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MARKET FOR FLAVONOID-RICH APPLES

Co-operative Enterprise Research Unit
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CONTENTS

INTRODUCTION

This report summarises the findings from study of Australian consumers into their attitudes and preferences for Flavonoid-rich apples, in particular, a new variety of apple known as "ANABP01". This study was undertaken by the Co-operative Enterprise Research Unit (CERU) at UWA with a focus on investigating the following issues:

1) Consumer attitudes and preferences for Flavonoid-rich apples with specific focus on:
   a) Stated versus real preferences for healthy foods such as those high in anti-oxidants.
   b) Attitudes towards the consumption of foods such as flavonoid-rich apples with respect to the potential trade-offs over such attributes as:
      i) Perceived health benefits
      ii) Taste
      iii) Appearance
      iv) Price
      v) Local production
   c) Consumption patterns and likely demand

2) Marketing claims that could be made about the fruit – with respect to the health benefits.

Initially the study was also planning to develop a business case analysis for the ANABP01 or "ANABP01" apple that could be used for future funding opportunities and the development of a sustainable business model for an apple and pear supply chain building on this innovation in plant breeding. However, this was not possible due to developments outside the control of the research team that led to this final phase of the project being cancelled.

BACKGROUND

Apples are one of the most widely cultivated fruits in the world with more than 7.500 cultivars (RIRDC, 2009). They are also a highly popular fruit and a good source of vitamin C, potassium, dietary fibre and phytonutrients including antioxidants. They are low in saturated fat, cholesterol and sodium as well as being a low GI food (HAL, 2010). Over 15 different varieties of apple are grown commercially in Australia of which the most common are: Cripps Pink or Pink Lady™, Granny Smith, Gala and Cripps Red or Sundowner™. Most apples are self-incompatible and require cross-pollination from pollinators such as honey bees. Pollination is therefore a critical aspect of the commercial production of apples (RIRDC, 2009). The breeding of a new variety of apple can take 10 to 15 years and involves a series of stages (HAL, 2010).

THE ANABP01 "ANABP01" APPLE PROJECT

The Department of Agriculture and Food WA (DAFWA), in conjunction with the Australian National Apple Breeding Program (ANABP) and UWA have been engaged in a research project focusing on the development of high flavonoid apples. The project's aims were to:

> "Identify and develop the necessary knowledge and capacities required to capture the opportunity to selectively breed, commercialise and market a flavonoid-rich apple".

The project has two specific goals:

- **Goal 1:** Defining the knowledge and capacity required to selectively breed a flavonoid-rich apple.

- **Goal 2:** Defining the knowledge and capacity required to identify markets and pathways to that market for a flavonoid-rich apple.

The broader research project has been guided by two questions:

1) Can we breed a flavonoid-rich apple, if given the tools to identify it?
2) Can we identify a market and particularly a pathway to that market?

The first question has been addressed with the production of the "ANABP01" apple. This current project addresses the second question by identifying a market and a pathway to that market.

The "ANABP01" apple is a new variety with a dark burgundy coloured skin that has been developed from cross-breeding the "Royal Gala" and "Sundowner™" apples. The production of this new variety has been undertaken by DAFWA who own the plant breeder rights to the apple. This breeding program has been taking place over much of the past 20 years. It has involved DAFWA employees and the famous breeder of the Pink Lady™ and Sundowner™ apples, John Cripps.

The origins of the "ANABP01" apple have a long history commencing with the production of the "Lady Williams" apple that first appeared in Donnybrook Western Australia in 1935 as what is thought to have been an accidental cross-breeding of the American Jonathan and the Australian Granny Smith apples. The "Lady Williams" apple was then cross-bred by the WA Department of Agriculture with the American "Golden Delicious" variety in the 1970s to produce the "Sundowner™" apple. This WA apple was subsequently cross-bred with the New Zealand "Gala" apple to produce the new variety. The "ANABP01" apple not only looks attractive with its dark burgundy skin colour, it also has a creamy yellow flesh and is crisp and juicy with a well-balanced flavour (Fruit West, 2015).

Apple production in Australia

The Australian apple, pear and stone fruit growing industry is comprised of approximately 2,007 mostly small orchards who generated combined revenues of around $1.1 billion in 2014 with a total estimated profit of $91.6 million (Tonkin, 2014). Although the annual growth rate in the industry has been around 2.4 per cent per annum over the past five years, the outlook for the sector is one of decline.

Major challenges facing growers are changing weather patterns, water shortages, falling demand from local fruit processors, falling profit margins and increasing competition from cheaper imported products. This has seen fruit processes demand lower prices from growers for their product while the costs of production have increased. As Tonkin (2014) predicts:

> "The industry's prospects remain bleak. Industry revenue is forecast to fall marginally over the five years through 2019-2010, at an annualised 0.6%, to reach $1.06 billion. Over the next five years, the industry will be confronted by a combination of increasing competition from low-priced imports, uncertainty in the downstream processing industry and ongoing pressures from supermarkets. These factors will cause great concern for farmers, as they will continue to place downward pressure on prices and profit margins. Fruit farmers will remain at the mercy of rainfall and weather conditions over the period." (p. 5)

The major external influences on the apple, pear and stone-fruit industry are the demand from fruit processors, demand from supermarkets and grocery stores, domestic fruit prices, consumer attitudes toward healthy food and the opportunities for exports. According to IBISWorld research (Tonkin, 2014):

- **Demand from fruit and vegetable processors is declining.** The pressure of cheap foreign imports has had negative impacts on local fruit and vegetable processors. As a result, they are expected to reduce their

demand for fruit from local producers which will impact significantly on farmers as this is a major supply channel for local growers.

- **Demand from supermarkets is forecast to grow.** Fruit growers rely on supermarkets and grocery stores for the direct sale of whole fruit to consumers. In recent years' supermarkets and grocery chains have begun sourcing fresh fruit directly from farmers due to the benefits this provides in terms of reduced supply chain transaction costs and enhanced control over prices from both sides.

- **The domestic price of fruit is expected to rise.** Fruit prices are highly volatile and prices paid by processors have declined due to the impact of cheaper imports. However, for fresh fruit that is subject to seasonality prices can be higher and this can help growers to improve their profit margins.

- **Consumers are becoming more health conscious.** Australian households are increasingly interested in eating healthier diets. The level of consumer interest in nutrition and the long-term effects of poor diet on obesity and disease have seen consumers increasing their consumption of natural foods such as fruit. Nielsen's (2015) recent Global Health and Wellness Survey highlighted the increasing consumer desire for health foods. In Australia, 88 per cent of respondents signalled that they are willing to pay more for food with healthy attributes. Nielsen Home Scan data shows the total grocery health foods category in Australia is growing at 8.2 per cent. More than two thirds (69%) of households have bought health food products in the past year.

- **International market opportunities.** The Australian apple, pear and stone-fruit industry currently exports around $82.8 million in annual sales. However, prices and profit margins are impacted by the fluctuations in the Australian dollar and the price competitiveness of local growers. The high exchange rate for the Australian dollar has meant that many growers have focused more on sales to the domestic market. However, the outlook for the Australian dollar is for a decline in the trade-weighted index which will see exports become more attractive.

These competitive pressures have had a significant impact on the Australian apple, pear and stone-fruit industry in recent years. Growing concentration of market power within the supermarket and grocery sector has generated an imbalance for smaller producers. For example, around 74 per cent of the total supermarket and grocery sector in Australia is dominated by two firms, Woolworths (41.4% market share) and Coles (32.5%) (Witham, 2013).

The majority of apple, pear and stone-fruit producers are small family farms of which nearly half are non-employing micro-businesses. More than 60 per cent of growers earn less than $200,000 per annum and there are very few large companies in the industry. Only 5 per cent of orchards generate annual revenues of more than $2 million (Tonkin, 2014).

Apple varieties grown in Australia

Apples area major category for the apple, pear and stone-fruit sector and in 2014-15 comprised around 45.3 per cent of the total market, representing around $498.3 million in revenues (Tonkin, 2014). They are a staple food item for most Australian households. At least 13 major varieties of apples are produced in Australian orchards. These varieties include:

- **Braeburn** – originally discovered in New Zealand in 1952 as a chance seedling. It is thought to have been a cross between Lady Hamilton and Granny Smith varieties. The apple has a red/orange colour with vertical streaky appearance on yellow/green background. It has a sweet and tart flavour. This apple is able to be stored once chilled.

- **Cripps Pink or Pink Lady™** – bred in Western Australia in 1973 by John Cripps who crossed the Golden Delicious and Lady Williams varieties. The apple has a pink blush colour over a greenish yellow base skin. It is high in sugar content and has a crisp firm flesh and pleasant effervescent flavour. It is Australia's favourite apple and is grown in at least 15 countries and sold internationally to more than 30 countries. It is generally harvested in April and available for much of the year.

- **Cripps Red or Sundowner™** – this apple is a cross between a Golden Delicious and Lady Williams and was also bred in Western Australia. The apple has a dark red skin and a round shape with white markings or "lenticles" occurring naturally on the skin. It has a sweet, flavoursome taste and sugar levels improve with storage making it suitable for baking. Sundowner apples are harvested in March and available in stores from April through to November.

- **Eve** – a sweet and tangy apple with a bright red skin and white flesh. It is very crisp and crunchy, firm and flavoursome. It is popular for salads and fresh eating. It is generally harvested in June and sold in July to September.

- **Fuji** – this apple originated in Japan and is one of the main varieties in that country. It has a red/dull pink blush over a green/yellow base. It is a large apple and has a honey sweet flavour with firm texture and a crisp and juicy taste. It has been described as the "perfect eating apple" and has high sugar content and is suitable for cooking due to its ability to retain its shape. Fuji apples are usually harvested in March and sold through April to October.

- **Golden Delicious** – this apple originated in West Virginia USA in 1912 and is considered an excellent eating apple. It has a bright yellow to golden skin colour that may have a pink tinge. It also has a creamy white flesh that is sweet, tasty and juicy. These apples are usually harvested in February and sold from March through to August.

- **Granny Smith** – this apple was discovered in 1868 by "Granny" Anne Smith of Ryde NSW. It is thought to be a cross between a French Crab apple and other varieties. The apple has a bright green flesh and a sharp tart taste. It is popular for cooking. These apples are usually harvested in April and available for sale for much of the year.

- **Green Star™** – originating in Europe this apple is large with a bright shiny green skin and a crisp white flesh. The apple is bred for its sweet taste despite its green skin colour. The Green Star™ is very juicy and contains a high amount of vitamin C. This ensures that they don't brown as quickly as many other apples when cut and don't need preservatives. This makes them popular as a side serving for cheese platters.

- **Jazz™** – a new apple variety it is a cross-between a Gala and Braeburn. The Jazz is a small apple with a pink/red blush over a light green background. The apple is crunchy and effervescent offering a sweet tangy flavour. It was first produced in 2009 and has been building up production. It is generally harvested in April and sold in stores from May to October.

- **Jonagold** – bred in 1953 in the United States it is a cross between the Golden Delicious and Jonathan apples. It has a green-yellow basic colour with crimson brindled highlights. The apple is crisp, juicy and aromatic with a sweet-sour taste. It is a large apple with a thin skin.

- **Kanzi™** – this apple originated in Belgium as a cross between the Gala and Braeburn apples. The trademarked name is Swahili for "hidden treasure". It is a large apple with a bright red/green skin and white flesh. The flavour is rich and slightly sharp rather than sweet. The texture of the flesh dense, crisp

and juicy. This makes it a popular eating apple. At least 250,000 trees are expected to be planted in Australia by 2018.

- **Lady Williams** – discovered by chance in the 1930s in Donnybrook Western Australia and is the parent stock for Pink Lady™ and Sundowner™ apples. It is thought to have its origins in the Granny Smith and Jonathan apples.

- **Red Delicious** – this crimson to dark red coloured apple has a tapered shape with four distinct crowns at its base. It originated in Iowa USA in the 1870s and is one of the most commonly grown apples in NSW. The apple has a sweet, highly aromatic, creamy white flesh. Harvested in February it is sold in stores for most of the year.

- **Royal Gala** – was bred in New Zealand around 1934 as a cross between Kidd's Orange Red and Golden Delicious. It was brought into Australia in the 1980s. The apple has a pink/red blush with orange to deep orange strips over a yellow base. It is sweet to the taste, with dense white flesh. It is popular for eating, cooking or for salads. The apple is harvested in February and sold from March to September.

ANTIOXIDANTS IN APPLES

Antioxidants are food compounds that help to neutralise free-radicals, which are unstable molecules produced in the human body due to oxidation. Free radicals have been associated with a range of chronic diseases such as heart and liver disease and cancer.

Antioxidants can be sourced from a wide range of foods that contain different types of these compounds. One of these is flavonoids, which can be obtained by eating citrus fruits, onions and apples, as well as drinking tea, green tea and red wine. A range of foods have flavonoids, including dark chocolate, which can have potential health benefits (Engler, *et al.,* 2004).

Dietary flavonoids are a diverse range of polyphenolic compounds that are found naturally in plant foods such as fruits, vegetables, grains, herbs and beverages. There are a wide range of flavonoids and they have a degree of structural complexity and diversity that include antioxidant and anti-inflammatory benefits (Hooper et al., 2008). These benefits are understood to be related to the ability of the antioxidants to reduce the oxidation of LDL cholesterol, which is thought to be associated with atherosclerotic diseases. As such these antioxidant benefits of flavonoids may have a positive impact on the human cardiovascular system (Mink et al., 2006).

The antioxidant benefits of flavonoids are due to their "free radical scavenging properties and because they are chelators of metal ions", which if included in regular diets at relatively high levels may help to reduce the risk of some chronic diseases such as ischemic heart disease, cerebrovascular disease, lung cancer and prostate cancer as well as Asthma (Knekt *et al*., 2002).

However, the flavonoid quercetin is one that has been found to have a positive benefit on the possible prevention of chronic diseases, and apples are a rich source of quercetin. According to Knekt et al. (2002 p. 567):

> "In summary, we found inverse relations between the dietary intake of some flavonoids and the incidence of several chronic diseases. These associations were mainly attributable to the consumption of apples, the main source of quercetin in the present population."

The health benefits of flavonoids in apples has seen a trend towards including this as a new quality parameter for this fruit in addition to size, shape, colour and taste (Schirrmacher & Schempp, 2003). Apples and pears contain a range of compounds within the peel, which contains procyanidins, catechin, epicatechin, chlorogenic

acid, phloridzin and quercetin conjugates. By contrast the flesh contains similar compounds but is lower in concentrations (HAL, 2010).

According to CSIRO research the apple peel has the best marker of antioxidants with between 1.5 to 9.2 times the total antioxidant activity, and 1.2 to 3.3 times the level of phenolic content compared to the apple flesh. Darker peels with more red or blue colours, and flesh that is lighter in colour and with lower soluble solids, are likely to contain more antioxidant compounds (HAL, 2010).

METHODOLOGY

The research methodology for this study was undertaken in distinct but related stages. These are summarised as follows:

1) **Conduct a search of social media sites and blogs related to healthy eating.** The aim of this step was to identify how apple consumers think, for example priorities, and attributes that they consider when purchasing or eating apples. A number of relevant Australian-based forums were explored.

2) **Focus groups with consumers who purchase apples in WA to explore their attitudes towards food, healthy eating and the consumption of fresh fruit**. The aim of these focus groups was to examine consumer attitudes towards the "ANABP01" apple and help identify the main attributes that motivate purchase of apples. Six focus groups were held where consumers from a range of backgrounds discussed healthy eating, fruit purchasing and consumption, apple preferences, flavonoids and the new "ANABP01" apple. These focus groups included a taste testing and comparison between the "Pink Lady" and "ANABP01" apples.

3) **Conjoint experiment via an online consumer panel.** This involve setting up the attributes identified in the focus groups and building them into an online experiment among apple purchasers where the respondents rated their preference for a range of combinations of price, taste, health benefit etc. as determined from the qualitative stage (1 above). This generated a list of options that were preferred by most or some market segments.

The conjoint experimental design is a well-proven method for both the development of new products and assessing potential market segments and indeed estimating market share through simulation (Green & Srinivasan, 1990; Carroll & Green, 1995; Gustafsson, *et al.*, 1999); Green, Krieger & Wind, 2001; Krishnan & Ulrich, 2001). This phase of the project involved an initial pilot study to assess the appropriate number of levels in the conjoint design, and a large-scale field survey using an online consumer panel provider for data collection.

SOCIAL MEDIA ANALYSIS INTO HEALTHY EATING

The aim of this stage of the study was to identify key concepts around healthy eating, based on the content searched for by Australia consumers and posted to social media by Australian consumers. An investigation was undertaken into a range of social media channels including Twitter, Instagram and Blogs.

Overall the most common phrases used within Australian social media contained the word "healthy" and in relation to apples, the "Pink Lady" was the most searched for apple variety, followed by the "Sundowner", "Braeburn" and "Golden Delicious" in order. The findings also suggest that the most common searches were in relation to the number of calories found within apples, with "Pink Lady apple calories" and "Granny Smith apple calories" searched for around 110 times a month. Another very common online search was around "benefits of eating apples" (approx. 50 times a month), "flavonoids in foods" (approx. 50 times a month),

"Quercetin Australia" and "Quercetin benefits" (both approx. 50 times per month), and "What are flavonoids" (approx. 40 times per month).

This pattern of searching and social media activity was also found in a study of Twitter and Instagram. As illustrated in Figure 1, the most common "hashtag" reference was to "healthy eating", but it was associated with more general "health" or "healthy" issues, as well as more specific areas such as "vegan" and "clean eating". The issues of "fitness" and "instant food" were also noted as significant points of focus. This suggests a pattern of social media activity in which the consumers are interested in the health benefits of food, as well as its role in supporting fitness or lifestyle, plus the general convenience of foods. As can be seen in Figure 1, women were more likely than men to be searching for this type of information via social media.

FIGURE 1: TOP THEMES ON HEALTHY EATING IN AUSTRALIAN SOCIAL MEDIA

A similar pattern emerged in relation to the term "healthy food" as illustrated in Figure 2. Once again women were more likely to be interested in these issues than men.

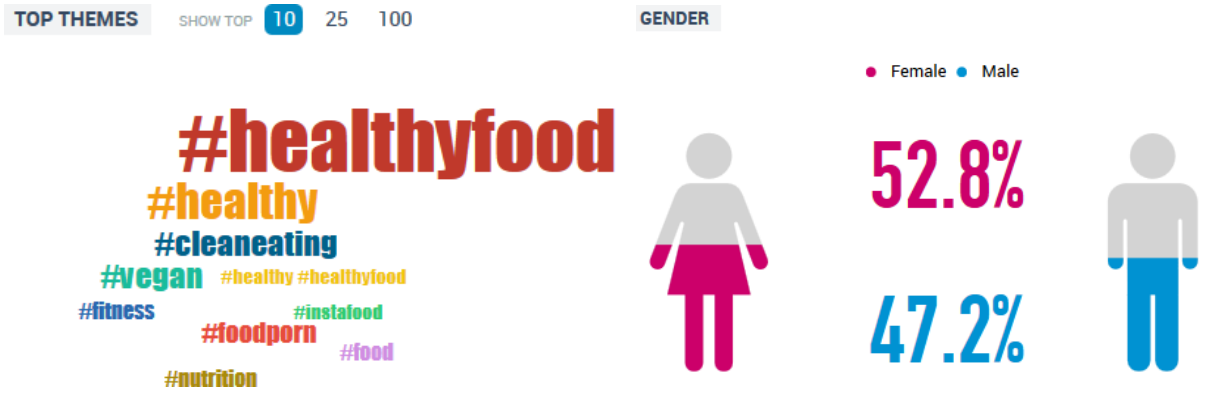


FIGURE 2: TOP THEMES ON HEALTHY FOOD IN AUSTRALIAN SOCIAL MEDIA

This gender divide was even more pronounced in relation to the issue of "Health Diet". As shown in Figure 3, this was associated with "healthy choices", "health" and "healthy" as well as lesser or more niche issues such

as "vegan" or "nutrition". Yet as can be seen, women were significantly more likely to be interested and engaged in this issue than men.

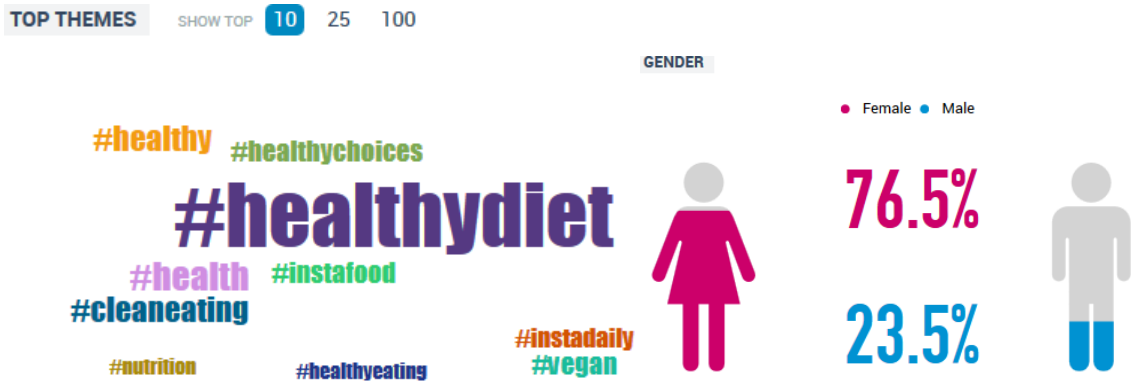


FIGURE 3: TOP THEMES ON HEALTHY DIET IN AUSTRALIAN SOCIAL MEDIA

The level of consumer interest in "antioxidants" was investigated and as shown in Figure 4, it was broadly associated with issues such as "gluten free", "clean eating", "healthy", "paleo" and "vegan". In this case, it was found that men were more likely to take an interest in the issue than women.

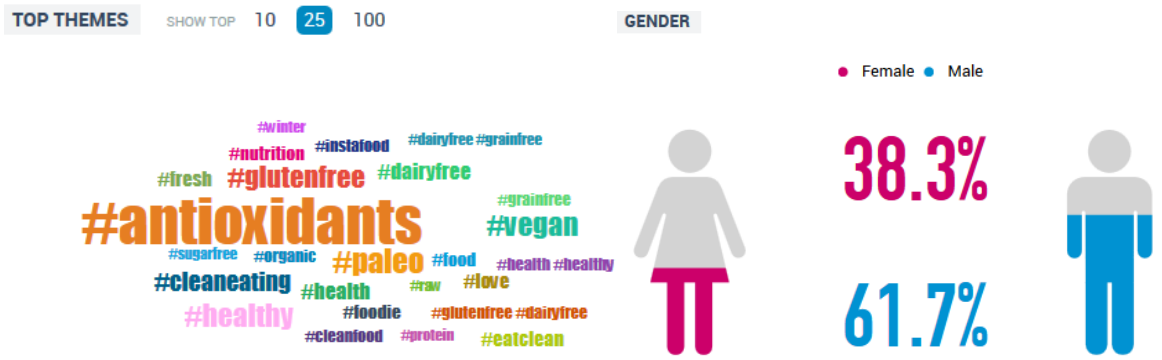


FIGURE 4: TOP THEMES ON ANTIOXIDANTS IN AUSTRALIAN SOCIAL MEDIA

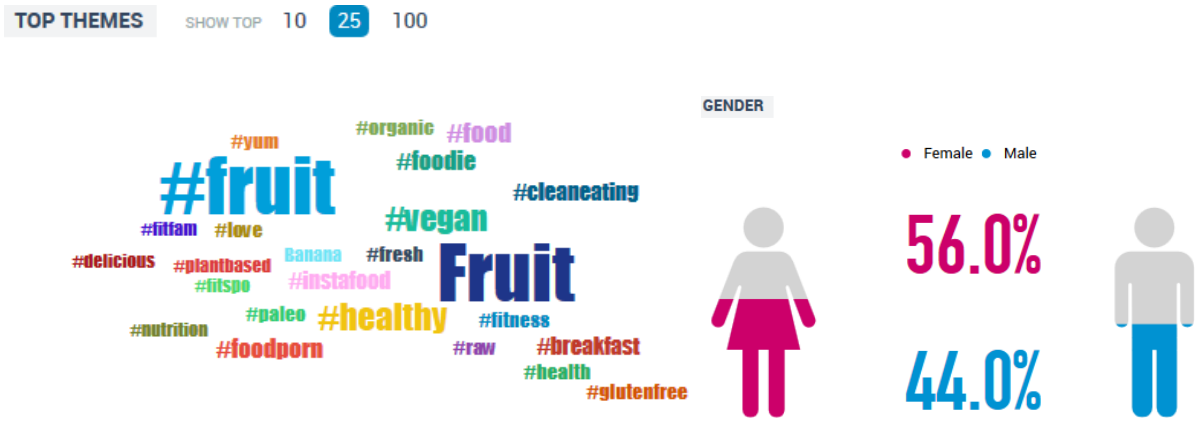


FIGURE 5: TOP THEMES ON FRUIT IN AUSTRALIAN SOCIAL MEDIA

The search also focused on fruit where it can be seen in Figure 5 that the level of interest and engagement across the genders was fairly even, with women slightly more likely than men to be involved. Some of issues associated with "fruit" were "healthy" and "health" as might be expected, but also "breakfast", "fitness", "instant food", "fresh", "delicious" and "yum".

Finally, the word apple was explored and as shown in Figure 6, this was associated with "healthy", "health" and "organic", but also "fitness" and "wellness", plus "delicious". In addition, it was found to be associated with some other foods such as "coconut" and "dark chocolate", as well as location issues like "Australia" and "farmers". As can be seen from Figure 6, the level of interest and engagement with this was much stronger for men than women.

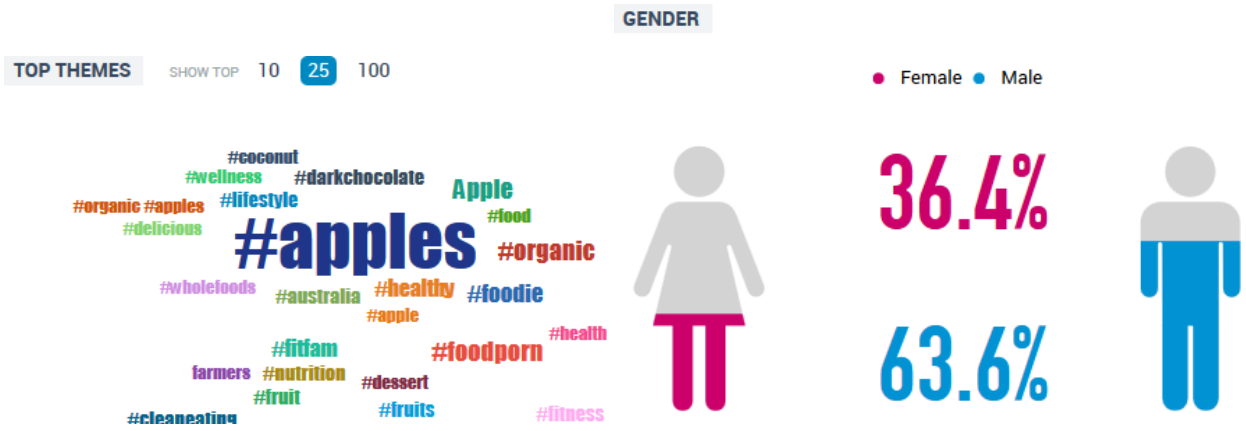


FIGURE 6: TOP THEMES ON APPLES IN AUSTRALIAN SOCIAL MEDIA

These findings were used as a foundation for the development of the focus groups in the second stage. They suggest a relatively strong interest in healthy eating in order to promote health and fitness, as well as for specific lifestyles (i.e. Vegan or Paleo diets). A clear gender divide also emerged with women more likely to focus their attention on healthy eating to assist with dieting, while men were more likely to focus on specific issues such as antioxidants and apples. Overall, apples were identified as a very positive food for a healthy diet and one that also offered a convenient food.

FOCUS GROUPS

Six focus groups were run in August 2015 with consumers who purchase apples in WA with a view to exploring their attitudes towards food, healthy eating and the consumption of fresh fruit. The aim of these focus groups was to examine consumer attitudes towards the "ANABP01" apple and assist in identifying the main attributes that motivate purchase of apples (Threlfall, 1999). These attributes were then to be used in the following conjoint experiment discussed below.

FOCUS GROUP METHODOLOGY

The participants in the focus groups were recruited by a professional market research data collection agency and drawn from their large consumer panel. They were selected to provide a good representative sample of the general population and included a wide range of ages, family, education, income and lifestyles.

All focus groups took place in specialist focus group meeting rooms and were audio recorded and transcribed by the data collection agency, although the focus groups were facilitated by the UWA CERU research team. The focus groups took place over one and half hours and followed a common discussion guide that commenced with a general discussion over healthy diet and eating, the role of fruit, knowledge of apples, purchase and consumption behaviour in relation to apples, knowledge of flavonoids, and a final taste testing of the "Pink Lady" and "ANABP01" apple varieties.

The data from the transcripts were analysed using the NVIVO qualitative data analysis software. This was coded against six nodes:

1. Apple buying (apple buying behaviour and consumer preferences);
2. Eating Habits (Eating habits and health issues);
3. Apple varieties,
4. Antioxidants,
5. The New Apple and
6. Naming (name the new apple, which at the time had not be finally given its official name).

Discussions during the first half of the focus groups typically blended discussions of eating habits, apple variety preferences, and apple buying preferences, so there is some overlap in the coding between those nodes.

The node outputs of "Apple Buying" and "Apple varieties" were analysed through Leximancer, text analysis software that allows the identification of higher level concepts in text. This was conducted in order to identify the factors that drive consumer purchasing behaviour and inform the conjoint model analysis. Purchasing behaviour and preferences were most evident when apple purchasing and favourite apple varieties were discussed, hence the inclusion of those two node outputs in this phase of the analysis.

The themes identified by the software were grouped in performing what is termed "seeding concepts". The following concepts were used, some of which emerged through the literature review and others from an exploratory reading of the data prior to analysis:

- **Price** (merging: cheap, cheaper, cheapest, discounted, dollar, dollars, expensive, paying, price, prices)
- **Size** (merging: bigger, biggest, large, medium, size, sized, smaller)
- **Colour** (merging: colour, dark, green, red, reddest, yellow)
- **Flavour** (merge: bitter, chalky, flavour, floury, juicier, juicy, powdery, starchy, sweet, sweeter, sweetness, tart, taste, tasteless)
- **Crispness** (merge: crisp, crispness, crispy, crunch, crunchy)
- **Eating pre**ferences (merge: cook, cooking, fresh, juice, juices, salads, slices, whole)
- **Health** (health)
- **Looks fresh** (merge: blemishes, bruised, bruises, bruising, fresher, look, looking, looks, smell, smells)
- **Local** (merge: imported, local, WA)

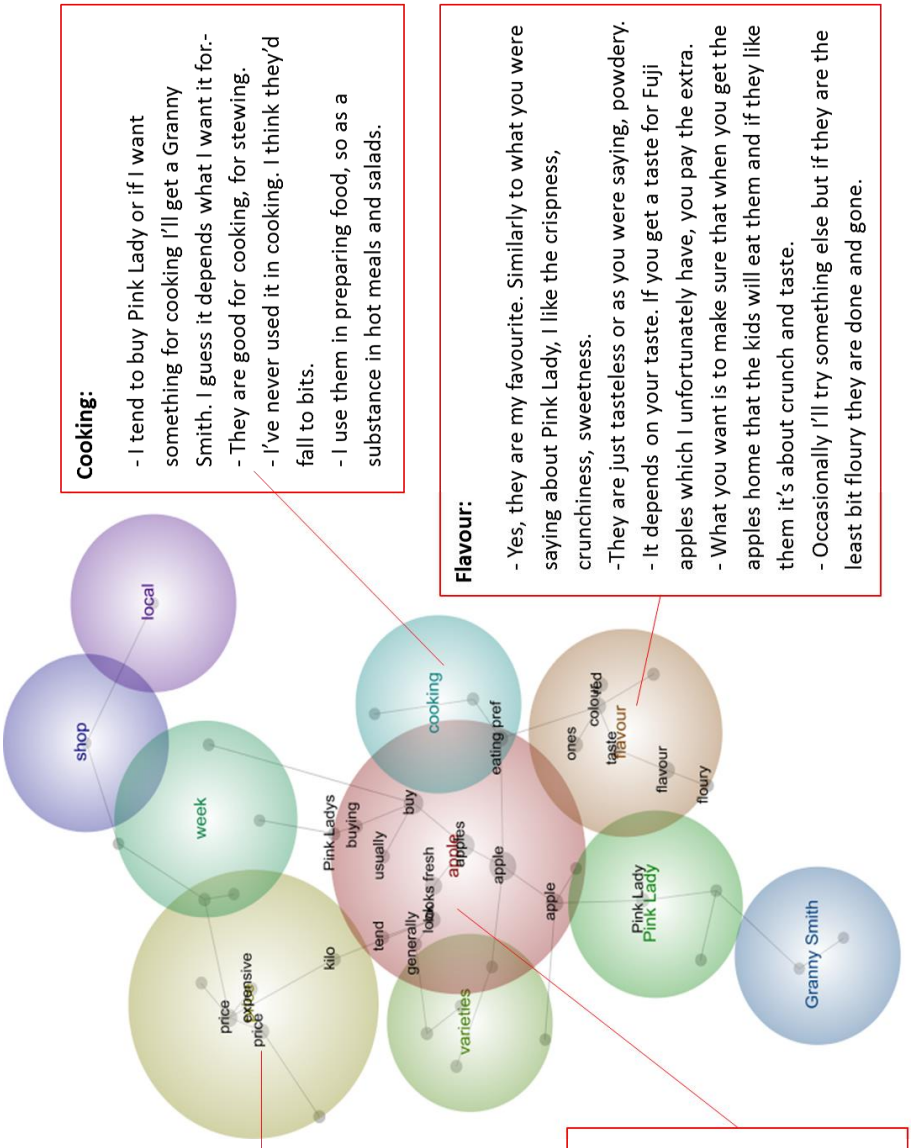


FIGURE 7: CONCEPT MAP – FACTORS DRIVING CONSUMER BEHAVIOUR

FINDINGS FROM THE FOCUS GROUPS

Figure 7 shows a "concept map" as generated by the Leximancer software, over which some of the transcription text has been included to illustrate the concepts. A Leximancer concept map draws together the concepts as they emerged from within the transcript data, and display them as clusters that have connecting lines representing associated concepts, and groupings within "themes" that are shown as coloured "bubbles". The "hotter" the colour (i.e. red), the more important or central to the discussion of a theme and its associated concepts.

What emerged from the analysis is the strong focus on apples, as might be expected, but their key importance of an apple looking fresh and the equally strong or important focus on price, flavour and the use of apples within cooking. The high public profile of the "Pink Lady" apple variety is also well illustrated in this diagram, as is the "Granny Smith" apple variety.

In relation to the participants' awareness of apple varieties, the "Pink Lady" was the most commonly known and emerged within 33% of the transcripts relating to apple knowledge. Other well-known varieties in order of their names appearing in the discussions were "Red Delicious", "Golden Delicious", "Granny Smith" and "Fuji".

Themes with the highest connectivity were: flavour 35% and price 29%. This highlights that in buying an apple consumers are primarily concerned with: price, freshness, flavour, apple variety, colour and cooking/eating preference. The "health" theme did not appear on the concept map at all, noting that the health benefits of eating an apple did not emerge in any of the focus groups prior to prompting by the facilitator. However, this does not suggest that consumers do not view apples as being a healthy food. It is more likely a reflection that the apple is accepted as a healthy food, as are most fruits.

REACTION TO THE NEW "ANABP01" APPLE

Participants had a mixed reaction when presented with the new "ANABP01" apple variety. They were mostly not attracted, but more intrigued by the look of it. They commented that the apple is very "different" to other apples they have been exposed to; darker in colour (termed red, or even black), with a shape that was commented as "very traditional by some" or "unusual" by others, "symmetrical" and "flatter", and "apple you can hold properly" and "get your way around it", "perfect for a bite". It was commonly noted that it looks like a plum. Some liked the look of the apple whilst others not as much.

Upon tasting the vast majority of participants liked the new apple more or on par with "Pink Lady" (provided for tasting comparison). Some felt that the new apple has a taste that resembles a green apple, "fresh" and "crisp", others commented that they enjoyed the firmness, whilst some felt that it was "woody", had a "coarse" or "weird" texture; participants were mixed in terms of which variety was more flavoursome. Overall the vast majority of participants would purchase the new apple instead of or in addition to Pink Lady or the other apple varieties they purchase, provided that it was of similar price (to the Pink Lady).

Figure 8 shows the Leximancer concept map encompassing the focus group comments about the new "ANABP01" apple. As can be seen, the key areas of focus were the apple's colour, shape and appearance, and flavour. The focus group participants had already seen and tasted the "Pink Lady" apples prior to being shown the "ANABP01" apple. They therefore had a direct comparison with the current "benchmark" product and their reactions to its colour, shape and general appearance were mixed. Had they only seen but not tasted the "ANABP01" apple, the positive responses – which were generally universal – to the new variety would have been more subdued.

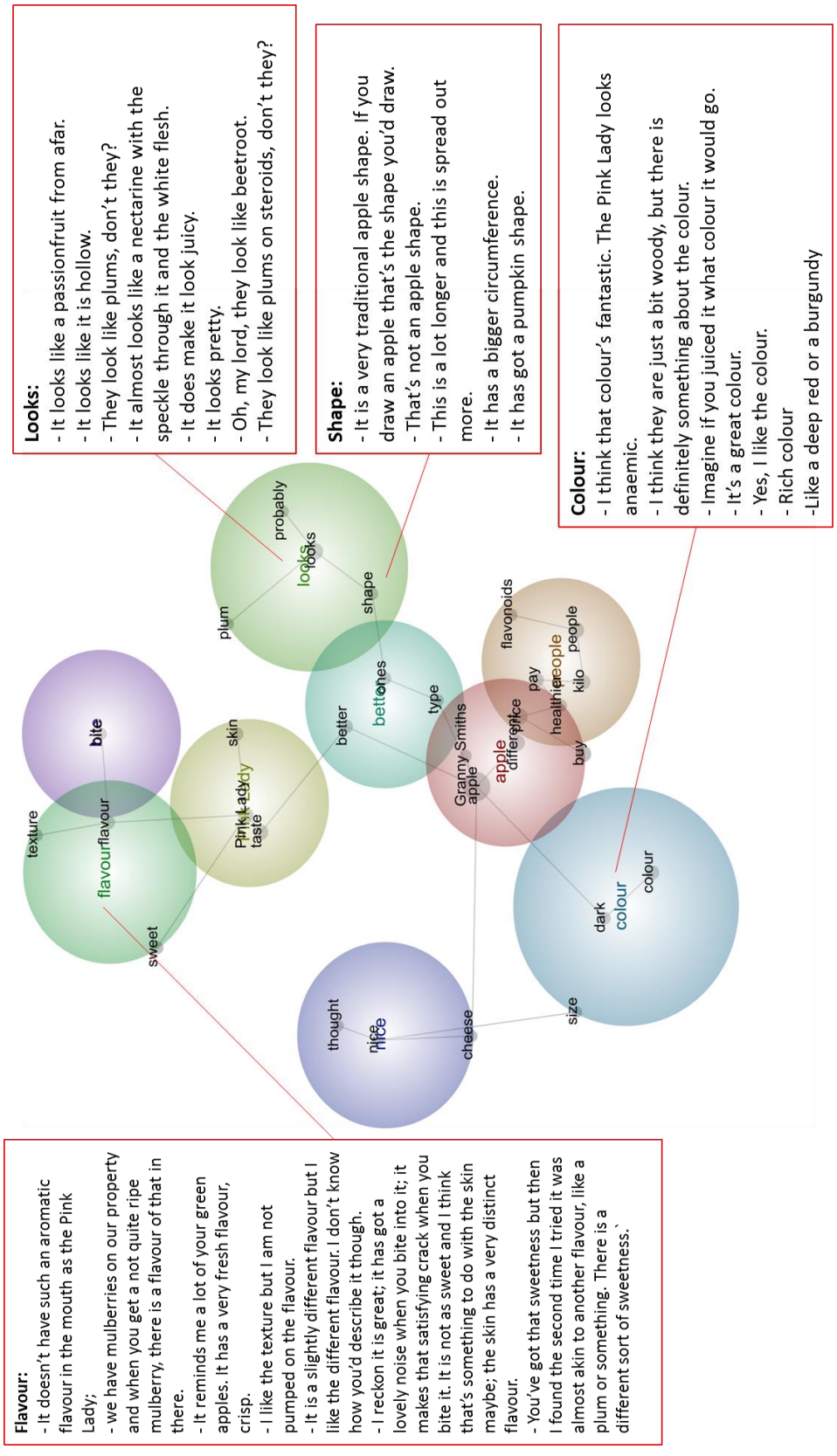


FIGURE 8: CONCEPT MAP – REACTIONS TO THE NEW "ANABP01" APPLE

NAMING THE NEW APPLE

At the time the focus groups were held the "ANABP01" apple's brand name had not been determined and the research was tasked with exploring the name using a number of potential names. Participants were asked to try to name the new apple in an unprompted "brain storming" session. They were then presented with several names that had been provided by the research team sponsoring the research. These names were:

- Majestic
- Flavauri
- Flavory
- Auria
- Eminence
- Aurizon
- Bewitched
- Flavauria

Participants in all focus groups overwhelmingly rejected the proposed names, with the least unfavourable being "Majestic". They expressed a preference for a simpler name, one that can be easily remembered by adults and children, and that does not have a scientific connotation or link to flavonoids. It was felt by the majority of participants that the distinctive colour of the apple should be a major consideration when naming it, the name Ruby, Royal Ruby and variations of that (Rubbie, Rubi, Black) emerging from each group independently. Other popular suggestions included making some reference to its locality, specific region on the fact that it originates from WA/Australia (Swan, Black Swan). This research was reported to the sponsoring client, but the "ANABP01" name had been developed independently through other market research taking place at the same time.

CONJOINT ANALYSIS

The attributes identified in the focus groups were built into an online experiment among apple purchasers where the respondents are asked to rate their preference for a range of combinations of price, taste, health benefit etc. as determined from the preceding stages.

This generated a list of options that were preferred by most or some market segments. A pilot conjoint experiment was undertaken with a sample of 200 respondents to test the design prior to moving to a survey of 600 additional participants.

PILOT CONJOINT STUDY

The conjoint experimental design is a well-proven method for both the development of new products and assessing potential market segments and indeed estimating market share through simulation. It involves the identification of a set of product attributes and then multiple levels of preference that are formed into a number of combinations that potential consumers are asked to evaluate in terms of their preferences. It requires a trading-off of attributes (i.e. lower cost less features) as an ideal combination is not attainable.

The following set of profiles provided 16 different combinations of apple characteristics. Consumers were asked to consider combinations of the following options:

- **Colour:** Red, Green, Yellow, Dark Red
- **Price:** Low (less than $3/kg), Average ($3 to $5/kg), High ($5 to $7/kg), Very High (more than $7/kg)
- **Taste:** tart or crispy
- **Skin:** Thick or Thin

- **Antioxidants:** Average or High

Table 1 illustrates the preference (utility values) for each attribute level within the pilot conjoint design. Within each attribute, the utility values sum to 0. It reflects the fact that the origin of the utility scale for each attribute is unknown and the utility of one level of one attribute cannot be directly compared to the utility of one level from another attribute (Louviere & Islam, 2008). The mean scores shown in Table 1 indicate the importance of each factor and it can be seen than colour (μ = 45.27) and price (μ = 27.84) are the most important attributes followed by taste (μ = 10.42), skin thickness (μ = 8.86) and antioxidants (μ = 7.61).

TABLE 1: PILOT CONJOINT STUDY – PART WORTH UTILITIES

	N	Minimum	Maximum	Mean	SD
Yellow	198	-5.63	5.00	-1.26	1.40
Green	198	-5.56	4.25	0.04	1.44
Red	198	-1.56	7.50	1.57	1.45
Dark Red	198	-5.44	2.88	-0.35	1.36
Low	198	-1.63	4.94	0.76	1.15
Average	198	-1.31	3.88	0.49	0.78
High	198	-3.88	2.38	-0.34	0.76
Very High	198	-4.06	1.63	-0.91	1.13
Thick	198	-1.13	1.94	0.05	0.49
Thin	198	-1.94	1.13	-0.05	0.49
Tart	198	-3.75	1.13	-0.25	0.61
Crispy	198	-1.13	3.75	0.25	0.61
Average AOs	198	-1.88	1.38	-0.06	0.43
High AOs	198	-1.38	1.88	0.06	0.43
colour	198	4.44	100.00	45.27	21.60
price	198	0.00	88.89	27.84	18.04
skin	198	0.00	36.84	8.86	7.17
taste	198	0.00	68.00	10.42	10.70
antioxidants	198	0.00	46.67	7.61	7.18
R^2	198	0.54	1.00	0.87	0.10
AdjustedR^2	198	-0.14	1.00	0.68	0.24

The preferences or levels for each of these key attributes were then ascertained as follows:

Colour	**Price**	**Taste**	**Skin thickness**	**Anti-oxidants**
1. Red	1. Low	1. Crispy	1. Thick	1. High AO
2. Green	2. Average	2. Tart	2. Thin	2. Average AO
3. Dark Red	3. High			
4. Yellow	4. Very High			

These attributes and levels and their part-worth utilities are further illustrated in Figure 9, where it can be seen that the colour red was significantly preferred over other colours.

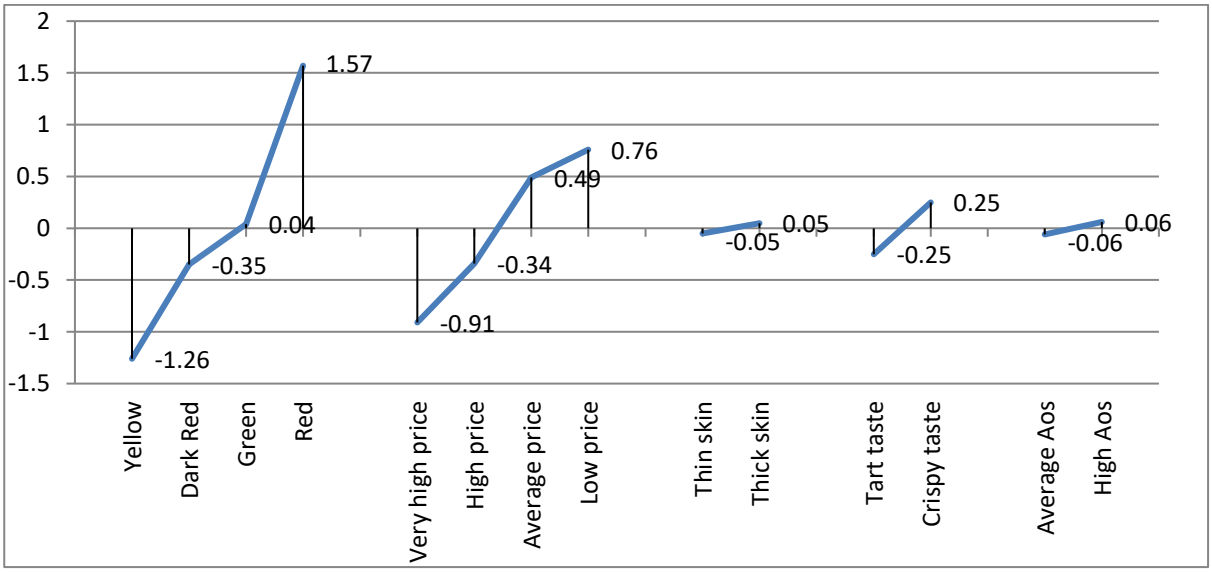


FIGURE 9: PILOT CONJOINT – PART-WORTH UTILITIES

The pilot conjoint study identified the "ideal" apple as something approximate to the existing "Pink Lady" apple, with the exception of its skin, which is relatively thin. By comparison the new "ANABP01" apple is a very close match to the "ideal" apple as found by the pilot study.

The "ideal" apple is therefore:

- Red in colour
- Low in price
- Crispy in taste
- With a thick skin
- Plus, high in antioxidants

The new ANABP01 apple is:

- Dark red in colour
- Currently very high in price
- Crispy in taste
- With a thick skin
- Plus, high in antioxidants

FINAL CONJOINT STUDY

Based on the findings of the pilot survey the apple characteristic of *Colour*, *Taste*, and *Skin* were dropped from the survey as they were not significant determinants of a willingness to pay. The "Antioxidants" characteristic was rephrased to "Antioxidants in Apple/ Health Benefit". New attributes were included to evaluate the impact of Organic and Origin on consumer preference. A final set of 12 different combinations of attributes and characteristics associated with apples were developed. These were used in the final conjoint study where consumers were asked to consider combinations of the following options:

- **Price:** various combinations

- **Health Benefit/ Antioxidant content:** Low, Average, High
- **Organic:** Yes, No
- **Origin:** South West (WA), Kimberley, Eastern Australia, New Zealand

Respondents' demographics, fruit purchasing preferences, apple purchasing and consumption preferences were also surveyed. There were 813 respondents in the final sample. Out of these, 797 were used as these had an adjusted R^2 of 0.30 or higher for the conjoint questions (not filling the conjoint with the same answer throughout).

Sample Demographics

The sample comprised of 54% female and 46% male respondents and covered all age brackets with good representation across these demographics. As shown in Figure 10, the sample comprised a good cross-section of occupations ranging from professional and semi-professional "white collar" employees, skilled trades, self-employed business owners, students, domestic or home duties, retirees and the unemployed.

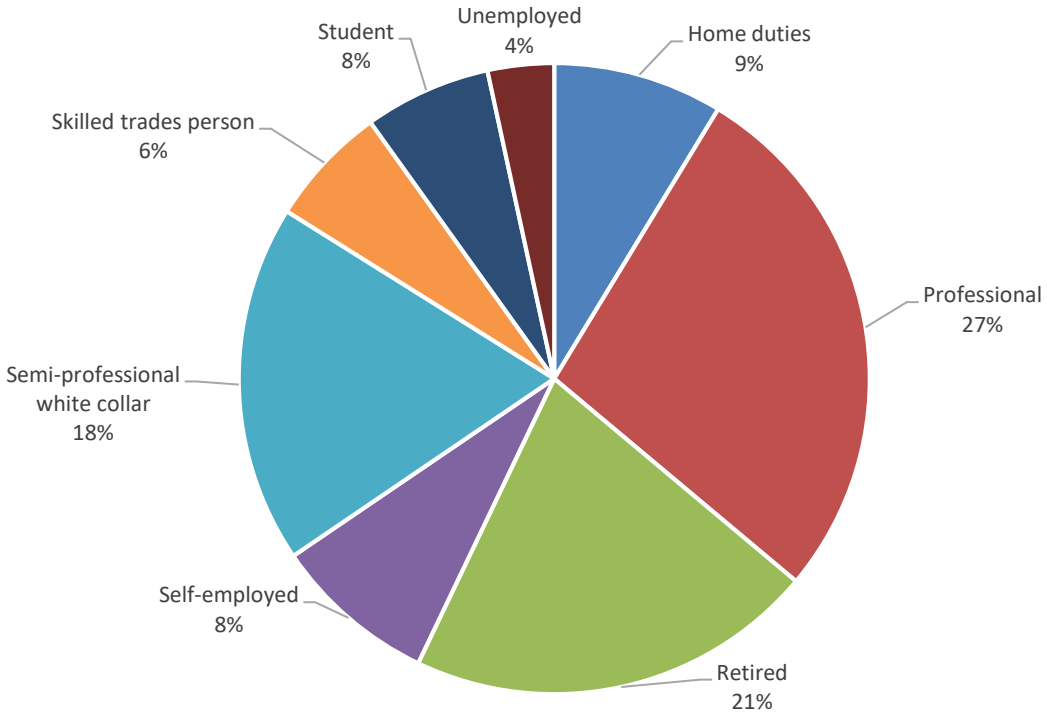


Figure 10: Respondents by Occupation

The majority (59.5%) of respondents were married, followed by single respondents (26.7%) and separated or divorced (11.4%). Nearly a third of respondents (32.5%) indicated an annual combined household income over $100,000 with the remaining two thirds allocated quite evenly in all other (lower) income brackets. Figure 11 provides details of the annual household income levels of the survey participants. This shows that the final sample encompassed a good cross-section of household income levels representative of wider population.

FIGURE 11: RESPONDENTS BY ANNUAL HOUSEHOLD INCOME

When considering respondent's apple and fruit purchasing preferences and behaviour it should be noted that the majority lives in households with other one more (52.6%) or two more adults (20.9%). Respondents in a household with children aged 3years or less accounted for 12.6% of the sample, whilst respondents in households with children between 3 and 18 years of age accounted for 29.1%.

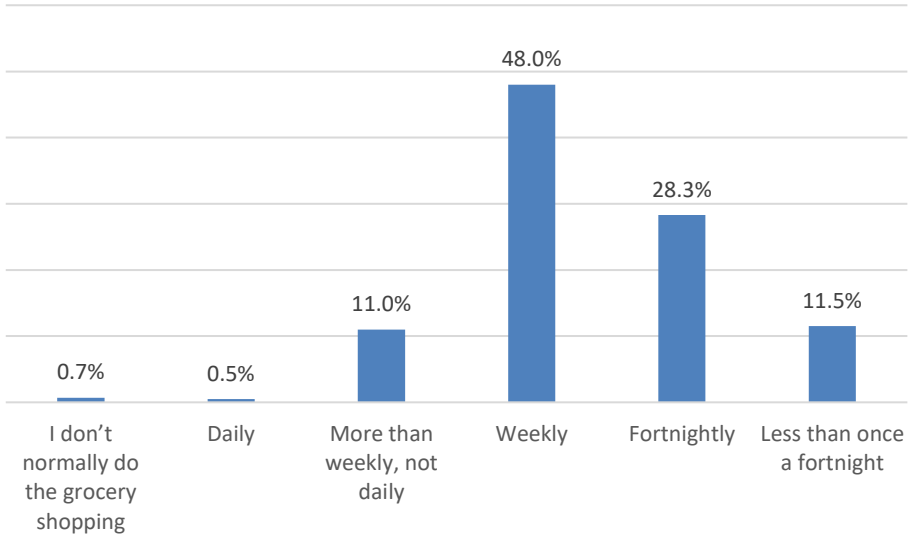


FIGURE 12: RESPONDENTS BY RESPONSIBILITY FOR GROCERY SHOPPING

It is also important to note that only 0.7% of respondents were not normally responsible for their household's grocery shopping, with 59.5% doing the grocery shopping weekly or more frequently. The majority (79.4%) of respondents would in addition consume 2-3 apples per week or more (on a daily basis).

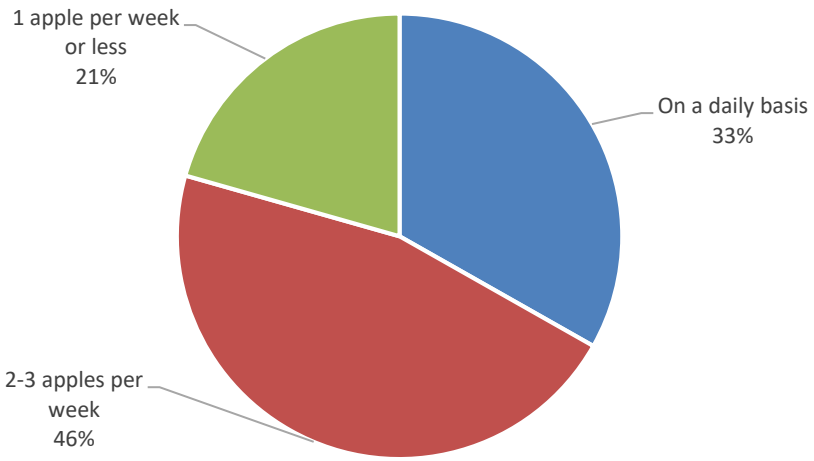


FIGURE 13: RESPONDENTS APPLE CONSUMPTION

CONSUMER PREFERENCE FINDINGS

This section examines the findings from the final conjoint model in relation to preferences for the "ideal" apple.

TABLE 2: FINAL CONJOINT PART-WORTH UTILITIES

	N	Minimum	Maximum	Mean	Std. Deviation
Intercept	738	1.8333	9.5000	5.291328	1.2700914
Antiox: low	738	-4.4667	2.4000	-1.007678	0.8679398
Antiox: aver	738	-2.4667	2.1333	-0.001716	0.5694918
Antiox: hi	738	-2.1333	4.6667	1.009395	0.9290440
Price: low	738	-2.8000	5.3333	1.198193	1.0312162
Price: aver	738	-2.6667	4.1333	0.140470	0.7329449
Price: hi	738	-6.0000	2.5333	-1.338663	1.2253572
Location:SWWA	738	-2.9167	6.1875	1.268377	1.1454601
Location:Kimb	738	-1.7917	4.0417	0.709942	0.9646758
Location:EastAUS	738	-4.0208	2.4792	-0.536501	0.9585980
Location:NZ	738	-6.2917	3.9167	-1.441819	1.3271245
Organic: Yes	738	-2.5625	3.8125	0.233316	0.5896122

Organic: No	738	-3.8125	2.5625	-0.233316	0.5896122

Table 2 illustrates the preference (utility values) for each attribute level in the final conjoint model. Within each attribute, the utility values sum to 0. It reflects the fact that the origin of the utility scale for each attribute is unknown and the utility of one level of one attribute cannot be directly compared to the utility of one level from another attribute.

However, it can also be seen that the highest mean preference scores were associated with the ideal apple as one the is sourced from the South West of WA (μ =1.27), with a low price (μ = 1.20), and with high levels of antioxidants (μ = 1.01).

Table 3 lists the relative importance of each characteristic examined (Antioxidants, Price, Origin and Organic) in terms of their impact on consumer preference. It should be noted that these values provide **the relative importance** of these factors when compared to each other and the values could change if different factors were included in the design.

TABLE 3: APPLE CHARACTERISTIC PREFERENCES IN ORDER OF IMPORTANCE

	N	Importance score (%)	Std. Deviation
1. origin	738	35.8	19.76
2. price	738	30.8	20.07
3. antioxidants	738	24.3	14.72
4. organic	738	9.0	9.00
R^2	738	0.947	0.05
AdjustedR^2	738	0.794	0.17

The values shown in Table 3 provide a measure (in percent) of the relative importance of the single factors for the determination of the utilities. We can see "origin" is the most importance factor accounting for 35.8%, followed by price (30.8%) and antioxidants (24.3%). Organic was the least important as might be expected.

CONCLUSIONS

This study highlights the importance that Australian consumers place on healthy eating and the consumption of healthy food as part of the maintenance of a healthy diet. As shown in the analysis of the social media, these are issues that are more likely to interest women than men. However, men are more likely to take an interest in antioxidants and specifically apples.

These findings were further reinforced in the focus groups, where participants displayed a high level of awareness of the importance of healthy eating and the role of fruit, specifically apples in that process. These focus groups also highlighted the prominent role that the "Pink Lady" apple variety now has as a "benchmark" product for consumers.

Apple consumption varies from person to person, with fresh, mostly red apples, eaten for breakfast, lunch and snacks a popular choice for children and busy adults. Consumption broadly fell into fresh or cooked, with "Granny Smith" or perhaps "Golden Delicious" more popular in the cooking segment.

Not surprisingly flavour, freshness and price were found to be important factors in apple purchase and consumption decisions. For many of the consumers in the focus groups, the "Pink Lady" was the most preferred apple variety.

When exposed to the new "ANABP01" apple, the focus group participants were initially surprised by the size, colour and shape of the apple. While their reactions were not overly negative, there was a mixed response with what is an unusual apple in appearance. However, once the new apple was subjected to a taste testing process, the overwhelming response was positive.

The pilot conjoint analysis found the "ideal" apple to be red in colour, low in price, crispy in taste, with a thick skin and high antioxidants. This profile is a very good match for the "ANABP01" apple, with the exception of price.

The final conjoint analysis explored these issues with a large, representative sample of Australian consumers. This model highlighted the relative importance to Australian consumers of the new apple being sourced from local growers, offered at a low or affordable price, and able to provide the consumer with a positive health benefit from having high antioxidant levels.

As shown in Table 4, the "ideal" apple as perceived by Australian consumers is one that is currently associated with the "Pink Lady" apple. The new "ANABP01" variety meets or exceeds these attributes, with the exception of its current pricing, which is due largely to it being still in early production and relatively limited supply.

TABLE 4: COMPARISON OF "PINK LADY" AND "ANABP01" APPLES AGAINST THE IDEAL

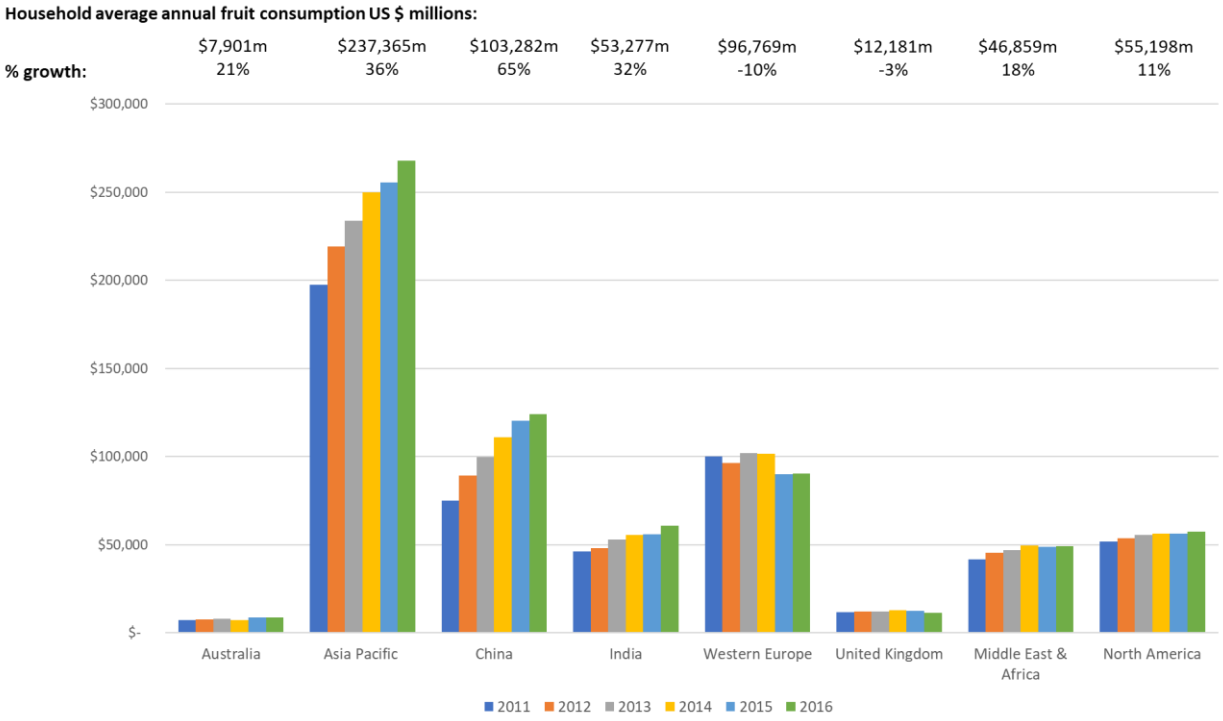
Attributes	Ideal Apple	Pink Lady	ANABP01
Origin	Locally grown	✓	✓
Price	Low	✓	✗
Antioxidants	High	✓	✓✓
Colour	Red	✓	✓✓
Taste	Crisp	✓	✓✓
Skin	Thick	✓	✓✓

MARKET OUTLOOK FOR "ANABP01"

Drawing these findings together suggests that the market for a new variety of apple such as the "ANABP01" is likely to be positive. This new variety offers the majority of the attributes identified as representative of the "ideal" apple. The fact that the "ANABP01" is high in flavonoids should also satisfy the consumer. The local origins of the "ANABP01" should also resonate with WA consumers.

As outlined in the background section of this report, there are already a large number of apple varieties available to the consumer. Many of these have similar attributes to the "ANABP01" and are also relatively new varieties, and/or in large scale production. The demand for apples, even new varieties, is likely to be significant over the foreseeable future, and the outlook for export of the "ANABP01" should also be positive.

For example, fruit consumption has expanded rapidly around the world in recent years. As illustrated in Figure 14, the annual consumption of fresh fruit has grown significantly across the Asia Pacific region, in particular China, with steady growth experienced in Australia, India, North America, the Middle East and Africa. The Asia Pacific fresh fruit market has grown by around 35% over the past five years and is worth about US $237.4bn. The China market has seen the highest rate of growth (65%), and is worth about US$103.3bn. It currently comprises around 44% of the household expenditure on fresh fruit within the Asia Pacific region.



Source: Euro monitor (2017)

FIGURE 14: HOUSEHOLD EXPENDITURE ON FRUIT – SELECTED COUNTRIES AND REGIONS

Marketing the "ANABP01" into the Australian market will need to consider the price sensitivity that has emerged strongly from this research study. As outlined above, the Australian consumer is well acquainted with apples and consumes them on a regular basis. This consumer does not need to be convinced of the benefits of apple consumption within a healthy diet, nor the healthy nature of fruit, in particular apples. Most apple consumption is for fresh fruit, and a new variety such as "ANABP01" will be unable to sustain a price premium

over rival varieties such as the "Pink Lady", "Fuji" or Kanzi", unless it can be successfully marketed as offering additional benefits.

The research undertaken for this project suggests that Australian consumers will prefer an apple that can offer high antioxidants, and the flavonoid-rich qualities of the "ANABP01" as well as its somewhat unique "red-green" or "sweet-tart" flavour, could potentially offer a point of differentiation with appropriate marketing communications. However, is seems unlikely that these attributes are sufficiently strong enough to enable the "ANABP01" to command a premium price in the Australian market over the long term.

Future market opportunities for the "ANABP01" are likely to be found in exporting channels, particularly in markets such as China and the Middle East. These are growing markets with rising household incomes and an expanding middle class. For example, China's population will continue to shift from rural to urban over the next decade and is going to comprise nuclear families, couples and singles living busy inner-city lifestyles with a strong interest in healthy food and diet for children and adults. The Chinese population is also ageing and the health benefits of foods are also likely to be of greater importance to this type of consumer.

Market research into Chinese consumer behaviours suggests that the contemporary Chinese consumer is moving from a "no frills saver" to a brand conscious, often spontaneous buyer, but one that is seeking quality for price. They are also interested in special features of products and environmental considerations such as the "green" qualities or attributes of the product, specifically in relation to source or origin (Euro monitor, 2016).

A "ANABP01" apple launched into the China market, could be positioned at the urban consumer seeking a unique, value for money, high quality product with benefits to health such as being flavonoid-rich. Chinese consumers in this segment will be keen to purchase products that have a strong brand image, and the "ANABP01" has the potential to be positioned as a high-end, health food, from Australia, that can provide busy families with a delicious ready to eat meal for all ages. Quality, taste and performance are the primary attributes likely to attract Chinese consumers from a wide-range of market segments. These desired attributes are followed by health and ingredients (Euro monitor, 2016).

The "ANABP01" apple offers a prima facie case for positioning within the China market as a delicious new fruit that can offer the key attributes of quality, taste, and good health (i.e. antioxidants / flavonoids). Chinese consumers are also particularly interested in all natural fresh foods. They also make high use of social media for searching for products and information on where and what to buy, as well as online shopping or smart phones as a tool for making purchases (Euro monitor, 2016).

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