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The chocolate challenge

Quantitative sensory evaluation of food

Aim

To carry out a quantitative sensory evaluation of different brands of chocolate. This method is also suitable for comparing other types of food.

Introduction

Every country in Europe has its own favourite chocolate, and the characteristics of the best-selling brands vary greatly. Thus, milk chocolate with a caramel note dominates the English market while the French prefer darker chocolate with a greater content of cocoa solids.

How can different brands of chocolate be objectively compared, and how can quantitative data be obtained from such comparisons? Here are some simple yet effective comparative procedures that are widely used in the food industry. Typically, they are used for quality control, to assess changes in the product (*e.g.*, due to changes in raw materials or production methods), to monitor shelf life and to assist in the development of new products. The methods yield data suitable for statistical analysis and can be used for chocolate or for a wide variety of food products such as fruit juice or biscuits.

Equipment and materials

Needed by each person

Equipment

- A ruler marked in millimetres
- Coloured pencils (a different colour for each type of chocolate)

Materials

- Three or four different brands of chocolate, cut into small squares about 10 mm x 10 mm (one sample of each type)
- A clean paper plate on which to place the chocolate samples
- A glass of water for cleaning the palate after tasting each sample
- Photocopied sheets on which to record the results

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Procedure

1 Taste each chocolate sample in turn and, as you do so, use the sensory testing chart below to record the characteristics of each brand of chocolate. Use a different coloured pencil for each chocolate sample, or write the number of the sample above each mark. *Take a sip of water after tasting each sample to refresh your palate.*

2 Measure the distances between the start of each line and the coloured marks you have made on the lines. Convert the positions marked for each characteristic for each chocolate sample into percentage values, and record these values in the personal summary table. *Note that each line on the chart is 100 mm long, so that the positions marked on the line are easily converted into percentages.*

Sensory testing chart

	NONE	A LOT
Aroma COCOA		
Aroma MILK		
Flavour SWEET		
Flavour BITTER		
Flavour COCOA		
Texture MELTING		

For each chocolate sample, mark a point on the line showing where you think the relative strength of each attribute lies. Use a different coloured pencil for each chocolate sample or write the chocolate's code number above the mark.

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Personal summary table	CHOCOLATE SAMPLE NUMBER			
Aroma COCOA				
Aroma MILK				
Flavour SWEET				
Flavour BITTER				
Flavour COCOA				
Texture MELTING				

Each line on the sensory testing chart is 100 mm long. By measuring the distances from the left hand edge to your marks, turn your assessment for each chocolate and characteristic into a percentage, where 1 mm = 1%. Record your assessment of each chocolate sample in the chart above.

3 Collate the results for your group in the table below, and calculate the group means for each characteristic. *You will need a separate copy of this table for each chocolate brand. Note that it may be easier if you divide the work and one person collects all the data for one chocolate type.*

Chocolate sample number:	GROUP MEMBER NAMES				Group mean
Aroma COCOA					
Aroma MILK					
Flavour SWEET					
Flavour BITTER					
Flavour COCOA					
Texture MELTING					

4 OPTIONAL: You may also collect the data for the entire class in tables similar to the one below:

Chocolate sample number:	GROUP NUMBER										Class mean
	1	2	3	4	5	6	7	8	9	10	
Aroma COCOA											
Aroma MILK											
Flavour SWEET											
Flavour BITTER											
Flavour COCOA											
Texture MELTING											

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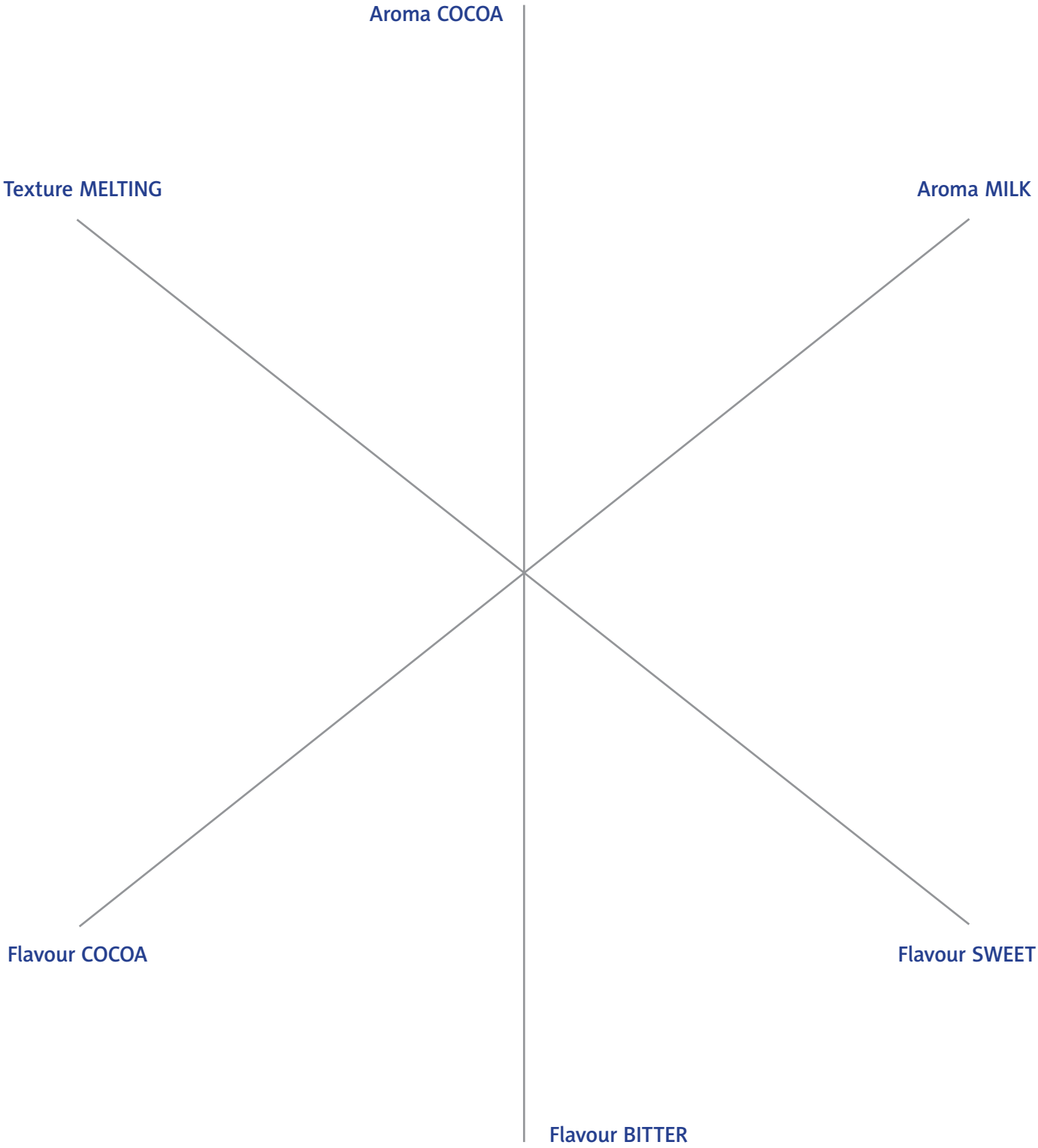
5 In the chart below, plot a sensory profile (zero at the centre, 100% at the extremity) for each chocolate brand. Each brand of chocolate will have a sensory profile represented by a different shape. *If you use coloured pencils for this, all the data can be shown on one chart.*



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6 If time allows, the data for the entire class can be collated and compared. Your personal perception of the chocolate's characteristics can be compared with group or class results.

7 Finally, discover the identity of each of the different brands of chocolate you have tasted. Look at the ingredients such as milk and cocoa solids listed on the wrappers for each of the chocolate samples. Try to relate the results you have obtained to information on chocolate wrapper and any advertising claims made for each brand.

Advance preparation

For this exercise, you will need at least three different brands of chocolate. The maximum number of brands you can compare will be determined largely by the time you have available, but in practice it is difficult to compare more than six products. Four different types of chocolate, carefully selected to give a range of characteristics, are ideal for a classroom activity.

To avoid bias, the chocolate should be presented to the students without identifying the brand. Identify each of the products with a three digit code picked at random so that there is no number bias.

Manufacturers' names are often moulded into chocolate bars, so you may wish to remove the name to preserve the anonymity of each type. This can be done in two ways. We have a laboratory heating block set to 40 °C, which we cover with a clean sheet of aluminium foil. We place the chocolate bars face down on the foil for a few seconds until the manufacturers' names have been melted away. If you do not have a heating block, remove the names with a spoon or knife that has been warmed in boiling water: this takes a little time, but it is effective as most chocolate melts at about 37 °C. Unfortunately the shapes of chocolate bars often provide a clue about the identity of the brand, so removing the name may not be a fool-proof means of ensuring that the tasters are not biased.

Once the names have been removed, cut chocolate into pieces that are suitable for tasting — we usually provide students with pieces about 10 mm x 10 mm.

For each working group, put samples of each type of chocolate into separate clean plastic bags, labelled with the appropriate identification code. Provide one sample for each student (we usually ask students to work in groups of four).

Safety guidelines

Do not carry out this work in a laboratory

For reasons of hygiene, wear disposable plastic gloves while you are preparing the chocolate: the samples must be prepared in a kitchen or room suitable for food preparation, not a laboratory. The chocolate should not be tasted in a laboratory.

IMPORTANT! Teachers should be aware that some students may have food allergies (*e.g.*, to nuts) and will therefore be unable to carry out this work.

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Ethical and other concerns

This work presents no ethical concerns, but for good nutrition education, teachers may to substitute the chocolate with healthier types of food such as fruit juices.

Preparation and timing

This activity takes about 60 minutes. The chocolate samples should be prepared in advance.

Storage of materials

The chocolate samples can usually be stored for several months in dry conditions away from heat, bright light and strong flavours.

Specimen results

The composition of some typical British milk chocolate brands is shown below. Students tend to be able to detect these differences by sensory evaluation, but although *Galaxy* and *Yorkie* have an identical composition, they appear very different, as the size of cocoa particles within the chocolate varies (*Yorkie* contains larger particles).

BRAND	% MILK SOLIDS	% COCOA SOLIDS
Galaxy	14	25
Cadbury Dairy Milk	20	20
Waitrose Continental	20	33
Yorkie	14	25

Other sources of information

Further information about chocolate manufacture, including practical investigations suitable for the school laboratory are given in *The science of chocolate* by Stephen T. Beckett (2004) Royal Society of Chemistry, London. ISBN: 0 85404 600 3.

Additional information is provided by Chapter 12 of *McGee on food and cooking: An encyclopedia of kitchen science, history and culture* by Harold McGee (2004) Hodder and Stoughton Ltd, London. ISBN: 0 340 83149 9.

A useful compendium of chocolate facts and figures is provided by *A passion for chocolate* by Domonique Ayral (2001) Cassell & Co., London. ISBN: 1 84202 124 9.

Acknowledgement

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