



JMP Instructional data set 018

Taste Test of Gluten Free Cake Mixes

JMP platforms and statistical methods

Graph Builder:	Mosaic Plot
Categorical:	Contingency table chi-square analysis; multiple comparisons; confidence intervals for proportions
Text Explorer:	Analysis of unstructured text data

Problem statement

A food product company is interested in offering a gluten-free cake mix to enhance its offerings in that important market. It has developed three test mixes, each a blend of several alternative flours (e.g., almond, rice, sorghum, millet). Ideally, a cake made from these alternatives would very closely match the taste and texture of its traditional wheat flour cake mix. The company will move forward with development of one of these mixes if its research shows that at least 80% of consumers would find it as good as, or better than, its traditional mix.



It conducted an experiment in which 50 tasters compared cakes made with these three alternatives flours to cake made with the standard wheat mix. Across three separate sessions, each taster tasted a cake made with the standard wheat mix and then one made with one of the alternatives flour mixes. For each session, the taster indicated whether they thought the alternative mix tasted Not as Good, Same, or Better than the standard mix. The assignment of the alternative mixes to the sessions was chosen randomly for each taster.

If the taster thought the alternative mix was Not as Good or Better Than the standard mix, they were asked to describe why.

Data

IDS_018.jmp

Taster:	ID of the taster (1, 2, ... , 50)
Formulation:	Formulation of the gluten-free mix (F1, F2, F3)
Order:	Random assignment of the alternative mixes to the three tasting sessions
Rating:	Comparison to standard wheat flour mix ('Not as Good', 'Same', 'Better Than')
Comments:	Taster's description of why they rated the alternative gluten-free mix 'Not as Good' or 'Better Than' the standard wheat flour mix

Exercises

1. Create a mosaic plot displaying the percentage of each rating for each formulation. Briefly describe the results.

Instructions:

Graph > Graph Builder. Place 'Rating' on the Y axis, 'Formulation' on the X, and choose the mosaic plot icon. 

Add the percent values by selecting Label by Percent in the Cell Labeling drop down menu on the left. Set Label Format to Percent with 0 decimal places.

2. Perform a statistical test to determine if these data provide statistically significant evidence that the distribution of the ratings is not equal across the three formulations. Summarize the conclusion that can be reached from this analysis using non-statistical terminology.
Hint: Here and in the other exercises, be careful with your wording to state only what can be concluded from the result of this specific statistical test.

Instructions:

Analyze > Consumer Research > Categorical. Choose 'Rating' for the Response role in the Simple tab. Choose 'Formulation' for the X, Grouping Category. Click OK.
In the Categorical report window created, select Test Response Homogeneity under the top red triangle. Examine the p-value for the test. Note: Two test results are shown (Likelihood ratio Chi-Square and Pearsons Chi-Square). For this and the other analyses, use results from Pearson's test.

Note: The Fit Y by X platform can also be used to conduct this statistical test. We're using the Categorical platform instead as it provides the opportunity to perform additional analyses in later exercises.

3. Perform a set of statistical tests to determine if there are significant differences in the distribution of the ratings between each possible pair of formulations. Summarize the results using non-statistical terminology.

Instructions:

In the top red triangle menu, select Compare Each Sample. Examine the Pearson Chi-Square p-values for the tests. Note: There are 3 statistical tests being done in this analysis.

4. Perform a set of statistical tests to determine if there are significant differences between each pair of the formulations in their proportions for each of the three rating levels. Summarize the results using non-statistical terminology.

Instructions:

In the top red triangle menu, select More Cell Options > Compare Each Cell. Examine the Pearson Pairs p-values for the tests. Note: There are 9 statistical tests being done in this analysis.

5. Evaluate if the order in which the tasters evaluated each mix had an unwanted impact on their rating. Do you have any concerns? Explain why randomizing the order that the formulations are evaluated is a good strategy in this kind of an experiment.

Instructions:

Graph > Graph Builder. Place 'Rating' on the Y axis, 'Order' on the X, and 'Formulation' on the Group X. Choose the mosaic plot icon.



Choose to display the percent labels and conduct a Chi-Square test for each formulation. A test statistic and p-value for each formulation will be displayed testing for a statistical difference in the distribution of the ratings across the order.

6. Calculate confidence intervals estimating the proportion of a population of consumers who would conclude each of the three ratings for each of the three formulations. Interpret these confidence intervals.

Instructions:

Back in the Categorical platform report, select More Cell Options > Share Confidence Interval under the top red triangle menu. Note: There are 9 confidence intervals that have been added to the table to interpret.

7. Is there enough statistical evidence at the 95% confidence level to conclude for any of these formulations that over 80% of consumers would find it as good or better than the wheat mix? If not, which mix at least appears to be the most promising for further development?

Instructions:

Examine the CIs for the 'Not as Good' category and translate that in terms of 'Same or Better Than'.

8. Examine the comments the testers provided when they thought the mix was either 'Not as Good' or 'Better Than' the standard mix. Identify a few of the common themes for each of the mixes.

Instructions:

Analyze > Text Explorer. Place 'Comments' as the Text Columns and click OK. In the report created, select Local Data Filter under the top red triangle. Select 'Formulation' and 'Rating'. Click the + symbol. Now you can select a specific 'Formulation' and a specific 'Rating' and the data will be filtered to only those rows. Right-click on any of the words and/or phrases in the list and choose Show Text to see the full comments that use the selected word/phrase.

9. Returning to the 9 confidence intervals created in Exercise 6. How do you feel about the precision in these estimates captured by the interval width? What would be needed in this kind of experiment for them to be more precise?
10. Determine the number of tasters that would be needed to produce confidence intervals that would have a margin of error of $\pm .05$. How many additional tasters would be needed for this study to achieve this margin of error?

Instructions:

Launch DOE > Sample Size Explorers > Confidence Intervals > Confidence Interval for One Sample Proportion.

Set the Proportion in the graph in the lower right to 0.50. Note: This will produce the most conservative answer as this is the proportion where the confidence interval would be widest.

Type in the value 0.05 for the Bound Margin. Set the Target Variable to Sample Size. Click Go.

11. Provide some ideas for other types of experiments or data that would be valuable to collect.