

# Food & Nutrition subject report

2023 cohort

February 2024





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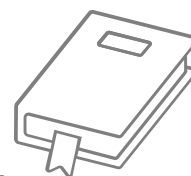
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# Introduction

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Throughout 2023, schools and the Queensland Curriculum and Assessment Authority (QCAA) continued to improve outcomes for students in the Queensland Certificate of Education (QCE) system. These efforts were consolidated by the cumulative experience in teaching, learning and assessment of the current General and General (Extension) senior syllabuses, and school engagement in QCAA endorsement and confirmation processes and external assessment marking. The current evaluation of the QCE system will further enhance understanding of the summative assessment cycle and will inform future QCAA subject reports.

The annual subject reports seek to identify strengths and opportunities for improvement of internal and external assessment processes for all Queensland schools. The 2023 subject report is the culmination of the partnership between schools and the QCAA. It addresses school-based assessment design and judgments, and student responses to external assessment for this subject. In acknowledging effective practices and areas for refinement, it offers schools timely and evidence-based guidance to further develop student learning and assessment experiences for 2024.

The report also includes information about:

- how schools have applied syllabus objectives in the design and marking of internal assessments
- how syllabus objectives have been applied in the marking of external assessments
- patterns of student achievement.

The report promotes continuous improvement by:

- identifying effective practices in the design and marking of valid, accessible and reliable assessments
- recommending where and how to enhance the design and marking of valid, accessible and reliable assessment instruments
- providing examples that demonstrate best practice.

Schools are encouraged to reflect on the effective practices identified for each assessment, consider the recommendations to strengthen assessment design and explore the authentic student work samples provided.

## Audience and use

This report should be read by school leaders, subject leaders and teachers to:

- inform teaching and learning and assessment preparation
- assist in assessment design practice
- assist in making assessment decisions
- help prepare students for internal and external assessment.

The report is publicly available to promote transparency and accountability. Students, parents, community members and other education stakeholders can use it to learn about the assessment practices and outcomes for senior subjects.

## Report preparation

The report includes analyses of data and other information from endorsement, confirmation and external assessment processes. It also includes advice from the chief confirmer, chief endorser and chief marker, developed in consultation with and support from QCAA subject matter experts.

## Subject highlights

**84**

schools offered  
Food & Nutrition

**72.4%**

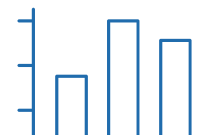
of students  
completed  
4 units

**90.35%**

of students  
received a C  
or higher



# Subject data summary



## Subject completion

The following data includes students who completed the General subject.

**Note:** All data is correct as at January 2024. Where percentages are provided, these are rounded to two decimal places and, therefore, may not add up to 100%.

Number of schools that offered Food & Nutrition: 84.

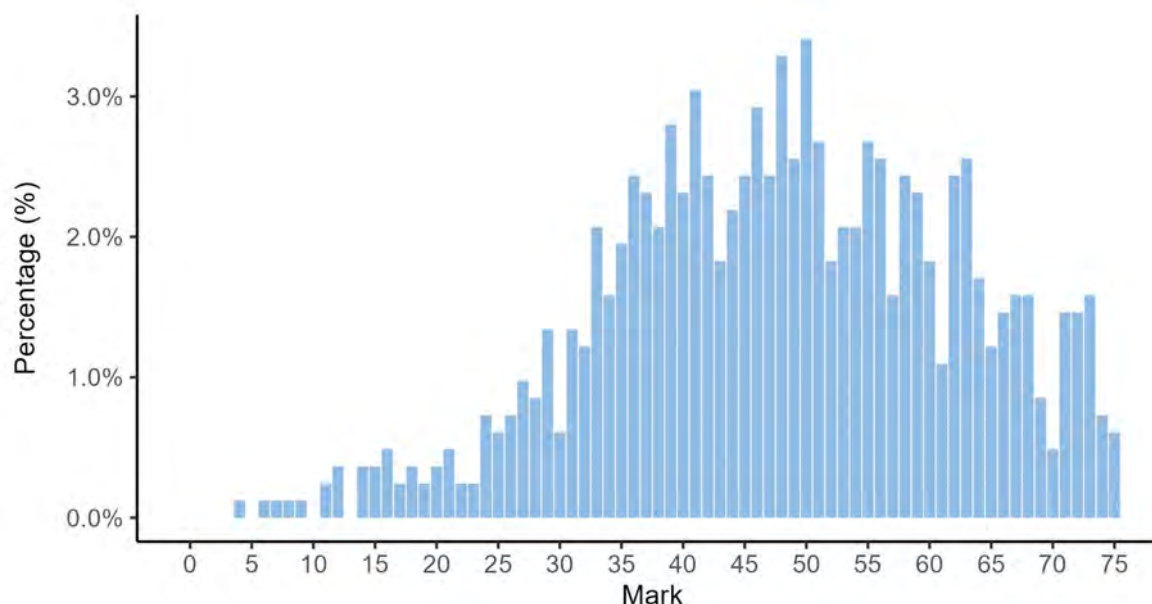
Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	1,116	1,002	808

## Units 1 and 2 results

Number of students	Satisfactory	Unsatisfactory
Unit 1	900	216
Unit 2	845	157

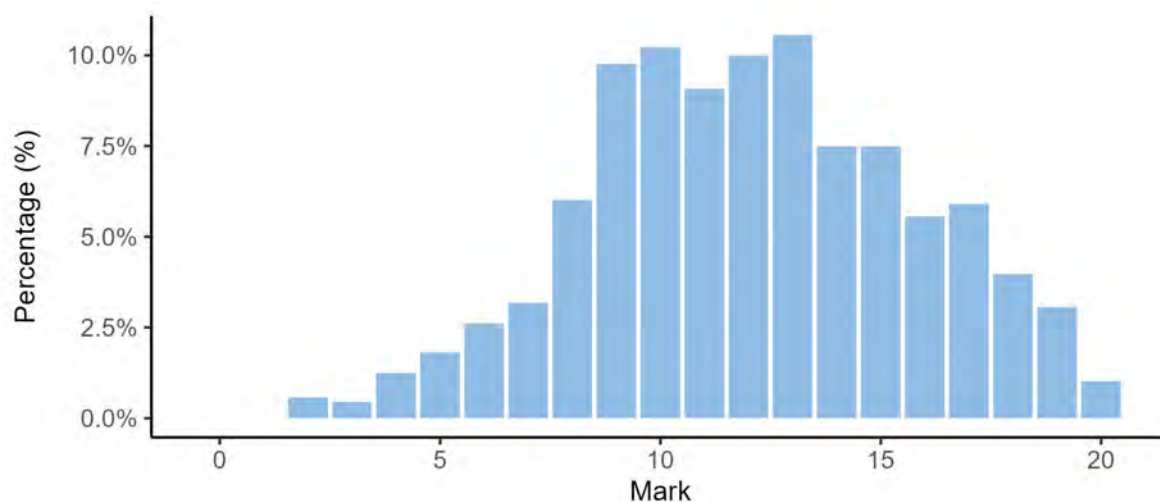
## Units 3 and 4 internal assessment (IA) results

### Total marks for IA

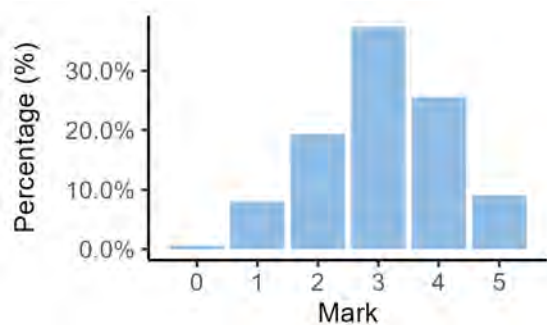


## IA1 marks

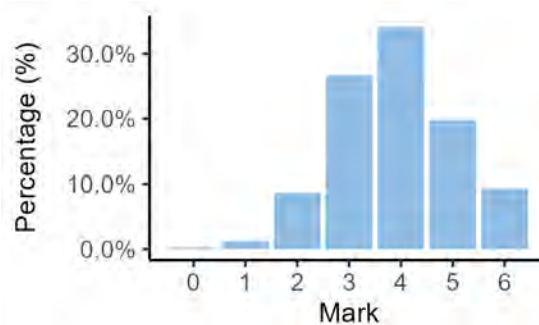
### IA1 total



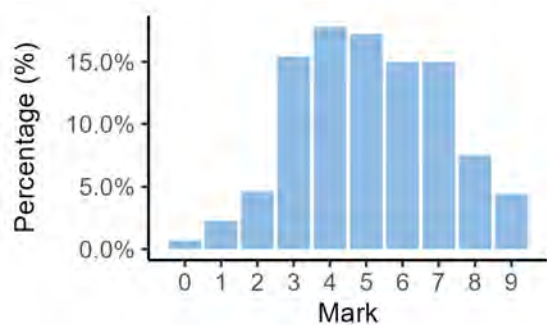
### IA1 Criterion: Recognising and explaining



### IA1 Criterion: Analysing and determining

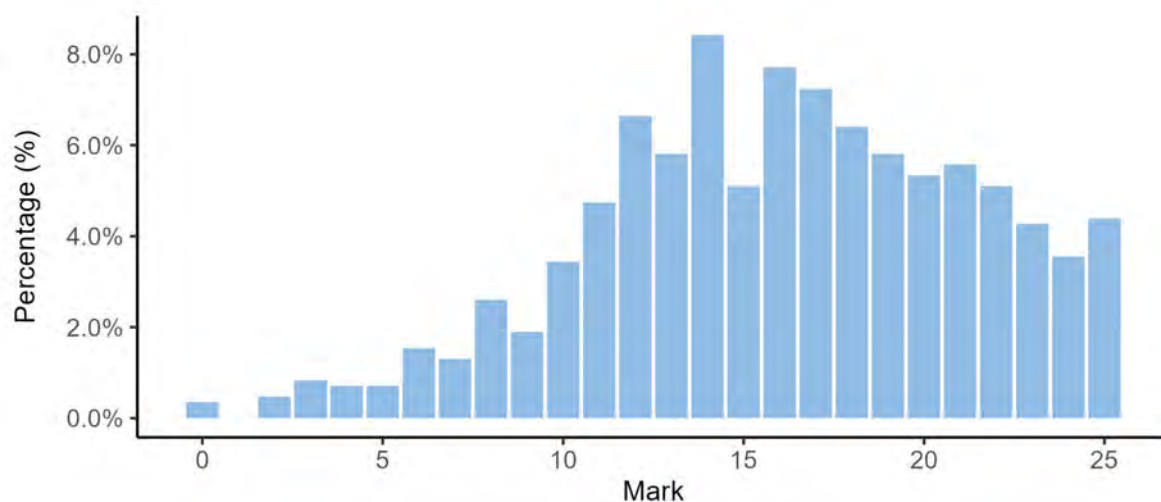


### IA1 Criterion: Synthesising and evaluating

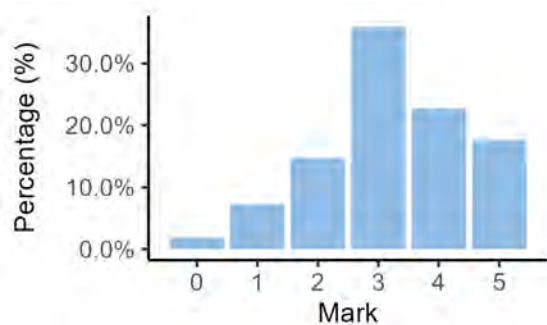


## IA2 marks

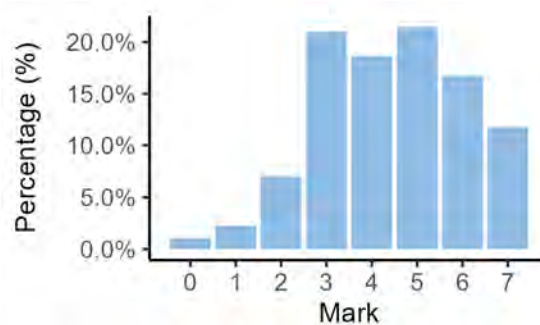
### IA2 total



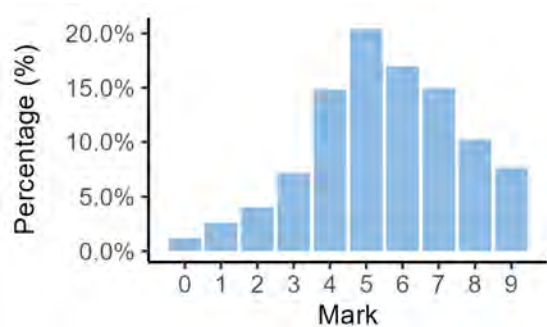
### IA2 Criterion: Recognising and explaining



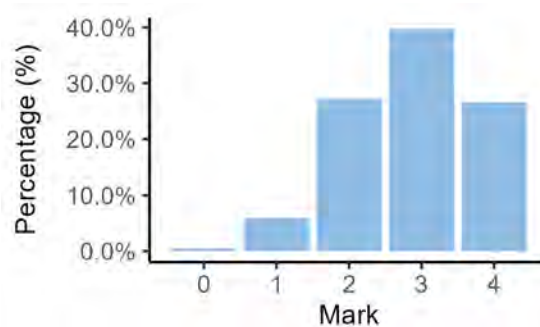
### IA2 Criterion: Analysing and determining



### IA2 Criterion: Synthesising, generating and evaluating



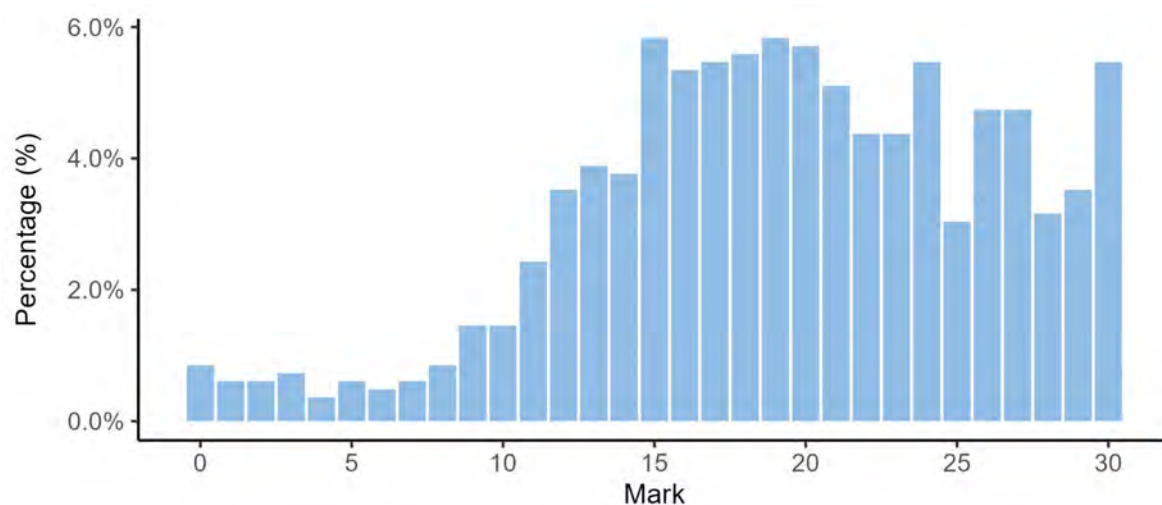
### IA2 Criterion: Communicating



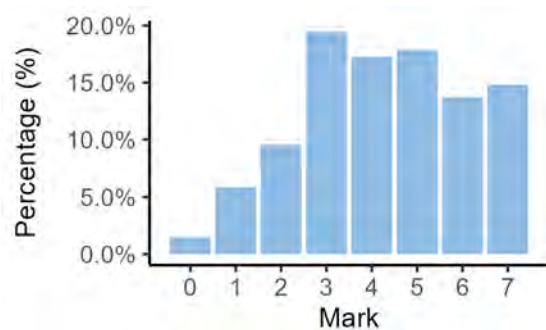


## IA3 marks

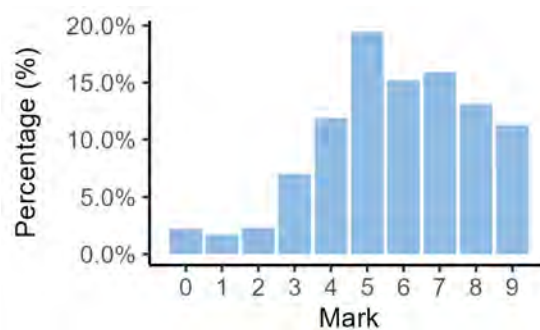
### IA3 total



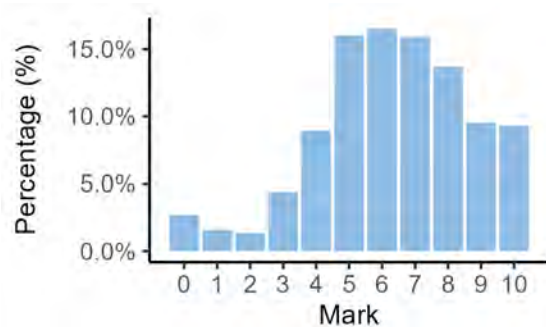
### IA3 Criterion: Recognising and explaining



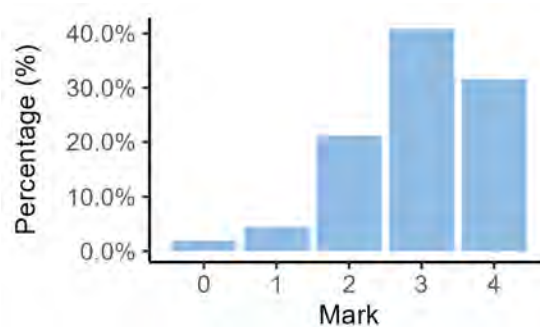
### IA3 Criterion: Analysing and determining



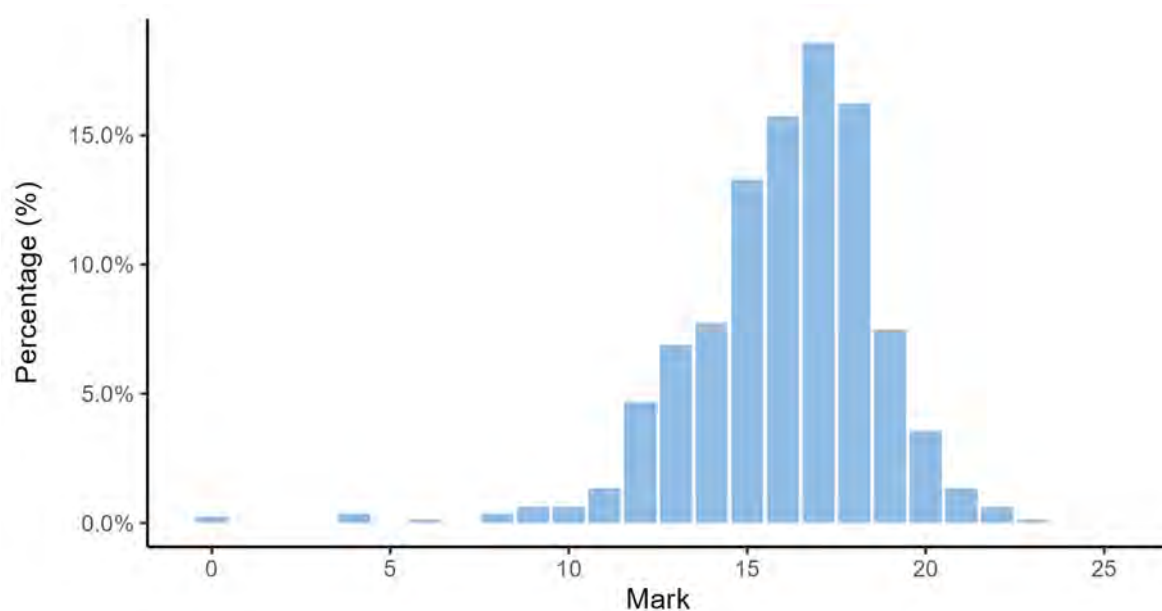
### IA3 Criterion: Synthesising, generating and evaluating



### IA3 Criterion: Communicating

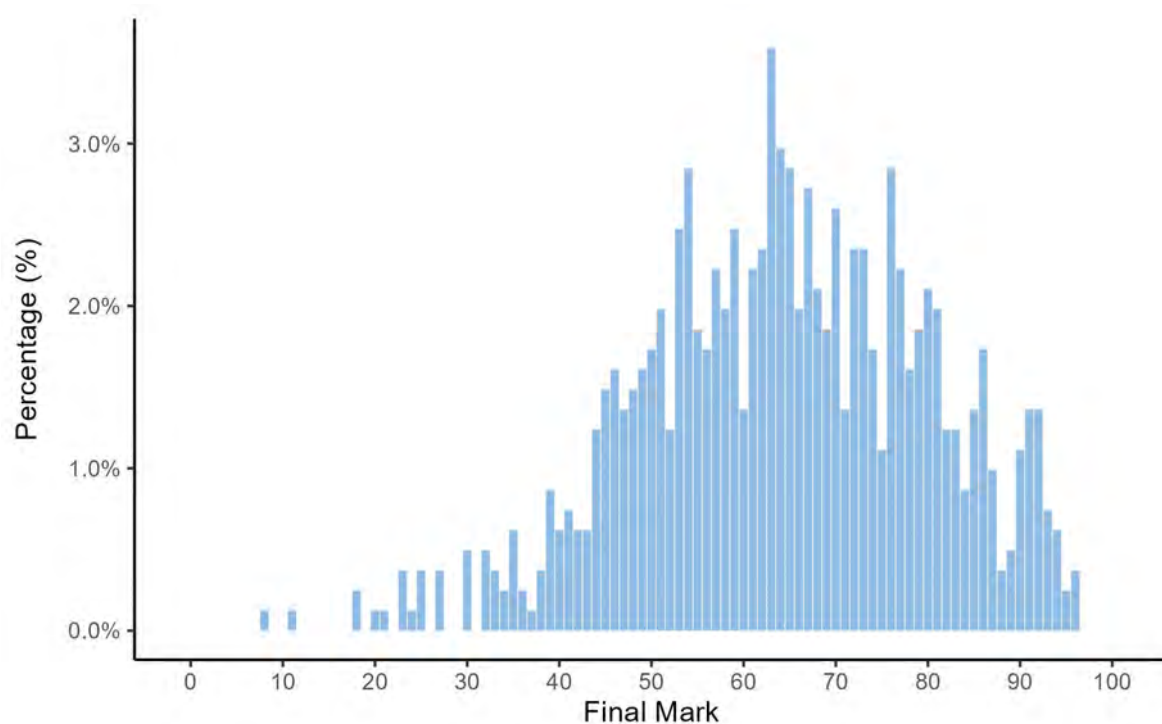


## External assessment (EA) marks



## Final subject results

### Final marks for IA and EA



## Grade boundaries

The grade boundaries are determined using a process to compare results on a numeric scale to the reporting standards.

Standard	A	B	C	D	E
Marks achieved	100–83	82–65	64–45	44–19	18–0

## Distribution of standards

The number of students who achieved each standard across the state is as follows.

Standard	A	B	C	D	E
Number of students	104	298	328	74	4

# Internal assessment



The following information and advice relate to the assessment design and assessment decisions for each IA in Units 3 and 4. These instruments have undergone quality assurance processes informed by the attributes of quality assessment (validity, accessibility and reliability).

## Endorsement

Endorsement is the quality assurance process based on the attributes of validity and accessibility. These attributes are categorised further as priorities for assessment, and each priority can be further broken down into assessment practices.

Data presented in the Assessment design section identifies the reasons why IA instruments were not endorsed at Application 1, by the priority for assessments. An IA may have been identified more than once for a priority for assessment, e.g. it may have demonstrated a misalignment to both the subject matter and the assessment objective/s.

Refer to *QCE and QCIA policy and procedures handbook v5.0*, Section 9.6.

### Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA2	IA3
Total number of instruments	85	85	85
Percentage endorsed in Application 1	51%	52%	43%

## Confirmation

Confirmation is the quality assurance process based on the attribute of reliability. The QCAA uses provisional criterion marks determined by teachers to identify the samples of student responses that schools are required to submit for confirmation.

Confirmation samples are representative of the school's decisions about the quality of student work in relation to the instrument-specific marking guide (ISMG), and are used to make decisions about the cohort's results.

Refer to *QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.

The following table includes the percentage agreement between the provisional marks and confirmed marks by assessment instrument. The Assessment decisions section of this report for each assessment instrument identifies the agreement trends between provisional and confirmed marks by criterion.

### Number of samples reviewed and percentage agreement

IA	Number of schools	Number of samples requested	Number of additional samples requested	Percentage agreement with provisional marks
1	83	530	62	56.63%
2	83	521	80	53.01%
3	83	516	14	62.65%

# Internal assessment 1 (IA1)



## Examination (20%)

The examination assesses the application of a range of cognitions to provided items — questions, scenarios and problems.

Student responses must be completed independently, under supervised conditions, and in a set timeframe.

## Assessment design

### Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

### Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	6
Authentication	0
Authenticity	10
Item construction	7
Scope and scale	26

\*Each priority might contain up to four assessment practices.

Total number of submissions: 85.

### Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- included several carefully constructed questions using Unit 3 subject matter with clear cues that provided sufficient opportunity for students to respond with evidence to meet the upper performance-level descriptors in the ISMG
- provided unseen, sufficient and relevant stimulus that allowed students to analyse, synthesise and evaluate information and data to solve a fat- or carbohydrate-based food problem. This included the needs of relevant stakeholders, consumer trends, sensory data, nutritional data and information and data related to the properties and processing of a fat- or carbohydrate-based food.

### Practices to strengthen

It is recommended that assessment instruments:

- include questions that are constructed with a range of cognitions allowing students to demonstrate upper performance-level descriptors in the analysing, synthesising and evaluating syllabus criterion

- align to the subject matter for Unit 3 and the topic of either carbohydrate or fat. Nutrition consumer markets such as glycaemic index, vegan, health-conscious, obesity, heart disease and food intolerance refer to Unit 4 subject matter
- include extended response stimulus that has a food industry context rather than a hospitality industry or school tuckshop context. The stimulus should align with the syllabus specifications and allow students to demonstrate sustained analysis, synthesis and evaluation to fully respond to a food problem.

## Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

### Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	2
Language	4
Layout	1
Transparency	1

\*Each priority might contain up to four assessment practices.

Total number of submissions: 85.

## Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided clear instructions and cues within the task and stimulus that aligned with syllabus specifications, including sensory profiling data and formulations related to a carbohydrate- or fat-based problem (Syllabus Section 4.7.1)
- contained succinct stimulus, including clear images and graphs, that allowed student engagement within the timing of the examination.

## Practices to strengthen

It is recommended that assessment instruments:

- use the language of the syllabus throughout the examination, e.g. sectors of the food system, processes, procedures, food components.

## Assessment decisions

### Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

### Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Recognising and explaining	83.13%	15.66%	1.2%	0%
2	Analysing and determining	83.13%	13.25%	3.61%	0%
3	Synthesising and evaluating	60.24%	39.76%	0%	0%

### Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- for the Recognising and explaining criterion
  - responses showed accurate and discriminating recognition of facts and principles related to the processing and nutritional, chemical and functional properties of carbohydrate- or fat-based food, e.g. gelatinisation, rancidity, emulsions
  - responses provided discerning explanations of food science ideas related to a carbohydrate- or fat-based food solution by explaining the chemical processes of
    - gelatinisation using different starches and including the effects of tenderiser and acid
    - rancidity (e.g. oxidation) and emulsification (e.g. role and structure of emulsifying agents and use of shear)
  - when matching evidence to characteristics within the 4–5 mark performance level descriptor
    - explanations of food science ideas were discriminating, e.g. explanation of the role of emulsifiers included their hydrophilic and hydrophobic bonds that help to prevent separation of oil and water components in an emulsion
- for the Analysing and determining criterion
  - responses to short and extended response questions showed insightful analysis of information and data related to the properties and processing of
    - carbohydrate-based food, e.g. analysis of types of leavening in baked products, analysis of information and data related to prototypes using gelatinisation for a food problem solution
    - fat-based food, e.g. analysis of fat suitability for frying, analysis of information and data related to emulsion prototypes for a food problem solution
  - when matching evidence to characteristics within the 3–4 mark performance level descriptor, attention was given to the appropriateness of self-determined criteria and whether they included some quality, functionality or reliability indicators, e.g. shelf-life, sensory properties.



## Samples of effective practices

The following excerpts demonstrate:

- accurate and discriminating recognition and discerning description of facts and principles related to the processing and chemical and functional properties of fat-based food, and discerning explanation of food science ideas and problems related to a fat-based food (Excerpts 1 and 2)
- insightful analysis of information and data related to the properties and processing of fat-based food (Excerpt 3)
- critical evaluation and discerning refinement of ideas and fat-based food solutions against self-determined criteria to make astute recommendations for enhancement, justified by data (Excerpt 4).

**Note:** The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

### Excerpt 1

The chemical process that has caused changes to the almond croissants is hydrolytic rancidity. Hydrolytic rancidity is when water is absorbed by a food and starts to break down the fats, causing the food to smell bad and deteriorate. This process is most common in high humidity areas. The almond croissants have been left out in a hot, humid environment causing hydrolytic rancidity to change them and make them distasteful. In order to extend their shelf life in the hot, humid summer a possible solution could be to store them in the refrigerator.



**Excerpt 2**

An emulsion is the mixture of two immiscible liquids (water + oil) created using shear force or an emulsifying agent. An emulsion can be temporary or permanent.

An emulsifying agent binds two immiscible liquids together as they have hydrophilic heads which attach to the water molecules and hydrophobic tails which join to oil molecules. The agents create a permanent emulsion as they stop the products from separating.

**Excerpt 3**

It is recommended that sunflower oil is used by the fish & chip shop as it meets their needs the best. Firstly, they require an oil that is healthy. The canola oil has the lowest amount of saturated fat with 7% & sunflower oil has 8%. This is still a very low amount, thus it will be chosen for the fish & chip shop. Secondly, sunflower oil has the highest smoke point of 265°C. A higher smoke point indicates a better oil to fry with. Lastly, the oil is also neutral meaning it doesn't have a strong flavour that will change the taste of the food being cooked in it.

**Excerpt 4**

Once all prototypes were measured against the self determined criteria, it was found that prototype 2, the sracha and sesame mayonaise, was the most suitable. All prototypes met the criteria of being a flavoured mayonaise, and relatively met the 'exotic flavours' and highly rated sensory properties. However, prototype 2 scored the highest spiciness level, aligning with the spicy foods trend, and also had the most balanced nutritional value (lowest fat by 2g, tied lowest cholesterol by 5mg, and lowest sodium by 10mg) which met the 'mindful eating' trend. To improve this prototype, it is recommended that the amount of sracha is increased to make it more spicy, and that an ingredient such as garlic is added to improve the exotic flavours.

**Practices to strengthen**

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- when matching evidence to characteristics for the Synthesising and evaluating criterion within the 8–9 mark performance level descriptor, attention is given to
  - ensuring all prototypes and the solution were evaluated against each self-determined criterion and data, e.g. sensory profiling and nutritional data
  - determining if the refinement of ideas and generated solution are 'discerning', i.e. recommendations for refinements address areas of sensory feedback that are deficient (e.g. data showing less than satisfactory ratings) as well as any relevant self-determined criteria such as portion size or energy content
  - determining if recommendations for enhancements are 'astute', e.g. refinements that are justified by generated data, feasible and discerning
  - ensuring that all relevant chemical, functional and nutritional information, and data have been synthesised for the chosen solution. Decisions about appropriate alternative solutions

are based on logical synthesis of information and data, e.g. the analysis of nutritional data and information of existing and competing products such as energy and wholegrain content is used to determine the most important food components for use in experimentation with alternative solutions.

## Additional advice

- The best-fit approach must be used when awarding marks across all criteria (*QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.1). Teachers must first choose the performance level that 'best fits', overall, the evidence found in the student work. If the work clearly matches all the characteristics in the performance-level descriptor (or with some characteristics from above), then the student should be awarded the higher mark for that performance level. If any characteristic is missing from that performance level, the provisional mark awarded should be the lower mark of the two-mark range. For more information about making judgments using an ISMG, refer to *Module 3 – Making reliable judgments* in the Assessment Literacy application (app) and *Food and Nutrition making judgments and using ISMG* support resources in the Syllabuses app in the QCAA Portal.
- Teacher annotations should be distinguishable from the student response (*QCE and QCIA policy and procedures handbook*, Section 9.7.1). It must be clear in student submissions for confirmation what is the original work of the student versus comments or feedback from the teacher. It may also be useful to review Section 8.2.4 of *QCE and QCIA policy and procedures handbook v5.0*, which provides information about the purpose of teacher feedback.

# Internal assessment 2 (IA2)



## Project — folio (25%)

This assessment focuses on a problem-solving process that requires the application of a range of cognitive, technical and creative skills, and theoretical understandings. Students document the iterative process undertaken to develop a solution to a food-related problem. The response is a coherent work that may include written paragraphs and annotations, diagrams, sketches, drawings, photographs, tables, spreadsheets and a prototype.

This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a response to the food and nutrition problem.

## Assessment design

### Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

### Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	9
Authentication	1
Authenticity	14
Item construction	9
Scope and scale	21

\*Each priority might contain up to four assessment practices.

Total number of submissions: 85.

### Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided a fat- or carbohydrate-based food problem with an industry context that required students to apply the problem-solving process (Syllabus section 1.2.4) and gave students the opportunity to demonstrate their understanding of Unit 3 subject matter
- included concise stimulus material that was relevant to the problem.

### Practices to strengthen

It is recommended that assessment instruments:

- include a context and stimulus that align with Unit 3 subject matter of either carbohydrate or fat. Nutrition consumer markets such as vegan, fitness-focused, allergens and heart disease are Unit 4 subject matter
- provide stimulus of appropriate scope and scale. Stimulus should be concise and relevant to the problem, providing contextual information, stakeholder needs, company ethos and product

lines. Students should conduct further research themselves about food science ideas related to the processing of a carbohydrate- or fat-based food solution (Syllabus section 4.7.2)

- provide an authentic problem with a food industry context rather than a school tuckshop context, e.g. a food company problem.

## Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

### Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	0
Language	1
Layout	0
Transparency	0

\*Each priority might contain up to four assessment practices.

Total number of submissions: 85.

### Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided clear instructions and cues that aligned to the task specifications and objectives
- included relevant and clear images and diagrams in the stimulus
- used the language of the syllabus in the task description and cues that aligned with the assessable evidence, ISMG and syllabus objectives.

### Practices to strengthen

There were no significant issues identified for improvement.

## Assessment decisions

### Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

### Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Recognising and explaining	86.75%	13.25%	0%	0%
2	Analysing and determining	77.11%	22.89%	0%	0%



Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
3	Synthesising, generating and evaluating	55.42%	39.76%	3.61%	1.2%
4	Communicating	89.16%	9.64%	1.2%	0%

## Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- for the Recognising and explaining criterion
  - responses showed discerning explanation of food science ideas and a problem related to the processing of carbohydrate- or fat-based food solution including explanation of the problem within the context of the task and clarification of the important aspects of the problem
- for the Analysing and determining criterion
  - astute determination of self-determined criteria was evident when relevant impacts and implications were considered, including quality, functionality and reliability indicators for the problem
  - insightful analysis was evident through the inclusion of relevant information related to the properties and processing of a carbohydrate- or fat-based food, e.g. leavening, dextrinisation, emulsification
- for the Communicating criterion
  - responses demonstrated fluent use of language for a technical audience and visual features, such as sensory profiling graphs, to communicate a solution.

## Samples of effective practices

The following excerpts demonstrate:

- insightful analysis of a problem, information and data (Excerpt 1)
- astute determination of self-determined criteria that include the relevant impacts and implications for the problem (Excerpt 2)
- insightful analysis of information and data related to the properties and processing of a carbohydrate-based food (Excerpt 3)
- coherent and logical synthesis of chemical, functional, sensory and nutritional information (Excerpt 4)
- purposeful generation of a carbohydrate-based food processing solution to provide valid sensory profiling data (Excerpt 5).

**Note:** The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

**Excerpt 1****1.1.1 PROBLEM**

The business, [REDACTED] produces a range of large bread loaves and are currently looking at developing a line extension of a small individual bread roll that can be easily transported, shelf-stable, has limited preparation and is ready to be used by the consumers. Additionally, there is a need for products that are flavoursome, unique and incorporates Indigenous flavours. Concerningly, consumers today are actively avoiding bread or reducing consumption due to popular diet trends like low carbohydrate and gluten-free choices (Stimulus 1). However, bread has a crucial role in the human diet. Bread supplies a significant portion of the nutrients required for growth, maintenance of health and wellbeing, as well as being versatile in everyday foods. Underconsumption of carbohydrates may lead to fatigue, nausea and constipation. Therefore, it is important that a bread product is developed to encourage people to consume carbohydrates which is vital in their diet. Current trends in bread rolls have seen a rise in popularity of savoury breads. Savoury breads such as cheesy garlic bread and spicy chilli bread are trendy. This trend is driven by consumers' desire for more interesting and varied flavour profiles in their breads. There is also a growing interest in health and wellness, leading to a surge in demand for high-quality, nutrient-rich breads that can support a healthy lifestyle (BBM, 2023). Currently, an Australian food trend is the use of local or native ingredients, including lemon myrtle, bush tomato, and wattle seed. This is strengthening our connection to Country. 'Bush tucker' ingredients that have been used by Indigenous Australians for thousands of years have been gaining more awareness and popularity over recent years, continuing into 2023. Sustainability is also widely influencing food purchases of Australians. Many consumers are reducing their food miles from paddock to plate, by choosing to shop at independent grocers and farmer's markets (Tuckerman, 2023). Furthermore, the traditional food driver of convenience is significantly prominent in current food trends, as many people lead busy lifestyles and do not have enough time to prepare nutritious meals. Therefore, a single-serve bread roll will specifically appeal to people who need and prefer a convenient snack or meal.

For copyright reasons, the company name has been redacted.

**Excerpt 2**

Solution Requirements/success criteria	Self-determined Criteria
<ul style="list-style-type: none"> <li>✓ Single-serve bread roll</li> <li>✓ Incorporate Indigenous flavours</li> <li>✓ Requires minimal preparation time to satisfy time-poor consumers who need a convenient food product</li> <li>✓ Unique to current products at [redacted] and other competing bread retailers.</li> <li>✓ Aligns with the company ethos and values at [redacted] 'handcrafted, simple, sustainably sourced and satisfies consumer dietary needs'</li> <li>✓ Shelf-stable – semi-perishable within paper packaging, while stored in the pantry, maintains quality after a few days of storage</li> <li>✓ Consider and apply the sensory profilers' feedback and sensory analysis, in terms of taste, aroma, appearance and mouth feel</li> <li>✓ Flavoursome – combinations of flavour complement each other well</li> <li>✓ Sustainability – dehydrated Indigenous ingredients can be used for a long period of time, do not have to wait for in-season ingredients, minimal food waste and food miles, environmentally-friendly packaging</li> <li>✓ Ethically-sourced ingredients – consideration of worker's and animal welfare</li> <li>✓ Easily transported – maintain quality of the product when distributed, and should not crumble easily or lose taste, appearance etc.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Appetising appearance, aroma, and mouth feel to satisfy the sensory profilers' preferences</li> <li>✓ Functional food product - provides health benefits such as reducing hypertension</li> <li>✓ No use of artificial additives and preservatives</li> <li>✓ Ingredients are cost-effective, making the food product affordable to the consumers to purchase, consider the economic impacts on both the company and the consumer</li> <li>✓ Appropriate packaging – single-serve paper packaging, ensures minimal waste and supports sustainability</li> <li>✓ Manufactured using the bakery's current cooking equipment and branding to minimise costs.</li> <li>✓ Nutritionally-sound – contains an abundance of other nutrients on top of carbohydrates, such as, vitamins, proteins etc.</li> <li>✓ Follows current trends in breads such as Indigenous cuisine, savoury bread rolls, and minimal-preparation food products</li> </ul>

For copyright reasons, the company name has been redacted.



## Excerpt 3

Chemical and Functional Properties	<p>During the processes of making the rolls <b>leavening</b> occurs when yeast is added to the dough, and it is left to proof, allowing the dough to rise creating a light and airy mouthfeel. The dried fruit that is put in the dough has been <b>dehydrated</b> to get rid of any excess moisture, keeping it shelf stable for longer. <b>The addition of additives</b> such as sugar and spices improve the flavour, creating desirable taste and even aroma. <b>Physical manipulation</b>, such as kneading, takes place allowing for a smooth dough that is soft and fluffy. <b>Physical manipulation</b> also occurs when dough is then rolled into balls and placed in a pan, allowing the final rolls to look neat and uniform. The uncooked buns are then brushed with an egg and milk mixture. The <b>application of heat</b> occurs when the rolls are placed in an oven to cook, causing the <b>dextrinization</b> of starch molecules. Heat also allows causes <b>Maillard reaction</b>, when the starch and protein molecules to react, creating a final product that has a shiny dark golden brown colour.</p>	<p>While making the Finger Buns, the <b>addition of additives</b> such as extracts, and gelatine are added in order to improve the taste and texture of the final product. <b>Leavening</b> occurs when yeast is added to the dough, then it is left to proof, allowing the final product to become fluffy and soft. The dough is kneaded allowing for a light and airy mouthfeel. The dough is then shaped into a 'finger' shape, this <b>physical manipulation</b> creates uniform final products. A milk and egg mix is also brushed over the top, resulting in <b>Maillard Reaction</b> when <b>heat is applied</b>, creating a shiny gold brown crust. The dough is placed in the oven to bake, this <b>application of heat</b> causes the <b>dextrinization</b> of starch molecules, resulting in a golden-brown final product. When making the icing the icing sugar and butter is creamed together, this <b>aeration</b> and <b>physical manipulation</b> creates an icing with a light and smooth mouthfeel. <b>Gelification</b> occurs when gelatine is added in order to help thicken the icing and allow it to keep its shaped and create smooth mouthfeel.</p>	<p>When making the apple filling the apples are placed in a pan and cooked over medium heat. This <b>application of heat</b> causes the sugar molecules in the apple to <b>caramelize</b> deepening the flavour and giving them a slightly browned colour. This also causes <b>crystallisation and nucleation</b> as there are large amounts of sugar in the mix, the sugar molecules then stick together, however due to the small amount of fat, it causes tiny crystals to form allowing for a smooth mouth. A small amount of lemon juice is also added to the filling, this <b>change in pH</b> gives the final product a better taste. <b>Physical manipulation</b> occurs when the pastry is rolled and shaped into heart, with room for the filling. It is then put in the oven as bake, this <b>application of heat</b> causes the <b>dextrinization</b> of starch molecules, allowing the final product to crisp and golden brown. Sugar, salt, and <b>perseverative</b> are also added to the filling and pastry, bettering the flavour and texture.</p>	<p>When making the custard filling, a small amount of flour is added to a cream, egg and sugar mixture and it is heated. This <b>application of heat</b> causes <b>gelatinisation</b>, allowing the starch molecules to absorb the liquid, creating a thick custard. <b>Physical manipulation</b> occurs when the pastry is rolled, latticed, and filled with filling in order to create uniform final products. The <b>addition of additives</b> such as sugar, vanilla extract and vegetable gum is added to the product in order to improve the taste and texture. The danish is then put in the oven to bake, this <b>application of heat</b> causes the <b>dextrinization</b> of starch molecules, resulting in a golden brown and crisp final product.</p>
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## Excerpt 4

Information and data in section 1.0 supports the development of ideas for alternative solutions. In section 1.1 the problem identified was the lack of gluten free alternatives available to consumers, in turn this was decreasing sales. It was determined that in order to get sales back up a new prototype must be created that meets the needs of consumers. 50 profiters were asked question about what type of product they would like to see on the market, and it was evident that the new prototype should be carbohydrate-based, gluten free, sweet snack that is able to be packaged in an ecofriendly way, is high in fibre and can easily fit into a lunch box. The needs of the Stakeholders were also discussed in section 1.0, the new prototype had to be different to any else on the menu and meet the consumers' wants and needs, it must also have a self-life of two days and be easily packaged. The menu also has a range of different items on their menu that use many different processing techniques including gelatinisation, crystallisation, nucleation, caramelisation, dextrinization, gelification, leavening, application of cold, application of heat, dehydration, change of pH (acid/alkali), addition of additives and physical manipulation. These techniques allow the menu to change and better the chemical and physical properties of different products on the menu. An analysis was also done of four different options on the menu and wider market, allowing for the ingredients, labelling, and food safety to be analysed. Labelling provides information to consumers surround the ingredients, nutrients, serving sizes, allergies, product description and origins of the product. Food safety refers to how the food is prepared, stored, and packaged, this in turn reduces the risk of causing food born illnesses to any consumers (McCahon. Pamment. York. 2018). Proper food safety can be upheld by ensuring food is kept at a safe temperature and ensuring proper hygiene is kept. Ingredients refers to what the final product is made of, and it was found that consumer of the menu would prefer to have a product that is sweet rather than savory. However, it was also determined that many products on the menu were not meeting consumer demand, solution requirements or self-determined criteria, indicating that change must be made to the current product line.

Initial feedback from the focus group recommended that the alternative food product must be made from gluten free carbohydrate-based products, single serve, easily packaged, easy to fit into a lunch box, have eco-friendly packaging and be high in fibre. It is important to take on consumer feedback as trends and lifestyles are constantly changing, as well as ensuring the longevity of the company. Based on the research found in section 1, the proposed prototypes are:

- Caramel Slice
- Mini Vanilla Cupcakes with Chocolate Icing
- Salted Caramel and Chocolate Tart

For copyright reasons, the company name has been redacted.

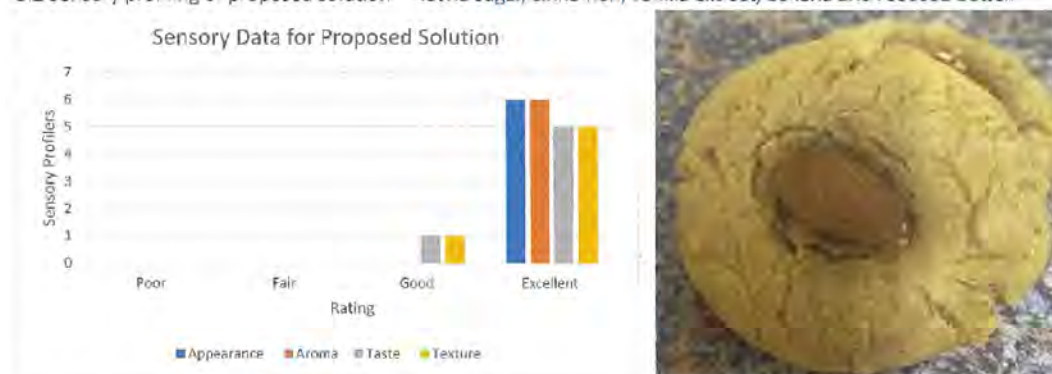
## Excerpt 5

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

## 3.1 Proposed solution for generation

Overall, formulation 3 is the chosen formulation that requires improvements to enhance the sensory profiling, fat, sodium and sugar quantities and therefore ultimately be the most appealing, nutritious, sustainable snack food for the target market health-conscious consumers. The almond cookies specifically require enhancements with regard to the taste and texture and the need to decrease the sugar quantity. The sugar must be adjusted to a healthier option due to the sugar levels (8g/100g) exceeding the recommended amount for a snack food (5g/100g). The taste of this formulation was very bland, lacking much flavour with only slight hints of almond which was extracted from the almond butter. The texture requires improvements due to being dry and lacking a light and airy texture. This can be as a result of the inclusion of many dry ingredients such as plain flour, bicarbonate soda and baking powder (chemical leavening agents), salt, and white and brown sugar. To improve this formulation to better appeal to the stakeholder target consumers while ensuring it meets the Company's ethos, characteristics and constraints, enhancements will be made. To enhance the taste and texture of the almond cookies, the inclusion of cinnamon, vanilla extract, banana, and natural sweetener (natvia) will be used. The cinnamon and vanilla extract will be used to enhance the taste and further complement the almond butter. The butter in the formulation will be reduced to minimise the fat content and therefore  $\frac{1}{2}$  a banana will be used instead as a healthy, organically produced ingredient while also improving the texture of the formulation by creating a lighter, creamier cookie. Natvia will be used as a replacement to the white sugar, refining the excess sugar content. It is desired that these improvements will improve the original sensory profiling and appeal to more of the consumers.

## 3.2 Sensory profiling of proposed solution – Natvia sugar, cinnamon, vanilla extract, banana and reduced butter.



Conclusions: The proposed solution was well supported by the sensory profilers with clear improvements in all aspects. The addition and substitution of the original ingredients proved to be a success and clearly supported the refined proposed solution to better appeal to the target market while adhering to the [redacted] characteristics and constraints. The appearance and aroma both improved with 100% of the sensory profilers now rating it excellent. The addition of spices such as cinnamon and fruit such as banana enhanced the aroma. The chemical leavening agents (bicarbonate soda and baking powder) allowed the cookie to rise adequately, allowing for a well aerated, soft final product. The extra addition of an almond on top also enhances the appearance and clearly indicates to sensory profilers that the biscuit is almond based. The texture and taste also improved greatly with 83% of sensory profilers rating excellent and 17% rating good. The addition of banana was the perfect ingredient to support a perfectly light textured cookie while also enhancing the taste by allowing the banana to complement the almond flavours extracted from the almond butter. The extra addition of cinnamon also complements this combination, ultimately improving the taste. Further refinements to improve the taste and texture can be made to which may include the inclusion of crushed almonds combined in the mixture, or the addition of botanicals like ginger which would enhance the aroma, taste and texture immensely, while also providing further health benefits. It is important however to always maintain the kilojoule content within the snack food to ensure it does not exceed the required amount to be classified as a snack.

For copyright reasons, the company name has been redacted.

## Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- when matching evidence to the characteristics for the Synthesising, generating and evaluating criterion at the top performance level, attention should be given to
  - ensuring purposeful generation of a food solution by
    - generating the final solution after experimentation with prototype ideas, e.g. the best prototype is generated with the recommended refinements
    - aligning the prototypes and solution with the self-determined criteria and data
  - ensuring coherent and logical synthesis of information to develop ideas is evident by including chemical, functional, sensory and nutritional information as well as primary and secondary data
  - considering self-determined criteria and data when critically evaluating ideas and the generated solution.

## Additional advice

- When determining provisional marks for an assessment response, marked ISMGs should indicate the characteristics evident in the student response and the mark awarded for each criterion. Refer to the *QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.1, and the resources *Module 3 — Making reliable judgments* in the Assessment Literacy app, the Making judgments webinar in the Syllabuses app, and the additional advice section for IA1 on page 16 for further information and guidance.
- Students should independently develop folio conventions including sensory profiling graphs, images and tables (Syllabus Section 4.7.2). Teacher provision of a project folio template does not allow students to independently produce an authentic and unique response.



# Internal assessment 3 (IA3)



## Project — folio (30%)

This assessment focuses on a problem-solving process that requires the application of a range of cognitive, technical and creative skills and theoretical understandings. Students document the iterative process undertaken to develop a solution to a food and nutrition problem. The response is a coherent work that may include written paragraphs and annotations, diagrams, sketches, drawings, photographs, tables, spreadsheets and a prototype.

This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a response.

## Assessment design

### Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

### Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	6
Authentication	2
Authenticity	20
Item construction	8
Scope and scale	22

\*Each priority might contain up to four assessment practices.

Total number of submissions: 85.

### Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- followed the conventions for item construction such as identifying a real-world problem and containing contextual and stimulus information about stakeholder needs
- provided a stimulus that was aligned with the requirements of the syllabus and referred to each of the selected nutrition consumer markets identified in the context.

### Practices to strengthen

It is recommended that assessment instruments:

- include only nutrition consumer markets contained in Unit 4 subject matter
- provide a problem that is related to the food industry rather than one that refers to the hospitality industry or school tuckshop, e.g. addressing consumer demand for products

- include stimulus of appropriate scope and scale with a choice of more than one nutrition consumer market, allowing students to complete their own research in relation to syllabus-stated nutrition consumer markets and produce an authentic response.

## Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

### Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	3
Language	1
Layout	1
Transparency	3

\*Each priority might contain up to four assessment practices.

Total number of submissions: 85.

### Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided appropriate cues from the syllabus to support student responses to the food problem, e.g. to complete this task, you must
- provided a task and stimulus that were free from errors and contained the language of the syllabus, e.g. reformulate or formulate, nutrition consumer market, diet-related conditions.

### Practices to strengthen

There were no significant issues identified for improvement.

## Assessment decisions

### Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

## Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Recognising and explaining	86.75%	12.05%	1.2%	0%
2	Analysing and determining	77.11%	21.69%	1.2%	0%
3	Synthesising, generating and evaluating	72.29%	16.87%	2.41%	8.43%
4	Communicating	96.39%	1.2%	2.41%	0%

## Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- for the Recognising and explaining criterion
  - responses showed
    - accurate and discriminating recognition and discerning description of food processing principles related to the chosen nutrition consumer market
    - discerning explanation of food science ideas that were precise and directly related to the nutrition consumer market
- for the Communicating criterion
  - responses showed discerning decision-making and fluent use of mode-appropriate features, language and conventions by including
    - referencing from a range of sources to support the explanation and description of facts and principles related to the food formulation process
    - use of language for a technical audience e.g. formulation, prototype
    - student-developed folio structure that used a unique layout rather than a teacher-provided template.

## Samples of effective practices

The following excerpts demonstrate:

- insightful analysis of a relevant problem, information and data related to a specific nutrition consumer market to identify essential characteristics and constraints (Excerpts 1 and 2)
- coherent and logical synthesis of chemical, functional, sensory and nutritional information to develop ideas for a chosen solution (Excerpt 3)
- purposeful generation of a nutrition consumer market solution to provide valid sensory profiling data to determine the feasibility of the solution (Excerpt 4)
- critical evaluation and discerning refinement of a solution against self-determined criteria to make astute recommendations for enhancements, justified by data (Excerpt 5).

**Note:** The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

**Excerpt 1**

When considering the recommendation for whole grain, the idea of pie was considered. Whole grain pie could include a sweet fruit or berry filling which would meet the criteria stated above. Heating the filling beforehand could caramelize the sugars inside it to create a sweeter filling. Therefore, chemical properties could be utilized to create an even better prototype. Furthermore, since the crust is thin and the main flavours would be from the filling, the taste and texture which may be negatively affected by replacing flour with whole grain flour should not be as noticeable to the consumers as they would be in cakes or muffins. In addition to this, the pie would expand the company's product line, extending it to more products and appealing to more consumers.

For the crust of the pie, it was important to consider the fats, sugars, and sodium. Whilst sodium and sugars can be avoided fully with some loss in taste, the fat is the main issue. Saturated fats are often used in pie crusts since it contributes to taste, a flaky texture and appearance. Unsaturated fats such as oils would not only decrease flavour but would also negatively impact the texture of the fat due to its lower melting point than saturated fats (Manetti, 2022). This decreases the flaky texture. Therefore, a balance between saturated, unsaturated and texture should be explored before further improving the product with different kinds of fillings. Canola oil was considered ideal for replacing part of the saturated fat in the pie crust since it is tasteless and it is high in polyunsaturated fats, which is even healthier than monounsaturated fats for people at risk/suffering from heart disease.

For the filling, different fruits should be considered to find one which satisfies the cravings of the consumers. Nuts which would be great to include for their healthy aspect of polyunsaturated fats, could be considered for the filling of the pie. Therefore, pecan pie was considered. Adding nuts to other flavours were also considered with nuts to improve the health level.

## Excerpt 2

## Prototype experimentation

- Zucchini slice
- Creamy carbonara
- Bacon and pumpkin fritters

Prototype	Zucchini slice	Creamy carbonara	Bacon and pumpkin fritters																																																																																																			
Components	Eggs, brown onion, cheddar cheese, self-raising flour, zucchini, bacon, vegetable oil	Pasta, butter, bacon, garlic, eggs, parmesan cheese, salt and pepper	Pumpkin, bacon, eggs, breadcrumbs, parmesan, pine nuts, olive oil, salt and pepper																																																																																																			
Adjustments made	<ul style="list-style-type: none"><li>• Adding walnuts to increase the healthy fat choices</li><li>• Substituting canola oil for vegetable oil (less total fat)</li><li>• Using whole grain flour to incorporate wholegrains</li><li>• Substituting the bacon for ham to reduce fat intake and energy and reduce sodium</li></ul>	<ul style="list-style-type: none"><li>• Using low fat butter and cheese to reduce the amount of total fat and saturated fat</li><li>• Substituting the bacon for ham to reduce fat and sodium intake</li><li>• Using whole grain pasta to incorporate whole grains</li><li>• Omit the added salt</li></ul>	<ul style="list-style-type: none"><li>• Using whole grain bread crumbs to incorporate whole grains</li><li>• Substituting the bacon for ham to reduce total fat and saturated fat intake as well as decrease sodium</li><li>• Adding kidney beans to increase the legumes</li><li>• Using low-fat cheese to reduce total and saturated fat</li><li>• Omit the added salt</li></ul>																																																																																																			
Chemical and functional properties	<p><i>Physical manipulation</i> - to combine the ingredients they are mixed.</p> <p><i>Application of heat</i> - the slice is cooked in the oven.</p> <p><i>Addition of additives</i> - salt and pepper are added to enhance the flavour.</p> <p><i>Denaturation &amp; coagulation</i> - during cooking, the egg proteins denature and coagulate, resulting in a firm and sponge-like texture for the slice.</p> <p><i>Dextrinisation</i> - as the slice bakes in the oven, its exterior transforms into a beautiful golden colour.</p> <p><i>Aeration</i> - pockets of air are added to the batter when mixed.</p> <p><i>Leavening</i> - the addition of self-raising flour aids in the zucchini slice's rising process.</p>	<p><i>Physical manipulation</i> - to combine the ingredients they are mixed</p> <p><i>Application of heat</i> - the pasta is boiled until it reaches the desired level of tenderness, while the sauce is cooked in a pan.</p> <p><i>Addition of additives</i> - salt and pepper are added to enhance the flavour.</p> <p><i>Denaturation &amp; coagulation</i> - while cooking, the egg proteins denature and coagulate.</p>	<p><i>Physical manipulation</i> - the ingredients are mixed, and the fritters are shaped into balls for cooking.</p> <p><i>Application of heat</i> - the fritters are fried to achieve a crispy texture and golden-brown appearance.</p> <p><i>Application of cold</i> - before frying the fritters are stored in the fridge for an hour to set and hold their shape during cooking.</p> <p><i>Addition of additives</i> - salt and pepper are added to enhance the flavour.</p> <p><i>Denaturation &amp; coagulation</i> - while cooking, the egg proteins denature and coagulate, contributing to the firm consistency of the fritters.</p> <p><i>Dextrinisation</i> - when fried the outside of the fritters turns golden brown.</p>																																																																																																			
Nutritional information	<table><tr><th colspan="3">NUTRITION INFORMATION</th></tr><tr><td colspan="3">Servings per package: 16</td></tr><tr><td colspan="3">Serving size: 90 g</td></tr><tr><td></td><td>Average Quantity per Serving</td><td>Average Quantity per 100 g</td></tr><tr><td>Energy</td><td>453 kJ</td><td>503 kJ</td></tr><tr><td>Protein</td><td>8.4 g</td><td>9.3 g</td></tr><tr><td>Fat, total</td><td>4.9 g</td><td>5.5 g</td></tr><tr><td>- saturated</td><td>2 g</td><td>2.2 g</td></tr><tr><td>Carbohydrate</td><td>6.7 g</td><td>7.5 g</td></tr><tr><td>- sugars</td><td>0.9 g</td><td>1 g</td></tr><tr><td>Sodium</td><td>155 mg</td><td>173 mg</td></tr></table>	NUTRITION INFORMATION			Servings per package: 16			Serving size: 90 g				Average Quantity per Serving	Average Quantity per 100 g	Energy	453 kJ	503 kJ	Protein	8.4 g	9.3 g	Fat, total	4.9 g	5.5 g	- saturated	2 g	2.2 g	Carbohydrate	6.7 g	7.5 g	- sugars	0.9 g	1 g	Sodium	155 mg	173 mg	<table><tr><th colspan="3">NUTRITION INFORMATION</th></tr><tr><td colspan="3">Servings per package: 10</td></tr><tr><td colspan="3">Serving size: 90 g</td></tr><tr><td></td><td>Average Quantity per Serving</td><td>Average Quantity per 100 g</td></tr><tr><td>Energy</td><td>340 kJ</td><td>378 kJ</td></tr><tr><td>Protein</td><td>6.5 g</td><td>7.3 g</td></tr><tr><td>Fat, total</td><td>2.2 g</td><td>2.4 g</td></tr><tr><td>- saturated</td><td>0.8 g</td><td>0.9 g</td></tr><tr><td>Carbohydrate</td><td>7.9 g</td><td>8.8 g</td></tr><tr><td>- sugars</td><td>0.5 g</td><td>0.6 g</td></tr><tr><td>Sodium</td><td>171 mg</td><td>190 mg</td></tr></table>	NUTRITION INFORMATION			Servings per package: 10			Serving size: 90 g				Average Quantity per Serving	Average Quantity per 100 g	Energy	340 kJ	378 kJ	Protein	6.5 g	7.3 g	Fat, total	2.2 g	2.4 g	- saturated	0.8 g	0.9 g	Carbohydrate	7.9 g	8.8 g	- sugars	0.5 g	0.6 g	Sodium	171 mg	190 mg	<table><tr><th colspan="3">NUTRITION INFORMATION</th></tr><tr><td colspan="3">Servings per package: 8</td></tr><tr><td colspan="3">Serving size: 125 g</td></tr><tr><td></td><td>Average Quantity per Serving</td><td>Average Quantity per 100 g</td></tr><tr><td>Energy</td><td>548 kJ</td><td>438 kJ</td></tr><tr><td>Protein</td><td>9.5 g</td><td>7.6 g</td></tr><tr><td>Fat, total</td><td>5.8 g</td><td>4.6 g</td></tr><tr><td>- saturated</td><td>0.6 g</td><td>0.5 g</td></tr><tr><td>Carbohydrate</td><td>9 g</td><td>7.2 g</td></tr><tr><td>- sugars</td><td>2.8 g</td><td>2.3 g</td></tr><tr><td>Sodium</td><td>158 mg</td><td>127 mg</td></tr></table>	NUTRITION INFORMATION			Servings per package: 8			Serving size: 125 g				Average Quantity per Serving	Average Quantity per 100 g	Energy	548 kJ	438 kJ	Protein	9.5 g	7.6 g	Fat, total	5.8 g	4.6 g	- saturated	0.6 g	0.5 g	Carbohydrate	9 g	7.2 g	- sugars	2.8 g	2.3 g	Sodium	158 mg	127 mg
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Sodium	158 mg	127 mg																																																																																																				
Improvements needed	Over in recommend sodium (should be 120mg) for CHD consumers, instead it is 173mg	Over in recommend sodium (should be 120mg) for CHD consumers, instead it is 190mg	Over in recommend sodium (should be 120mg) for CHD consumers, instead it is 127mg. Also it's over in saturated fat (should be 3g) for CHD consumers, instead it is 4.6g																																																																																																			
Criteria met	<ul style="list-style-type: none"><li>• Reformulation of [redacted] current recipes made suitable for consumers with CHD</li><li>• [redacted] eggs are used in the recipe</li></ul>	<ul style="list-style-type: none"><li>• Reformulation of [redacted] current recipes made suitable for consumers with CHD</li><li>• [redacted] eggs are used in the recipe</li></ul>	<ul style="list-style-type: none"><li>• Reformulation of [redacted] current recipes made suitable for consumers with CHD</li><li>• [redacted] eggs are used in the recipe</li></ul>																																																																																																			

For copyright reasons, the company name has been redacted.



## Excerpt 3

## Developing ideas

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

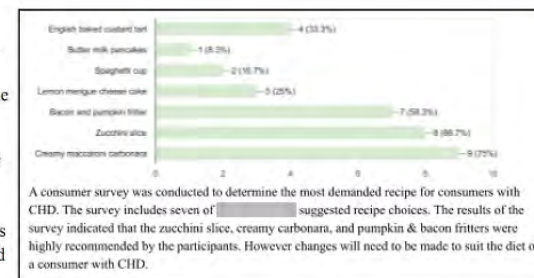
In the first section, explore the problem, the following were investigated; the stakeholders and their needs, constraints, chemical and functional properties of protein and carbohydrates, relevant chemical reactions and processing techniques, analysis of [redacted] current suggested recipes, and analysis of possible substitutable components for CHD consumers. Combining this information, the requirements for the solution and the criteria for self-determination were derived. The target market consumers are represented by sensory profilers selected based on their relevance to [redacted] company. It was identified that the final prototype solution must effectively satisfy both the requirements of the stakeholders [redacted] and the specific needs of consumers seeking a diet or food source tailored to coronary heart disease.

“Over the last 30 years, deaths and disability from cardiovascular disease have been steadily rising across the globe. In 2019 alone, the condition, which includes heart disease and stroke, was responsible for a staggering one-third of all deaths worldwide” (NIH, 2021). This provides the opportunity to develop a CHD-suitable meal. Research by Cubrilo-Turek (2003) indicates that people with CHD are at a higher risk of encountering health issues such as high blood pressure, high cholesterol, obesity, diabetes, heart attacks, stroke, or fatigue. It is evident that they often have subpar dietary habits and limited physical activity. Therefore, developing a product that can alleviate these concerns would involve ingredient substitutions to meet the specific solution requirements and self-determined criteria. People with CHD often have poor diet-related health and limited exercise; developing a product to reduce this will require the substitution of ingredients, meeting the solution requirements and self-determined criteria.

Three prototypes were chosen, all using [redacted] eggs, taking into account the chemical and functional properties of the chosen recipes. To ensure the prototypes will be well-received by consumers, they must be highly accepted by sensory profilers who represent the chosen NCM. By incorporating all these factors, the prototypes will meet the determined criteria and be a valuable reformulation for [redacted] current suggested recipes. After considering the chemical and functional properties of carbohydrates and proteins the following processing techniques and chemical reactions will be used;

- Application of heat, application of cold, physical manipulation, the addition of additives, denaturation, coagulation, dextrinisation, aeration and leavening.

For copyright reasons, the company name has been redacted.



## Excerpt 4

## Data from sensory profilers on the final product: Zucchini slice

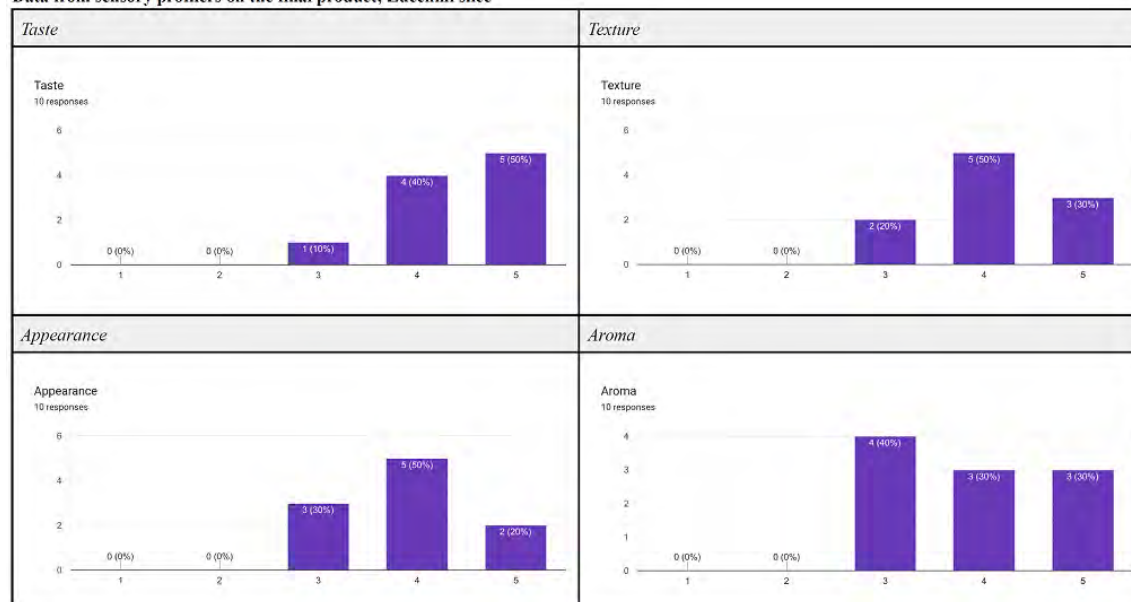
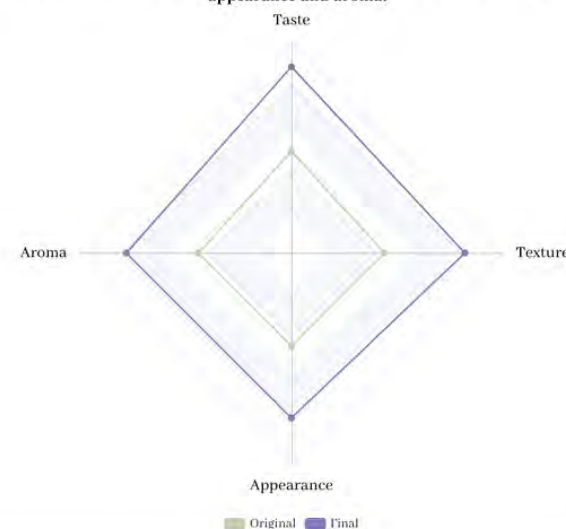


Figure 2: Comparison of the original and final Prototype in terms of taste, texture, appearance and aroma.

**Conclusions**

This final prototype was overall well received by the sensory profilers across all four aspects, as they all received a 3 or above. Half (50%) of profilers rated the taste a 5, 40% rated it a 4 and 1% rated it a 3. The texture was rated a 5 by 30% of sensory profilers, 50% rated it a 4 and 20% rated it a 3. With the appearance 50% rated it a 4, 20% rated it a 5 and 30% rated it a 3. 40% of profilers rated the aroma a 3, and 30% of people rated it a 4 or 5.

**Improvements:**

- Taste → improved from 0% of people rating it a 5 to 50%
- Texture → improved from 0% of people rating it a 5 to 30%
- Appearance → improved from 0% of people rating it a 5 to 20%
- Aroma → improved from 0% of people rating it a 5 to 30%

Based on the results rated on a 5-point scale, the prototype is accepted as a final product. Figure 2 displays that the final prototype received improved ratings across all aspects; taste, texture, appearance, and aroma. The adjustments and refinements made from the original prototypes have played a significant role in achieving this acceptability, along with minor adjustments to the final method. However, it is worth noting that further experimentation could still be conducted to make additional improvements in all aspects of the products.

When looking at the nutritional information, it is apparent that the energy, saturated fat, and sodium content all fall within the recommended limits for individuals dealing with CHD. This reduction in energy, saturated fat, and sodium renders the recipes well-suited for inclusion in the diets of CHD-affected individuals. When comparing the original recipe and the first prototype created, this final prototype has reduced energy, saturated fat and sodium;

- Energy: 571kJ → 503kJ → 289kJ
- Saturated fat: 1.4g → 2.2g → 1.1g
- Sodium: 404mg → 173mg → 109mg

**NUTRITION INFORMATION**

Servings per package: 16		
Serving size:	90 g	
	Average Quantity per Serving	Average Quantity per 100 g
Energy	260 kJ	289 kJ
Protein	5.9 g	6.6 g
Fat, total	1.8 g	2 g
- saturated	1 g	1.1 g
Carbohydrate	5 g	5.5 g
- sugars	1.3 g	1.4 g
Sodium	98 mg	109 mg



## Excerpt 5

## Evaluate and refine ideas and the solution

Self-determined criteria	Evaluating using self-determined criteria	Recommendations for enhancement
<ul style="list-style-type: none"> <li>Reformulate a recipe for [redacted] website for consumers with coronary heart disease.</li> <li>The recipe uses [redacted] products (eggs) is required.</li> <li>Align with [redacted] ethos; taste, quality and animal welfare.</li> <li>Be highly accepted by sensory profilers in terms of taste, texture, appearance and aroma.</li> <li>The prototype must use chemical and functional properties of carbohydrates and proteins, including but not limited to the application of heat, application of cold, physical manipulation, the addition of additives, denaturation, coagulation, dextrinisation, aeration and leavening.</li> <li>Product must contain; <ul style="list-style-type: none"> <li>Low sodium - 120mg per 100g</li> <li>Low saturated fat - 3g per 100</li> <li>Additional serving of fruit or vegetables and whole grains</li> <li>Increased legumes</li> <li>Use of low-fat dairy</li> </ul> </li> <li>Minimal preparation time for convenience purposes</li> </ul>	<ul style="list-style-type: none"> <li>The prototype is a successful reformulation of the current zucchini slice recipe on the [redacted] website; the recipe was reformulated to be suitable for a CHD consumer.</li> <li>5 eggs were used in the recipe, sourced from [redacted]</li> <li>This prototype aligns with the current values and expectations, the slice is quality and was rated highly from the taste.</li> <li>The sensory profilers highly rated and accepted the final prototype, with scores of three and above for all aspects: taste, texture, appearance, and aroma.</li> <li>The prototype incorporates multiple chemical and function properties of carbohydrates and proteins, including the use of physical manipulation, application of heat, the addition of additives, denaturation, coagulation, dextrinisation, aeration and leavening.</li> <li>The product contains; <ul style="list-style-type: none"> <li>Low sodium - 109mg per 100g</li> <li>Low saturated fat - 1.1g per 100g</li> <li>Peas and corn were added to increase the vegetable servings</li> <li>Whole grain flour was used instead of white flour</li> <li>Kidney beans were added to increase the serving of legumes</li> <li>Low-fat cheese was used</li> </ul> </li> <li>The slice takes 10 minutes to prepare and 30 minutes to cook</li> </ul>	<p>Further refinement of this product could involve extending the cooking time to ensure thorough cooking and enhance the texture of the final slice. Extend the cooking time from 30 minutes to 35-40 minutes, also make sure the temperature of the oven is maintained by making sure it is not opened during the cooking process.</p> <p>To improve the texture, the chicken can be chopped into smaller pieces and the frozen vegetables could be defrosted and drained before being put in the slice. This adjustment will improve the texture making it less moist.</p> <p>The addition of different types of vegetables could also be experimented with further depending on their vitamin and mineral content for which a CHD consumer would benefit, e.g. green leafy vegetables.</p>

For copyright reasons, the company name has been redacted.

## Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- when matching evidence to the characteristics for the Analysing and determining criterion at the top performance level, attention should be given to
  - including specific and accurate self-determined criteria that include quality, functionality and reliability indicators that affect the chosen nutrition consumer market
  - ensuring that the response analyses nutrition consumer markets from the context and the syllabus, e.g. elderly, health-conscious, obesity, heart disease. Type 1 diabetes and adolescents are not part of the syllabus subject matter. Relevant nutritional information and data should be analysed to show an insightful understanding of the relationship to the selected nutrition consumer market
- when matching evidence to the characteristics for the Synthesising, generating and evaluating criterion at the top performance level, attention should be given to
  - ensuring that a final solution has been generated, including valid sensory profiling data. The data for the proposed solution should be unique and not a duplicate of the experimental data and sensory profiling
  - ensuring all self-determined criteria are used to evaluate ideas and a solution, and to make recommendations for enhancements
  - ensuring coherent and logical synthesis of information from nutrition information panels and chemical, functional and sensory information in relation to the nutrition consumer market problem.

## Additional advice

- Marked ISMGs should be annotated to indicate the characteristics evident in the student response and the mark awarded for each criterion (*QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.1). Teachers use the best-fit approach when student work matches characteristics from across different performance levels. For support, please review the *Making judgments* webinar in the Syllabuses app, *Module 3 — Making reliable judgments* in the Assessment Literacy app in the QCAA Portal and the additional advice section for IA1 on page 16.



# External assessment



External assessment (EA) is developed and marked by the QCAA. The external assessment for a subject is common to all schools and administered under the same conditions, at the same time, on the same day.

## Examination (25%)

### Assessment design

The assessment instrument was designed using the specifications, conditions and assessment objectives described in the summative external assessment section of the syllabus.

The examination consisted of one paper:

- Paper 1, Section 1 consisted of short response questions (28 marks)
- Paper 1, Section 2 consisted of an extended response question (45 marks).

The examination assessed subject matter from Unit 4. Questions were derived from the context of Topic 1: Formulation and reformulation for nutrition consumer markets and Topic 2: Food development process.

### Assessment decisions

Assessment decisions are made by markers by matching student responses to the external assessment marking guide (EAMG). The external assessment papers and the EAMG are published in the year after they are administered.

### Effective practices

Overall, students responded well to:

- Question 1, determining that a health claim was not reasonable for a product
- Question 2a, developing a graph to compare sensory profiles of formulations
- Question 3a, determining nutritional benefits and risks of a formulation for a consumer experiencing chronic heart disease
- Question 4, listing substituted food components for a chosen formulation and justifying them by referring to the nutrition consumer market.

Student responses that used stimulus data to support decisions provided the best justifications.

### Samples of effective practices

#### Short response

The following excerpts are from Question 1. It required students to determine if a health claim for a product was reasonable and justify their response using the Nutrient Profiling Scoring Criterion (NPSC) calculation.

Effective student responses:

- identified that the health claim was not reasonable

- stated that a category 2 food must score less than 4 in the NPSC, but this product scored 10.

These excerpts have been included:

- as they show identification that a health claim is not reasonable
- to provide examples of use of the NPSC to justify the response.

#### Excerpt 1

The health claim that the category 2 breakfast cereal makes of Break fast being 'a good source of fibre', is not reasonable as the final NPSC score is 10. category 2 foods need an NPSC score of under 4 to make a health claim.

#### Excerpt 2

Whilst 'Break fast' does have a notable 13.1g/100g of dietary fibre, it's NPSC score renders it unable to make this claim. All food items looking to make a nutritional claim require an NPSC score of less than 4, this product breaches which at a score of 10, disabling the reasonableness of the claim.

The following excerpts are from Question 2. Part a required students to develop a graph comparing the sensory profiles of three risotto formulations. Part b required students to analyse the food components and procedures to reformulate the risotto and to justify their response.

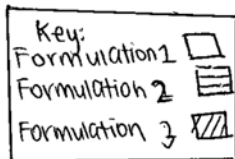
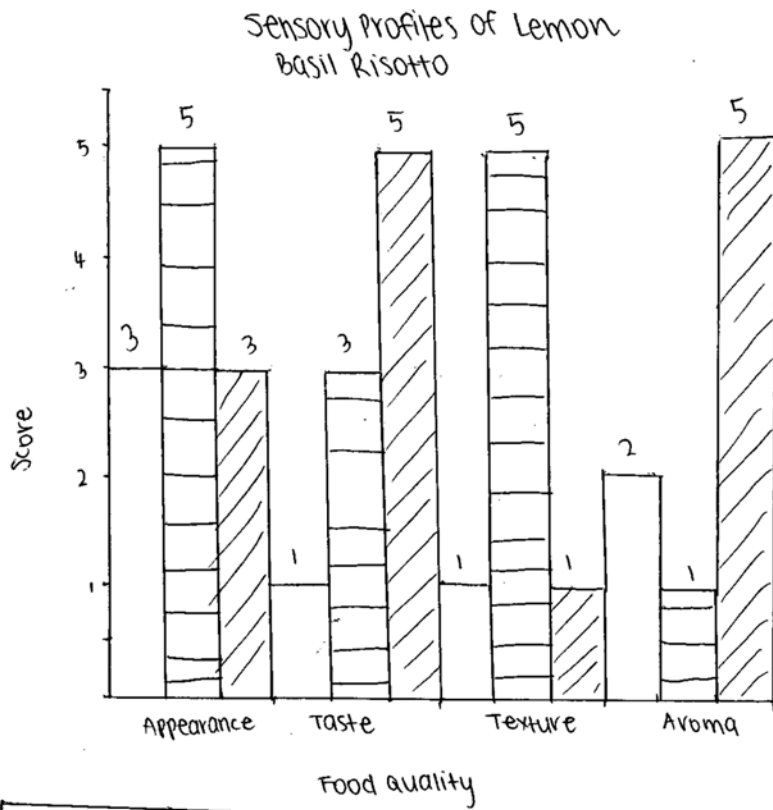
Effective student responses:

- synthesised the sensory profiling data into a graph comparing appearance, taste, aroma and texture
- identified that formulation 3 was rated best in taste and aroma due to the food components that were used
- identified that formulation 2 was rated best in texture and appearance due to better procedure
- specified modifications to food components and/or procedure to improve sensory ratings.

These excerpts have been included:

- to show synthesis of sensory data into a graph comparing three risotto formulations (Excerpt 1)
- to demonstrate identification of formulations that are best rated in each sensory aspect and the relationship to food components and procedure (Excerpt 2)
- to show an example of modifications to improve sensory ratings (Excerpt 2).

Excerpt 1



**Excerpt 2**

Formulation 2 displayed the best food qualities of appearance and texture (both scored 5). This could be due to the procedure stating to stir until water and stock are absorbed, creating a less runny risotto. The best (5) taste and aroma was achieved by formulation 3 with a good balance of <sup>ricotta</sup> cheese (100g) and lemon juice (40ml) creating the perfect lemony and cheesy flavor unlike formulation 1 which was too tart <sup>and had a very strong lemon aroma (rated 2)</sup> due to 80ml lemon juice, and formulation 2 with mild flavour and aroma<sup>as there was less cheese (50g), less lemon juice (20ml), and no white wine.</sup> To reformulate the risotto to make a new formulation with the best sensory qualities, the food components must include 100g ricotta cheese, 40ml lemon juice, 150ml dry white wine and the food procedure must state to absorb the wine before adding in the stock, then continue stirring stock until absorbed before removing from heat. This will overall improve the sensory qualities of appearance, taste, texture, and aroma.

The following excerpt is from Question 3. Part a required students to use information to determine the nutritional benefits and risks for a consumer experiencing chronic heart disease if they were to consume formulation 1 every day. Part b required students to analyse formulations 2 and 3 to decide which would be better for a consumer experiencing chronic heart disease, determine the nutritional benefits and risks of the selected formulation, justify their decision using data, and suggest modifications to the selected formulation.

Effective student responses:

- determined that the nutritional benefits of formulation 1 were few and the nutritional risks were high
- justified the nutritional benefits and risks using the formulation, recommended daily intake (RDI) panel and definition of a snack
- correctly stated that formulation 3 was best for a consumer experiencing chronic heart disease
- correctly determined the nutritional benefits and risks of the formulation
- justified the nutritional benefits and risks using the RDI panel, formulation 2 and formulation 3.



This excerpt has been included:

- as it shows determination of poor nutritional benefits and high nutritional risks
- to illustrate justification of nutritional benefits and risks using the formulation, RDI panel and definition of a snack.

If a consumer experiencing chronic heart disease (CHD) was to consume formulation 1 everyday, this could lead to further negative health effects. Firstly, the Hawaiian pizza scrolls are considered to be a snack and should only be ~~8~~ from 400-600 kilojoules per serve. This ~~meal~~ snack is 1230 kJ/<sup>per serve</sup> which exceeds the limit. CHD consumers should also ensure they have a decrease amount of saturated fat, sodium, sugar and an increased amount of dietary ~~to~~ fibre. The fat and saturated fat content exceed the recommended snack serving as fat should be  $\leq 10$ g and the saturated fat should be  $\leq 3$ g. This snack has ~~fat~~ 14.3g/serve of fat and 7.4g/<sup>serve</sup> of ~~3~~ saturated fat. This could contribute to obesity, thus further negatively affecting the heart. The sugar content is within the guidelines for a snack being below 15g/<sup>serve</sup> as it is 7.4g/serve. However, there is an excessive amount sodium being 794mg which exceeds the recommended 300mg/meal therefore contributing to high cholesterol, which adds plaque to the heart vessels making it hard to transport oxygenated rich blood. Finally, the dietary fibre (Q3-a) content is also too low being 1.4g/serve which ~~doesn't~~ makes the consumer lack ~~for~~ a sense of fullness.

The following excerpt is from Question 3. It required students to analyse two formulations and decide which would be better for a consumer and justify their decision with data.

This excerpt has been included:

- as it identifies coconut strawberry muffins (student has mislabelled the formulation number) as the better formulation for a consumer with chronic heart disease
- as it determines the nutritional benefits and risks of the formulation
- as it justifies the nutritional benefits and risks using the RDI panel, formulation 2 and formulation 3.

Based on an examination of both formulations, the ~~most~~ best suited formulation for a CHD consumer is formulation 2. Firstly, based on stimulus from Q3a), the recommended energy content for a snack is 400-600kJ, and formulation 2 has 784 kJ compared to formulation 1 having a high amount being 1800kJ. The fat content of the snack meets the recommended amount for snacks of below 10g/100g, therefore decreasing the risk of obesity and further heart complications. However, the saturated fat content is too high being 6.8g/100g which can contribute to further health complications, thus this would need to be modified. The dietary fibre content can also be increased as it is only 2.5g/100g and should be above 3g/100g to make the consumer feel more full. Finally, while the sodium content is above formulation 1 of 5mg/100g, being 160mg<sup>/100g</sup>, this is still a suitable amount for CHD consumers as it is below 300mg/100g. To improve this formulation, ~~the~~ the energy level could be modified to decrease 784 kJ to below 600 kJ by decreasing the amount of coconut powder substituting the coconut flour for wholemeal flour which further contributes to the increase of dietary fibre. To reduce the amount of saturated fat, coconut oil should be substituted for a vegetable oil lower in saturated fat such as sunflower oil. A final modification to improve the sodium levels would be to replace the buttermilk with a low salt buttermilk.

The following excerpt is from Question 4. It required students to identify the best formulation to modify using substitute food components and to justify them by referring to the nutrition consumer market and sensory profiling.

Effective student responses:

- selected formulation 1 (zucchini slice)
- provided three valid food component substitutions
- justified two substitutions by linking to nutrition consumer market needs
- justified a third substitution by linking to possible sensory profiling.

This excerpt has been included:

- as it shows identification of zucchini slice as the best formulation
- to show three valid food component substitutions
- to show justifications of food component substitutions by linking to nutrition consumer market needs and sensory profiling.

Chosen formulation: ~~pancake~~ Zucchini and bacon slice

	Original food component	Substituted food component
1.	Self raising flour	wholemeal self-raising flour
2.	<del>bacon</del> Smoked bacon	Sweet potato
3.	Thickened cream	Low-fat almond milk

The health conscious consumer market requires ~~unprocessed~~ minimally processed foods, and are focussed on fresh food components that provide nutrients and vitamins. The self-raising flour can be substituted for wholemeal self-raising flour which provides more fibre and is a healthier alternative<sup>without altering the texture greatly</sup>. The smoked bacon is a highly processed ingredient that is cooked in oil, ~~which~~<sup>and</sup> contains high amounts of fat and sodium. Instead, it could be substituted for sweet potato that is roasted to still provide flavour<sup>and aroma</sup>, but reduce the amount of processed foods and increase the nutritional benefits of the meal. The last substitution is swapping thickened cream for low-fat almond milk. This swap decreases the slice's fat content and is a healthier alternative to highly processed thickened cream.

### Extended response

The following excerpts are from Question 5. It required students to:

- analyse the problem to determine the solution requirements, including the stakeholders (the pregnant vegan nutrition consumer market and the food company), and explain their needs
- synthesise and evaluate how prototypes meet the needs of the nutrition consumer market and reflect consumer trends and their performance in sensory profiling
- evaluate prototypes to make a decision, refine ideas and make justified recommendations for enhancement.

Effective student responses:

- identified and explained the needs of the food company and the pregnant vegan nutrition consumer market

- provided an accurate determination of solution requirements to meet these needs, including consumer trends
- provided a critical evaluation of
  - the appropriateness of each prototype for the pregnant vegan nutrition consumer market
  - each prototype's alignment to the consumer trends
  - the sensory properties of each prototype, using data
- identified a solution and provided detailed justification of the identified solution
- made effective recommendations for enhancement that were justified with detailed and accurate data from the stimulus.

These excerpts have been included:

- to demonstrate accurate determination of solution requirements for each stakeholder (Excerpts 1 and 2)
- to demonstrate analysis of how prototypes reflect the pregnant vegan consumer trends (Excerpt 3)
- to demonstrate analysis of sensory profiling of each prototype (Excerpt 4)
- to demonstrate justification of a prototype as the best solution including its appropriateness for the nutrition consumer market, trends and sensory data (Excerpt 5).



## Excerpt 1

The ~~identite~~ identified problem is that there is a gap in the market for products which are able to be consumed by pregnant vegan consumers. The food company would like to provide a range of delicious, nutritionally balanced foods to this nutrition consumer market. The main stakeholders are the food company and the ~~pregan~~ pregnant vegan consumers. The needs of the company include meeting the NCM needs of the consumer, following the current food trends and ~~a product the propo~~ the proposed solution being able to be sealed, and last up to seven days in the refrigerator. The consumer needs include meeting the consumer trends, having adequate sensory profiling results and meeting their needs and requirements. The consumers needs are high iron, which is needed for the growth of cells and if high amounts are not consumed there is an increase risk of premature births and low birth weight. Another need ~~is~~<sup>is</sup> high calcium content to ensure the baby consumes enough, if not the baby draws calcium from the mum resulting in the mum having brittle bones. Pregnant vegan consumers also require high ~~is~~ protein and high fibre which both needed for the growth and development of a healthy baby. The food trends which the proposed solution needs to follow are

eating a variety of foods, meaning the meal needs to incorporate a variety of ingredients, incorporate more ~~to~~ plant-based proteins, meaning the protein needs to be from a plant-based source, and being aware of foodborne illness, meaning the meal needs to not contain ingredients that may introduce cross contamination. ~~The~~ Therefore, the solution criteria of the proposed solution is meeting the NCM needs, following food trends and have adequate sensory profiling results including appearance, taste, aroma and texture.

## Excerpt 2

The solution requirements of the task include that the meal must be enjoyed by pregnant vegans with high and acceptable sensory properties, it must be a delicious and nutritionally balanced food, and it must be suitable for the NCM by being vegan and providing essential nutrients that pregnant women require. The prototypes must be sealed and last up to seven days in the refrigerator, and they may require heating before consumption.

The stakeholders of the task include the food company, dietitians, chefs and the pregnant vegan consumers. The food company requires the ~~food~~ <sup>food</sup> to meet regulation standards ~~and~~ for the safe consumption of food. They also need their customers to desire their products, so people purchase them to make profit. The needs of the dietitians is to provide all the essential nutrients of the meal including protein, calcium, iron, fibre, <sup>and only vegan ingredients</sup> etc. for

the pregnant women. The chef needs to ensure no cross contamination of non-vegan products and any other ingredients that are not stated for food safety. The vegan pregnant women (NCM) require foods high in protein for growing their child, high calcium for the ~~their~~ <sup>and</sup> foetus's bones and teeth, low saturated fat, sodium, kilojoules to maintain a healthy heart and weight during the pregnancy period. They also need high fibre for preventing constipation and they need an easy meal to consume without using too much energy as they get fatigued easily. Their food must be vegan. The current food trends include eating a variety of foods, incorporating plant-based protein, and being aware of food-borne illness.

## Excerpt 3

The food trends are eating variety of foods, incorporating more plant-based proteins and being aware of foodborne illness. Prototype 1 provide variety as it is not normally vegan and also uses dates, oats and walnuts to incorporate plant-based protein. Additionally, prototype 1 does not contain any ingredients which may ~~eat~~ cause foodborne illness. Prototype 2 also provide variety as frittatas are normally not vegan, uses ~~protein~~ plant-based protein or egg substitute, however, it does contain tofu which is a food that can cause foodborne illness. Furthermore, prototype 3 is normally not vegan which means it provides variety, contains TVP mince, egg substitute and rehydrated beans to incorporate ~~to~~ plant-based protein. Prototype 3 also does not contain any foods which may result in foodborne illness. Thus, prototype 1 and 3 meet the food trends the most.

## Excerpt 4

The consumers require adequate sensory profiling results to ensure they like the ~~meat prototype~~ meal. Prototype 1 overall received good results with appearance receiving 46/50 good or great, taste receiving 38/50 satisfactory or above, aroma receiving 48/50 good or great and texture receiving 43/50 satisfactory or above. Prototype 2 received ~~poor~~ <sup>poor</sup> average results with appearance receiving 47/50 satisfactory or above and aroma receiving 42/50 satisfactory or above. However, the taste received 45/50 satisfactory or below which may be from using vegan substitutes such as cheese, milk, egg and tofu. The texture also received 50/50 satisfactory or below which also may be a result of the ~~the~~ frittatas being vegan. Prototype 3 received average results with appearance receiving 39/50 good or great, taste receiving 44/50 satisfactory or above and aroma receiving 38/50 good or great. However, the texture received 47/50 satisfactory or below which may be a result of them being ~~B~~ packaged and then reheated. Therefore, with refinements prototype 1 received the best sensory profiling results.

**Excerpt 5**

The proposed solution is prototype 1 as it is high in protein (13.6g per 100g), high in fibre (6.9g per 100g), high in calcium (76mg per 100g) and high in iron (35.7mg per 100g). Prototype 1 also provide variety as a brownie is been reformulated to be vegan, uses walnuts, dates and oats as plant-based protein and does not contain any food which may cause foodborne illness. Additionally, prototype 1 recieved the best sensory profiling data receiving 46 good or great for appearance, 38 satisfactory or above for taste, 48 good or great for aroma and 43 satisfactory or above for texture. However refinements can still be made.

**Practices to strengthen**

When preparing students for external assessment, it is recommended that teachers consider:

- instructing students to refer to data from the stimulus when analysing formulations and justifying decisions
- providing regular opportunities for students to practise questions that require them to apply the problem-solving process in a range of contexts, including analysing data and justifying decisions
- encouraging students to read and break down the questions carefully so that they identify all elements of the question including the cognitive verbs and how to respond
- in the extended response, instructing students to evaluate the proposed solution against all solution requirements.