

## Testing consumer acceptability of new crops: an integrated sensory and marketing approach using muntries, an Australian native berry

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The Australian native berry, muntries, is one of few palatable native fruits and can be used in savoury and sweet dishes. Muntries possess antioxidant levels equivalent to those in a commercial high antioxidant berry mix and approximately five times higher than frozen blueberries and strawberries. A modified focus panel (MFP) approach and subsequent central location trial (CLT) explored consumer awareness of muntries, purchasing behaviour of native foods and acceptability of a broad range of muntries products. The MFP showed that muntries are not well known and identified flavour as significantly more important than 14 other purchasing drivers. Of six muntries products, sparkling juice and chutney obtained the highest acceptability scores. In the CLT, hot cross buns made with muntries achieved a high acceptability. This study, showing that muntries are not well known but have broad consumer appeal, highlights the need for marketing communications to provide consumers with information about new products and their health benefits.

New crops such as kiwifruit, avocado, macadamia nut and mango have contributed to increased crop production in Australia, providing 70% of the growth observed from 1950–1992 (Fletcher 2002). Many countries are looking for potential new plant crops from the food plants that were staple diets of indigenous people (Ahmed & Johnson 2000, Reinten & Coetzee 2002, Prohens & others 2003, Ryder & others 2008). Indigenous crops are likely to be better adapted to local environments and may therefore require fewer inputs in terms of water, fertilisers and pesticide use, thereby earning higher returns per unit input. There is a growing body of consumers who seek locally grown produce to reduce their “food-miles” (Weber & Matthews 2008). The current value of the native food industry, excluding the established macadamia nut industry, is between \$5 and 10 million (Robins 2004).

There is a high failure rate of new food products introduced into the market (Costa & Jongen 2006), and new crops provide additional challenges for entry to market. Challenges include lack of consumer product awareness, lack of understanding of product attributes and uses, and lack of knowledge about potential markets. The successful introduction of kiwifruit to consumers can be attributed to several factors, including selection of varieties with long shelf life (Ferguson & Bollard 1990), a more memorable name and astute marketing of the high vitamin C content (Fletcher & others 1959).

### Potential of muntries as a new crop

Muntries is one of the few Australian native fruits that is palatable to Australians of European descent when consumed directly from the plant. It is one of 15 crops with established farm-gate and/or wild-harvest values (Graham & Hart 1997, Fletcher 2002). Muntries, also known as muntries berries and munthari, are produced on the plant *Kunzea pomifera* F. Muell. which is indigenous to South Australia and Victoria (Graham & Hart 1997, Page 2004, Hele 2006). The berries are small, green and pink in colour (Figure 1), and the flavour is described as spicy apple. There are about ten growers in South

Australia and a few in Victoria with more than 10 000 plants in total. A few commercial products, eg jams and chutneys, are available in a limited number of retail outlets throughout Australia. An increase in consumer demand for muntries is needed to encourage growth of the industry. Market expansion will require an increase in the grower base and co-investment between growers and entrepreneurs.

We hypothesise that the reason for low market demand for muntries is primarily because muntries are unknown to most consumers. The aims of this study were to: 1) learn more about native food consumers, 2) identify muntries products that are acceptable to consumers and 3) increase awareness, as this should lead to a higher demand for muntries. To meet these aims, we adopted a modified focus panel (MFP) approach combining qualitative focus groups with quantitative acceptance testing and a consumer questionnaire. Focus panels traditionally permit the panellists to discuss a product, take and trial products at home, then return for further discussions (Meilgaard & others 1999).



Figure 1. Muntries, an Australian native berry, growing on a trellised bush.

**Table 1. Demographic mix of participants in muntries MFP (N = 37) and CLT (N = 102).**

	MFP (%)	CLT (%)
<b>Age</b>		
18–24	6	12
25–34	24	24
35–44	16	15
45–54	38	21
55–65	16	17
> 65	0	8
not given	0	3
<b>Gender</b>		
Female	57	61
Male	43	34
not given	0	5
<b>Highest education level</b>		
School Leaving (15+)	8	8
HSC/Year 12	16	11
TAFE/Diploma/Trade	38	14
Bachelor's Degree	22	32
Graduate/Post Graduate Diploma	13	13
Master's degree	3	5
PhD	0	9
Other	0	2
Not given	0	6
<b>Household income (\$A)</b>		
< \$25 000	5	12
\$25 001 – \$50 000	14	20
\$50 001 – \$75 000	24	24
\$75 001 – \$100 000	32	17
\$100 001 – \$150 000	22	9
\$150 001 – \$200 000	3	3
> \$200 000	0	1
Not given	0	14

**Table 2. Acceptability of muntries products.**

Muntries Product <sup>1</sup>	Acceptability Score <sup>2</sup>
Goats' curd and glace muntries tart	6.5 ± 1.6 (MFP)
Muntries hot cross bun	5.2 ± 1.6 (MFP)
Muntries sparkling juice <sup>3</sup>	7.7 ± 1.2 (MFP)
Muntries chutney <sup>3</sup>	7.6 ± 1.5 (MFP)
Muntries chocolates	6.3 ± 1.5 (MFP)
Muntries fruit leather	5.8 ± 1.9 (MFP)
Muntries hot cross bun	7.0 ± 1.3 (CLT)

<sup>1</sup> Products are listed in the order of presentation.

<sup>2</sup> Rated on a 1 (strongly dislike) to 9 (strongly like) hedonic scale, mean ± standard deviation

<sup>3</sup> Muntries sparkling juice and Muntries chutney are not significantly different in acceptability but are significantly more acceptable than all other products at  $p < 0.01$ .

Our modified version allows panellists to rate the acceptability of products on an individual basis, followed by a group discussion in one session, providing immediate qualitative feedback plus quantitative information on each product. The findings from the questionnaire of the MFP were validated using a central location trial (CLT).

## Materials and methods

### Modified focus panels

MFP were conducted by a moderator from McGregor Tan Research (a market research company) at the University of Adelaide's focus group room in June 2006. The room was equipped with a closed circuit TV and microphones. MFP sessions were recorded on a VCR/DVD recorder and monitored in an adjacent control room with a two-way communication system to the moderator who led discussions. McGregor Tan was employed to recruit participants from their consumer database. The selection criteria for participants were that they must have consumed an Australian native food product in the last 14 days. The aim was for four groups of ten, with a broad age range and balanced gender. Three last minute cancellations gave 37 participants (Table 1). MFP were segmented by age (18 to 45 and > 46 y) as focus groups that are homogenous with respect to age are more likely to engage in smooth dialogue (de Laine 1997). Each group consisted of both males and females.

Prior to the MFP sessions, a questionnaire was developed to gather demographic data and to gauge consumers' awareness of muntries and purchasing behaviour with respect to native and gourmet foods. The questions relating to purchasing behaviour were extended to cover gourmet foods, because only a few participants were expected to have purchased native foods and most available muntries products are sold in specialty/gourmet food stores. The questionnaire was piloted by nine participants at the University of Adelaide and minor changes were implemented.

The questionnaire was conducted at the start of the MFP session. Upon completion, participants were given a 5 min introduction on the history and cultivation of muntries by one of the research team and this was followed by individual acceptance testing. Participants were presented with six muntries products (Table 2). Fresh fruit was not available for tasting because it was out of season. Tasting of products was strictly controlled to obtain quantitative data. The first product was tasted and, without discussion, the participants individually and confidentially rated the product on a hedonic scale of 1 (strongly dislike) to 9 (strongly like) and wrote comments on the positive or negative attributes of the product. This approach eliminated potential group interaction bias. After tasting and scoring, the moderator led a discussion of the product (5 to 8 min) to gain qualitative data and reduce carry over effects, before moving on to the next product. Participants were not allowed to change their scores or comments at any time. The remaining products were evaluated in the same manner.

Normally when conducting sensory analysis, the presentation order of products is randomised across panellists, to reduce presentation order effects. However, it was not feasible to randomise products as participants individually assessed the acceptability of products in the

presence of the other panellists. Products were presented in the order of savoury to sweet to reflect a normal Western culture dining experience.

All products were presented in individual paper baskets, with the exception of sparkling muntries juice, 30 mL of which was presented in a Viticole 215 mL XL5 stemmed wine tasting glass. Each MFP lasted approximately 90 min and all four were conducted, two per night, over two consecutive evenings.

### Product selection and formulation

The six presented products were chosen from a short list of 15 to cover a broad spectrum of products. Fruit leather and glacé fruit were included because they retain the muntries flavour and have long shelf lives. Sparkling muntries juice was chosen because it 1) represented a new product type for native foods, 2) beverages represent a large market and 3) the product rated highly during bench top testing by the research team. Muntries chocolates were developed because they represent another established market. Hot cross buns were developed because of their annual marketing potential which could be useful for establishing a new crop where continuity of supply can be an issue. Muntries chutney was chosen as blended products can compensate for raw fruit variability, another frequent problem with new crops.

Muntries (unknown cultivars) were obtained from Mt Pleasant South Australia (SA) (G and J Dennis, Simva Farm Forestry). Fresh fruit (April 2006) was used for fruit leathers and frozen fruit was used for all other products.

**Fruit leathers:** Fruit was blanched in boiling water for 1 min, then cooled in cold water, homogenised in a blender (Robot Coupe R2) for 3 min, then mixed with 3 parts 100% apple puree (Australian Pure Fruits, Lobethal, SA). The mixture was spread onto 345 mm x 345 mm trays, smoothed to 1–2 mm, and dried for 24 h in a Nara dehydrating oven at 50–55°C. The leather was cut into 1 cm<sup>2</sup> pieces.

**Glacé muntries:** Sugar syrup (1 L, 54° Brix), containing 5 g/L citric acid and 1.5 g potassium metabisulfite was heated gently with 1 kg of washed muntries until boiling (for 2 min). Fruit was removed and drained, and remaining syrup boiled (reduced) to 65° Brix. The syrup was cooled to 60°C and the fruit returned to the syrup and left to stand for 24 h at room temperature. Fruit was removed and dried at 45°C for 24 h, to reach a water activity of < 0.65.

**Muntries juice:** 400 mL muntries flavoured sugar syrup (byproduct of the glacé process, 67° brix, pH 3.4) was combined with 800 mL soda water (selzer) and 60 mL freshly squeezed lemon juice.

**Goats' curd and glacé muntries tarts:** Goats curd (2–3 mm Woodside Cheese Wrights, Woodside, SA) was placed in a prepared pastry case (salad/cocktail cups, Jos Poell, Holland); 8–10 glacé muntries were added with flat leaf parsley for garnish.

**Muntries hot cross buns:** Hot cross buns were developed in a home kitchen. The following were added to a bread maker (Panasonic SD-251): 475 g of crusty white flour mix (Laucke Flour Mills, Strathalbyn, SA), 10 g dried yeast, 45 g full cream milk powder (Nestlé), 25 g sugar, 10 g cinnamon, 10 g mixed spice, 45 g butter and 350 mL water. The dough raisin option (rest 30–50 min; knead 15–30 min; rise 1 h–1 h 20 min) was selected, and thawed berries added at the beep

during the kneading step. The dough was divided into 15 portions and kneaded. After rising, crosses were piped on top of buns using flour water mix (½ cup plain flour, 100 mL water). Buns were baked in a preheated 180 °C fan forced oven for 25 min. Cooked buns were glazed with the following mixture (5 g dissolved gelatin, 30 mL water and 15 g sugar). Buns for the central location trial were made as a one-off contract purchase from Willunga Peacock Farm (Soul'y Bread), Willunga Farmers Market, Willunga, SA ([www.farmersmarkets-oz.com/market.asp?mktname=willunga](http://www.farmersmarkets-oz.com/market.asp?mktname=willunga)).

**Muntries chutney:** This was purchased from Native Harvest, Mount Pleasant, SA.

**Muntries chocolate clusters:** Clusters of muntries glacé fruit (10–15 berries) were coated in dark chocolate (Nestlé Club).

### Central location consumer trial

A central location trial (CLT) was conducted at a Food, Jazz and Research Festival at the University of Adelaide, Waite Campus, November 2006. Approximately 5000 people attended the festival. People were asked if they would take part in a survey on native foods and 102 accepted the invitation. A refined and shortened questionnaire based on the MFP questionnaire was used. Respondents were asked to answer questions based on their knowledge prior to attendance at the Waite Festival. Respondents rated the acceptability of a commercially baked muntries hot cross bun on the same 1 to 9 hedonic scale used for the MFP. It was impractical to have respondents sample the other five muntries products at this venue. At any one time two trained interviewers conducted the survey. Upon completion, the interviewer invited the next passerby to participate, regardless of age, sex or ethnicity.

### Antioxidant potential

Antioxidant activity was measured using the ferric reducing ability of plasma (FRAP) assay (Benzie & Strain 1996) on Rivoli Bay muntries obtained from two different growers. Muntries samples were compared to frozen strawberries, frozen blueberries and a "high antioxidant berry mix" (60% blackcurrants, 30% bilberries and 10% wild blueberries), all from Creative Gourmet, Australia. Berries collected from five plants (from each farm) were assayed separately and the mean FRAP value determined (mmol Fe<sup>2+</sup>/100 g fresh weight) ± standard deviation. Three technical replicates were performed for each commercial berry sample. Experimental means were compared to controls using least significant difference (LSD) at a 5% significance level.

Antioxidants were extracted using the method detailed by Rodriguez-Saona & Wrolstad (2001). Extracts were thawed, and serial dilutions (1/5, 1/25, 1/125) were performed to ensure an OD reading within the linear range of the response. The FRAP reagent was made by combining stock reagents in the ratio 10:1:1 (v/v), as follows, 40 mL 300 mM sodium acetate buffer (pH 3.6): 4 mL 10 mM 2,4,6 tripyridyl-S-triazine (Sigma-Aldrich Chemical Co.) in 40 mM HCL : 4 mL 20 mM FeCl<sub>2</sub>. FRAP reagent (1.5 mL) and 20 µL of water were measured into a disposable cuvette. A 50 µL sample of extract was pipetted into the cuvette and mixed well. Absorbance readings were made at 593 nm exactly 6 min after the addition of the sample. A calibration curve was made with aqueous solutions of FeSO<sub>4</sub>•7H<sub>2</sub>O (2877, 575, 115, 23 µmol/L).

**Statistical analyses**

The data were analysed with a combination of Descriptive Techniques, Student's t-test and one way ANOVA with Tukey's post-hoc test using SPSS 13.0 and Microsoft Excel 2003.

**Results**

Four modified focus panel sessions were held with 37 consumers. The demographics of the four groups revealed a broad range of ages (from 18 to > 55) and slightly more females (57%) than males (43%) (Table 1).

**Prior knowledge of muntries**

For each native food, participants were asked to indicate whether they had 1) not heard of the food (raw or processed), 2) heard of it but not tasted it, 3) tasted but not purchased or 4) purchased the food product. If they had purchased any of the foods, the frequency of purchase was requested. The results confirmed the hypothesis that muntries are not a well known native food; 65% of the MFP participants had never heard of muntries (Figure 2), highlighting the need for consumer education and promotion of muntries; 16% of participants had heard of muntries and 11% had tasted, but not purchased muntries. Only 8% of participants had purchased muntries and the frequency of purchase was less than once a month (Figure 3). In contrast, greater than 50% of the MFP participants had purchased quandong (native peach) and 30% had purchased bush tomato (Figure 2), although the frequency of purchase was still low (Figure 3).

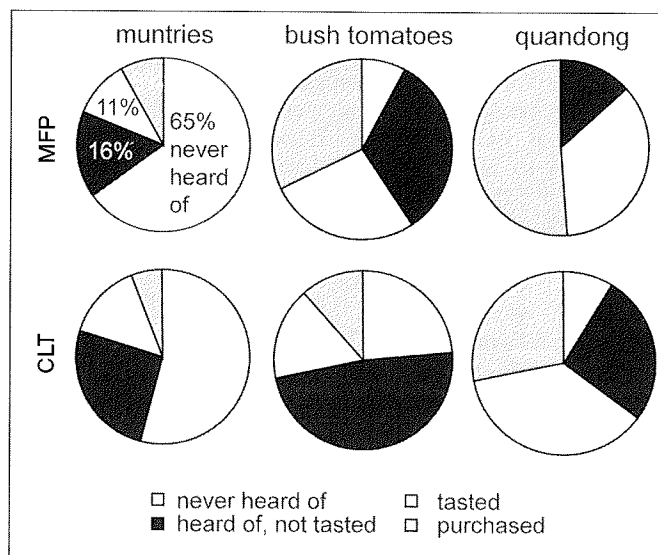
**Acceptability trials**

MFP participants tasted and rated six products under strictly controlled conditions to ensure independent ratings. All products were liked, achieving acceptability scores greater than 5 (out of 9) (Table 2). The acceptability scores were generally not significantly different across respondents, regardless of age, gender, income or education levels. The exceptions were the significantly higher scores ( $P < 0.05$ ) observed

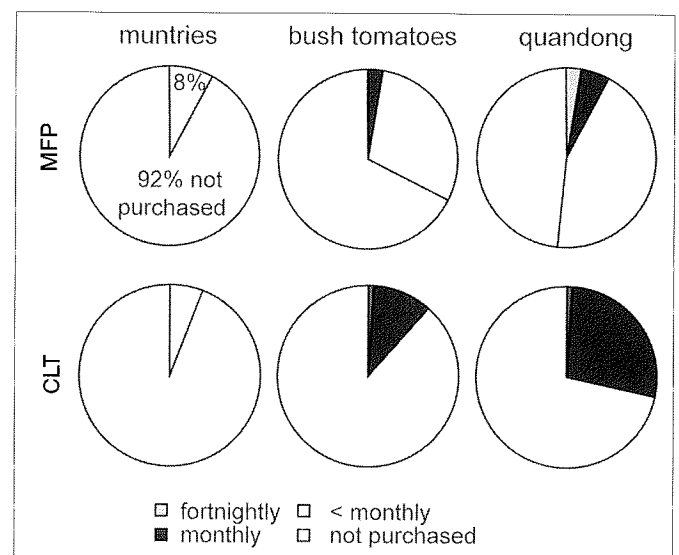
( $N = 37$ ) between males ( $5.8 \pm 1.6$ , standard deviation) and females ( $4.8 \pm 1.4$ ) for the acceptability of muntries hot cross buns and between younger ( $5.8 \pm 1.8$ ) and older ( $7.2 \pm 1.1$ ) participants for goats' curd and muntries tarts. The product with the highest score was the muntries sparkling juice at  $7.7 \pm 1.2$ . Positive comments on the drink, obtained during the qualitative phase of the MFP, included "great colour", "really trendy look", "a mixer for a cocktail – just add alcohol", "captured the muntries flavour well", "if presented in a small elegant bottle ... it can be sold at a premium price". The second most liked product was the chutney with a likeability score of  $7.6 \pm 1.5$ ; comments included "awesome", "amazing flavour" and "refreshing". The lowest scoring product was the hot cross bun ( $5.2 \pm 1.6$ ) but most felt "the idea does have potential" if product formulation could be improved.

The acceptability of commercially baked muntries hot cross buns was tested at the CLT ( $N = 102$ ). The mean acceptability score  $7.0 \pm 1.3$  was significantly higher ( $P < 0.01$ ) than the MFP mean of  $5.2 \pm 1.6$ . In contrast to the MFP result that males preferred the product more than females ( $P < 0.05$ ), the results from the CLT showed no significant difference in mean acceptability scores across males and females (6.95 and 6.94, respectively). There was a marked increase in preference as respondents' age increased. At 55+ years of age ( $N = 25$ ), the preference score of  $7.8 \pm 0.7$  was significantly higher ( $P < 0.01$ ) than the under 55 ( $N = 72$ ) score of  $6.7 \pm 1.2$ .

At the CLT, a modified version of the MFP questionnaire was conducted prior to tasting the hot cross bun and the results supported the findings of MFP. At the CLT, slightly more respondents had tasted muntries (15% compared with 11%), but 54% of respondents had not heard of muntries, cf 65% of respondents in the MFP. The increased awareness of the product did not translate into sales, as only 6% had purchased muntries compared to 8% for the MFP participants. The CLT demographics showed a similar age and gender distribution to the MFP (Table 1).



**Figure 2. Consumer awareness of muntries (*Kunzea pomifera*), bush tomatoes (*Solanum centrale*) and quandong (*Santalum acuminatum*) based on MFP ( $N = 37$ ) and CLT ( $N = 102$ ).**



**Figure 3. Purchasing behaviour of MFP and CLT participants for native foods.**

### Factors affecting purchasing behaviour

To determine the major factors driving purchase choice of native and gourmet foods, participants rated the importance of each of 15 different purchasing factors. Ratings were conducted using a 1 (not important) to 7 (extremely important) point category scale. Results from the MFP showed that for this luxury (high involvement) food category, taste/flavour was significantly more important ( $P < 0.0001$ ) than the next most important factor, which was recommendation from a friend (Table 3).

The discussions during the qualitative phase of the MFP suggested that consumers discriminated between health benefits and nutritional information and between country of origin and region of origin. Therefore two additional questions were added to the CLT questionnaire. Interestingly, the two added factors (health benefits and country of origin) were ranked second and third, respectively by the CLT respondents. The number one choice for the CLT respondents was taste/flavour and it was significantly higher than the second choice factor, as for the MFP respondents. Gender and age comparisons were also performed and taste/flavour was consistently rated the number one purchasing factor. Older respondents ( $> 45$  years) placed less reliance on price, than other respondents.

### Antioxidant content

At the time of the study, no reports of the antioxidant values for muntries could be found in the literature. The antioxidant activity (FRAP value) of frozen muntries, was compared to commercially available frozen strawberries, blueberries and a "high antioxidant berry mix" (Table 4). Table 4 also includes FRAP values for common fruits measured by an independent research group for comparison (Proteggente & others 2002). The Rivoli Bay muntries, from two different farms, had a mean antioxidant level  $\pm$  standard deviation, of  $10.63 \pm 1.5$  and  $8.77 \pm 2.8$  mmol  $\text{Fe}^{2+}/100$  g fresh weight, respectively, that was significantly higher ( $P < 0.05$ ) than the commercially available blueberry ( $2.11 \pm 0.2$  mmol  $\text{Fe}^{2+}/100$  g fresh weight) and strawberry ( $2.22 \pm 0.9$  mmol  $\text{Fe}^{2+}/100$  g fresh weight) samples. The levels of the two muntries samples were similar to the high antioxidant berry mix ( $8.35 \pm 1.2$  mmol  $\text{Fe}^{2+}/100$  g fresh weight).

### Discussion

#### Modified focus panels make good sense for new crops

Traditionally, separate sensory and marketing departments in organisations have reflected their disparate backgrounds, however recent developments have seen a pooling of these disciplines, as both realised that they were working towards the same objectives (Moskowitz & others 2006). Here we have developed an adapted consumer research method by combining focus groups with acceptance tests and a consumer questionnaire to form a modified focus panel. From the quantitative and qualitative data we learnt that consumer acceptance of most of the products was high despite the fact that these berries are not well known.

The MFP approach described here is applicable to any new crop or novel product group where resources

**Table 3. Factors influencing purchase choice in native and gourmet foods.**

Rank	Focus panels (N = 37)	Central Location Trial (N = 102)
	Purchasing Factor (score) <sup>1</sup>	Purchasing Factor (score) <sup>1</sup>
1	Taste/flavour (6.51) <sup>2</sup>	Taste/flavour (6.32) <sup>2</sup>
2	Recommendation of Friend (5.43)	Health Benefits (5.53) <sup>3</sup>
3	Price (5.16)	Country of Origin (5.45) <sup>3</sup>
4	Value (5.05)	Nutritional Information (5.14) <sup>4</sup>
5	Recommendation of Store Owner (4.97)	Value (5.45)
6	Write up (4.95)	Price (5.27)
7	Recipe Card (4.51)	Recommendation of Friend (4.94)
8	Nutritional Information (4.35) <sup>4</sup>	Recipe Card (4.90)
9	Advertising/promotion/special (4.30)	Advertising/promotion/special (4.51)
10	Region of Origin (3.86)	Write up (4.48)
11	Novelty (3.73)	Region of Origin (4.21)
12	Convenient Packaging (3.65)	Indigenous Link (4.18)
13	Indigenous Link (3.65)	Recommendation of Store Owner (4.21)
14	Attractive Packaging (3.54)	Convenient Packaging (3.97)
15	Brand Name (2.86)	Novelty (3.93)
16	Not Applicable	Attractive Packaging (3.69)
17	Not Applicable	Brand Name Importance (3.47)

<sup>1</sup> Rated on a 1 (not important) to 7 (extremely important) point category scale. <sup>2</sup> Significantly higher than all other factors,  $P < 0.001$ . <sup>3</sup> This option was not included in the first questionnaire. <sup>4</sup> Significant between MFP and CLT,  $P < 0.05$ .

**Table 4. Antioxidant levels in frozen muntries and other common fruits.**

Fruit	Antioxidant activity <sup>1</sup>
<b>Current study</b>	
Muntries (farm 1), frozen	$10.63 \pm 1.5$
Muntries (farm 2), frozen	$8.77 \pm 2.8$
High antioxidant berries, frozen <sup>2</sup>	$8.35 \pm 1.2$
Blueberries, frozen	$2.11 \pm 0.2$
Strawberries, frozen	$2.2 \pm 0.9$
<b>Proteggente &amp; others (2002)</b>	
Strawberries, fresh	$3.35 \pm 0.04$
Raspberries, fresh	$2.32 \pm 0.05$
Grapefruit, fresh	$0.83 \pm 0.01$
Orange, fresh	$1.18 \pm 0.01$
Pear, fresh	$0.32 \pm 0.02$
Apple, fresh	$0.39 \pm 0.01$
Peach, fresh	$0.34 \pm 0.00$
Banana, fresh	$0.16 \pm 0.03$

<sup>1</sup> FRAP antioxidant activity (mmol  $\text{Fe}^{2+}/100$  g fresh weight)  $\pm$  standard deviation (this study) or  $\pm$  standard error (Proteggente & others 2002).

<sup>2</sup> 60% blackcurrants, 30% bilberries and 10% wild berries.

for early feasibility studies are limited. The major value in undertaking this approach is the instant feedback received and quantitative data gathered along with a reduction in the time required of panellists. The value of the combined approach was highlighted when the MFP participants responded unfavourably (rank 8/15, Table 3) to "nutritional information" in the questionnaire, but actively asked about the health benefits of muntries. This disparity may have been overlooked if the participants had only completed the questionnaire. We were able to show in the subsequent CLT, that the health benefits of foods were indeed an important purchase consideration (rank 2/17, Table 3).

Two products were clearly preferred by the participants within the MFP and represent good candidates for further product development. The muntries sparkling juice and muntries chutney both had acceptability ratings greater than 7 out of 9, with standard deviations  $\leq 1.5$ . The number of external consumers recruited for the MFP ( $N = 37$ ), was within the range (25–50) used for laboratory tests, suggesting that statistical inferences are valid where the standard deviation is low ( $\leq 1.5$ ) (Stone & Sidel 2004), as observed in this study (Table 2). For future trials, it would be worth recruiting 12 consumers for each of the four MFP to allow for the possibility of last minute withdrawals, thereby increasing the chance of recruiting the recommended 40 participants for laboratory tests (Stone & Sidel 2004). In the CLT, a third muntries product, the commercially produced hot cross bun, had an acceptability score of  $7 \pm 1.3$ , suggesting a diverse range of potential products for this berry.

### **Flavour is the most important purchasing driver**

In both MFP and CLT, taste/flavour was the most important driver for the purchase of gourmet foods (Table 3). The importance of flavour has been demonstrated in other studies (Steptoe & others 1995, Cherikoff 2000, Bruwer & Johnson 2005). One finding from this study was that it was not necessary for the flavour of the muntries to be dominant, as long as the flavour of the final product was good. This was demonstrated by the high acceptability score for the muntries chutney (Table 2). This information is important for growers and food producers because it allows them to increase profit margins by blending "high value" muntries with cheaper products such as apple, and still meet consumer expectations of a good product.

The importance of the recommendation of friends (Table 3) demonstrates the role that opinion leaders play in the information gathering and risk reduction process (Wansink & Westgren 2003). The MFP participants were willing to pay a little more for muntries as it is a new and different food that might impress their friends. They were demonstrating opinion leader behaviour and could become good ambassadors for future products. The opinion of others reduces the social/psychological risk associated with the purchase of a new product (Mitchell & Greatorex 1989). Further risk reduction can be gained through free tasting of muntries products at venues such as local farmers' markets and food fairs. Tastings have the dual advantage in providing information on, and reassurance about, the product.

Such strategies are applicable to all new food products. Price and health benefits are other important factors in food choice for both groups (Table 3). A recent review highlights that while price is important it is rarely the primary driver in choice (Iop & others 2006). Health benefits, such as antioxidants, are widely recognised as important considerations in food choice decisions (Goldman 2003).

The high levels of antioxidants in muntries will allow producers of muntries products to market the health benefits of the fruit. The high FRAP values for Rivoli Bay muntries from two different farms (8.77 and 10.6 mmol Fe<sup>2+</sup>/100 g) were comparable to a commercial high antioxidant berry mix and were significantly higher than frozen blueberries (Table 4). A recent paper confirmed the differences in antioxidant levels between muntries and blueberries that we observed (Netzel & others 2006).

### **Creating a market for muntries**

The low purchase rate (6–8%) of muntries likely reflects the limited product choice and the relatively few retail outlets that sell muntries products. Increased market demand for the existing fruit will be necessary before there is any long-term investment in plant improvement and in turn market demand will not increase without an increase in awareness about the fruit and its products.

There is no guaranteed successful strategy for the commercialisation of a new crop and the strategies used to commercialise two recently domesticated crops, macadamia nut and kiwifruit (*Actinidia deliciosa*), show that a variety of factors contribute to success. It is noteworthy that for both of these examples, commercialisation occurred in a foreign country: the Australian macadamia nut was first commercialised in Hawaii and the Chinese gooseberry, now kiwifruit, was commercialised in New Zealand.

For kiwifruit, it is difficult to pin-point a single strategy that was responsible for its success. A number of strategies for raising awareness ultimately led to a local industry in New Zealand (Ferguson & Bollard 1990). They included: a local nurseryman, Bruno Just, who drove around New Zealand selling ten thousand seedlings in the early 1930s, making it a common garden plant. Restrictions of fruit imports into the country during World War II (1939–1945) and the high vitamin C content of the fruit also contributed (Fletcher & others 1959). The export market for kiwifruit had a breakthrough in the USA in 1964 when it was showcased as the fruit of the month by a catalogue company that saw advertising literature mailed to approximately two million homes. The name change from Chinese gooseberry to kiwifruit in 1959 may have played an important role and an analogous strategy should be considered for muntries, which might be more marketable with a different name. Science also contributed with the selection of the cultivar Hayward that had excellent storage potential.

The first commercial harvest of macadamia nuts was in Hawaii in 1956 (Suryanata 2000). Marketing of the macadamia nut was clearly linked to tourism with packaged macadamia nuts providing tourists with an edible souvenir. The continued growth of the industry is in part attributed to macadamia nuts becoming a symbol of cosmopolitanism, and as such they appealed to buyers long after their vacations finished (Suryanata 2000).

These examples indicate that no single strategy exists for commercialising new crops. A variety of different approaches will be needed in parallel to ensure the success of Australian native fruits such as muntries.

**Conclusion**

This study suggests that a modified focus panel approach combining qualitative focus groups with quantitative acceptance testing is both robust and particularly transferable to new food products where there are limited information and resources. The high acceptability scores suggest a favourable market potential for muntries products, especially muntries sparkling juice, muntries chutney and hot cross buns. The increasingly global nature of the food industry appears to be more receptive to novel food products, than it does to me-too based products (Costa & Jongen 2006), which should further increase the appeal of muntries. Market research will be required in the future to test whether consumer acceptability translates to consumer willingness to purchase, as the latter does not always follow (Stone & Sidel 2004, Jaeger & Harker 2005).

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