Food and Nutrition 2019 v1.2

IA2 high-level annotated sample response

March 2024

Project — folio (25%)

This sample has been compiled by the QCAA to assist and support teachers to match evidence in student responses to the characteristics described in the instrument-specific marking guide (ISMG).

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. recognise and describe facts and principles related to nutritional, chemical, functional and sensory properties and processing of carbohydrate- or fat-based food
2. explain food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution
3. analyse a problem, information and data related to the properties and processing of carbohydrate- or fat-based food
4. determine solution requirements and criteria for a carbohydrate- or fat-based food problem
5. synthesise chemical, functional and nutritional information and data to develop ideas for a carbohydrate- or fat-based food solution
6. generate a carbohydrate- or fat-based food solution to provide data to determine the feasibility of the solution
7. evaluate and refine ideas and a solution to make justified recommendations for enhancement to a carbohydrate- or fat-based food solution
8. make decisions about and use mode-appropriate features, language and conventions to communicate development of the solution.

Instrument-specific marking guide (ISMG)

Criterion: Recognising and explaining

Assessment objectives

1. recognise and describe facts and principles related to the processing, and nutritional, chemical, functional and sensory properties, of carbohydrate- or fat-based food
2. explain food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution

The student work has the following characteristics:	Marks
• accurate and discriminating recognition and discerning description of facts and principles related to the processing, and nutritional, chemical, functional and sensory properties, of carbohydrate- or fat-based food • discerning explanation of food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution.	4–5
• appropriate recognition and description of some facts and principles related to the processing, and nutritional, chemical, functional and sensory properties, of carbohydrate- or fat-based food • appropriate explanation of food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution.	2–3
• variable recognition and superficial description of the processing, or nutritional, chemical, functional or sensory properties, of carbohydrate- or fat-based food • superficial explanation of food science ideas and a problem related to a carbohydrate or fat-based food solution.	1
• does not satisfy any of the descriptors above.	0

Criterion: Analysing and determining

Assessment objectives

3. analyse a problem, information and data related to the properties and processing of carbohydrate- or fat-based food
4. determine solution requirements and criteria for a carbohydrate- or fat-based food problem

The student work has the following characteristics:	Marks
• insightful analysis of a relevant problem, information and data related to the properties and processing of carbohydrate- or fat-based food to identify essential characteristics and constraints • astute determination of – essential solution requirements from the brief – self-determined criteria that include the relevant impacts and implications, and the quality, functionality and reliability indicators for the carbohydrate- or fat-based food problem.	6–7
• considered analysis of a relevant problem, information and data related to the properties and processing of carbohydrate- or fat-based food to identify characteristics and constraints • logical determination of – effective solution requirements from the brief – self-determined criteria that include the impacts and implications, and the quality, functionality and reliability indicators for the carbohydrate- or fat-based food problem.	4–5
• appropriate analysis of a problem, information and data related to the properties or processing of carbohydrate- or fat-based food to identify some of the characteristics and constraints • reasonable determination of – some solution requirements from the brief – self-determined criteria that include impacts and implications, and the quality, functionality or reliability indicators for the carbohydrate- or fat-based food problem.	2–3
• description of a problem or information related to a carbohydrate- or fat-based food problem • identification of a criterion for a carbohydrate- or fat-based food problem.	1
• does not satisfy any of the descriptors above.	0

Criterion: Criterion: Synthesising, generating and evaluating

Assessment objectives

5. synthesise chemical, functional and nutritional information and data to develop ideas for a carbohydrate- or fat-based food solution
6. generate a carbohydrate- or fat-based food solution to provide data to determine the feasibility of the solution
7. evaluate and refine ideas and a solution to make justified recommendations for enhancement to a carbohydrate- or fat-based food problem

The student work has the following characteristics:	Marks
• coherent and logical synthesis of chemical, functional, sensory and nutritional information, and a range of primary and secondary data to develop ideas for a chosen solution • purposeful generation of a carbohydrate- or fat-based food processing solution to provide valid sensory profiling data to determine the feasibility of the solution • critical evaluation, and discerning refinement, of ideas and the generated solution, against self-determined criteria and data, considering impacts and implications of the solution, to make astute recommendations for enhancements, justified by data.	8–9
• logical synthesis of chemical, functional, sensory and nutritional information and primary and secondary data to develop ideas for a chosen solution • effective generation of a carbohydrate- or fat-based food processing solution to provide valid sensory profiling data to determine the feasibility of the solution • reasoned evaluation and effective refinement of ideas and a solution, against self-determined criteria to make effective recommendations for enhancements, justified by data.	6–7
• simple synthesis of chemical, functional, sensory and nutritional information and primary or secondary data to develop ideas for a chosen solution • adequate generation of a carbohydrate- or fat-based food processing solution to provide relevant sensory profiling data to determine the feasibility of the solution • feasible evaluation and adequate refinement of ideas and a solution, against self-determined criteria to make fundamental recommendations for enhancements, justified by data.	4–5
• rudimentary synthesis of information and data to develop partial ideas for a chosen solution • partial generation of a carbohydrate- or fat-based food processing solution to provide elements of sensory profiling data to determine the feasibility of the solution • superficial evaluation and refinement of ideas and a solution against some criteria to make elementary recommendations for enhancements.	2–3
• unclear combination of information or ideas about a carbohydrate- or fat-based food problem	1

The student work has the following characteristics:	Marks
• generation of parts of a solution • identification of a change to idea or solution.	
• does not satisfy any of the descriptors above.	0

Criterion: Communicating

Assessment objective

8. make decisions about and use mode-appropriate features, language and conventions for particular purposes and contexts

The student work has the following characteristics:	Marks
• discerning decision-making about and fluent use of – written and visual (if appropriate) features to communicate a solution – language for a technical audience – grammatically accurate language structures – referencing and folio conventions.	3–4
• variable decision-making about and inconsistent use of – written and visual (if appropriate) features - suitable language – grammar and language structures – referencing or folio conventions.	1–2
• does not satisfy any of the descriptors above.	0

Context

The company Essential Snack Foods produces a range of snack foods. Consumer research has identified a need for the company to develop a line extension of carbohydrate-based snack food. The analysis of consumer research identified a niche market for a single-serve, easily transported, shelf-stable and preparation-free snack food. The company values the ethical production of food and has various requirements around ethical production, which are outlined in its company ethos (see stimulus).

Task

Using the provided stimulus, identify a carbohydrate-based food problem and develop a solution for a snack food line extension for Essential Snack Foods. Document the problem-solving process using written and visual modes of communication.

See IA2 sample assessment instrument: Project — folio (available on the QCAA Portal).

Sample response

Criterion	Marks allocated	Provisional marks
Recognising and explaining Assessment objectives 1, 2	5	5
Analysing and determining Assessment objectives 3, 4	7	7
Synthesising, generating and evaluating Assessment objectives 5, 6, 7	9	9
Communicating Assessment objective 8	4	4
Total	**25**	**25**

The annotations show the match to the instrument-specific marking guide (ISMG) performance-level descriptors.

Table of Contents

Recognising and explaining [4–5]

discerning explanation of food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution

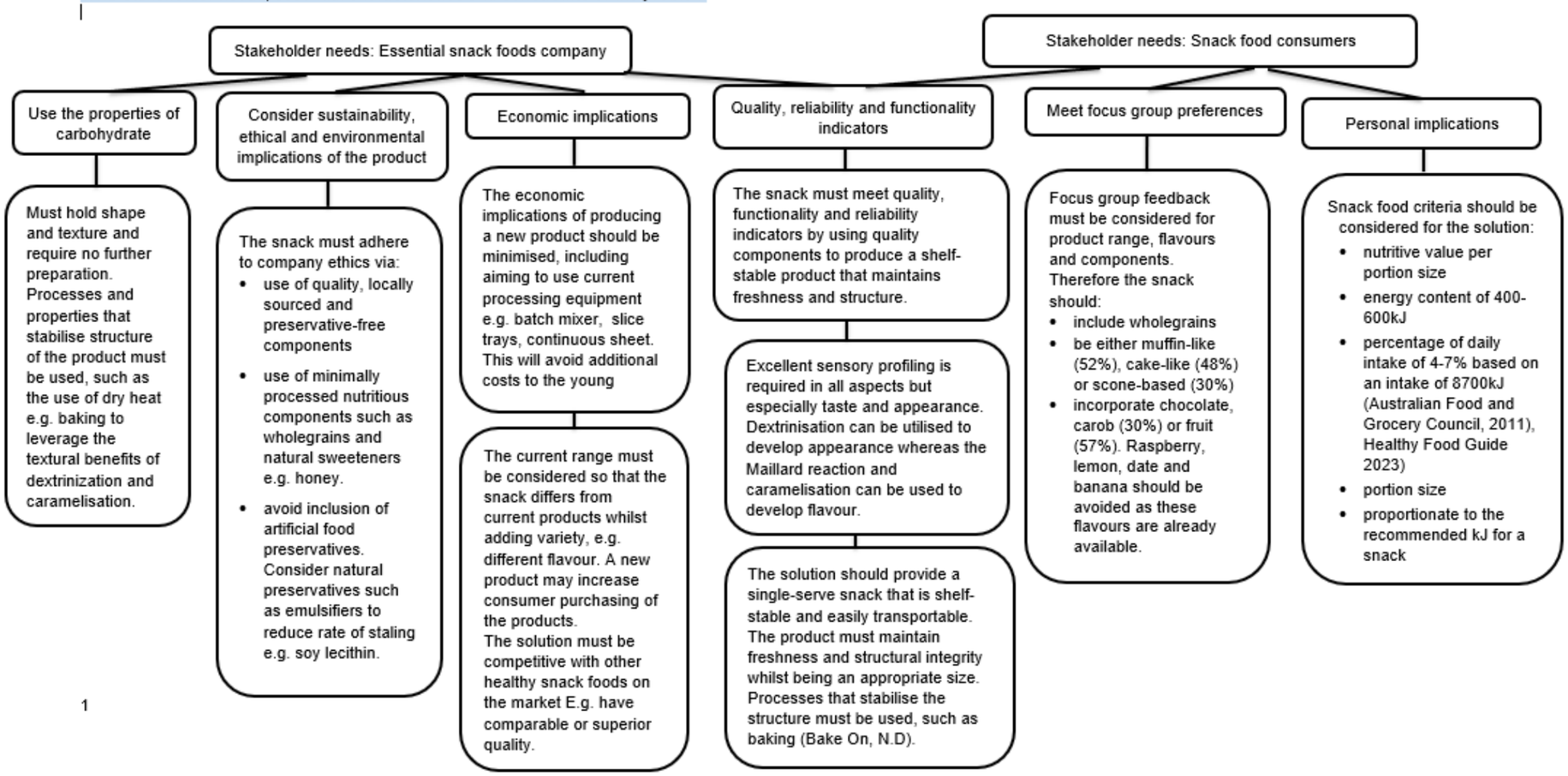
1.0 Explore the problem

1.1 Explanation of the problem by recognising and explaining the stakeholder needs and constraints

1.1.1 Problem

The Essential Snack Food Company has identified an opportunity to develop an extension to its current range of snack foods. The extension must be high quality single-serve, shelf-stable, preparation-free and carbohydrate-based. The snack food must comply with the company's aims of using locally sourced, preservative-free, and minimally refined components such as wholegrains and natural sweeteners. It should also meet key quality and functionality indicators such as retaining its structure whilst being transported. The functional properties of carbohydrate must be used when creating the snack. The company's current snack product range and existing manufacturing equipment must be considered. Focus group feedback must also be considered, including consumer preference for the type of snack, flavours, and nutritional preferences such as the inclusion of wholegrains and expectations for high quality sensory characteristics.

1.1.2 Stakeholder needs, essential characteristics and constraints of the problem



1

Analysing and determining [6–7]

insightful analysis of a relevant problem, information and data related to the properties of carbohydrate- or fat-based food to identify essential characteristics and constraints

Communicating [3–4]

discerning decision making about and fluent use of
- written and visual features to communicate a solution
- language for a technical audience
- grammatically accurate language structures
- referencing and folio conventions

1.2 Analysis of the Essential Snack Foods current line

Essential Snack Foods' current line of carbohydrate-based snack foods may be grouped into two categories: bars/slices and single-serve cake slices.

Current products and components	**Processing**	**Food processing techniques** **The processing of food assists in extending shelf life and palatability of foods (QCAA, 2017)**	**Chemical and functional properties** **Chemical properties enable the formulation to change during processing or storage and include changes in enzymes, acids, alkalis, moisture, and the nutrients themselves (QCAA, 2017)**	**Serving size and kilojoules per portion**
Raspberry and lemon muffin bar Whole wheat flour, water agave sweetener, raspberries (12%), canola oil, egg, lemon zest, baking powder, salt	Combine flour, baking powder, zest, salt and sweetener. Combine water, oil and egg and then stir into the flour mix. Fold the raspberries through the batter before portioning into muffin bar trays and baking.	Physical manipulation of components creates a batter which is divided into rectangular trays ready for baking. Baking powder (chemical leavening) creates aeration by the production of carbon dioxide which assists in the creation of a soft texture and crumb.	Dextrinization occurs during the application of dry heat causing the breakdown of starches to form dextrins which create a golden colour. Dry heat causes the breakdown of sweetener/sugar molecules and banana to create caramelisation and the development of colour and flavour in the product. The Maillard reaction produces colour and flavour to the surface of the product when amino acids and reducing sugars in the components react during baking (Food a fact of life, 2019). Gelatinisation occurs during heating when starches in the flour bind with water and swell creating increased viscosity and helping to develop structure in the product (Baking Business, 2023).	25g serve provides 564kJ 6.5 % of daily intake* (Australian Food and Grocery Council, 2011).
Date slice Dates, whole wheat flour, butter, water, maple syrup, egg, bicarbonate soda, mixed spice	Combine flour, bicarbonate soda and mixed spice. Melt butter over low heat and add boiling water, syrup and finely chopped dates. Add the date mixture to the flour mix and gently fold through before pouring the batter into slice trays and baking.	Butter is melted so that it can be incorporated in the slice batter without forming lumps. Dates are processed by cutting to create small pieces and softening in melted butter. Physical manipulation of components creates a batter which is divided into rectangular trays ready for baking. Baking powder (chemical leavening) creates leavening by the creation of carbon dioxide, resulting in a soft crumb texture.		35g serve provides 502kJ 5.7% of daily intake*
Banana bread Banana (30%), whole wheat flour, coconut palm sugar, canola oil, egg, baking powder	Combine flour, sugar and baking powder. Mash banana, then add oil and egg and stir to combine. Gently fold flour into banana mix before pouring the batter into loaf trays and baking.	Bananas are mashed to create a lumpy texture. Physical manipulation of components creates a batter which is divided into rectangular loaf trays ready for baking. Baking powder (chemical leavening) creates aeration by the production of carbon dioxide which assists in the creation of a soft texture and crumb.		50g serve provides 600kJ 6.7% of daily intake*
Carrot cake slice Carrot (15%), honey, wholewheat flour, walnuts (9%), canola oil, egg, baking powder, ground cinnamon, mixed spice, ginger	Combine flour, baking powder, ginger and spices. Add grated carrot and roughly chopped walnuts. Add combined egg, oil and honey to the carrot mixture. Gently fold egg mixture through flour mixture before pouring the batter into slice trays and baking.	Carrots are processed by shredding so that they can be evenly distributed and cooked. Physical manipulation of components creates a batter which is divided into rectangular loaf trays ready for baking. Baking powder (chemical leavening) creates aeration by producing carbon dioxide which assists in the creation of a soft texture and crumb.	Dextrinization occurs during the application of dry heat causing the breakdown of sugars to form dextrins which create a golden colour. Heat causes the breakdown of sugar molecules in the honey to create caramelisation and the development of colour and flavour in the cake. The Maillard reaction occurs when baking the walnuts as a result of the reaction between amino acids and sugars within the walnuts. This produces a distinctive flavour and aroma in the cake.	50g serve provides 595kJ 6.8% of daily intake*

1.2.1 Summary

The muffin bar and date slice are baked in flat trays. The banana bread and carrot cake slice are both prepared in a loaf-shaped baking tray and sliced when cool to avoid crumbling. All products are processed using physical manipulation, chemical aeration and application of heat to create dextrins and caramelisation. Each product uses wholemeal flour, natural sweetener (e.g. agave syrup, honey) and some locally sourced components (e.g. canola, banana), whilst being void of artificial preservatives. Products have been portioned in serving sizes that provide appropriate kilojoule content for a snack food, of between 400-600kJ (Australian Healthy Food Guide, 2017).

2

Analysing and determining [6–7]

astute determination of
- essential solution requirements from the brief
- self-determined criteria that include the relevant impacts and implications, and the quality, functionality and reliability indicators for the carbohydrate- or fat-based food problem

1.3 Determination of solution requirements and self-determined criteria to be used to evaluate the solution.

Solution requirements	Self-determined criteria
The solution must: • be a single serve, preparation-free carbohydrate-based snack suitable as a line extension • be an easily transported snack that maintains quality including structure and freshness • address focus group feedback for style of snack, flavours and type of components • not contain artificial preservatives • incorporate quality, natural and minimally processed components e.g. wholegrains • incorporate locally sourced components • be shelf-stable within the existing styles of packaging	The solution must: 1. be compatible with the current range of snack food flavours (date, berry, banana, lemon and carrot) and snack styles (slice, muffin bar and cake slice) 2. have high quality sensory profiling data with highly rated flavour, appearance, texture and aroma 3. include fruit and chocolate or carob flavours 4. be a muffin-like, cake-like or scone-based item 5. meet snack food energy recommendations for between 400-600 kJ 6. incorporate natural food preservatives for shelf-stability where needed e.g. tocopherols as antioxidants 7. use wholegrains, natural sweeteners and fresh, frozen or dried fruits 8. incur minimal costs by being manufactured using the company's current processing technology and equipment, e.g. slice trays, loaf tins, batch mixers and ovens 9. use dextrinisation, caramelisation and the Maillard reaction to develop flavour, create golden appearance and promote product stability

Synthesising, generating and evaluating [8–9]

coherent and logical synthesis of chemical, functional, sensory and nutritional information, and a range of primary and secondary data to develop ideas for a chosen solution

2.0 Developing ideas

2.1 Synthesis of food and nutrition information

The stakeholders, Essential Snack Food and their consumers require a line extension in the form of a carbohydrate snack that adheres to company ethos and consumer feedback. Initial feedback from the focus group recommended the formulation of products such muffin and cake-like products and scone-based products. The flavours of potential solutions should include chocolate, carob or fruit, to align with focus group feedback.

The current muffin bar, slice and cake products are processed through physical manipulation and baking, and rely on processes such as dextrinisation, caramelisation, the Maillard reaction and leavening to produce desirable sensory qualities in each product e.g. golden colour, soft crumb. These processes are appropriate for use in the proposed solution; however, the company's current manufacturing equipment presents a constraint to the type of potential solution, as it is a new company with limited equipment allowing it to primarily process bar and cake loaf shaped snacks. The inclusion of an individual round muffin or an individual scone as a line extension would require investment in new manufacturing equipment such as flat trays and cutting equipment, and as such are not appropriate. However, a scone or cake loaf product could be produced using the same equipment that is used to manufacture the cake slices. A muffin bar or slice item that does not require shaping would be suitable. Therefore, proposed formulations for experimentation will be muffin bars, cake slices and scone loaf slices.

The proposed ideas for a carbohydrate-based snack food are:

Prototype 1 Chocolate muffin bar

Prototype 2 Jaffa cake slice

Prototype 3 Sultana scone loaf

3

Analysing and determining [6–7]

insightful analysis of a relevant problem, information and data related to the properties of carbohydrate- or fat-based food to identify essential characteristics and constraints

2.2 Analysis of alternative ideas to determine a proposed solution

<table>
<tr><th>Prototype</th><th>Chocolate muffin bar</th><th>Jaffa cake slice</th><th>Sultana scone loaf</th></tr>
<tr><td>Components and
Processing</td><td>Components:
250 g Whole wheat flour, 100 ml canola oil, 60 g agave sweetener, 60 g egg, 180 g milk chocolate (cocoa mass, sugar, cocoa butter), 4 g raising agents (2 g sodium bicarbonate, 2 g cream of tartar), 5 ml vanilla essence
Processing:
Combine flour, sweetener and raising agents.
Whisk egg into the oil and the add vanilla.
Melt chocolate and allow to cool. Mix into the oil and egg mixture.
Fold chocolate mixture into flour mixture until smooth. Pour batter into rectangular slice tray.
Bake at 180 °C for 25 minutes or until cooked in the centre.
When cool, portion into individual bars.</td><td>Components:
250 g Whole wheat flour, 180 ml milk, 125 g coconut sugar, 50 ml orange juice, 50 ml canola oil, egg, 20 g raw cocoa powder, 100 g dark chocolate (cocoa mass, sugar, cocoa butter), 3 g raising agent (sodium bicarbonate)
Processing:
Combine flour, sugar, cocoa and sodium bicarbonate.
Whisk egg into combined milk, juice, and oil. Fold into the flour mixture until smooth. Divide the cake batter into two portions.
Melt the chocolate and cool slightly. Fold the chocolate through one portion of the cake batter.
Spoon the chocolate and plain batter alternately into loaf tray. Use a skewer to swirl the batter.
Bake at 180 °C for 30 minutes or until cooked in the centre.
When cool, portion into individual slices.</td><td>Components:
200 g Whole wheat flour, 40 g butter, 50 g sultanas, 270 ml milk, 3 g raising agents (2 g sodium bicarbonate, 1 g cream of tartar), 60 g egg
Processing:
Combine flour and raising agents.
Add butter to the flour and process until there are no visible lumps of butter.
Fold sultanas through the flour mix.
Combine 250 ml milk and egg, and then fold through the flour mixture until the mixture forms a ball-like shape.
Gently knead the mixture.
Place the dough into a lightly greased loaf tin, brush with remaining milk and bake at 200 °C for 25 minutes or until cooked in the centre and golden.
When cool, portion into individual slices.</td></tr>
<tr><td>Chemical and functional properties</td><td colspan="3">During processing and baking:
• aeration occurs when raising agents react with water to produce carbon dioxide
• sugars are broken down to form dextrins and create a golden colour
• caramelisation of sugar molecules develops colour and flavour
• amino acids and reducing sugars react to cause browning of the surface via the Maillard reaction
• starches are gelatinised which assists with the structure development in each product.</td></tr>
<tr><td>Energy content

(FSANZ, 2021)</td><td><table><tr><td>Energy (kJ)</td><td>Average quantity per serving</td><td>Average quantity per 100g</td></tr><tr><td></td><td>538</td><td>1790</td></tr><tr><td>Sugar (g)</td><td>6.6</td><td>22.1</td></tr></table></td><td><table><tr><td>Energy (kJ)</td><td>Average quantity per serving</td><td>Average quantity per 100g</td></tr><tr><td></td><td>569</td><td>1260</td></tr><tr><td>Sugar (g)</td><td>10.4</td><td>23</td></tr></table></td><td><table><tr><td>Energy (kJ)</td><td>Average quantity per serving</td><td>Average quantity per 100g</td></tr><tr><td></td><td>578</td><td>1290</td></tr><tr><td>Sugar (g)</td><td>9.1</td><td>20.2</td></tr></table></td></tr>
<tr><td>Self-determined criteria</td><td>• compatible with existing products as it is a new flavour
• meets focus group preference for a muffin-type product and chocolate flavour
• 538kJ per 30g serve 6.8 % of daily intake* which meets the recommended snack food energy content
• free from artificial preservatives and uses wholegrain flour and agave syrup
• can be manufactured using existing equipment used to make current muffin bars, e.g. slice trays, mixers, ovens</td><td>• compatible with existing products as it is a new flavour
• meets focus group preference for a cake-type product and combines chocolate and fruit flavour
• 569kJ per 45g serve 6.8% of daily intake* which meets the recommended snack food energy content
• free from artificial preservatives and uses wholegrain flour and coconut sugar
• can be manufactured using existing equipment used to make current cake slices, e.g. loaf tins, mixers, ovens</td><td>• compatible with existing products as it is a new flavour
• meets focus group preference for a scone-type product and fruit flavour
• 578kJ per 45g serve 6.6% of daily intake* which meets the recommended snack food energy content
• free from artificial preservatives and uses wholegrain flour and sultanas to sweeten the product
• can be manufactured using existing equipment used to make current cake slices, e.g. loaf tins, mixers, ovens</td></tr>
<tr><td colspan="4">All prototypes use dextrinization, caramelisation, aeration and the Maillard reaction in their processing.</td></tr>
</table>

2.2.1 Summary

All proposed formulations use wholegrain flour, natural sweeteners and some locally-sourced components such as canola oil, sultanas and oranges. All proposed formulations can be manufactured using the company's existing equipment. Based on the self-determined criteria all the formulations will be generated to develop sensory data that will be used to determine their feasibility and the best possible solution.

Communicating [3–4]

discerning decision making about and fluent use of
- written and visual features to communicate a solution
- language for a technical audience
- grammatically accurate language structures
- referencing and folio conventions

4

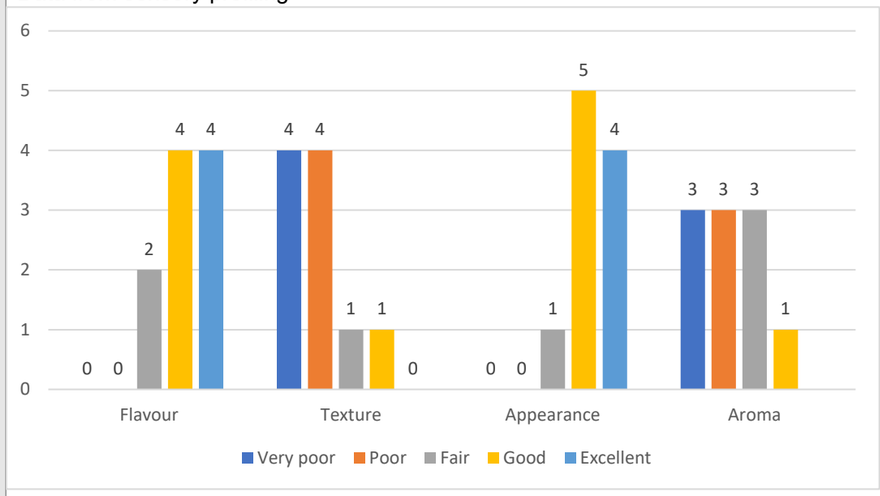
Synthesising, generating and evaluating [8–9]

purposeful generation of a carbohydrate- or fat-based food processing solution to provide valid sensory profiling data to determine the feasibility of the solution

2.3 Primary experimental data about alternative solutions

Food experimentation – sensory profiling of Chocolate muffin bar

Data from sensory profiling

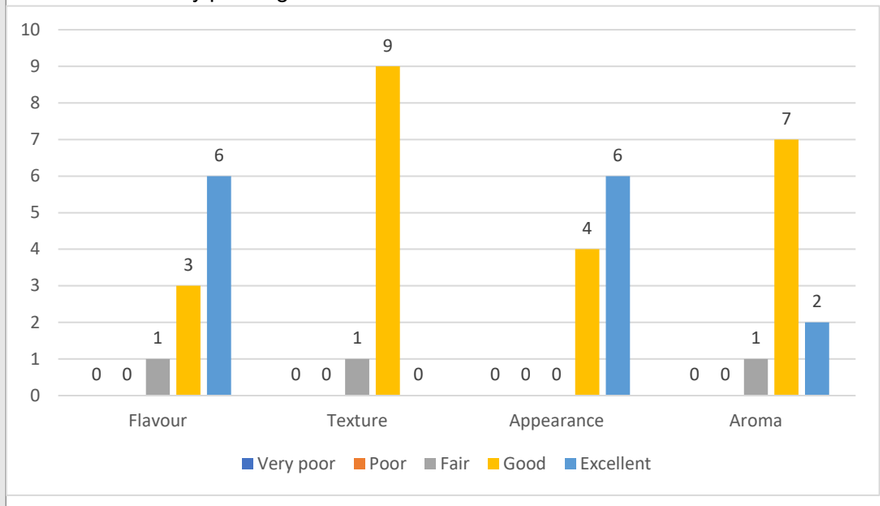


Conclusions: While this prototype was well received by the sensory profilers, the formulation would require further refinement as 80% of the profilers rated texture poorly commenting that it was 'too dry.' Further experimentation with the ratio of liquid to dry components is needed to improve the moisture content, e.g. addition of milk. The flavour of this formulation was also commented on by some profilers who considered it to be 'very sweet.' However, 80% of profilers were satisfied with the flavour of the product (rating good-excellent) and it met their preference for chocolate flavour. 90% of profilers found the appearance appetising but 60% rated aroma poorly. This prototype in its current formulation, although acceptable to profilers, would require considerable refinement to be proposed as the solution.

Image of Chocolate muffin bar

Food experimentation – sensory profiling of Jaffa cake slice

Data from sensory profiling



Conclusions: This prototype was the most well accepted by the sensory profilers. 90% of profilers rated texture as 'good.' 90% of profilers rated aroma as 'good' or 'excellent' and only 10% as fair. 90% of profilers also rated flavour as 'good' to 'excellent', with 10% rating it as 'fair.' 20% of profilers suggested that adding orange zest would increase satisfaction with flavour and aroma. Profilers commented favourably on the inclusion of a fruit flavour. Appearance was highly rated with 100% at 'good' to 'excellent.' Further experimentation is needed to develop flavour, texture and aroma, such as the incorporation of chocolate chips. Although 10% of profilers suggested an icing be added to the top of the cake slice, this would increase the kilojoule value of the snack and impact on the shelf life of the product due to the fat content. This prototype would be a suitable solution for the problem but needs further refinement to increase consumer satisfaction.

Image of Jaffa cake slice

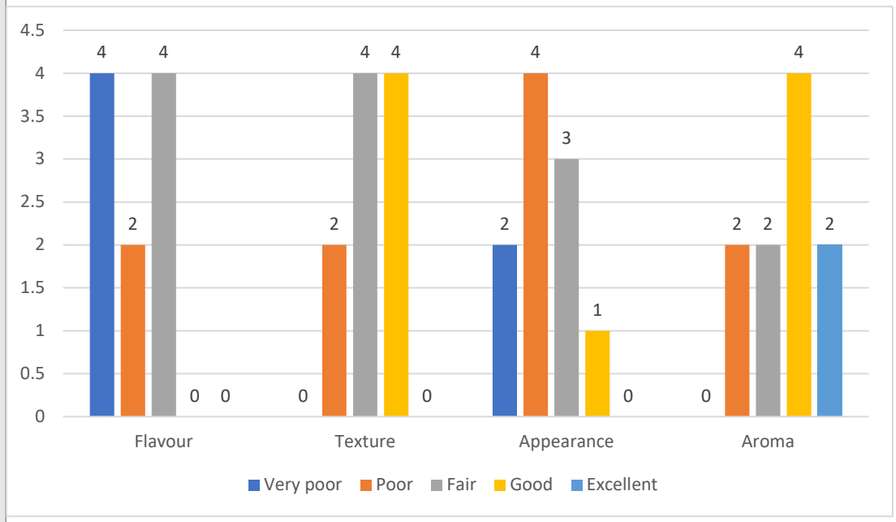
5

Synthesising, generating and evaluating [8–9]

coherent and logical synthesis of chemical, functional, sensory and nutritional information, and a range of primary and secondary data to develop ideas for a chosen solution

Food experimentation – sensory profiling of Sultana scone loaf

Data from sensory profiling



Conclusions: 60% of profilers rated the flavour of this prototype as 'poor' or 'very poor.' These profilers commented that the product was 'bland' and 'not sweet enough for a fruit scone loaf.' Further experimentation would need to include the addition of components such as sugar and extra sultanas to add flavour. The addition of sugar would also help to create a softer and more tender crumb texture and improved mouthfeel as 60% of profilers rated texture 'fair' to 'poor.' 60% of profilers rated the aroma of the sultana scone loaf as 'good' or 'excellent' and only 40% rated the appearance of the loaf as 'fair,' or 'good'. This product, in the current formulation, would need further experimentation to be acceptable as the solution.

Image of Sultana scone loaf

2.4 The proposed solution for generation

Based on the development of ideas in Section 2, the proposed solution for a carbohydrate-based snack food is Formulation 2: Jaffa cake slice. This prototype has been selected because it complies with all the self-determined criteria in section 1.3. It is compatible with the current range and combines focus group flavour preferences for chocolate and fruit flavour, and cake-like style of snack. It also incorporates wholegrain flour and locally-sourced components such as oranges and canola. It uses dextrinization, caramelisation and the Maillard to create a golden appearance and pleasing aroma. It is free from artificial preservatives and can be manufactured using the company's current equipment, e.g. loaf tins. It is within the recommended kJ range for a snack (569 kJ) and has the best sensory profiling for aroma, appearance and texture and the second best for flavour. Therefore a refined version of this formulation will be generated and evaluated against the self-determined criteria.

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Synthesising, generating and evaluating [8–9]

purposeful generation of a carbohydrate- or fat-based food processing solution to provide valid sensory profiling data to determine the feasibility of the solution

Communicating [3–4]

discerning decision making about and fluent use of
- written and visual features to communicate a solution
- language for a technical audience
- grammatically accurate language structures
- referencing and folio conventions

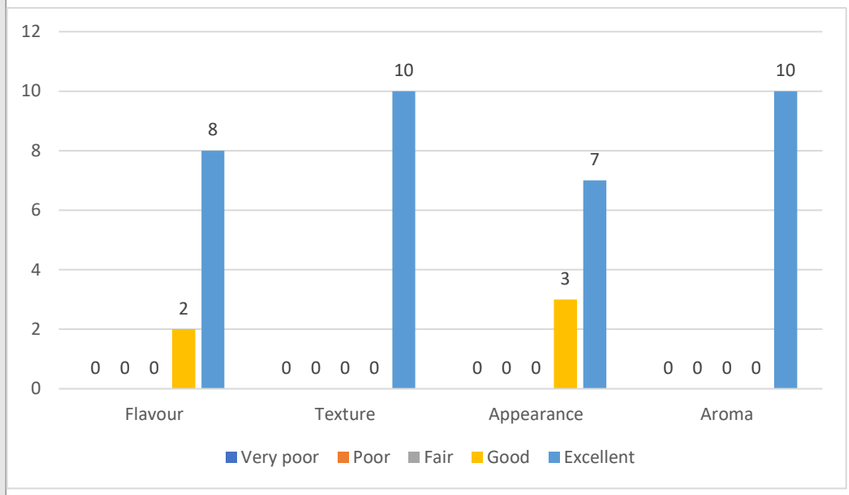
3.0 Generation of proposed solution for the problem and data to determine the feasibility of the solution

3.1 Refinements

Sensory data from initial experimentation indicated that further experimentation would need to occur to develop flavour, texture and aroma and improve consumer satisfaction. Orange zest will be added to the cake slice batter to improve flavour and aroma as per focus group comments. This will further accommodate consumer preference for fruit flavour. Chocolate chips will be added to the cake batter prior to baking to improve the texture. The heat during baking will cause them to soften and melt, creating areas of melted chocolate within the cake. These areas will become firm after cooling and provide a new texture. Whilst the chocolate chips will add variety to the textural properties of the cake, they will also add extra flavour.

3.1.1 Prototype generation – sensory profiling of Proposed Solution: Jaffa cake slice

Data from sensory profiling



Conclusions: This refined prototype was well accepted by the sensory profilers. 100% of profilers rated texture and aroma as 'excellent' and gave improved ratings for flavour (80% excellent) and appearance (70% excellent). Further experimentation with the formulation has been conducted based on sensory data and feedback that 'orange zest' would increase satisfaction with flavour and aroma, and the addition of chocolate chips would improve texture and appearance. Improved sensory data indicates that this prototype would be a suitable solution for the problem and could be further refined to increase consumer satisfaction in flavour and appearance.

Image of Jaffa cake slice

Synthesising, generating and evaluating [8–9]

critical evaluation and discerning refinement of ideas and the generated solution, against self-determined criteria and data, considering impacts and implications of the solution, to make astute recommendations for enhancements, justified by data.

4.0 Evaluation and refinement of ideas and the solution, using self-determined criteria and generated data to recommend and justify enhancements to ideas and the solution to the carbohydrate problem

4.1 Evaluation and refinement using self-determined criteria

The proposed solution: Jaffa cake slice has been selected as the carbohydrate-based snack food solution as it meets the criteria:

Evaluation using self-determined criteria	Recommendations for enhancement
1. The prototype is compatible with the current range. The chocolate and orange Jaffa flavour is different to existing product flavours of berry, date, banana. As the prototype is a cake-slice it complements the existing style of snacks produced by the company.	• The cake slice should be packaged in the same way as the existing carrot cake slice and banana bread thereby using existing technology
2. The prototype has excellent (100%) sensory profiling in texture and aroma. The appearance was rated as excellent by 70% of profilers and good by 30%, and the flavour was rated as excellent by 80% of profilers and good by 20%. Therefore these two aspects require improvement.	• The addition of desiccated or shredded coconut should be used to improve flavour and appearance– see recommendations regarding the Maillard reaction below

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3. The prototype meets the focus group preferences for chocolate and fruit flavour (orange) and the combination of these components provides a new and different flavour for consumers	• This flavour combination could also be trialled as a muffin bar as per focus group request (52%)
4. The prototype meets the criteria of being a cake-like product but is not a muffin-like or scone-based item	• This prototype can be trialled as muffin bar thereby meeting focus group interest in this style of product (52%). A chocolate flavoured scone loaf could also be developed to meet the request for scone-based products (30%)
5. 569kJ per 45g serve is within the energy recommendation for a snack however it is at the upper level of the range and could be reduced	• Use of apple puree could enable the reduction of coconut sugar and a reduction in total kJ. This would be beneficial because the kJ level is on the upper level of the recommended range.
6. The product does not use artificial preservatives thereby adhering to the company ethos but could include a natural preservative if required	• If shelf-stability was an issue, the use of natural preservatives could be investigated in order to prolong the shelf-life of the product e.g. soy lecithin (Bakerpedia, N.D) or tocopherols as an antioxidant
7. The prototype includes a wholegrain component (wholemeal flour) a natural sweetener (coconut sugar) and fresh fruit (orange juice and zest)	• This prototype could be trialled with addition of dried orange pieces to the top of the cake slice to enhance appearance whilst incorporating another fruit product
8. The prototype can be manufactured using the existing equipment (loaf tins, mixers and ovens) that are used to make the carrot cake and banana bread thereby minimising the cost associated with purchasing new equipment	• Using the existing tins, mixers and ovens for the prototype may result in pressure on these resources when required to manufacture existing products. Careful scheduling of production will be required to maximise the use of these resources until such time as the company is able to purchase more equipment.
9. Dextrinization, the Maillard reaction and caramelisation of sugar molecules within the coconut sugar, flour and chocolate creates a golden appearance	• Desiccated coconut could be included in the components. When subjected to dry heat the Maillard reaction would also contribute to browning of the cake and enhanced aroma and appearance.

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