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 assessment objectives.

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:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
<td>4–5</td>
</tr>
<tr>
<td>discerning explanation of food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution.</td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>2–3</td>
</tr>
<tr>
<td>appropriate explanation of food science ideas and a problem related to the processing of a carbohydrate- or fat-based food solution.</td>
<td></td>
</tr>
<tr>
<td>variable recognition and superficial description of the processing, or nutritional, chemical, functional or sensory properties, of carbohydrate- or fat-based food</td>
<td>1</td>
</tr>
<tr>
<td>superficial explanation of food science ideas and a problem related to a carbohydrate- or fat-based food solution.</td>
<td></td>
</tr>
<tr>
<td>does not satisfy any of the descriptors above.</td>
<td>0</td>
</tr>
</tbody>
</table>
## 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 | 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. | 4–5
• 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. | 2–3
• 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. | 1
• 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. | 0
• does not satisfy any of the descriptors above. | 0
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** | 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** | 6–7
• **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.** | 4–5
• **logical synthesis of chemical, functional, sensory and nutritional information and primary and secondary data to develop ideas for a chosen solution** | 2–3
• **effective generation of a carbohydrate- or fat-based food processing solution to provide valid sensory profiling data to determine the feasibility of the solution** | 1
• **reasoned evaluation and effective refinement of ideas and a solution, against self-determined criteria to make effective recommendations for enhancements, justified by data.** | 0
• **simple synthesis of chemical, functional, sensory and nutritional information and primary or secondary data to develop ideas for a chosen solution** | 0
• **adequate generation of a carbohydrate- or fat-based food processing solution to provide relevant sensory profiling data to determine the feasibility of the solution** | 0
• **feasible evaluation and adequate refinement of ideas and a solution, against self-determined criteria to make fundamental recommendations for enhancements, justified by data.** | 0
• **rudimentary synthesis of information and data to develop partial ideas for a chosen solution** | 0
• **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** | 0
• **superficial evaluation and refinement of ideas and a solution against some criteria to make elementary recommendations for enhancements.** | 0
• **unclear combination of information or ideas about a carbohydrate- or fat-based food problem** | 0
• **generation of parts of a solution** | 0
• **identification of a change to idea or solution.** | 0
• **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

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

**Context**

The company Wellness Snack Foods produces a range of snack foods. Consumer research has identified a need for the company to develop a line extension of carbohydrate 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 also values the ethical production of food and has various requirements around ethical production — these requirements are outlined in their company ethos (see stimulus).

**Task**

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

**Sample response**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Allocated marks</th>
<th>Marks awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognising and explaining</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Analysis objectives 1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysing and determining</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Analysis objectives 3, 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthesising, generating and evaluating</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Analysis objectives 5, 6, 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicating</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Analysis objective 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>
1.1.1 Problem
From an analysis of the task context and in the stimulus, the problem identified is the opportunity to develop a carbohydrate-based snack food, that is an extension of the snack foods currently manufactured by the Wellness Snack Foods company.

1.1.2 Stakeholders
Stakeholders are people or groups that have an investment, share, or interest in something. The stakeholders in this problem include Wellness Snack Foods and the target-market consumers, represented by the focus group and sensory profilers.

Wellness Snack Foods, as stakeholders, are investing in the development of a new carbohydrate snack food as an extension to the current range. A prototype solution must different to current products, providing variety within the range for the target market. However, a prototype solution must be compatible with the company ethos. Wellness Snack Foods’ custom or practice is to develop...
snack foods using a range of organic, natural components. The company’s aim is to decrease the amount of highly-refined, processed components within the formulations of their product range, providing nutritious snacks. A minimal increase in manufacturing costs would be incurred if the new carbohydrate snack food could be manufactured in the company’s plant and utilising the current processing technology and equipment, packaging and branding and would make the introduction of the new snack food solution more acceptable. The target-market for Wellness Snack Foods are health-conscious, consumers who are concerned about selecting nutritious, wholesome foods. Although the target consumers want to save money, they perceive value in consuming products that are organically-certified and made with natural ingredients. Research supports that 38% of snack consumers are purchasing healthier snack options and that ‘health’ influences the snack-purchasing of 78% of female consumers (Your Watson, 2017). Predictions of the snack-market suggests a 23% growth within the ‘18-34 year-old’ consumer group and a 48% growth in the over-55 consumer group (Your Watson, 2017).

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

These target market consumers are represented by the focus group and include sensory profilers. The focus group provides qualitative research for food product development and marketing research (ThoughtCo, 2017). This focus group consists of two groups. The first focus group is represented in the focus group marketing report. The second focus group is made up of 10 sensory profilers who will engage in guided discussions about prototype solutions. Members of the focus group have been selected based on their relevance and relationship to the Wellness Snack Food company, current and future stakeholders and the carbohydrate snack food solution to be developed. An advantage, of using the focus group and sensory profilers, is the rapid generation of valid, primary data.

The focus group’s initial feedback in the focus group marketing report for Wellness Snack Foods included recommendations to develop:

- a ‘chocolate product’
- ‘different to current products’
- ‘cake-type product’
- ‘price in line with other products’
- ‘vegan products if possible’.

Further primary data from the focus group will inform the project.

1.1.3 Constraints
The constraints or the restrictions of the problem require a prototype solution to be:

- carbohydrate-based snack food, using organically-certified components. Minimal use of highly-refined components and artificial additives and preservatives;
- a snack food. A snack is defined as small portions of food or drink, consumed as a light meal. It can be packaged in individual serves (QCAA, 2017). Australian nutritional advice suggests that a healthy snack contains between 400 – 600 kilojoules (Australian Healthy Food Guide, 2017) representing 4 – 7% of the daily intake based on an average adult intake of 8700kJ (Mydailyintake.net, 2017);
- minimal preparation or preparation-free for the consumer
- packaged individually
- semi-perishable in packaging
- transportable
- shelf-stable and not require refrigeration
- competitive with other health-conscious snack foods in the market

1.2 Exploration of the chemical and functional properties of carbohydrates and the processing of carbohydrates as related to the problem and solutions
The functional properties of a food are determined by the food’s physical and chemical characteristics. The chemical characteristics or properties of food are components such as enzymes, acids, alkalis, moisture and nutrients, that enable foods to change during processing and storage, whereas the physical characteristics or properties of food are a food’s size, shape, colour, volume, viscosity and elasticity. These chemical and physical properties work together to determine the functional properties of food and how a food may be processed or undergo activities to prepare it for sale (QCAA, 2017).

To explore the problem of developing a carbohydrate snack food and possible solutions, the chemical and functional properties of carbohydrates, processing of carbohydrate foods and their relationship to the problem must be analysed.

The chemical and functional properties of carbohydrates include: leavening, caramelisation, dextrinisation, gelatinisation, crystallisation and nucleation and gelfication.

Leavening is a chemical process used to make baked goods rise by the formation of carbon dioxide, in a batter or dough by using chemical leavening agents such as baking powder or bicarbonate of soda (QCAA, 2017). The process of leavening could be relevant to this problem and solution if formulating a prototype that uses a dough, such as a quick bread, or batter, such as a muffin. Caramelisation is a process used extensively in cooking for the resulting nutty flavour and brown colour (QCAA, 2017). When dry heat is applied to a carbohydrate food, water is removed from the simple carbohydrates or sugars, such as sucrose or glucose. Caramelisation is responsible for the characteristics of baked goods such as golden appearance, desirable aromas and flavours. It would be relevant to the problem and solution if formulating a baked prototype such as a muffin, muesli bar or a biscuit.
Recognising and explaining (4–5)
accurate and discriminating recognition and discerning description of facts and principles related to the processing, and nutritional, chemical, functional and sensory properties of carbohydrates or fat-based food

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

Communicating (3–4)
discerning decision, reasoning, deduct and inductive and visual and written representations to communicate a solution; language for a technical audience; grammatically accurate language structures; referencing and visual aids

Dextrinisation describes a chemical change in starch molecules caused by the breakdown of sugar chains when dry heat is applied. This process causes the formation of dextrins and causes browning to occur. For example, when bread is toasted, dry heat is applied and browning or dextrinisation occurs (QCAA, 2017). The process of dextrinisation could be the relevant to this problem if formulating a prototype that contains starch and is baked, such as a muffin, biscuit or muesli bar.

Gelatinisation is the process where starch and water are subjected to heat, causing the starch granules to swell and water to be gradually absorbed in an irreversible manner (QCAA, 2017). The process of gelatinisation could be the relevant to this problem if formulating a prototype that is baked, such as a fruit-bread, muffin or biscuit or if developing a product that contains a popped-cereal component such as popcorn.

Crystallisation is a separation technique that is used to separate a solid that has dissolved in a liquid and made a solution. For example, if a saturated sugar solution is warmed and then cooled, the solids will come out of the solution (gsescience.com/elf/crystalization.htm) and nucleation, or the initial process of the formation of sugar crystals begins (QCAA, 2017). These processes utilise the properties of simple carbohydrates and are typically used in confectionery production. Crystallisation and nucleation are not suitable processes for the formulation of a solution. These processes are used in the formulation of confectionery and analysis of the focus-group market research indicates that confectionery would not be an acceptable snack-food solution.

Gelification is the process of turning a liquid substance into a gelatinous form, using a gelling agent such as agar-agar, gelatine, carrageenan, gelan gum and methylcellulose (QCAA, 2017). The gelification process is used to stabilise liquids without influencing the flavour of a product. It is also used to suspend food particles, to create various shapes for aesthetic purposes and to vary textures in food products (amazingfoodmadeeasy.com/define/molecular-gastronomy-glossary/what-is/gelification). Examples of food products using the gelification process include gels, jellies, aspics and some confectionery products such as jubes. Gelification may be suitable for the process of the formulation of a solution, analysis of stimulus material, focus-group and market research indicate that while confectionery such as a jube may not be an acceptable snack-food solution, a shelf-stable jelly containing suspended components may not be relevant to the problem and solution.

Food processing techniques used to control the access to and consumability of carbohydrate food sources (QCAA, 2017). The processing of carbohydrates includes the application of heat, dehydrating, addition of additives, and the alteration of the acidity or alkalinity (pH), physical manipulation and the application of cold processes.

Applying heat to a carbohydrate food alters appearance, texture, flavour, palatability and may slow the growth of bacteria and other pathogens (HowFlux, 2017). The application of heat is used in leavening, caramelisation, dextrinisation, gelatinisation, crystallisation and nucleation and gelification, and so this processing technique is relevant to the problem and solution and would be used in a carbohydrate-based, snack-food solution.

Dehydration is a process used to eliminate or control conditions that cause spoilage by drying the moisture from foods (QCAA, 2017). It occurs during the baking process and so would occur during dextrinisation and gelatinisation, and it would be relevant to a baked carbohydrate-based, snack-food solution. As dehydration extends the shelf-life of a food product, it would also be relevant in the development of semi-perishable, carbohydrate-based, snack-food solution.

Additives are substances added to food by manufacturers and are substances not normally consumed alone as an ingredient (QCAA, 2017). Components such as salt, sugar, antioxidants, yeast, baking powder and cream of tartar, are added to food formulations to improve flavour, appearance and extend storage life of a product and preserve flavour. The addition of these ingredients may alter the acidity or alkalinity of a formulation. Additives may be included in the components of food formulations to cause or improve leavening, caramelisation, dextrinisation, gelatinisation, crystallisation and nucleation and gelification.

Physical manipulation refers to mixing, beating or kneading of food components in the processing stage of food production (QCAA, 2017). It would be a processing technique used in a carbohydrate food formulation assisting leavening, gelatinisation, crystallisation and gelification. This process would be relevant to the problem and solution and would be used in a carbohydrate-based, snack-food solution.

The application of cold processing includes chilling or freezing a food to control the growth of bacteria and pathogens, extending the shelf-life of a product (lor.org.uk, 2017). It also alters flavour, palatability, texture and appearance of a product. It is not a suitable processing technique for the problem and solution as it applies to products that are perishable, requiring refrigeration to maintain product integrity and food safety.

1.3 Analysis of the Wellness Snack Foods current line

Wellness Snack Foods’ current line of carbohydrate-based snack foods may be grouped into three categories: vegetable chips, muesli bars and popcorn bars.

<table>
<thead>
<tr>
<th>Category: Vegetable chips</th>
<th>Category: Vegetable chips</th>
<th>Category: Muesli Bar</th>
<th>Category: Muesli Bar</th>
<th>Category: Muesli Bar</th>
<th>Category: Popcorn Bar</th>
<th>Category: Popcorn Bar</th>
</tr>
</thead>
</table>

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IA2 high-level annotated sample response

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Queensland Curriculum & Assessment Authority July 2018
**1.3.1. The chemical and functional properties of carbohydrates used to process the three categories of snack food products currently produced by Wellness Snack Foods.**

**Category 1: Vegetable Chips**
- In Product 1: Sweet Potato Chips and Product 2: Beetroot Chips, the vegetables have been processed by peeling and thinly slicing. The vegetable slices are then processed by deep frying and this application of heat has caused the dehydration and dextrinisation of the starch, developing texture, flavour and colour. The dehydration of the starch in the sweet potato or beetroot and the moisture in the corn kernel has been absorbed as it has gelatinised or popped. The wheat and rice have been ground and manipulated to develop the rice and wheat crisp prior to the formulation of the chip.

**Category 2: Muesli Bars**
- In Product 3: Carob protein Muesli Bar and Product 4: Honey Peanut Muesli Bar, the muesli bar components have been manipulated by mixing and then dry heat has been applied in the baking process. The application of dry heat has caused caramelisation of the simple carbohydrates, such as cane sugar, molasses, and honey, to develop a rich brown colour, aroma and nutty flavour.

**Category 3: Popcorn Bars**
- In Product 5: Peanut and Popcorn Bar and Product 6: Cranberry Popcorn Bar, the application of heat has caused the un-popped corn to swell and the starch wall have burst. Moisture in the corn kernel has been absorbed as it has gelatinised or popped. The application of dry heat has also caused caramelisation of the simple carbohydrates, such as cane sugar and glucose, to develop a rich brown colour, aroma and nutty flavour.

**1.3.2. Packaging of the snack food products currently produced by Wellness Snack Foods.**
- The Wellness Snack Foods’ current product range is packaged in individual serves and sold in boxes of 6 items. The range does not provide customers an opportunity to purchase a variety mix within categories. This may be an opportunity that Wellness Snack Food company could explore in future. It would provide a line extension to current products that would be of no extra cost to production and minimal costs to package and branding.

**1.3.3. Energy value of the snack food products currently produced by Wellness Snack Foods.**
- Products 1, 3, 4 and 5 have been portioned in serving sizes that provide appropriate kilojoule content for a snack food, of between 400-600kj (Australian Healthy Food Guide, 2017). However, Products 2 and 6, contain slightly more kilojoules than the recommendation of between 400-600kj for a snack food.

**1.4 Analysis of competing products available in the market**
- The products selected are current lines of carbohydrate-based snack foods manufactured by competing snack food companies. These snack foods have been grouped into three categories: vegetable chips, bite-sized snacks and muffins.
Analysing and determining [6-7]

Communicating [3-4]

| Ingredients: Cassava, hi oleic sunflower oil, sugar, shallot leaf, salt, sesame seeds. | Ingredients: Taro, canola oil/ sunflower oil, sea salt | Product 3: Chia Coconut Balls | Ingredients: Coconuts, cane sugar, pineapple juice concentrate, chia seeds, sea salt | Product 4: Bliss Bites | Ingredients: Dates, cashews, coconut, apple, cinnamon, natural apple flavour. | Product 5: Chocolate Ginger Muffin | Ingredients: Wheat flour, sugar, soya flour, lucin bran, milk solids, egg powder, raising agents (341, 450, 500), humectant (420), emulsifier (481), wheat gluten, flavour, colour, thickeners (415, 464), colour (160 B), water, canola oil, milk, ginger, copra powder, cane sugar, wheat Bran flour, crystallised ginger, vanilla essence, firming agent (508) |
| Individual package 21g, sold in a bag of 4 individual packets. 21g serve provides 390kJ 4.5% of daily intake* | Individual package 28g, sold in individual packets. 28g serve provides 665kJ 6.6% of daily intake* | Not individual packages, recommended serving size 20g, sold in an 80g box (4 serves) 30g serve provides 753kJ 6.6% of daily intake* | Not individual packages, recommended serving size 20g, sold in an 80g box (4 serves) 20g serve provides 332kJ 3.8% of daily intake* | Individual package 158g, sold in individual packets. 158g serve provides 2380kJ 32% of daily intake* | Individual package 158g, sold in individual packets. 158g serve provides 2380kJ 32% of daily intake* |

Based on a daily intake of 8700kJ (Australian Healthy Food Guide, 2017)

1.4.1. The chemical and functional properties of carbohydrates used to process the three categories of snack food products currently produced by other snack food companies

Category 1: Vegetable Chips

In Product 1: Tropical Chips and Product 2: Taro Chips, the vegetables have been processed by peeling and thinly slicing. The vegetable slices are then processed by deep frying and this application of heat has resulted in the caramelisation of the carbohydrates in the cassava or taro, to produce the characteristic caramelised qualities of nutty-flavour and rich-brown colour. The addition of sugar to the Tropical Chips would increase the caramelisation of this product. During the frying process, dehydration of the starches in the cassava and the taro, has altered the texture, causing the development of a crisp-like texture appropriate for a chip product. These products are vegan, dairy-free and gluten-free.

Category 2: Bite-sized Snacks

In Product 3: Chia Coconut Balls, the components have been processed prior to manipulation by mixing, for example the coconut has been desiccated and dehydrated. The pineapple juice has been processed to become concentrated. After manipulation by mixing, the components are processed by baking and the dry heat promotes caramelisation of the simple carbohydrates, components such as cane sugar and pineapple juice concentrate to develop a rich-brown colour, aroma and nutty flavour.

In Product 3: Bliss Bites, the cashews have been roasted and dehydrated prior to formulation, promoting dextrinisation to brown the starch in the cashew nuts. This dextrinisation develops the crunchy texture of the nuts. The application of dry heat during the roasting process allows the sugars in the cashew nuts to become caramelised. Caramelisation develops the characteristic rich-brown colour, aroma and nutty flavour. The components are then minced during manipulation and mixed. This product is not baked and the overall product has a soft texture. The addition of dates and apple increase the sugar in the formulation and may improve the shelf-life of the Bliss Bites. These products are vegan, dairy-free and gluten-free.

Category 3: Muffins

In Product 5: Chocolate Ginger Muffin and Product 6: Banana and Apricot Muffin, the components have been highly-refined and processed prior to formulation. For example, the wheat flour and maize flour have been dehydrated, desiccated, sifted, bleached and may have been treated with an anticaking agent. The components have been manipulated by mixing and then baked. During this process, the liquid ingredients are absorbed by the starch granules and the starches swell, causing a network of bloated starch granules to form. The starch granules also interact with gluten during the baking process resulting in the breakdown of gluten. The gluten releases water which is absorbed by the starch. It is because of this interaction of the gluten and the starch that these muffins don’t collapse when removed from the oven, as the process causes the gluten set and become rigid (Bakeinfo.co.nz, 2017).

The components include additives such as raising agents. The raising agents interact with the simple sugars in the carbohydrates causing the development of carbon dioxide resulting in the leavening of the batter. The addition of raising agents can also tenderise the muffin as it weakens the gluten network resulting in a finer crumb.

The application of this heat has caused the starch to dehydrate and dextrinise developing texture, colour and flavour and promoted the caramelisation of the simple carbohydrate components of cane sugar and glucose, to develop a rich-brown colour, aroma and nutty flavour.
These products are not vegan or dairy-free as they contain milk solids. Product 5: Chocolate Ginger muffin is not gluten-free, however, Product 6: Banana Apricot Muffin is gluten-free.

1.4.2 Packaging of the snack food products currently produced by other snack food companies.

These products are produced by a range of different snack food companies and have been packaged differently and serving sizes vary.

Product 1: Tropical Chips: individual packaging of 21g, sold in a bag of 4 individual packets.
Product 2: Taro Chips: individual packaging of 28g, sold as individual packets.
Product 3: Chia Coconut Balls: individual packaging of 30g, sold in a box of 4 individual packets.
Product 4: Bliss Bites: not individual packages, recommended serving size 20g, sold in an 80g box, contains 4 serves.
Product 5: Chocolate Ginger Muffin and Product 6: Banana and Apricot Muffin: individual package 158g, sold as individual packets.

The packaging of Products 1, 2, 3, 5 and 6 are individual and allow the product to be semi-perishable within its packaging. However, Product 4 does not come in individual serves and may become perishable during storage after the box has been opened.

1.4.3 Energy value of the snack food products currently produced by other snack food companies.

Product 1 has been portioned in serving sizes that provide appropriate kilojoule content for a snack food, of between 400-600kJ (Australian Healthy Food Guide, 2017). However, Products 2 and 3, contain slightly more kilojoules than the recommendation of between 400-600kJ for a snack food and the serving sizes of Products 5 and 6 are too large and contain above the recommended kilojoule content for a snack food at 2380kJ and 1440kJ per serve. Product 4 is not portioned for an individual serve and allows for overconsumption of kilojoules by unwary consumers, as the package contains 4 serves.

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

<table>
<thead>
<tr>
<th>Solution requirements</th>
<th>Self-determined criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop an ethical carbohydrate snack food line extension, using natural and organic (sustainable and pesticide free) components, with limited use of processing techniques.</td>
<td>Carbohydrate-based, snack food line-extension should:</td>
</tr>
<tr>
<td>The prototype solution must be single serve, easily transported, preparation-free, refrigeration-free but semi-perishable within packaging.</td>
<td>processed using the chemical and functional properties of carbohydrates formulated using quality, natural, organic ingredients, packaged in single serve, easily transported preparation-free refrigeration-free semi-perishable with appropriate shelf life.</td>
</tr>
<tr>
<td>The company currently produces products of high freshness, safety, taste and appearance with no artificial food preservatives, sustainable and pesticide-free. As a line extension, the solution would also need to maintain high freshness, be safe, flavoursome and appetising appearance. The prototype solution should not contain any artificial preservatives.</td>
<td>comply with recommendation for the nutritional value and serving size for a snack food free of highly-refined, processed components and artificial preservatives.</td>
</tr>
<tr>
<td>The range currently includes only gluten-free vegetable chip products and this could be an opportunity to extend the gluten-free range of products available.</td>
<td>Additional considerations</td>
</tr>
<tr>
<td>As a line extension, the prototype solution must be consistent with the current products by using organic, natural ingredients, with a limited use of highly-refined, processed ingredients.</td>
<td>Carbohydrate-based, snack food line-extension could be:</td>
</tr>
<tr>
<td>The formulation of the prototype solution must use the chemical and functional properties of carbohydrate and use appropriate processes for carbohydrate foods.</td>
<td>• gluten-free</td>
</tr>
<tr>
<td>A minimal increase in manufacturing costs would be incurred if the new carbohydrate snack food could be manufactured in the company’s plant and utilising the current processing technology and equipment, packaging and branding and would make the introduction of the new snack food solution more acceptable.</td>
<td>• manufactured utilising the company’s current processing technology and equipment, packaging and branding, to minimise costs and maximise profit.</td>
</tr>
<tr>
<td>The solution must consider the focus group feedback such as a chocolate product, different to current products, cake type product, price in line with other products and keep to the vegan products if possible.</td>
<td></td>
</tr>
</tbody>
</table>
2 Developing ideas

2.1 Synthesis of food and nutrition information and data to develop ideas for alternative solutions

The development of ideas for alternative solutions is supported by information and data presented in Section 1. The problem, stakeholder needs, constraints, chemical and functional properties of carbohydrates, techniques used to process carbohydrates, and the analysis of the Wellness Snack Foods current line and other manufacturers competing products were synthesised in Section 1.1 to determine the solution requirements and self-determined criteria.

In section 1.1, the problem was identified as the opportunity to develop a carbohydrate-based snack food that is an extension of the snack foods currently manufactured by the Wellness Snack Foods company. The needs of the stakeholders, Wellness Snack Foods and the target market consumers were explored. The target market consumers are represented by the focus group and sensory profiling, selected based on their relevance and relationship to the Wellness Snack Foods company, current and future stakeholders and the carbohydrate snack food solution to be developed.

Constraints for the development of a carbohydrate-based snack food solution such as using organically certified components, minimal use of highly refined components and artificial additives and preservatives, packaged in individual portion sizes providing between 400 – 600kJ per serve, semi-perishable in packaging, not require refrigeration, minimal preparation or preparation-free for the consumer, have been considered.

Section 1.1 identified that the prototyped solution must be competitive with other health-conscious snack foods in the market.

It was determined that the processes including application of heat by baking or roasting, dehydration, use of additives, physical manipulation and the change of pH through the addition of acids or alkalines, were used in the Wellness Snack Foods' and competing manufacturers' current lines. These current lines were processed to utilise the chemical and functional properties of carbohydrates to leaven, caramelise, dextrinise, gelatinise. Crystallisation and nucleation and gelification were not used in Wellness Snack Foods or competing manufacturers' current lines. In Section 1.1.2 it was identified that manufacturing costs could be minimal if the new carbohydrate snack food could be manufactured using existing processing technology and equipment, packaging and branding therefore utilising the current processing techniques would be important the development of the proposed solution.

2.2 Alternative solutions to determine a proposed solution

Initial feedback from the focus group recommended the formulation of products such as: ‘a chocolate product’, ‘different to current products’, ‘cake-type product’, ‘price in line with other products’ and ‘vegan products if possible’. Ideas for products need to be developed for further primary data from the focus group to occur.

Based on the exploration of the problem, in Section 1, the proposed ideas for a carbohydrate-based snack food are:

Possible solution 1: Crackled Tahini Biscuits
Possible solution 2: Nutty Chickpea Cakes
Possible solution 3: Seed and Nut Bar
Possible solution 4: Coconut Coriander Rice Ball
Possible solution 5: Carob Muffin

An analysis of these possible solutions is presented in the table below.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Crackled Tahini Biscuits</th>
<th>Nutty Chickpea Cakes</th>
<th>Seed and Nut Bar</th>
<th>Coconut Coriander Rice Ball</th>
<th>Carob Muffin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td>Vegan formulation</td>
<td>Vegetarian formulation</td>
<td>Vegan formulation</td>
<td>Vegan formulation</td>
<td>Vegan formulation</td>
</tr>
<tr>
<td></td>
<td>Components include: nuts, coconut, coconut oil, honey and tahini</td>
<td>Components include: chickpeas and fresh herbs, egg, wholemeal flour and assorted nuts</td>
<td>Components include: nuts and seeds with honey, vanilla and macadamia oil</td>
<td>Components include: rice, fresh coriander and shallots, coconut and coconut oil peanut butter and soy</td>
<td></td>
</tr>
</tbody>
</table>

Food & Nutrition 2019 v1.1
IA2 high-level annotated sample response
Queensland Curriculum & Assessment Authority
July 2018
## Processing

| Processing | All ingredients manipulated by mixing, physically shaped and then baked to utilise dextrinisation and caramelisation to develop colour, flavour, texture and aroma. | Most ingredients are minced or processed then physically manipulated by mixing then shaped into balls, and baked to utilise gelatinisation to develop structure, dextrinisation and caramelisation to develop colour, flavour, texture and aroma. | Nuts and seeds partially crushed in a processor, physically manipulated by mixing with other dry ingredients. Liquid ingredients are heated then physically manipulated by pressing into tray and then baked to utilise gelatinisation to develop the product structure, dextrinisation and caramelisation to develop colour, flavour, texture and aroma. | Rice is refined and processed prior to the application of moist heat to steam the rice and cause gelatinisation. In doing so, the coconut is toasted causing the starch in the coconut to become dextrinised. This occurs by the application of heat to the product and this impacts in the structure of the product, influencing the texture. Dextrinisation and caramelisation would positively impact on the release, texture, aroma and appearance of the product. The components are physically manipulated to be mixed and then rolled. Requires refrigeration and is not applicable in other forms to produce commercially due to the types of ingredients. Formulation may be refined for commercial processing. Wellness Snack Foods do have products that are manufactured using these processes. This solution may be implemented with minimal financial outlay as no specialist equipment would need to be purchased. | Components such as: margarine, flour, sugar, and carob are refined and desiccated prior to processing the formulation. Margarine and sugar are physically manipulating by mixing, then liquid and dry ingredients are physically manipulated as they are folded into the batter. The batter is placed in trays and baked. During the baking process gelatinisation occurs as the liquid ingredients are absorbed by the starch in the flour. This develops the structure of the muffin. The application of dry heat also causes dextrinisation of the starch and caramelisation of the sugars to develop the characteristic colours, flavour, texture and aroma of a baked good. |

<table>
<thead>
<tr>
<th>Healthy Snack Food Criteria</th>
<th>Nutritive value per portion size</th>
<th>Percentage of daily intake *, based on an intake of 8700kj (Australian Healthy Food Guide, 2017)</th>
<th>658kj per 35g serve (2 biscuits)</th>
<th>6.4% of daily intake*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>365kj per 50g serve (2 cakes)</td>
<td>4.2% of daily intake*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>669kj per 30g serve (1 bar)</td>
<td>7.7% of daily intake*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>350kj per 40g serve (2 balls)</td>
<td>5.7% of daily intake*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>820kj per 160g serve (1 muffin)</td>
<td>9.5% of daily intake*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This meets the recommended goal of between 400-600kj per serve of snack food.</td>
<td>This is slightly higher than the recommendations of between 400-600kj per serve of snack food.</td>
<td>This meets the recommended goal of between 400-600kj per serve of snack food.</td>
<td>This is significantly higher than the recommendations of between 400-600kj per serve of snack food.</td>
</tr>
</tbody>
</table>

Based on the analysis of the ideas, the formulations for Possible solution 1: Crackled Tahini Biscuits, Possible solution 2: Nutty Chickpea Cakes, Possible solution 3: Seed and Nut Bar and Possible solution 5: Carob Muffin, will be experimented to develop data for alternative solutions. Experiments will not be conducted on Possible solution 4: Coconut Coriander Rice Ball as the product requires refrigeration and does not meet the constraints of the problem.
2.3 Primary experimental data about alternative solutions

2.3.1 Food experimentation – sensory profiling of Crackled Tahini Biscuits

Data from sensory profiling

<table>
<thead>
<tr>
<th>Flavour</th>
<th>Textured</th>
<th>Appearance</th>
<th>Aroma</th>
</tr>
</thead>
<tbody>
<tr>
<td>tahini craddle biscuits</td>
<td>tahini craddle biscuits</td>
<td>tahini craddle biscuits</td>
<td>tahini craddle biscuits</td>
</tr>
<tr>
<td>no. of profilers</td>
<td>no. of profilers</td>
<td>no. of profilers</td>
<td>no. of profilers</td>
</tr>
<tr>
<td>very good</td>
<td>good</td>
<td>fair</td>
<td>bad</td>
</tr>
<tr>
<td>2.5</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
<td>0</td>
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<tr>
<td>1</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Conclusions:

While this prototype was well received by the sensory profilers, the formulation would require further refinement as 40% of the profilers commented that the texture was too dry. Further experimentation with the ratio of liquid to dry ingredients or cooking time is needed to improve the moisture content. The sweetness of this formulation was also commented on as the idea of a biscuit led profilers to think it would be a sweet snack product. However, 100% of profilers were satisfied with the flavour of the product. Ninety percent of profilers found the aroma and appearance appetising.

This prototype in its current formulation, although acceptable to profilers, would require considerable refinement to be proposed as a possible solution.

2.3.2 Food experimentation – sensory profiling of Nutty Chickpea Cakes

Data from sensory profiling

<table>
<thead>
<tr>
<th>Flavour</th>
<th>Texture</th>
<th>Appearance</th>
<th>Aroma</th>
</tr>
</thead>
<tbody>
<tr>
<td>nutty chickpea cakes</td>
<td>nutty chickpea cakes</td>
<td>nutty chickpea biscuits</td>
<td>nutty chickpea biscuits</td>
</tr>
<tr>
<td>no. of profilers</td>
<td>no. of profilers</td>
<td>no. of profilers</td>
<td>no. of profilers</td>
</tr>
<tr>
<td>very good</td>
<td>good</td>
<td>fair</td>
<td>bad</td>
</tr>
<tr>
<td>3.5</td>
<td>3</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2.5</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>2.5</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

This prototype in its current formulation, although acceptable to profilers, would require considerable refinement to be proposed as a possible solution.
Conclusions:
This prototype was not well received by the sensory profiling group. Sixty percent of profilers rated the flavour and appearance of this product as ‘poor’ or ‘very poor’, suggesting that the taste was not ‘acceptable’. The prototype was a savoury product and profilers commented that the name of ‘cake’ led them to believe it would be a sweet snack food. Sixty percent of profilers rated the texture as ‘poor’, commenting that it was ‘too dry’ and ‘too crumbly’. While there was a range of ratings and comments about the prototype’s aroma ranging from ‘very poor’ to ‘excellent’, 60% of profilers rated the aroma as ‘poor’. It must be noted that when sampled by 40% of profilers just after cooking, the product rated positively in flavour, texture, aroma, and appearance. Concluding that the quality of this prototype deteriorates after cooling and that this product’s shelf life is limited.

In the current formulation, this would not be a suitable prototype for the solution. The formulation would need considerable refinement before proposing for the solution.

### 2.1.1 Food experimentation – sensory profiling of Seed and Nut Bar

#### Data from sensory profiling

<table>
<thead>
<tr>
<th>Flavour</th>
<th>Texture</th>
<th>Aroma</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="seed_and_nut_bar_flavour.png" alt="Flavour Graph" /></td>
<td><img src="seed_and_nut_bar_texture.png" alt="Texture Graph" /></td>
<td><img src="seed_and_nut_bar_aroma.png" alt="Aroma Graph" /></td>
<td><img src="seed_and_nut_bar_appearance.png" alt="Appearance Graph" /></td>
</tr>
</tbody>
</table>

#### Conclusions:
This solution was the most well accepted by the panel of samplers. One hundred percent of profilers rated ‘excellent’ for texture, ‘good’ and ‘excellent’ for flavour and appearance. Aroma was rated ‘fair’ by 10% of profilers, while 50% of profilers rated the aroma ‘poor’ or ‘excellent’. Profilers feedback indicated that ‘no improvements were necessary’. 20% of profilers suggested that adding a ‘more crunchy texture’ would increase satisfaction with texture. Further experimentation could occur with the formulation to develop a crunchier texture. Profilers commented favourably that this prototype was ‘gluten-free’ and ‘vegan’.

This prototype would be a suitable solution for the problem and may involve further refinement to increase consumer satisfaction.
2.1.2 Food experimentation – sensory profiling of Carob Muffin

Data from sensory profiling

<table>
<thead>
<tr>
<th>Flavour</th>
<th>Texture</th>
<th>Aroma0</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>carob muffin</td>
<td>carob muffin</td>
<td>carob muffin</td>
<td>carob muffin</td>
</tr>
<tr>
<td>Flavour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>very poor</td>
<td>poor</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Textre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor</td>
<td>fair</td>
<td>good</td>
<td>excellent</td>
</tr>
<tr>
<td>Aroma0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>very poor</td>
<td>poor</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Appearance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor</td>
<td>fair</td>
<td>good</td>
<td>excellent</td>
</tr>
</tbody>
</table>

Conclusions:

Fifty percent of profilers rated the flavour of this product as ‘poor’ or ‘very poor’. These profilers commented that the product was ‘flavourless’ and ‘not sweet enough for a muffin’. Further experimentation would need to consider the addition of components such as sugar, banana, carrot and sultanas. The addition of moist components like banana or carrot would affect the shelf life of the product. Another idea could be to remove margarine form the components and add coconut oil. This is a would give the formulation a moist texture and improve mouthfeel. However, further experimentation and research would need to occur to determine the shelf life of the prototype and determine the rate of rancidity of the coconut oil. Although 10% of profilers suggested an icing or frosting, the addition of this would increase the kilojoule value of the snack and impact on the shelf life of the product. Sixty percent of profilers rated the aroma of the muffin as ‘fair’ or ‘good’ and 60% rated the appearance of the muffin as ‘fair’, ‘good’ or ‘excellent’.

This product, in the current formulation, would need further experimentation to be acceptable as the solution.

2.3.5 The proposed solution for generation

Based on the development of ideas in Section 2, the proposed solution for a carbohydrate-based snack food is Possible solution 3: Seed and Nut Bar. This prototype has been selected as the proposed carbohydrate-based snack food solution as it complies with the design brief and the self-determined as outlined in section 1.5. However, the proposed solution does not comply with the recommendation for the nutritive value and serving size for a snack food. As it contains 669kj per 30g serve (1 bar) or 7.7% of daily intake based on an average adult intake of 8700kJ (Australian Healthy Food Guide, 2017), it is 10% higher than the recommendations of between 400-600kj per serve of snack food. The decision to generate the proposed solution to determine feasibility has been determined by the acceptance of the second focus group and the analysis of the proposed solution using the self-determined criteria...
3 Generation of proposed solution for the problem and data to determine the feasibility of the solution

It was determined in Section 2.3.3 that further experimentation would need to occur to develop a crunchier texture and improve consumer satisfaction. The formulation will be altered in experimentation to develop a crunchier texture. Half of the nut and seed components will be processed by crushing, leaving the remaining nuts and seeds will not be crushed. The aim is to provide variety in the size and shape of the seeds and nuts, thereby producing a prototype with a crunchier texture.

3.1 Prototype generation – sensory profiling of Proposed Solution: Seed and Nut Bar

3.2 Data from sensory profiling

<table>
<thead>
<tr>
<th></th>
<th>Flavour</th>
<th>Texture</th>
<th>Appearance</th>
<th>Aroma</th>
</tr>
</thead>
<tbody>
<tr>
<td>seed and nut bar</td>
<td><img src="image" alt="Flavour graph" /></td>
<td><img src="image" alt="Texture graph" /></td>
<td><img src="image" alt="Appearance graph" /></td>
<td><img src="image" alt="Aroma graph" /></td>
</tr>
</tbody>
</table>

**Conclusions:**
This solution was well accepted by the sensory profilers. All profilers rated ‘excellent’ for texture, ‘good’ and ‘excellent’ for flavour and appearance. Further experimentation with the formulation has been conducted based on profilers’ feedback for more crunchy texture. This solution was well accepted at a consumer satisfaction rate of 78%. The Aroma was rated excellent by 100% of the profilers. This prototype would be a suitable solution for the problem and may involve further refinement to increase consumer satisfaction.

4 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 protein problem

4.1 Evaluation using self-determined criteria

The proposed solution: Seed and Nut Bar, has been selected as the carbohydrate-based snack food solution as it addresses the criteria which is:

- formulated using unique natural organic ingredients
- packaged in single 30g serve
- preparation-free
- refrigeration-free
- semi-perishable with 2 weeks shelf life in plastic packaging
- processed using the chemical and functional properties of carbohydrates, as analysed in Section 2.2. Gelatinisation, caramelisation and dextrinisation are utilised to develop structure, flavour, colour and aroma in this prototype.

This prototype would be a suitable solution for the problem and may involve further refinement to increase consumer satisfaction.
• Foods, flavoursome and appetising in appearance.
• Free of highly-refined, processed components and artificial preservatives.

Although Wellness Snack Foods does have other ‘bar’ products in the current range, the Seed and Nut Bar is a line extension that offers difference to the range as it is:
• Gluten-free
• Vegan

Manufactured utilising the company’s current processing technology and equipment, packaging and branding, to minimise costs and maximise profit.

However, the solution does not comply with recommendation for the nutritive value and serving size for a snack food. As it contains 669kJ per 30g serve (1 bar) or 7.7% of daily intake based on an average adult intake of 8700kJ (Australian Healthy Food Guide, 2017), it is 10% higher than the recommendations of between 400-600kJ per serve of snack food.

4.2 Refinements of ideas and solution

The proposed solution could be further refined to improve the kilojoule content and meet the recommendation for a snack food to have between 400-600kJ per serve. The portion size could be reduced to a 25g serve and this would reduce the kilojoule content to 557kJ or 6.4% of daily intake. Alternatively, the components in the formulation could be altered to lower the kilojoule content of the prototype without altering the 30g serving size. For instance, the addition of popcorn and reduction of nuts will lower the kilojoule content without significantly altering the flavour, texture or appearance of the bar.

References