

Food & Nutrition 2019 v1.1

IA3 high-level annotated sample response

August 2018

Project — folio (30%)

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 the food formulation process
2. explain ideas and a problem related to food formulation for a nutrition consumer market
3. analyse a problem, information and data related to a specific nutrition consumer market
4. determine solution requirements and self-determined criteria for a selected nutrition consumer market problem
5. synthesise information and data to develop ideas for a solution related to a selected nutrition consumer market problem
6. generate a nutrition consumer market 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
8. make decisions about and use mode-appropriate features, language and conventions for particular purposes and contexts.

Instrument-specific marking guide (ISMG)

Criterion: Recognising and explaining

Assessment objectives

1. recognise and describe facts and principles related to the food formulation process
2. explain ideas and a problem related to food formulation for a nutrition consumer market

The student work has the following characteristics:	Marks
<ul style="list-style-type: none">• accurate and discriminating recognition and discerning description of facts and principles related to the food formulation process and a specific nutrition consumer market• discerning explanation of food science ideas and a problem related to the nutrition consumer market.	6–7
<ul style="list-style-type: none">• accurate recognition and effective description of facts and principles related to the food formulation process and a specific nutrition consumer market• effective explanation of food science ideas and a problem related to a specific nutrition consumer market.	4–5
<ul style="list-style-type: none">• appropriate recognition and description of facts and principles related to the food formulation process and a specific nutrition consumer market• appropriate explanation of food science ideas and a problem related to a specific nutrition consumer market.	2–3
<ul style="list-style-type: none">• variable recognition and superficial description of the food formulation process related to a nutrition consumer market• superficial explanation of food science ideas and a problem related to a nutrition consumer market.	1
<ul style="list-style-type: none">• does not satisfy any of the descriptors above.	0

Criterion: Analysing and determining

Assessment objectives

3. analyse a problem, information and data related to a specific nutrition consumer market
4. determine solution requirements and self-determined criteria for a selected nutrition consumer market problem

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> • insightful analysis of a relevant problem, information and data related to a specific nutrition consumer market to identify essential characteristics and constraints • astute determination of <ul style="list-style-type: none"> – essential solution requirements from the brief – self-determined criteria that include the relevant impacts and implications of, and the quality, functionality and reliability indicators for, a selected problem that affects a nutrition consumer market. 	8–9
<ul style="list-style-type: none"> • considered analysis of a relevant problem, information and data related to a specific nutrition consumer market to identify essential characteristics and constraints • logical determination of <ul style="list-style-type: none"> – effective solution requirements from the brief – self-determined criteria that include the relevant impacts and implications of, and the quality, functionality and reliability indicators for, a selected problem that affects a nutrition consumer market. 	6–7
<ul style="list-style-type: none"> • appropriate analysis of a problem, information and data related to a specific nutrition consumer market to identify some characteristics and constraints • reasonable determination of some <ul style="list-style-type: none"> – solution requirements in the brief – self-determined criteria that include impacts and implications of, and the quality, functionality and reliability indicators for, a selected problem that affects a nutrition consumer market. 	4–5
<ul style="list-style-type: none"> • superficial analysis of a problem and information or data related to a specific nutrition consumer market to identify some characteristics or constraints • vague determination of some <ul style="list-style-type: none"> – solution requirements from the brief – self-determined criteria that include some of the impacts and implications of, and the quality, functionality or reliability indicators for, a selected problem that affects a nutrition consumer market. 	2–3
<ul style="list-style-type: none"> • description of a problem or information related to a nutrition consumer market • identification of a criterion for the consumer market. 	1
<ul style="list-style-type: none"> • does not satisfy any of the descriptors above. 	0

Criterion: Synthesising, generating and evaluating

Assessment objectives

5. synthesise information and data to develop ideas for a solution related to a selected nutrition consumer market problem
6. generate a nutrition consumer market 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

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> • <u>coherent and logical synthesis of chemical, functional and nutritional information, and a range of primary and secondary data to develop ideas for a chosen solution</u> • <u>purposeful generation of a nutrition consumer market solution to provide valid sensory profiling data to determine the feasibility of the solution</u> • <u>critical evaluation and discerning refinement of ideas and a solution, against self-determined criteria, to make astute recommendations for enhancements, justified by data.</u> 	9–10
<ul style="list-style-type: none"> • <u>logical</u> synthesis of chemical, functional and nutritional information, and primary and secondary data to develop ideas for a chosen solution • <u>effective</u> generation of a nutrition consumer market solution to provide valid sensory profiling data to determine the feasibility of the solution • <u>reasoned</u> evaluation and effective refinement of ideas and the generated solution, against self-determined criteria, to make effective recommendations for enhancements, justified by data. 	7–8
<ul style="list-style-type: none"> • <u>simple</u> synthesis of chemical, functional and nutritional information, and primary or secondary data to develop ideas for a chosen solution • <u>adequate</u> generation of a nutrition consumer market solution to provide <u>relevant</u> sensory profiling data to determine the feasibility of the solution • <u>feasible</u> evaluation and adequate refinement of ideas and a solution, against self-determined criteria, to make <u>fundamental</u> recommendations for enhancements, justified by data. 	5–6
<ul style="list-style-type: none"> • <u>rudimentary</u> synthesis of chemical, functional and nutritional information, and primary or secondary data to develop ideas for a chosen solution • <u>partial</u> generation of a nutrition consumer market solution to provide <u>some</u> sensory profiling data to determine the feasibility of the solution • <u>superficial</u> evaluation and refinement of ideas and a solution, against some criteria, to make <u>elementary</u> recommendations for enhancements. 	3–4
<ul style="list-style-type: none"> • <u>unclear</u> combination of information or ideas about a nutrition consumer problem • generation of parts of a solution • identification of a change to an idea or solution. 	1–2
<ul style="list-style-type: none"> • does not satisfy any of the descriptors above. 	0

Criterion: Communicating

Assessment objectives

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
<ul style="list-style-type: none">discerning decision-making about and fluent use of<ul style="list-style-type: none">written and visual (if appropriate) features to communicate about a solutionlanguage for a technical audiencegrammatically accurate language structures.referencing and folio conventions	3–4
<ul style="list-style-type: none">variable decision-making about and inconsistent use of<ul style="list-style-type: none">written and visual (if appropriate) featuressuitable languagegrammar and language structuresreferencing or folio conventions	1–2
<ul style="list-style-type: none">does not satisfy any of the descriptors above.	0

Task

Context
<p>Reformulating existing food products to improve the nutritional quality of food solutions presents significant challenges to food manufacturing companies wanting to increase market share. Maintaining desirable sensory properties and maintaining shelf life are already difficult enough that manufacturers are reluctant to change formulations fearing loss of market share. However, food formulations containing high-risk components, such as salt, sugar, saturated and trans fats, and low dietary fibre can have health impacts on consumers.</p> <p>During this Unit, we have explored food formulations and reformulations which can contribute to solutions for different nutrition consumer markets to support health, decrease chronic disease and sustain sensory properties. Some of the nutrition consumer markets include:</p> <ul style="list-style-type: none"> • elderly • health-conscious • allergic or food-intolerant • chronically ill.
Task
<p>Using the provided stimulus, identify a nutrition consumer market problem and develop a food formulation or reformulation solution for this market. Document the problem-solving process using written and visual modes of communication.</p>

Sample response

Criterion	Marks allocated	Result
Recognising and explaining Assessment objectives 1 & 2	7	7
Analysing and determining Assessment objectives 3 & 4	9	9
Synthesising, generating and evaluating Assessment objectives 5,6 & 7	10	10
Communicating Assessment objective 8	4	4
Total	30	30

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

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Explore the problem

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

This project will be exploring a food-intolerant consumer market, specifically consumers who are lactose-intolerant. Consumers who characterise the allergic or food-intolerant consumer market may identify as consumers from a range of other nutrition consumer markets. As the need for calcium is a common nutritional requirement to all consumers within the nutrition consumer markets ("Nutritionaustralia.org, 2017)), a high-calcium, lactose-free food solution will be investigated. Current research supports the consumption of products containing probiotics for improved gut health (Hill et al., 2017). A solution for a high-calcium, lactose-free, probiotic solution such as a cultured yoghurt will be explored.

Stakeholder analysis

The stakeholders, or people or groups that have an interest in this problem, include consumers who are lactose intolerant but may also identify with other nutrition consumer markets. The target market for a lactose-free yoghurt are food-intolerant consumers who may also be health-conscious consumers or fit into another consumer market as well such as the elderly, fitness-focused, pregnant or chronically-ill markets. However, the target-market for a non-dairy yoghurt include consumers from other nutrition markets, e.g. elderly consumers, health-conscious, pregnant and may also include vegan consumers. The identified consumer markets share a common concern about selecting nutritious foods to maintain and promote good health.

Lactose intolerance is an impaired ability to digest lactose, a sugar found in milk and other dairy products. Lactose is normally broken down by an enzyme called lactase, which is produced by cells in the lining of the small intestine (Reference, 2017.) Enzyme deficiencies which some consumers may develop can cause inability to digest, absorb or deal with some foods, such as a deficiency of the enzyme lactase results in lactose intolerance. These consumers are therefore unable to consume certain food due to negative reactions to the food source (Reference, 2017). While food intolerances may be unpleasant, they may impact the immune system and are generally not harmful beyond uncomfortable symptoms. Commonly confused as the symptoms of food intolerance occasionally resemble those of food allergy. However, food intolerance does not involve the immune system. It does not cause severe allergic reactions (known as anaphylaxis) and does not show on allergy testing. Reference, 2017).

Lactose intolerance can result from a natural physiological phenomenon. Lactose is digested by humans using an enzyme called lactase. Lactase production decreases from infancy until adulthood and may lead to a deficiency of lactase production in the body. It is estimated that only one in 20 Caucasians have some degree of lactose intolerance. Lactose intolerance is more common among Australian Aborigines and people from Asia, Africa, the Middle East and some Mediterranean countries (Nutrition Australia 2011). Research supports that those who are lactose intolerant can damage their intestinal tract by continuing to eat lactose rich foods (Foodsmatter.com, 2017)

The number of Australians who are lactose intolerant increased to 1.7% of men and 6.2% of women (Ryan, 2017). Women aged 25-49 are mostly likely to be lactose intolerance. According to Australian Government health statistics, people with lactose intolerance are 72% more likely to get osteoporosis, 212% more likely to be vitamin deficient and 421% more likely to suffer from digestive problems. Recent studies support that certain strains of probiotics or bacteria may have positive effects on conditions related to gut bacteria (Round and Mazmanian, 2017).

Fermented food products such as yoghurt, contain live bacteria, are claimed to provide numerous health benefits to consumers and are most beneficial consumed as a food (nutraingredients.com, 2017). Foods containing probiotics are mostly available as yoghurts and fermented dairy drinks; however, non-dairy probiotic foods have been identified as an emerging market (nutraingredients.com, 2017).

A focus group will be selected from consumers who are lactose-intolerant. These candidates will be interviewed for primary data regarding their experiences as food-intolerant consumers. The members of the focus group will also act as sensory profilers to test and provide feedback for prototypes. The prototype solution must have consumer acceptance and provide a solution that improves the availability and variety of products for the stakeholders.

Primary data collected from focus group research has identified that lactose-free food products available, such as dairy-based, lactose-free yoghurts and dairy-free yoghurts, are not acceptable due to both 'poor mouth-feel' characterised by a 'watery consistency' and 'lacking a creamy texture' and 'unacceptable flavour' characterised by a 'bitter' or 'lingering aftertaste'.

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

Yoghurt is a food which can be consumed throughout the day as a snack or can be the base of meals. Yoghurt is produced by the fermentation of milk-specific microorganisms, which remain active and plentiful in the product (Agostoni, 2011). Yoghurt is widely recognised as a healthy food. Manufacturers have responded to the growth in yoghurt consumption by introducing many different types of yoghurt, including low-fat and no-fat, creamy, drinking, bio-yoghurt, organic, baby, fruit, and frozen. However, the basic components and manufacturing are essentially consistent (Dairyconsultant.co.uk, 2017). Lactose-free products currently available in the market will need to be investigated.

Constraints

The constraints of the problem require a prototype solution to be:

- a non-dairy probiotic yoghurt, not containing lactose
- high in calcium and phosphorus

Recognising and explaining [6–7]

discerning explanation of food science ideas and a problem related to the nutrition consumer market

Communicating (3-4)

discerning decision-making about and fluent use of

- language for a technical audience
- grammatically accurate language structures

Recognising and explaining [6–7]

accurate and discriminating recognition and discerning description of facts and principles related to the food formulation process and a specific nutrition consumer market

Recognising and explaining [6–7]

discerning explanation of food science ideas and a problem related to the nutrition consumer market

- consumer accepted in flavour and mouth-feel
- nutritionally competitive with other yoghurt type products on the market
- free or minimal in use of artificial additives and preservatives.

Exploration of the chemical and functional properties of protein foods

To explore the problem of developing lactose-free yoghurt solutions, the chemical and functional properties of alternative milk products and their relationship to the problem must be analysed.

The chemical and functional properties of alternative milk products, high in protein, include:

- Denaturation, which is the permanent change in the structure of protein. It occurs when the bonds holding the helix shape are broken and the strands of the helix separate and unravel. Denaturation is useful in food preparation, e.g. in yoghurt making milk is heated to 43°C to denature the milk proteins and then stored in a warm, insulated environment for 12 hours to allow for the development of lactic acid (Stonesoup, 2017)).
- Coagulation, which occurs when denatured protein separates from other nutrients and solidify or semi-solidify; causing the protein structure to create a network and trap liquid, which will form a gel. Coagulation by acid, enzymes, salt or heat can all result in a thickening or setting of the protein source, e.g. yoghurt is produced by the fermentation of lactose by starter bacteria, which develops a lactic acid to coagulate milk proteins. (Lucey & Singh, 2017)

The chemical and functional properties of carbohydrates may also be used in this solution due to the chemical ability of starch type carbohydrates to thicken when in the presence of moisture and heat. Applying heat to a carbohydrate food alters appearance, texture, flavour, palatability and may slow the growth of bacteria and other pathogens (Food, 2017). The application of heat is used in gelatinisation, and so this processing technique is relevant to the problem and solution and could be used in a non-dairy yoghurt should thickening be required.

Nutritional analysis of possible non-dairy milk substitutes

Possible products which could be substituted for milk to make yoghurt include coconut milk, coconut cream, hemp milk, almond milk or soy milk. The composition of alternative milks is considerably different from that of dairy milk. The table below compares the energy, composition and cost of 100 mL of milk alternatives and compares these to 100 mL of dairy milk.

Nutritional analysis per 100 mL	Coconut Milk	Rice Milk	Almond Milk	Soy Milk	Lactose-free Milk	Dairy Milk – organic, full cream
Energy	103 KJ	213 KJ	86 KJ	175 KJ	271 KJ	288 KJ
Protein	0.2 g	0.3 g	0.7 g	3 g	3.3 g	3.2 g
Fat, total	2.2 g	1.2 g	1.8 g	1.8 g	3.6 g	4.1 g
saturated	2.1 g	0.1 g	0.2 g	0.3 g	2.4 g	2.7 g
Carbohydrates	0.8 g	9.5 g	0.3 g	3.1 g	4.7 g	4.8 g
Sugars	0.2 g	5.8 g	0.1 g	2.1 g	4.7 g	4.8 g
Calcium*	120 mg	120 mg	120 mg	120 mg	123 mg	123 mg
Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445						
Cost	\$0.33	\$0.24	\$0.25	\$0.24	\$0.29	\$0.29

Availability

These alternative milks can be purchased commercially and there are commercial yoghurts made from coconut milk, soy milk and lactose-free milk. Alternative milks may be nutritionally fortified with calcium and this is evident in the consistent levels of calcium seen in the table.

As coconut yoghurt, soy yoghurt and lactose-free yoghurt are already commercially available and focus group data indicates that the available products are considered acceptable, these will not be tested for a solution. The milk alternatives selected for further testing are: rice milk and almond milk. These milks have been selected as there are no current yoghurts available for sale made from these milks and a developed solution would be a lactose-free, probiotic solution.

As the commercially-available, plant-based milks may be fortified with additives, these additives can interfere with the culturing process. It is important to use alternative milks without additives or preservatives as yoghurt produced with non-dairy milks may not set until chilled and will require additional thickeners to achieve a consistency similar to store-bought yoghurts (Culturesforhealth.com, 2017).

Changes to processing required




The thickeners recommended for a non-dairy yoghurt are: gelatine, pectin, agar, guar gum, tapioca starch or arrowroot starch (Culturesforhealth.com, 2017). Gelatine is not suitable for a vegan product and if this product is to appeal to a wide range of consumer nutrition markets, it will not be used for a possible solution. Although pectin is considered to be the best thickener producing a smooth thick non-dairy yoghurt, it relies on the addition of sugar to minimise the overpowering flavour of the pectin (Culturesforhealth.com, 2017). Agar, made from seaweed, and guar gum, made from guar bean, are two other recommended thickeners that are readily available, produce a thick curd and are lactose-free and vegan-friendly. These two thickeners will be tested in the food experiments for possible solutions.

The selected yoghurt starter culture contains carefully chosen strains of streptococcus thermophilus and lactobacillus delbrueckii ssp. bulgaricus, and the probiotics bifidobacterium animalis ssp. lactis and lactobacillus acidophilus (Settachaimongkon S, 2017). This yoghurt starter is dairy-free and has been selected to ensure the development of a lactose-free, probiotic solution.

The cost of the plant-based milks is very similar and in fact are cheaper than the full-cream dairy milk, lactose-free milk or coconut milk. This would allow for possible production costs to be similar to the costs of producing a dairy-based or coconut yoghurt.

Analysis of non-dairy products

Lactose-free yoghurt, coconut yoghurt and soy yoghurt samples, that are available in stores, have been selected for sensory profiling by the focus group. The table below compares the composition and costs of lactose-free yoghurts available to consumers. Almond-milk yoghurt, while available in speciality stores, is not commercially available in supermarkets and has not been used for comparison and sensory testing in this analysis.

<u>Nutritional analysis per 100 mL</u>	<u>Coconut Yoghurt</u>	<u>Soy Yoghurt</u>	<u>Lactose-free Yoghurt</u>	<u>Dairy Milk – organic, full cream Yoghurt</u>
				
Energy	707 KJ	385 KJ	365 KJ	469 KJ
Protein	1.6 g	4.9 g	3.8 g	3.7 g
Fat, total	15.8 g	3.3 g	2.5 g	5.5 g
Saturated	15 g	0.2 g	1.7 g	3.7 g
Carbohydrates	4.5 g	9.9 g	12.2 g	11.8 g
Sugars	1.4 g	8.3 g	10.7 g	11.7 g
Calcium* Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	120 mg	48 mg	140 mg	132 mg
Cost	\$1.40	\$1.13	\$1.05	\$1.69

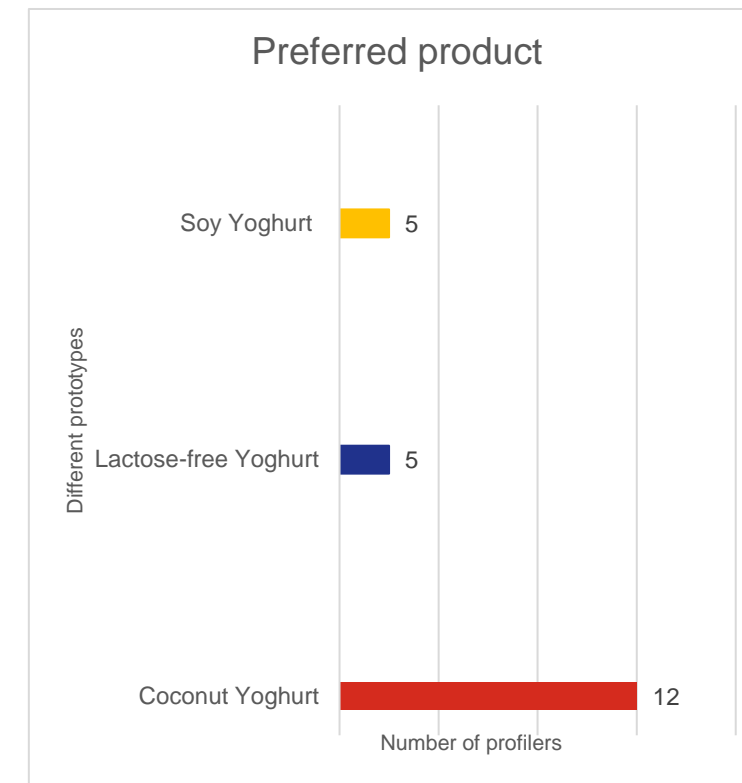
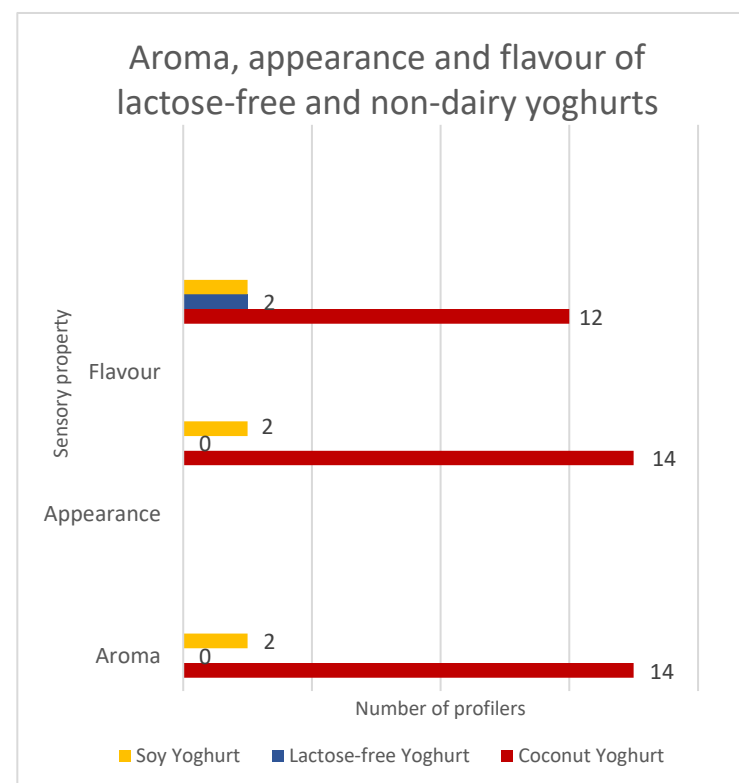
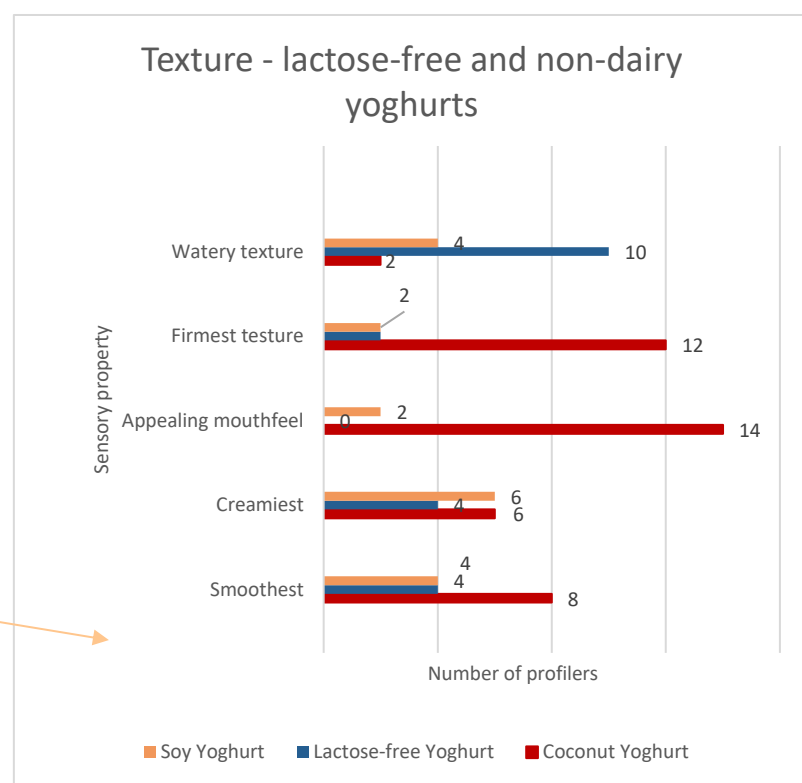
The yoghurts have been sensory profiled by the focus groups using a comparison test and a hedonic scale. The focus group compared the texture, aroma, appearance and flavour of the lactose-free yoghurts and then rated the products in order of preference.

Analysing and determining (8–9)

insightful analysis of a relevant problem, information and data related to a specific nutrition consumer market to identify essential characteristics and constraints

Analysing and determining (8–9)

Insightful analysis of a relevant problem, information and data related to a specific nutrition consumer market to identify essential characteristics and constraints



Analysing and determining (8–9)

astute determination of essential solution requirements from the brief self-determined criteria that include the relevant impacts and implications of, and the quality, functionality and reliability indicators for, a selected problem that affects an emerging nutrition consumer market

The product preferred by 75% of the profilers was the coconut yoghurt. Mouth-feel was a quality identified by the focus group that profoundly impacted consumer acceptance of yoghurt (Dairyconsultant.co.uk, 2017) and 87% of profilers preferred the mouth-feel of coconut yoghurt. Coconut yoghurt is higher in fat than other milk alternatives and this high proportion of fat may have positively impacted on the mouth-feel of the product. The appearance and aroma of Coconut yoghurt was preferred by 87% of profilers and the flavour of coconut yoghurt was preferred by 75% of the profilers. The most preferred product, coconut yoghurt had the highest kilojoule content of all tested yoghurts.

Based on the data collected, for a lactose-free yoghurt to be acceptable it must have a smooth, creamy texture and a fat content between 0.5-3.5%, (Dairyconsultant.co.uk, 2017) which would produce an acceptable mouth-feel. The colour of the yoghurt influences consumer acceptance and profilers commented on the appeal of the 'clean white' colour of the coconut yoghurt rather than the 'grey' or 'yellow' colours of the other samples. The aroma and flavour were influential in consumer acceptance and the profilers commented on the negative impact of distinctive aromas and after-taste from the soy and lactose-free yoghurts. Note that the appearance and aroma of the lactose-free yoghurt was rated as zero on the hedonic scale by the sensory profilers.

Determination of solution requirements and self-determined criteria for the solution

Develop a food solution for the allergic or food intolerant consumer market, which may be marketed at other consumers if company which do expand their customer base.

Solution requirements	Self-determined criteria
<ul style="list-style-type: none"> Develop a non-dairy probiotic yoghurt, not containing lactose Test to ascertain consumer acceptance in flavour and mouth-feel Compete nutritionally with other yoghurt type products on the market for example, a good source of calcium Use minimal artificial additives and preservatives Compete with other yoghurt type products on the market for example in taste, mouth-feel and appearance 	<ul style="list-style-type: none"> A non-dairy probiotic yoghurt prototype Acceptable colour, flavour and mouth-feel Nutritionally competitive with other yoghurt type products on the market, specifically high in calcium and within the recommendation of 600 KJ per serve Minimal use of artificial additives and preservatives Competitive with other yoghurt type products on the market Vegan to include a wider range of nutrition consumer markets

Synthesising, generating and evaluating (9-10)

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

Analysing and determining (8-9)

insightful analysis of a relevant problem, information and data related to a specific nutrition consumer market to identify essential characteristics and constraints

Developing ideas

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

The problem, stakeholder needs, constraints, chemical and functional properties of protein and carbohydrates, techniques used to process protein and carbohydrates, and the analysis of the competing products was synthesised to determine the solution requirements and self-determined criteria. It has been identified that the prototyped solution must be competitive with other lactose-free, probiotic yoghurts available in the market.

As the number of Australians who are lactose intolerant is increasing (Canstar Blue, 2017), the opportunity to develop a lactose-free yoghurt has been identified. Australian Government health statistics report that people with lactose intolerance are more likely to suffer poor health than lactose-tolerant people. Lactose-intolerant people are 72% more likely to get osteoporosis, 212% more likely to be vitamin deficient and 421% more likely to suffer from digestive problems (Canstar Blue, 2017) and recent studies support that certain strains of probiotics or bacteria found in fermented foods such as yoghurts may have positive effects on conditions related to gut bacteria (nutraingredients.com, 2017). Foods containing probiotics are mostly available as yoghurts and fermented dairy drinks; however, non-dairy probiotic foods are an emerging market (Culturesforhealth.com, 2017).

Based on the exploration of the problem, the proposed ideas for a lactose-free, probiotic yoghurt are:

Formulations and components	Sample 1: Rice Milk Yoghurt without thickeners	Sample 2: Rice Milk Yoghurt, thickened with guar gum	Sample 3: Rice Milk Yoghurt, thickened with agar	Sample 4: Almond Milk Yoghurt without thickeners	Sample 5: Almond Milk Yoghurt, thickened with guar gum	Sample 6: Almond Milk Yoghurt, thickened with agar
	<ul style="list-style-type: none"> Vegan formulation Components include: rice milk, non-dairy yoghurt culture 	<ul style="list-style-type: none"> Vegan formulation Components include: rice milk, non-dairy yoghurt culture, guar gum 	<ul style="list-style-type: none"> Vegan formulation Components include: rice milk, non-dairy yoghurt culture, agar 	<ul style="list-style-type: none"> Vegan formulation Components include: almond milk, non-dairy yoghurt culture 	<ul style="list-style-type: none"> Vegan formulation Components include: almond milk, non-dairy yoghurt culture, guar gum 	<ul style="list-style-type: none"> Vegan formulation Components include: almond milk, non-dairy yoghurt culture, agar
Processing	<ul style="list-style-type: none"> Rice milk is heated to 60°C to <u>denature</u> the protein and aid in the development of a <u>coagulated</u> curd during the <u>fermentation</u> process. The yoghurt is cooled to 44°C then the starter culture is added to the rice milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours, agitated and then chilled for 24 hours. Formulation may be refined for commercial processing 	<ul style="list-style-type: none"> Guar gum is dispersed in rice milk using a physical manipulation. The rice milk and guar gum are heated to 60°C to <u>denature</u> the protein and aid in the development of a <u>coagulated</u> curd during the <u>fermentation</u> process. Guar gum does not require heating for <u>gelatinisation</u> to occur. The yoghurt is cooled to 44°C then the starter culture is added to the rice milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours, agitated and then chilled for 24 hours. Formulation may be refined for commercial processing 	<ul style="list-style-type: none"> Agar is dispersed in rice milk using a physical manipulation. The rice milk and agar are heated to 90°C to <u>denature</u> the protein and for the agar to <u>gelatinise</u>. Heating enables the development of a <u>coagulated</u> curd during the <u>fermentation</u> process. The yoghurt is cooled to 44°C then the starter culture is added to the rice milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours, agitated and then chilled for 24 hours. Formulation may be refined for commercial processing 	<ul style="list-style-type: none"> Almond milk is heated to 60°C to <u>denature</u> the protein and aid in the development of a <u>coagulated</u> curd during the <u>fermentation</u> process. The yoghurt is cooled to 44°C then the starter culture is added to the rice milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours, agitated and then chilled for 24 hours. Formulation may be refined for commercial processing 	<ul style="list-style-type: none"> Guar gum is dispersed in almond milk using a physical manipulation. The almond milk and guar gum are heated to 60°C to <u>denature</u> the protein and aid in the development of a <u>coagulated</u> curd during the <u>fermentation</u> process. Guar gum does not require heating for <u>gelatinisation</u> to occur. The yoghurt is cooled to 44°C then the starter culture is added to the rice milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours, agitated and then chilled for 24 hours. Formulation may be refined for commercial processing 	<ul style="list-style-type: none"> Agar is dispersed in almond milk using a physical manipulation. The rice milk and agar are heated to 90°C to <u>denature</u> the protein and for the agar to <u>gelatinise</u>. Heating enables the development of a <u>coagulated</u> curd during the <u>fermentation</u> process. The yoghurt is cooled to 44°C then the starter culture is added to the rice milk and physically manipulated to disperse. Yoghurt is cultured at 40-44 °C for 6-8 hours, agitated and then chilled for 24 hours. Formulation may be refined for commercial processing

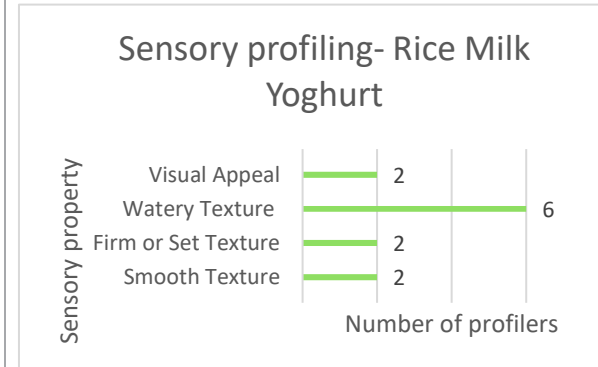
Legend: **Processing of carbohydrates are in bold**; Chemical and functional properties of carbohydrates are underlined

Synthesising, generating and evaluating (9-10)

critical evaluation and discerning refinement of ideas and a solution, against self-determined criteria, to make astute recommendations for enhancements, justified by data

Food experimentation – sensory profiling of Rice Milk Yoghurt without thickeners (Sample 1)

Data from sensory profiling



Nutritional analysis per 100 g

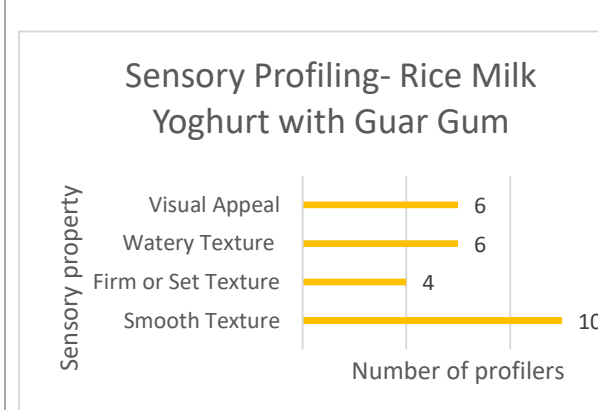
Energy	213 KJ
Protein	0.3 g
Fat, total saturated	1.2 g 0.1 g
Carbohydrates Sugars	9.5 g 5.8 g
Calcium*	120 mg
Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	
Cost	\$0.28

Conclusions:

This prototype was not well received by the sensory profilers, the formulation would require further refinement as 100% of the profilers commented that the texture was 'too watery' and uneven curds have formed through the yoghurt. The prototype's visual appeal was rated unacceptable by 60% of the focus group. Further experimentation with the components are required to decrease viscosity and thicken the yoghurt and improve the visual appeal. This prototype in its current formulation, is unacceptable to profilers and would require considerable refinement to be proposed as a possible solution.

Food experimentation – sensory profiling of Rice Milk Yoghurt, thickened with guar gum (Sample 2)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	213 KJ
Protein	0.3 g
Fat, total saturated	1.2 g 0.1 g
Carbohydrates Sugars	9.5 g 5.8 g
Calcium*	120 mg
Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	
Cost	\$0.32

Conclusions:

While this prototype was satisfactorily received by the sensory profilers, the formulation would require further refinement as 60% of the profilers commented that the texture was 'too watery'. Although profiling higher than rice milk yoghurt without thickeners, further experimentation with the ratio of components is required to decrease the watery consistency and to thicken the curd structure. This prototype in its current formulation, although more acceptable to profilers than sample 1, would require considerable refinement to be proposed as a possible solution.

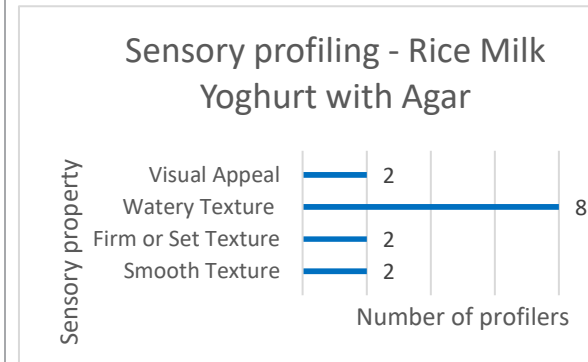
Communicating (3-4)

discerning decision-making about and fluent use of

- written and visual (if appropriate) features to communicate about a solution
- language for a technical audience
- grammatically accurate language structures

Food experimentation – sensory profiling of Rice Milk Yoghurt, thickened with agar (Sample 3)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	215 KJ
Protein	0.3 g
Fat, total saturated	1.2 g 0.1 g
Carbohydrates Sugars	10.1 g 5.8 g
Calcium* Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	120 mg
Cost	\$0.34

Conclusions:

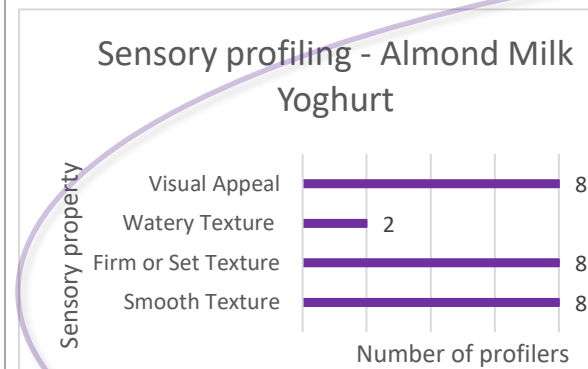
This prototype was not well received by the sensory profilers. The formulation would require further refinement as 100% of the profilers commented that the texture was 'watery' and 60% of profilers determined that the prototype was not visually appealing.

Further experimentation with the ratio of liquid to agar to decrease the watery consistency and improve the visual appeal of the prototype is required. While agar did not work in this formulation, it is successfully used with rice milk in many other formulations.

This prototype in its current formulation was not acceptable to profilers and would require considerable refinement to be proposed as a possible solution.

Food experimentation – sensory profiling of Almond Milk Yoghurt without thickeners (Sample 4)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	86 KJ
Protein	0.7 g
Fat, total saturated	1.8 g 0.2 g
Carbohydrates Sugars	0.3 g 0.1 g
Calcium* Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	120 mg
Cost	\$0.25

Conclusions:

This prototype was well received by the sensory profilers with 100% of profilers satisfied with the visual appeal of this yoghurt. The firm or set and smooth texture also received the highest rating from the sensory profilers. However, the formulation would require further refinement as 40% of the profilers commented that the texture was 'too watery'.

Further experimentation with the thickeners to decrease the moisture content is required. As can be seen in the conclusions of samples 5 and 6, while guar gum and agar may have thickened the prototypes, it has caused uneven curd structures that have been poorly received by the sensory profilers. An alternative thickener such as chia seeds may need to be trialed with almond milk to promote a set texture identified as desirable by profilers.

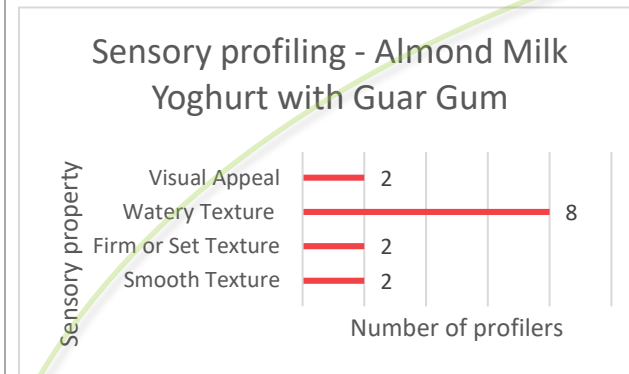
Although the most acceptable prototype to profilers, the current formulation could, with further experimentation and some refinement, be proposed as a possible solution.

Synthesising, generating and evaluating (9-10)

purposeful generation of a nutrition consumer market solution to provide valid sensory profiling data to determine the feasibility of the solution

Food experimentation – sensory profiling of Almond Milk Yoghurt, thickened with guar gum (Sample 5)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	86 KJ
Protein	0.7 g
Fat, total saturated	1.8 g 0.2 g
Carbohydrates Sugars	0.3 g 0.1 g
Calcium*	120 mg
Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	
Cost	\$0.29

Conclusions:

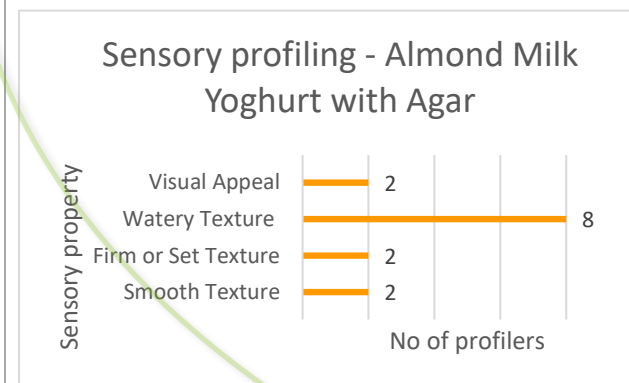
This prototype was not well received by the sensory profilers. The visual appeal of the prototype was rated poorly by 80% of the sensory profilers. Profilers also rated the degree of firm or set texture poorly and 80% of profilers identified the uneven curd structure impacting poorly on the smoothness of the prototypes texture.

This formulation would require further refinement and experimentation to improve the texture of the curd structure and decrease the watery texture. Guar gum may not be a suitable thickener for this prototype as the addition of this component may have caused uneven thickening to occur, resulting in the inconsistent curd structure.

This prototype in its current formulation was not acceptable to profilers and would require considerable experimentation and refinement to be proposed as a possible solution.

Food experimentation – sensory profiling of Almond Milk Yoghurt, thickened with agar (Sample 6)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	88 KJ
Protein	0.7 g
Fat, total Saturated	1.8 g 0.2 g
Carbohydrates Sugars	0.9 g 0.1 g
Calcium*	120 mg
Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	
Cost	\$0.31

Conclusions:

This prototype was not well received by the sensory profilers. The visual appeal of the prototype was rated poorly by 80% of the sensory profilers. Profilers also rated the degree of firm or set texture poorly and 80% of profilers identified the uneven curd structure impacting poorly on the smoothness of the prototypes texture.

This formulation would require further refinement and experimentation to improve the texture of the curd structure and decrease the watery texture. Agar may not be a suitable thickener for this prototype as the addition of this component may have caused uneven thickening to occur resulting in the inconsistent curd structure.

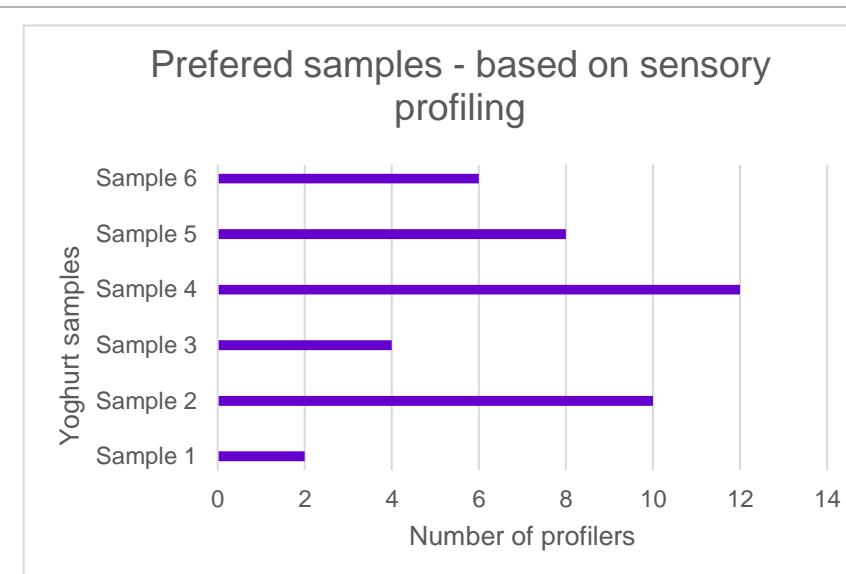
This prototype in its current formulation was not acceptable to profilers and would require considerable experimentation and refinement to be proposed as a possible solution.

Based on the development of ideas, the proposed solution is the almond milk yoghurt. This prototype has been selected as it is:

- preferred by 100% of sensory profilers from the six samples
- a non-dairy probiotic yoghurt. As it is not made from milk, it does not contain lactose.
- contains no artificial additives and preservatives.
- nutritionally competitive with other yoghurt type products on the market - high in calcium and without the addition of flavourings provides 215 KJ per 250 mL serve or 2.5% of the of daily intake based on an average adult intake of 8700 KJ (Australian Healthy Food Guide, 2017). This complies with the recommendations of 600 KJ per serve of yoghurt (Trap, 2017).
- minimal use of artificial additives and preservatives.
- vegan to include a wider range of nutrition consumer markets.
- consumer approved texture.

Further experimentation needs to occur to improve consumer acceptance of texture and mouth-feel of non-dairy yoghurt. The further experimentation to improve the consistency and thickness of curd structure will need to occur using chia seeds. Improving the texture will enhance visual appeal, mouth-feel and therefore consumer satisfaction allowing the product to be competitive with other alternative yoghurt products on the market.

The decision to generate this proposed solution to determine feasibility has been determined by the focus group's acceptance of the prototype's visual appearance, texture and the analysis of the proposed solution using the self-determined criteria.



Generate solutions and data

It was determined by sensory profiling that further experimentation would need to occur to improve the texture and visual appeal to improve consumer satisfaction. The formulation components will be altered by the addition of chia seeds to promote even thickening of the curd structure. The components in Samples 7 and 8 are the same: almond milk, non-dairy starter culture and chia seeds.

Components	Sample 7	Sample 8
	<ul style="list-style-type: none"> • Vegan formulation • Components include: almond milk, non-dairy yoghurt culture, whole chia seeds 	<ul style="list-style-type: none"> • Vegan formulation • Components include: almond milk, non-dairy yoghurt culture, ground chia seeds
Processing	<ul style="list-style-type: none"> • Almond milk is heated to 60°C to denature the protein and aid in the development of a coagulated curd during the fermentation process. The yoghurt is cooled to 44°C then the starter culture and whole chia seeds are added to the almond milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours and then agitated and then chilled for 24 hours. During the culturing and chilling, the chia seeds will, in the presence of the almond milk, cause gelification to occur. • Formulation may be refined for commercial processing 	<ul style="list-style-type: none"> • Whole chia seeds are physically manipulated to be ground to form a powder. These ground seeds are then sieved to separate and remove husks. Almond milk is heated to 60°C to denature the protein and aid in the development of a coagulated curd during the fermentation process. The yoghurt is cooled to 44°C then the starter culture and ground, sieved chia seeds are added to the almond milk and physically manipulated to disperse. Yoghurt is cultured at 40-44°C for 6-8 hours and then agitated and then chilled for 24 hours. During the culturing and chilling, the chia seeds, in the presence of the almond milk, will cause gelification to occur. • Formulation may be refined for commercial processing

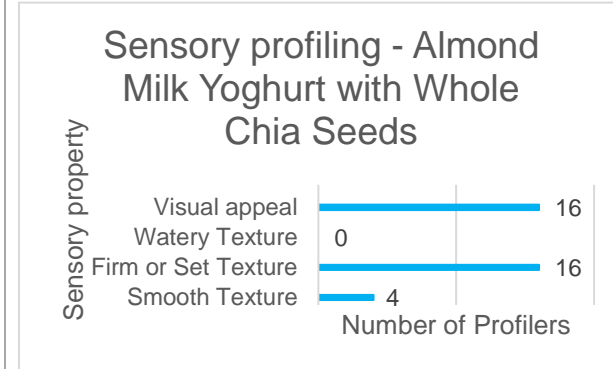
Legend: Processes – Bold; Chemical and functional properties of carbohydrates - underlined

Synthesising, generating and evaluating (9-10)

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

Food experimentation – sensory profiling of Almond Milk Yoghurt thickened with whole chia seeds (Sample 7)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	167 KJ
Protein	0.7 g
Fat, total saturated	1.8 g 0.2 g
Carbohydrates Sugars	0.3 g 0.1 g
Calcium* Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	120 mg
Cost	\$0.53

Conclusions:

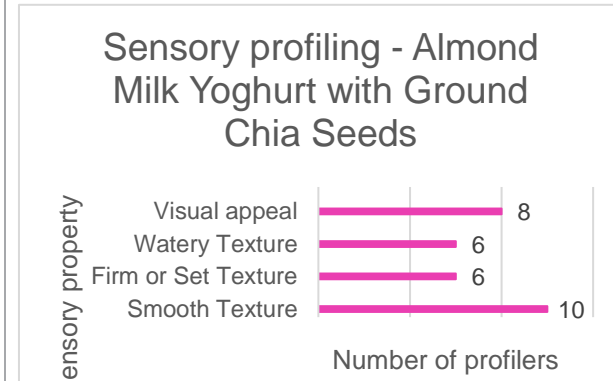
This prototype was well received by the sensory profilers with 100% of profilers satisfied with the visual appeal of the almond chia yoghurt. The firm or set texture also received 100% satisfaction from the sensory profilers. Note that 'watery texture' received a rating of zero on the hedonic scale from the sensory profilers. However, the formulation would require further refinement as 60% of the profilers commented that the texture was not smooth due to the chia seeds.

Further experimentation with ground rather than whole chia seeds to increase the smoothness of the prototype is required. Additions of flavourings could also be trialled.

Although this prototype was much more acceptable to the profilers, the current formulation could, with further experimentation and some refinement, be proposed as a possible solution.

Food experimentation – sensory profiling of Almond Milk Yoghurt thickened with ground chia seeds (Sample 8)

Data from sensory profiling



Nutritional analysis per 100 g

Energy	167 KJ
Protein	0.7 g
Fat, total saturated	1.8 g 0.2 g
Carbohydrates Sugars	0.3 g 0.1 g
Calcium* Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	120 mg
Cost	\$0.53

Conclusions:

This prototype was well received by the sensory profilers with 80% of profilers satisfied with the visual appeal of the almond chia yoghurt. While the firmer texture and gelatinous curd structure also received 60% satisfaction from the sensory profilers, 'watery texture' was still identified by 60% of the sensory profilers. The ground chia seeds did not gel as successfully as whole chia seeds as the grinding process causes the breakdown of the chia cell, inhibiting gelification. However, 100% of the profilers commented that the texture had a smoother, less dense texture due to the ground chia seeds.

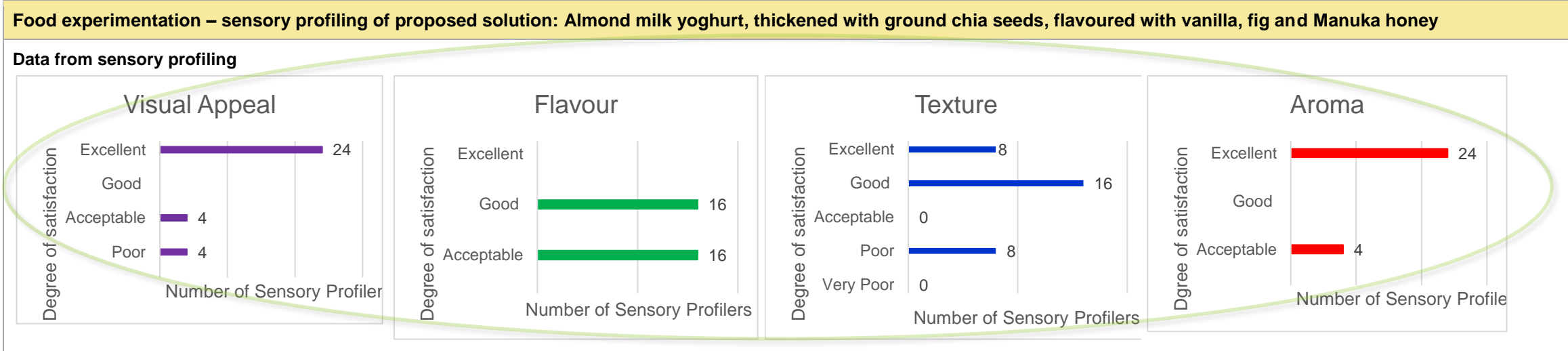
Further experimentation with a combination of ground and whole or the inclusion of ground chia husks and the addition of flavourings could now be trialled to develop the texture and flavour of the prototype.

This prototype was much more acceptable to the profilers. However, the texture and flavour of the current formulation requires refinement to be proposed as a possible solution.

The formulation components will include the addition of ground and whole chia seeds to thicken the yoghurt. The formulation components will also include the addition of natural flavours, cinnamon and fig, and manuka honey as a natural sweetener and will also be tested. The aim is to improve palatability, colour and aroma, thereby producing a prototype with greater consumer acceptance.

Synthesising, generating and evaluating (9-10)

purposeful generation of a nutrition consumer market solution to provide valid sensory profiling data to determine the feasibility of the solution



Conclusions:

This prototype was well received by the sensory profilers with 75% of profilers satisfied with the visual appeal. The aroma and flavour of the flavoured almond chia yoghurt rated as acceptable by 100% of the profilers. The firmer texture also received 75% satisfaction from the sensory profilers. While, 'watery texture' was still identified by 25% of profilers, it was noted that mouth-feel was not negatively impacted and that the consistency would be suitable for a drinking yoghurt. Further refinement of texture may be recommended. All the profilers commented that the texture had a smoother texture due to the ground chia seeds. This solution was highly acceptable to 85% of the sensory profilers.



Nutritional analysis per 100 g	
Energy	192 KJ
Protein	0.85 g
Fat, total saturated	1.8 g 0.2 g
Carbohydrates Sugars	8.85 g 8.4 g
Calcium *	120 mg
Many plant-based milk alternatives are fortified with calcium. www.usatoday.com/story/news/2015/02/22/dairy-plant-milk-soy-coconut-choices/23489445	
Cost	\$0.73

Synthesising, generating and evaluating (9-10)

critical evaluation and discerning refinement of ideas and a solution, against self-determined criteria, to make astute recommendations for enhancements, justified by data

Evaluate and refine ideas and the solution

Evaluate using self-determined criteria

The proposed solution: Almond milk yoghurt infused with cinnamon, fig and honey, has been selected as the lactose-free, probiotic solution as it is:

- a non-dairy probiotic yoghurt
- consumer acceptable in sensory properties of flavour and mouth-feel of non-dairy yoghurt
- nutritionally competitive with other yoghurt type products on the market - high in calcium and with the addition of flavourings provides 480 KJ per 250 g serve or 5.5% of the of daily intake based on an average adult intake of 8700 KJ (Australian Healthy Food Guide, 2017). This complies with the recommendations of up to 600 KJ per serve of 200 g yoghurt (Trap, 2017)
- artificial additives and preservative free
- competitive with other yoghurt products on the market
- a vegan product, appealing to a wider range of nutrition consumer markets.

Refinement of ideas and the solution

The proposed solution could be further refined to further improve the degree of firmness and the overall texture and mouth-feel. Profilers recommended suitability as a dairy-free, vegan, probiotic drinking-yoghurt. Further refinement could occur to develop a range of flavoured probiotic yoghurts to appeal to a wider range of health-conscious consumers, such as a ginger, cinnamon and turmeric almond yoghurt. Whole chia seeds could be used to develop a range of flavoured probiotic almond yoghurt chia pots, such as a cacao and agave syrup almond yoghurt chia pot.

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Communicating (3-4)

discerning
decision-making about
and fluent use of
referencing and folio
conventions

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