Reformulation for Health

Reformulation Support

A guide to sensory analysis for SMEs

fdf Scotland

fdf Scotland food & drink federation
passionate about food & drink

Helping food businesses REFORMULATE for a healthier future

Reformulation Support

A guide to sensory analysis for SMEs

The Reformulation for Health programme - funded by the Scottish Government- is helping to transform the way we produce food and drink in Scotland, by providing free to access reformulation support for SME manufacturers in Scotland. The government obesity prevention plan: A healthier Future highlights reformulation as one of the most effective ways that industry can help improve dietary health, but it can be a complex process for manufacturers to navigate.

The adjustment of a product can be an unsettling concept for a brand, which is why Reformul8 are committed to supporting industry with the tools to allow them to do so with confidence. We can help manufacturers to horizon scan and benchmark their produce against current and future nutritional standards, access funding to aid reformulation trials, connect with industry players through our Reformul8 Partnership, and access upskilling events and resources to empower teams to reformulate in a way that is best for their brand.

The Reformulation Process

Manufacturers may trial one or a few different formulations, with varying ratios or types of ingredients. While initial trials will indicate if a formulation provides sufficient functionality, sensory analysis will also be required to establish the formulation's performance for consumption quality.

There are multiple methods of gathering sensory information, allowing manufacturers to select the best range of options for their needs. To ensure you utilise the best of these, you should consider:

- The number of formulations to be trialled
- What product attributes are important to your customers
- Will this process be repeated with future formulations
- Specific ingredient or process alterations made in this reformulation
- What are the key product attributes important to the brand
- Is this a mid-process or final sensory analysis

Planning your sensory analysis

Location and environment
The enjoyment and analysis of a product can be influenced by external stimuli including visuals, smells and sounds. The location of sensory analysis should be situated away from any manufacturing areas, and any sources of smell or sound. All five senses are used when tasting food and drink: sight, smell, taste, hearing and touch, so care should be taken to not distract any of these senses during analysis. The environment itself should not be stimulating, with the absence of bright colours or lights where possible. Commercial sensory analysis uses white booths with samples presented through a hatch, to minimise environmental influence: while replicating these standards is not feasible, the importance of these factors should be noted.

Preparation
Food samples should be prepared away from the testing area, so that the samplers do not hear or see any activity that may influence their analysis.

Presentation
Samples should be presented in a uniform manner so as not to introduce any bias. Unless the presentation is a key feature of one of the options, all the samples should be served in an identical fashion. Use plain crockery such as white plates or cups, with sample preparation being carried out in a separate area from the analysis. Unless packaging is one of the factors in the test being analysed, all samples should be removed from packaging to ensure that this does not become an influencing factor.

Each sample should be presented with a unique code. Try to avoid ascending coding such as “sample 1” “sample 2” etc. which may influence preference. Instead, create random codes using lettering such as “XZY” “CTB” while ensuring the coding cannot be interpreted as specific acronyms or indications of sample characteristics.

Tasters
Encouraging members of staff who are not involved in the reformulation project is a great way to generate both impartial data, and raise awareness of your hard work across the business. You may wish to consider characteristics of your tasters in line with your project (eg. Who is your target customer? Do you have staff with a range of familiarity of the product?). You will need to consider dietary preferences and allergies, and if external factors such as smoking or illness will lead to skewed results due to ability to fully taste and smell. Commercial sensory analysis typically uses non-smokers, but if you know that your product is enjoyed by smokers and non-smokers alike then you may chose to structure your own data collection to flag these demographics.
Providing a Participant Information Sheet which outlines the structure and objectives of the analysis can also be useful for participants. A basic risk assessment and ethics consideration should be carried out prior to hosting the session; more information on which can be found here: https://www.ifst.org/membership/networks-and-communities/special-interest-groups/sensory-science-group/ifst-guidelines

Scheduling
The appetite of the samplers can influence and skew results gathered from sensory analysis panels carried out immediately before or after a meal. Traditionally, it is advised to schedule analysis for mid-morning or afternoon. If you are engaging with shift-workers however, ensure that the time of the sensory analysis falls appropriately within their routine to mitigate hunger or satiety.

Do your best to replicate these factors in your premises, or consider initial analysis in house and the use of external premises or services for final analysis (contact the Reformul8 programme for more information).

Selecting your analysis method

Sensory analysis is it's own science, carried out for all food and drink categories, applications and processes, and therefore there are multiple techniques to choose from. Many of these techniques have been formed in a way to allow for complex statistical analysis of the generated data. A worthwhile sensory analysis will use the basis of these tried and tested methods, executed in a considered way specific to the resources available, and type of information required by the business. This guide does not provide an exhaustive list, but provides basic information on those which may be useful for an in-house reformulation project.

If you are unsure which methods to use, or if you would like to discuss ways of tailoring methods for your application, please contact reformulation@fdfscotland.org.uk and we can help tailor an analysis process perfect for your needs.

With the many types of sensory analysis models to chose from, you should first decide what type of data you need to obtain, and how you will use the data.

You can select analysis methods to generate objective, subjective, and differentiating data; This can help you quantify the impact of any changes you have made, along with the qualitative observations specific to customer experience, and decide if the difference between products is acceptable.

This guide provides examples of discriminative, descriptive and affective analysis which are established methods, illustrated in a way to make them accessible to those with no prior experience of sensory analysis.

This guide will cover the following methods:

- **Triangle test**
- **Duo-trio test**
- **Paired comparison – discrimination**
- **Paired comparison – preference**
- **Hedonic scaling**
- **Ranking**
- **Check all that apply "CATA"**
- **Flash profile**
- **Star chart diagram**

Printable evaluation sheets are included within the document to illustrate how the data could potentially be collected during the process. They are free to use, and also available as word documents so that they can be edited to better suit your own analysis.

Selecting tests by objective:

Discriminative testing can be used to detect if a changed product is detectable by the consumer. In most professional sensory analysis there is not the option for samplers to indicate if they are unable to identify a difference, meaning there can be up to 50% chance of the correct identification being made by chance. To avoid this, the option of providing a “difference not detected” response may be provided as part of the test. An additional column can be added to the evaluation sheets for this purpose should you wish.

“Do I want to investigate a detectable difference between the original and reformulated product?”

Triangle test

Three samples are provided to the sampler, who is told that two are the same and one is different. The sampler is asked to identify which is the different “odd one out” product. Statistically, there is a 50% change that the tester could identify the correct product by chance, therefore you may wish give them the option of stating that they are unable to determine a difference.

Duo-trio test

Similar to the triangle test, this allows samplers to identify the “odd one out”. Three samples are provided: one labelled reference sample, containing at least double the amount of product than the other two. Of the other two samples, one contains the same as the reference and one is the reformulated product. Samplers are asked to identify which of the two are the same as the reference. Again, to confirm the result is not a chance selection, you may wish to give testers the option of indicating that they are unable to determine the similarity.

Paired comparison – discriminative
Some reformulations may involve recreating a sensory characteristic by utilising an alternative ingredient. To identify that this characteristic has been successfully recreated in the reformulated product, you may wish to use a test to indicate which formulation better fits to a specific description. A discriminative paired comparison test involves presenting two samples to the tester, with a characteristic description such as “creamy” “sweet” “smooth”. The sampler is asked to indicate which of the two samples better fits the provided description. This could be used to test the original product against the reformulated version, or to test between two reformulation options.

“How is the product received and rated by the consumer subjectively?”

You may choose a reformulation which is noticeably different from the original product, and want to test how enjoyable the new formulation is on its own merit or compared to the original. Affective testing can be carried out as well as discriminative testing, but should be positioned after discriminative analysis. This will allow you to assess:

Paired comparison – preference
Two samples are presented to the tester, who is asked to identify which sample they prefer based on overall enjoyment. This can be used to test an original vs reformulated product, or two reformulated options.

Hedonic scaling
Testers are presented with a sample of product, and asked to score it based on their overall enjoyment of it on a scale of 0 – 5 or 1 – 9 (the higher number indicating the more enjoyable). This can be done with multiple samples and formulations, and creates numerical data which is easily compiled and assessed. While numerical data allows for easy trending and comparison of results, the most reliable method of comparing sample data is to use that generated by the same group of testers on the same day.


Hedonic scaling One sample

Testers are presented with samples, and asked to score it based on their overall enjoyment of the product on a scale of 0 – 5 or 1 – 9 (the higher number indicating the more enjoyable).

Hedonic scaling: One sample.

Name:

Type of sample:

Date:

Sample code

Instructions

You are presented with a coded sample of product and asked to indicate your overall enjoyment on the product, using the scoring system below.

Liking Scores	Hedonic Rating	Selection
9	Like extremely	
8		
7	Like very much	
6	Like moderately	
5	Like slightly	
4	Neither like nor dislike	

Comments

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Ranking

Testers are presented with a number of samples at the same time, and asked to rank them in order of their overall enjoyment.

This can be used to observe hierarchy of enjoyment between the original product and reformulated options, with the benefit of gathering a direct comparison between different formulations.

Ranking

Name:

Date:

Type of sample:

Instructions

You are presented with coded samples and asked to assess your overall enjoyment of them. Please rank the samples in order of preference, using the columns below (1st indicating the sample you enjoyed the most). You

Sample	Ranking of sample 1st, 2nd, 3rd	Comments

fdf food & drink federation

Website: www.fdfscotland.org.uk Email: reformulation@fdfscotland.org.uk

Ranking
Testers are presented with a number of samples at the same time, and asked to rank them in order of their overall enjoyment. This can be used to observe hierarchy of enjoyment between the original product and reformulated options, with the benefit of gathering a direct comparison between different formulations.

Many reformulation projects involve reducing one or more ingredients which contribute to creating a specific sensory attribute, while introducing alternative ingredients to replicate the technical performance and characteristics of that removed. With knowledge of how these ingredients have been adjusted within a reformulation, it is useful to gather data on these characteristics score in the finished product.

> "What sensory characteristics does the alternative ingredient bring to the reformulated product?"

If you are unsure what characteristics to look for, the ingredient supplier will be able to advise those which are carried by the alternative ingredient being used, and may be able to suggest relevant vocabulary to use in your own sensory analysis to detect these.

Check all that apply

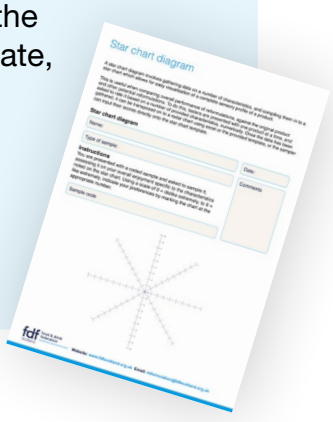
Testers are presented with a sample, and a check list which lists a variety of sensory characteristics. They are asked to check all of the characteristics which they feel apply to that sample. This can be carried out for multiple samples, but they should be presented one at a time to the tester. This allows a profile of attributes to be formed, based on those pre-determined by the test.

Flash profile

Similar to 'Check all that apply' this analysis allows for a profile of characteristics to be formed by the tester, but in their own vocabulary. This can allow for product attributes to be registered which may not have been considered previously, but it does require a baseline range of vocabulary to be held by the tester.

Star chart diagram

A star chart diagram involves gathering data on a number of characteristics, and compiling them in to a star chart which allows for easy visualisation of a complete sensory profile of a product. This is useful when comparing overall performance of reformulations, against the original product and other potential reformulations. To do this, tasters are presented with one product at a time, and asked to rate it based on a number of provided characteristics, numerically. Once the data has been gathered, it can be transposed on to a radar chart using excel or the provided template, or the sampler can input their scores directly onto the star chart template.



Please edit and use the following pages for your own use. Scottish based SME's can contact Reformulation@fdfscotland.org.uk for free support.

Environment

Is the environment for the sensory analysis:

- [ ] Away from any manufacturing areas, noise or smells
- [ ] As free as possible of bright colours
- [ ] Scheduled out with meal times
- [ ] Separate from the sample preparation area

Participants

- [ ] Are non-smokers, or have been asked not to smoke prior to analysis
- [ ] Have identified smokers' test results so they can be filtered
- [ ] Have read and understood the vocabulary guide
- [ ] Have declared any dietary preferences or allergies
- [ ] Are provided with water and asked to sip between samples

Samples

- [ ] Are presented using plain, consistent crockery
- [ ] Are visually identical on presentation
- [ ] Are labelled using coding which prevents bias

Vocabulary guide
You may wish to discuss the descriptive vocabulary relevant to sensory analysis with the tasters. Vocabulary guides such as the following from Food: A Fact of Life can be used for this: https://www.foodafactoflife.org.uk/media/6174/sensory-vocabulary-p316.pdf

Triangle test

Three samples are provided to the sampler, who is told that two are the same and one is different. The sampler is asked to identify which is the different “odd one out” product.

Statistically, there is a **50% chance** that the tester could identify the correct product by chance, therefore you may wish give them the option of stating that they are unable to determine a difference.

Triangle test

Name:

Date:

Type of sample:

Instructions

This test presents you with three samples. Two samples are identical, you are tasked with identifying the odd one out.

Taste the samples in the order provided (left to right) using the provided water to rinse out your mouth between samples.

Indicate the sample which you believe to be different to the other two, by marking the ‘odd one out’ column with X.

You may provide comments on the samples in the provided column.

Sample code	Odd one out?	Comments

Duo-trio test

Similar to the triangle test, this allows samplers to identify the “odd one out”.

Three samples are provided: one labelled reference sample, containing at least **double** the amount of product than the other two. Of the other two samples, one contains the **same as the reference** and one is the reformulated product.

Samplers are asked to identify which of the two are the same as the reference. Again, to confirm the result is not a chance selection, you may wish to give testers the option of indicating that they are unable to determine the similarity.

Duo-trio test

Name:

Date:

Type of sample:

Instructions

Presented in this test is one labelled reference sample and two coded samples. One of the coded samples is the same as the reference, one is different. You are required to taste all the samples and identify which of the coded samples is different to the reference sample.

Indicate this by marking the ‘odd one out’ column with X. You may provide comments on the samples in the provided column.

Sample code	Odd one out?	Comments

Paired comparison discriminative

Some reformulations may involve recreating a sensory characteristic by utilising an alternative ingredient. To identify that this characteristic has been successfully recreated in the reformulated product, you may wish to use a test to indicate which formulation better fits to a specific description.

A discriminative paired comparison test involves presenting two samples to the tester, with a **characteristic description** such as “creamy” “sweet” “smooth”. The sampler is asked to indicate which of the two samples better fits the provided description. This could be used to test the original product against the reformulated version, or to test between two reformulation options.

Paired comparison - discriminative

Name:

Date:

Type of sample:

Instructions

You are provided with two coded samples. Please sample and assess which of the samples better fulfils the characteristic stated below. Indicate which sample better fulfils this description by marking X in the provided column. You may provide comments on the samples in the provided column.

Sample code	Odd one out?	Comments

Paired comparison preference

Two samples are presented to the tester, who is asked to identify which sample they prefer based on overall enjoyment.

This can be used to test an **original vs reformulated** product, or two reformulated options.

Paired comparison - preference

Name:

Date:

Type of sample:

Instructions

You are provided with two coded samples. Please indicate which of the samples you prefer, based on overall enjoyment. You may provide comments on each sample in the provided column.

Sample code	Odd one out?	Comments

Hedonic scaling One sample

Testers are presented with samples, and asked to score it based on their overall enjoyment of the product on a scale of 0 – 5 or 1 – 9 (the higher number indicating the more enjoyable).

This can be done with multiple samples and formulations, and creates numerical data which is easily compiled and assessed. Using a larger scale allows for a more detailed analysis, and may provide valuable insight which might not be available if using a smaller scale with more opportunities to differentiate between samples. While numerical data allows for easy trending and comparison of results, the most reliable method of comparing sample data is to use that generated by the same group of testers on the same day.

Hedonic scaling: One sample

Name:

Date:

Type of sample:

Instructions

You are presented with a coded sample of product and asked to indicate your overall enjoyment on the product, using the scoring system below. You may provide comments on the sample if you wish.

Sample code

Liking Score	Hedonic Rating	Selection
9	Like extremely	
8	Like very much	
7	Like moderately	
6	Like slightly	
5	Neither like nor dislike	
4	Dislike slightly	
3	Dislike moderately	
2	Dislike very much	
1	Dislike extremely	

Comments

Hedonic scaling Three samples

Hedonic scaling: Three samples

Name:

Date:

Type of sample:

Instructions

You are presented with coded samples of product and asked to indicate your overall enjoyment on the product, using the scoring system below. You may provide comments on the sample if you wish.

Sample code

Liking Score	Hedonic Rating	Selection
9	Like extremely	
8	Like very much	
7	Like moderately	
6	Like slightly	
5	Neither like nor dislike	
4	Dislike slightly	
3	Dislike moderately	
2	Dislike very much	
1	Dislike extremely	

Comments

Ranking

Testers are presented with a number of samples at the same time, and asked to rank them in order of their overall enjoyment.

This can be used to observe hierarchy of enjoyment between the original product and reformulated options, with the benefit of gathering a direct comparison between different formulations.

Ranking

Name:

Date:

Type of sample:

Instructions

You are presented with coded samples and asked to assess your overall enjoyment of each. Please rank the samples in order of preference, using the columns below (1st indicating the sample you enjoyed the most). You may provide comments if you wish.

Sample	Ranking of sample 1st, 2nd, 3rd	Comments

Check all that apply

Testers are presented with a sample, and a check list which lists a variety of sensory characteristics. They are asked to check all of the characteristics which they feel apply to that sample.

This can be carried out for multiple samples, but they should be presented one at a time to the tester. This allows a profile of attributes to be formed, based on those pre-determined by the test.

Please edit the below form to suit the variety of characteristics applicable to your analysis. The British Nutrition Foundation; Food a Fact of Life sensory analysis vocabulary sheet can be found here. Other attributes such as “sound” may be added if this is relevant to your product.
Please contact reformulation@fdfscotland.org.uk for support.

Check all that apply

Name:

Date:

Type of sample:

Instructions

You are presented with a coded sample and asked to assess it for the following attributes. Please check all that you feel apply to the product in question.

Sample code

Appearance	Smell	Texture	Taste	After-taste
White ◯	Dairy ◯	Gritty ◯	Citrus ◯	Pleasant ◯
Shiny ◯	Nutty ◯	Smooth ◯	Salty ◯	Metallic ◯
Smooth ◯	Berry ◯	Claggy ◯	Dairy ◯	Creamy ◯
Matte ◯	Citric ◯	Light ◯	Bitter ◯	Bland ◯
Bright ◯	Strong ◯	Creamy ◯	Sweet ◯	Fruity ◯

Comments

Flash profile

Similar to ‘Check all that apply’ this analysis allows for a profile of characteristics to be formed by the tester, but in their own vocabulary.

This can allow for product attributes to be registered which may not have been considered previously, but it does require a baseline range of vocabulary to be held by the tester.

Flash profile

Name:

Date:

Type of sample:

Instructions

You are presented with a coded sample and asked to assess it. Please provide a description of the sample, on all attributes, in your own words below.

Sample code

Description

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Comments

Star chart diagram

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This is useful when comparing overall performance of reformulations, against the original product and other potential reformulations. To do this, tasters are presented with one product at a time, and asked to rate it based on a number of provided characteristics, numerically. Once the data has been gathered, it can be transposed on to a radar chart using excel or the provided template, or the sampler can input their scores directly onto the star chart template.

Star chart diagram

Name:

Date:

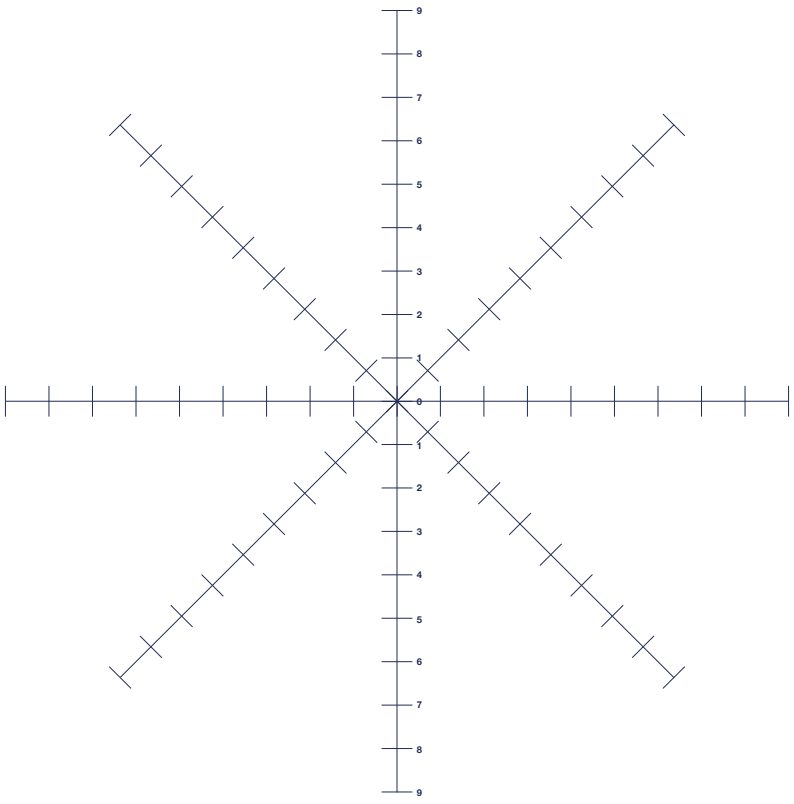
Type of sample:

Comments

Instructions

You are presented with a coded sample and asked to sample it, assessing it on your overall enjoyment specific to the characteristics noted on the star chart. Using a scale of 0 = dislike extremely, to 9 = like extremely, indicate your preferences by marking the chart at the appropriate number.

Sample code



Triangle test

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Statistically, there is a **50% chance** that the tester could identify the correct product by chance, therefore you may wish give them the option of stating that they are unable to determine a difference.

See test sheet example on next page

Triangle test

Instructions

This test presents you with three samples. Two samples are identical, you are tasked with identifying the odd one out.

Taste the samples in the order provided (left to right) using the provided water to rinse out your mouth between samples.

Indicate the sample which you believe to be different to the other two, by marking the 'odd one out' column with X.

You may provide comments on the samples in the provided column.

Sample code	Odd one out?	Comments

Name:

Date:

Type of sample:

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