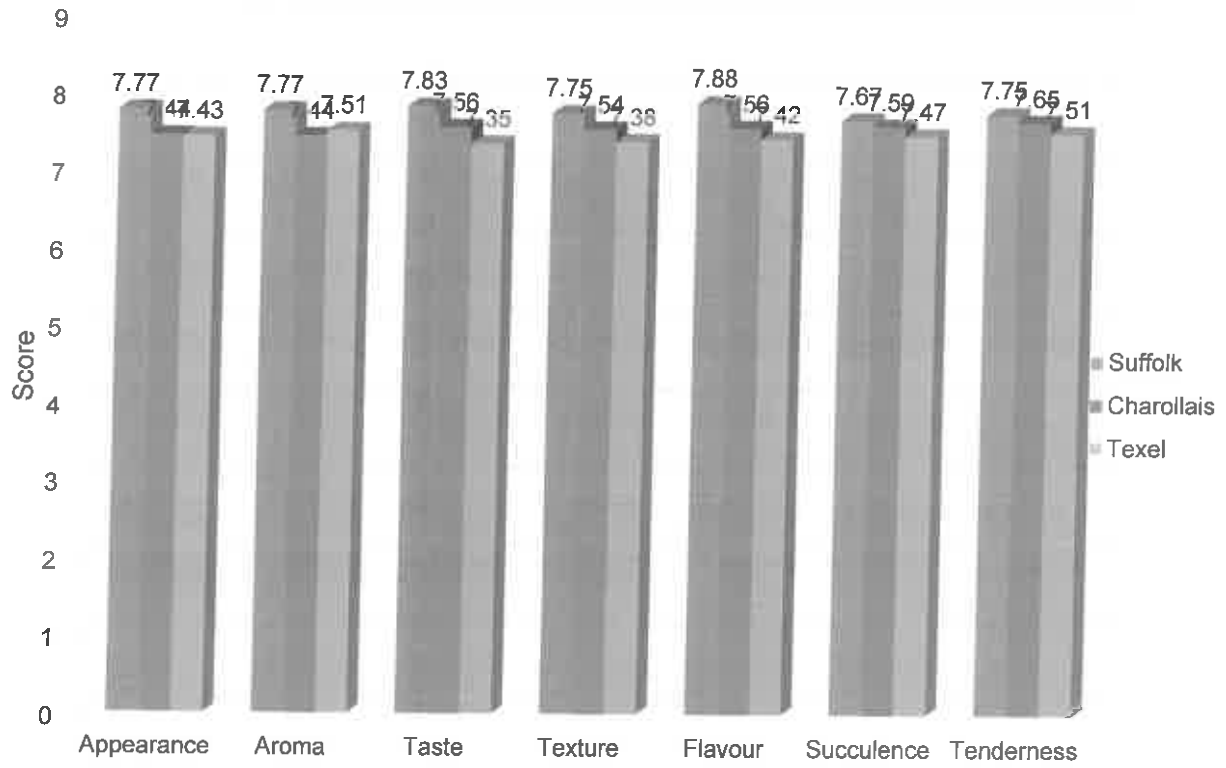## Appendix 1: FACTS Suite

Summary Report

Project: SUFFOLK SHEEP TESTING

# of Evaluations: 81

Sessions: 1 of 1

Project Date: 6/1/18 14:07

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Summary Results

Multiple Comparison Test Used: Tukey's HSD 5%

Question Title/ Attribute Title/ Standard Dev.	p value	HSD value	1-413 789 Suffolk Mean	2-676 1011 Charolais Mean	3-457 231 Texel Mean
Question Title/ Attribute Title/ Standard Dev.	p value	HSD value	1-413 789 Suffolk Mean	2-676 1011 Charolais Mean	3-457 231 Texel Mean
Appearance					
Appearance	0.0147	0.3051	7.77 a	7.44 b	7.43 b
(SD)			(1.14)	(1.20)	(1.16)
Aroma					
Aroma	0.0024	0.2285	7.77 a	7.44 b	7.51 b
(SD)			(1.03)	(1.10)	(1.05)
Taste					
Taste	0.0013	0.3075	7.83 a	7.56 ab	7.35 b
(SD)			(0.93)	(1.10)	(1.39)
Texture					
Texture	0.0526	0.3603	7.75 a	7.54 ab	7.38 b
(SD)			(1.16)	(1.11)	(1.29)
Flavour					
Flavour	0.0018	0.3073	7.88 a	7.56 b	7.42 b
(SD)			(0.90)	(1.10)	(1.21)
Succulence					
Succulence	0.2840	0.2977	7.67 a	7.59 a	7.47 a
(SD)			(1.27)	(0.95)	(1.11)
Tenderness					
tenderness	0.1551	0.3041	7.75 a	7.65 a	7.51 a
(SD)			(1.12)	(0.92)	(1.20)

Multiple comparison tests may appear above. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If Duncan's Multiple Range Test appears, only the largest critical range is reported. See analysis for other critical ranges. If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Project: SUFFOLK SHEEP TESTING

Question Number:1
Question Number:1
    Question Type:Category / Hedonics
    Question Title:Appearance
Attribute Number:1
    Attribute Title:Appearance
        Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Dislike Extremely
2	Dislike Very Much
3	Dislike Moderately
4	Dislike Slightly
5	Neither Like Nor Dislike
6	Like Slightly
7	Like Moderately
8	Like Very Much
9	Like Extremely

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413			1	2	1	4	11	46	16	
2 - 676			2	2	1	6	19	44	7	
3 - 457			5	1	3	25	39	8		
TOTALS			3	9	3	13	55	129	31	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	
2 - 676	81	

3 - 457	81	
TOTALS	243	

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413			1.2	2.5	1.2	4.9	13.6	56.8	19.8	
2 - 676			2.5	2.5	1.2	7.4	23.5	54.3	8.6	
3 - 457			6.2	1.2	3.7	30.9	48.2	9.9	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	100	
2 - 676	100	
3 - 457	100	

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	629.00	8.00	7.77	1.143
2 - 676	81	603.00	8.00	7.44	1.204
3 - 457	81	602.00	8.00	7.43	1.161

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	5.786	2.893	4.33	0.0147
Judges	80	221.539	2.769	4.15	0.0000
Error	160	106.881	0.668		
Total	242	334.206	1.381		
Standard Error (SEM) =	0.090				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.305 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample

Sample	Mean		Significantly Different Than Sample
1 - 413	7.77	a	2 3
2 - 676	7.44	b	
3 - 457	7.43	b	

Fisher's LSD = 0.254 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.77	a	2 3
2 - 676	7.44	b	
3 - 457	7.43	b	

Project: SUFFOLK SHEEP TESTING

Question Number:2
Question Number:2
   Question Type:Category / Hedonics
   Question Title:Aroma
Attribute Number:1
   Attribute Title:Aroma
      Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Dislike Extremely
2	Dislike Very Much
3	Dislike Moderately
4	Dislike Slightly
5	Neither Like Nor Dislike
6	Like Slightly
7	Like Moderately
8	Like Very Much
9	Like Extremely

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413				2	2	3	13	47	14	
2 - 676				3	4	2	23	43	6	
3 - 457				2	4	2	24	41	8	
TOTALS				7	10	7	60	131	28	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	
2 - 676	81	
3 - 457	81	
TOTALS	243	

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413				2.5	2.5	3.7	16.1	58.0	17.3	
2 - 676				3.7	4.9	2.5	28.4	53.1	7.4	
3 - 457				2.5	4.9	2.5	29.6	50.6	9.9	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	100	
2 - 676	100	
3 - 457	100	

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	629.00	8.00	7.77	1.028
2 - 676	81	603.00	8.00	7.44	1.095
3 - 457	81	608.00	8.00	7.51	1.050

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	4.700	2.350	6.27	0.0024
Judges	80	208.823	2.610	6.96	0.0000
Error	160	59.967	0.375		
Total	242	273.490	1.130		
Standard Error (SEM) =	0.068				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.229 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.77	a	3 2
3 - 457	7.51	b	
2 - 676	7.44	b	

Fisher's LSD = 0.19 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.77	a	3 2
3 - 457	7.51	b	
2 - 676	7.44	b	

Project: SUFFOLK SHEEP TESTING

Question Number:3
Question Number:3
   Question Type:Category / Hedonics
   Question Title:Taste
Attribute Number:1
   Attribute Title:Taste
        Design:T=3, K=3, B=104

Products

Product	Code		Name

Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Dislike Extremely
2	Dislike Very Much
3	Dislike Moderately
4	Dislike Slightly
5	Neither Like Nor Dislike
6	Like Slightly
7	Like Moderately
8	Like Very Much
9	Like Extremely

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413				2		4	11	51	13	
2 - 676				4	1	2	22	43	9	
3 - 457		1	3	2	1	2	23	43	6	
TOTALS		1	3	8	2	8	56	137	28	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	
2 - 676	81	
3 - 457	81	1
TOTALS	243	1

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413				2.5		4.9	13.6	63.0	16.1	
2 - 676				4.9	1.2	2.5	27.2	53.1	11.1	
3 - 457		1.2	3.7	2.5	1.2	2.5	28.4	53.1	7.4	

Sample	Total	2 [2]

Sample	Total	2 [2]
1 - 413	100	
2 - 676	100	
3 - 457	100	
		1.2

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	634.00	8.00	7.83	0.933
2 - 676	81	612.00	8.00	7.56	1.095
3 - 457	81	595.00	8.00	7.35	1.389

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	9.440	4.720	6.96	0.0013
Judges	80	211.342	2.642	3.89	0.0000
Error	160	108.560	0.678		
Total	242	329.342	1.361		
Standard Error (SEM) =	0.091				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.308 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.83	a	3
2 - 676	7.56	ab	
3 - 457	7.35	b	

Fisher's LSD = 0.256 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.83	a	2 3
2 - 676	7.56	b	
3 - 457	7.35	b	

Project: SUFFOLK SHEEP TESTING

Question Number:4
Question Number:4
    Question Type:Category / Hedonics
    Question Title:Texture
Attribute Number:1
    Attribute Title:Texture
        Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Dislike Extremely
2	Dislike Very Much
3	Dislike Moderately
4	Dislike Slightly
5	Neither Like Nor Dislike
6	Like Slightly
7	Like Moderately
8	Like Very Much
9	Like Extremely

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413	1			1		5	13	47	14	
2 - 676				4	1	3	21	43	9	
3 - 457	1			3	2	6	19	44	6	
TOTALS	2			8	3	14	53	134	29	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	
2 - 676	81	
3 - 457	81	
TOTALS	243	

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413	1.2			1.2		6.2	16.1	58.0	17.3	
2 - 676				4.9	1.2	3.7	25.9	53.1	11.1	
3 - 457	1.2			3.7	2.5	7.4	23.5	54.3	7.4	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	100	
2 - 676	100	
3 - 457	100	

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	628.00	8.00	7.75	1.157
2 - 676	81	611.00	8.00	7.54	1.107
3 - 457	81	598.00	8.00	7.38	1.290

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	5.588	2.794	3.00	0.0526
Judges	80	189.218	2.365	2.54	0.0000
Error	160	149.078	0.932		
Total	242	343.885	1.421		
Standard Error (SEM) =	0.107				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.36 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.75	a	3
2 - 676	7.54	ab	
3 - 457	7.38	b	

Fisher's LSD = 0.30 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.75	a	3
2 - 676	7.54	ab	
3 - 457	7.38	b	

Project: SUFFOLK SHEEP TESTING

Question Number:5
Question Number:5
    Question Type:Category / Hedonics
    Question Title:Flavour
Attribute Number:1
    Attribute Title:Flavour
        Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Dislike Extremely
2	Dislike Very Much
3	Dislike Moderately
4	Dislike Slightly
5	Neither Like Nor Dislike
6	Like Slightly
7	Like Moderately

8	Like Very Much
9	Like Extremely

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413				1	1	3	13	47	16	
2 - 676				4	1	3	19	46	8	
3 - 457			1	4	1	5	20	43	7	
TOTALS			1	9	3	11	52	136	31	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	
2 - 676	81	
3 - 457	81	
TOTALS	243	

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413				1.2	1.2	3.7	16.1	58.0	19.8	
2 - 676				4.9	1.2	3.7	23.5	56.8	9.9	
3 - 457			1.2	4.9	1.2	6.2	24.7	53.1	8.6	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	100	
2 - 676	100	
3 - 457	100	

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	638.00	8.00	7.88	0.900
2 - 676	81	612.00	8.00	7.56	1.095
3 - 457	81	601.00	8.00	7.42	1.213

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	8.914	4.457	6.58	0.0018
Judges	80	170.074	2.126	3.14	0.0000
Error	160	108.420	0.678		
Total	242	287.407	1.188		
Standard Error (SEM) =	0.091				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.307 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.88	a	2 3
2 - 676	7.56	b	
3 - 457	7.42	b	

Fisher's LSD = 0.256 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.88	a	2 3
2 - 676	7.56	b	
3 - 457	7.42	b	

Project: SUFFOLK SHEEP TESTING

Question Number:6
Question Number:6
Question Type:Category / Hedonics
Question Title:Succulence
Attribute Number:1
Attribute Title:Succulence
Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Extremely Unsucculent
2	Very Unsucculent
3	Moderately Unsucculent
4	Slightly Unsucculent
5	Neither Unsucculent nor Succulent
6	Slightly Succulent
7	Moderately Succulent
8	Very Succulent
9	Extremely Succulent

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413		1	1	2	1	2	15	45	14	
2 - 676				2	1	4	21	46	7	
3 - 457			1	2	2	4	23	42	7	
TOTALS		1	2	6	4	10	59	133	28	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	1
2 - 676	81	
3 - 457	81	
TOTALS	243	1

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413		1.2	1.2	2.5	1.2	2.5	18.5	55.6	17.3	
2 - 676				2.5	1.2	4.9	25.9	56.8	8.6	
3 - 457			1.2	2.5	2.5	4.9	28.4	51.9	8.6	

Sample	Total	←[2]
Sample	Total	2 [2]
1 - 413	100	1.2
2 - 676	100	
3 - 457	100	

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	621.00	8.00	7.67	1.275
2 - 676	81	615.00	8.00	7.59	0.946
3 - 457	81	605.00	8.00	7.47	1.108

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	1.613	0.807	1.27	0.2840
Judges	80	198.008	2.475	3.89	0.0000
Error	160	101.720	0.636		
Total	242	301.342	1.245		
Standard Error (SEM) =	0.088				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.298 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.67	a	
2 - 676	7.59	a	
3 - 457	7.47	a	

Fisher's LSD = 0.248 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.67	a	
2 - 676	7.59	a	

2 - 676	7.55	a	
3 - 457	7.47	a	

Project: SUFFOLK SHEEP TESTING

Question Number:7
Question Number:7
    Question Type:Category / Hedonics
    Question Title:Tenderness
Attribute Number:1
    Attribute Title:tenderness
        Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Scale Parameters

Value	Descriptor
Value	Descriptor
1	Extremely Untender
2	Very Untender
3	Moderately Untender
4	Slightly Untender
5	Neither Untender nor Tender
6	Slightly Tender
7	Moderately Tender
8	Very Tender
9	Extremely Tender

Note: Numbers shown in brackets are the 'values' associated with the category selected.

Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413		1		1	1	4	14	45	15	
2 - 676				2		4	21	45	9	
3 - 457			2	2	1	3	22	42	9	

TOTALS		1	2	5	2	11	57	132	33		

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	81	1
2 - 676	81	
3 - 457	81	
TOTALS	243	1

Percentage Crosstabulation

Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
Sample	1 [1]	2 [2]	3 [3]	4 [4]	5 [5]	6 [6]	7 [7]	8 [8]	9 [9]	
1 - 413		1.2		1.2	1.2	4.9	17.3	55.6	18.5	
2 - 676				2.5		4.9	25.9	55.6	11.1	
3 - 457			2.5	2.5	1.2	3.7	27.2	51.9	11.1	

Sample	Total	2 [2]
Sample	Total	2 [2]
1 - 413	100	
		1.2
2 - 676	100	
3 - 457	100	

Counts, Medians, Means and SD's

Sample Number	Count	Total	Median	Mean	Standard Deviation
Sample Number	Count	Total	Median	Mean	Standard Deviation
1 - 413	81	628.00	8.00	7.75	1.124
2 - 676	81	620.00	8.00	7.65	0.924
3 - 457	81	608.00	8.00	7.51	1.195

This is a Complete Block Design.

Analysis of Variance

This analysis does not compensate for missing data or lack of balance.

	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
	D.F.	Sum of Squares	Mean of Squares	F Value	p-value
Samples	2	2.502	1.251	1.89	0.1551
Judges	80	177.465	2.218	3.34	0.0000
Error	160	106.165	0.664		
Total	242	286.132	1.182		
Standard Error (SEM) =	0.090				

Multiple comparison tests may appear below. Tukey's HSD controls for maximum experimentwise error rate and can be used without F protection. Standard practice recommends that LSD and Duncan's be considered only if the ANOVA p-value is deemed acceptable to control for experimentwise error rates (under the complete null hypothesis). If automatic

significance is selected, an available significance level is chosen for the multiple comparison test based on the observed p-value.

Tukey's HSD = 0.304 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.75	a	
2 - 676	7.65	a	
3 - 457	7.51	a	

Fisher's LSD = 0.253 (5% Significance Level)

Sample	Mean		Significantly Different Than Sample
Sample	Mean		Significantly Different Than Sample
1 - 413	7.75	a	
2 - 676	7.65	a	
3 - 457	7.51	a	

Project: SUFFOLK SHEEP TESTING

Question Number:8
Question Number:8
Question Type:Ranking
Question Title:Preference
Design:T=3, K=3, B=104

Products

Product	Code	Name
Product	Code	Name
1 - 413	789	Suffolk
2 - 676	1011	Charolais
3 - 457	231	Texel

Crosstabulation

Sample	1	2	3	Total
Sample	1	2	3	Total
1 - 413	57	14	10	81
2 - 676	17	20	44	81
3 - 457	7	47	27	81

| TOTALS | 81 | 81 | 81 | 243 |

Percentage Crosstabulation

Sample	1	2	3	Total
Sample	1	2	3	Total
1 - 413	70.4	17.3	12.4	100
2 - 676	21.0	24.7	54.3	100
3 - 457	8.6	58.0	33.3	100

Friedman Analysis of Rank

This procedure is valid for Complete Block Experimental Designs with no missing data only.

This is a Complete Block Design.

Calculated Friedman Statistic	Degrees of Freedom	p-value
Calculated Friedman Statistic	Degrees of Freedom	p-value
41.2	2	0.000

Critical values corresponding to specific levels of significance:
    10%=4.61   5%=5.99   1%=9.21

The samples differ at the 10% level. (41.2 >= 4.61)

The samples differ at the 5% level. (41.2 >= 5.99)

The samples differ at the 1% level. (41.2 >= 9.21)

Tukey's HSD = 29.88 (5% Significance Level)

Sample	Rank Total		Significantly Different Than Sample
Sample	Rank Total		Significantly Different Than Sample
2 - 676	189.00	a	1
3 - 457	182.00	a	1
1 - 413	115.00	b	

Fisher's LSD = 24.947 (5% Significance Level)

Sample	Rank Total		Significantly Different Than Sample
Sample	Rank Total		Significantly Different Than Sample
2 - 676	189.00	a	1
3 - 457	182.00	a	1
1 - 413	115.00	b	