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United Arab Emirates beef consumer consumption behaviours and product preferences: A Latent Class Analysis

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Research Report No. 359
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Key Points

- The Agribusiness and Economics Research Unit (AERU) at Lincoln University with the support of research partners under the *Unlocking Export Prosperity from the Agri-food Values of Aotearoa New Zealand* research programme funded by MBIE has estimated willingness-to-pay (WTP) values for selected credence attributes of beef mince products by United Arab Emirates consumers, with a focus on identifying preferences for attributes considered *distinctively New Zealand.*
- Preferences for many of the credence attributes considered here are not readily observable from market prices and so the non-market valuation method of Choice Experiments was used. This involved an online survey of UAE residents in December 2019, using a research panel. The survey process achieved 996 responses with suitable representation of key population demographics.
- As well as WTP values, this survey reports on:
    - Purchase frequency by beef cut and country-of-origin
    - Prices paid by beef cut
    - Country-of-origin quality ranking
    - NZ beef purchases by cut
    - Reasons for buying NZ beef
    - Alternative protein purchasing frequency
    - Perceptions and attitudes related to beef production
    - Use of digital media and smart technologies for beef shopping

The Choice Experiment identified three groupings of beef mince consumers, and we describe profiles for these groups using the questions above.

The results showed that consumer group one (the largest at 50 per cent of the sample) were willing to pay the most for beef mince from New Zealand, with a premium of 75 per cent, and slightly more for New Zealand beef raised on Māori farms. They also were willing to pay more for organic beef. These consumers were typically female, under 44 years old, had the highest consumption of beef and pay higher prices than the other two consumer groups. Therefore, this would be potentially the demographic that New Zealand exporters could target.

- The average respondents percentage willingness-to-pay (WTP)

Beef mince Attribute	Group One 50% of consumers	Group Two 35% of consumers	Group Three 15% of consumers
Social responsibility	0	46	51
Organic	58	0	0
Enhanced Animal Welfare	9	0	0
Low fat	12	0	0
GMO-free	22	24	0
Chilled	0	0	0
Fresh	29	27	115
No added antibiotics	12	31	0
No added hormones	0	0	126
100% Grass-fed	23	44	46
Grain-fed	9	0	0
Feedlot Raised	0	0	0
100% Pasture Raised	15	36	48
Carbon Neutral	0	59	0
Biodiversity Enhancement	0	0	0
Water Quality Protection	14	16	0
Raised in NZ	73	0	80
Raised on Māori farms in NZ	78	0	0
Raised in Australia	26	23	77
Raised in Brazil	0	101	0
Raised in South Africa	0	26	0
Raised in Pakistan	16	0	169

Chapter 1
Introduction

This study is part of a research programme entitled *Unlocking Export Prosperity from the Agri-food Values of Aotearoa New Zealand*. It is funded by the Ministry of Business, Innovation and Employment (MBIE) Endeavour Fund for science research programmes.

The research aims to provide new knowledge on how local enterprises can achieve higher returns by ensuring global consumers understand the distinctive qualities of the physical, credence and cultural attributes of agri-food products that are "Made in New Zealand".

Agricultural exports are an important contributor to the New Zealand (NZ) economy. While NZ historically relied on key markets such as the United Kingdom for export trade, NZ has more recently significantly expanded its export markets and the United Arab Emirates (UAE) offers potential to become established as an important beef product destination. It is critically important for NZ exporters to understand export markets and the different cultures and preferences of those consumers to safeguard market access, and for realising potential premiums.

This report describes the application of a survey of United Arab Emirates beef mince consumers designed to examine consumption behaviour and consumer Willingness-to-Pay (WTP) for credence attributes. While search attributes such as price or colour can be observed directly, and experience attributes such as flavour can be assessed when consumed, credence attributes such as environmental sustainability cannot be immediately seen or experienced at the point of sale. For products promoting credence attributes, the role of verification including labelling is of significant importance.

Our approach is to apply a Choice Experiment economic valuation method, analysed using a statistical approach called Latent Class Modelling that describes profiles for different consumer segments identified in the data and provides estimates of attribute WTP across these segments.

Chapter 2
Beef Survey Method

To understand how consumers value NZ credence attributes, this study used a structured self-administered online survey that included a Choice Experiment, conducted in the UAE in December 2019. The survey was administered through Qualtrics™, a web-based survey system, and had a sample size of 996 beef mince consumers.

The survey was developed by the research team drawing from a literature review on consumer trends for animal meat products, results from previous surveys examining consumer attitudes in overseas markets, a scoping survey of 200 UAE beef consumers (November 2019) and consultation with industry partners and stakeholders, especially those on the AERU advisory board.

Sampling involved recruiting participants from an online consumer panel database provided by an international market research company (dynata.com). Panel members are recruited by online marketing across a range of channels and panels are profiled to ensure adequate representativeness. Panels are frequently refreshed, with the participation history of members reviewed regularly. Respondents for each survey are compensated with a retail voucher for completing a survey. Potential respondents were recruited by e-mail and were screened out if they purchased beef mince less than monthly.

2.1 Using Choice Experiments to examine consumer preferences

Choice Experiments are a survey-based valuation approach that have been widely used to value consumer preferences for food product attributes. They are particularly useful for examining the role of new attributes, and attributes that that are not easily observable in market prices, such as the attributes explored in the current report. The ability of this method to identify the relative importance of individual attributes are more important in consumer choices and to estimate consumers WTP for these

Designing a Choice Experiment survey involves deciding which product attributes are of interest, combining these into different product offerings, and asking consumers to pick which offering they prefer from a range of alternatives. In this study, the attributes associated with beef mince products are different production practices, country of origin, freshness and price (Table 2.1). These attributes were selected in consultation with the relevant industries and also was informed by the scoping survey that used a combination of open text and structured questions to identify which attributes UAE consumers considered distinctive of NZ beef.

Table 2.1 Beef mince attribute descriptions used in the Choice Experiment

Beef mince attributes	Attribute descriptions
Animal Feed	100% Grass-fed beef is lower in calories, contains more healthy omega-3 fats, vitamins A and E, beta-carotene and antioxidants. Grain fed beef have higher fat content and marbling which can produce a richer taste.
Environmental Sustainability	Environmentally sustainable farms actively minimise the environmental effects of beef production. The beef may be labelled as being produced using a system that is either Carbon Neutral, Enhances Biodiversity or Protects Water Quality
Antibiotics & Hormones	Beef may be raised with or without added antibiotics and/or hormones.
Social Responsibility	Socially responsible farms actively include public interest into decision making.
Product Origin	The beef may be labelled with the country where the cattle was raised.
GMO-Free	Animals are not genetically modified, and do not consume genetically modified feed.
Animal Housing	Animals can be raised mainly in feedlots, or mainly in pastures.
Māori Production	The beef may be labelled as being produced on Māori farms. Māori, New Zealand's indigenous people, value sharing food with family, friends and visitors. For Māori, sharing food is more than just good hospitality but is viewed as an essential component of society and of individual prestige, with the food representing a gift that binds people together.
Organic	No synthetic fertilisers, hormones, antibiotics or animal by-product supplementation during the entire life of the animal including in their feed.
Animal Welfare	Animal welfare practices can be enhanced above the minimum legal standards.
Freshness	The beef may be either frozen, chilled or fresh
Fat content	The beef may be labelled as being low-fat (<5%)
Animal Feed	100% Grass-fed beef is lower in calories, contains more healthy omega-3 fats, vitamins A and E, beta-carotene and antioxidants. Grain fed beef have higher fat content and marbling which can produce a richer taste.
Price	AED per kilogram beef mince

Changes in beef attributes are described using the levels in Table 2.2. Price levels were determined by market prices, and from what scoping survey respondents said that they usually paid. Countries of origin were selected based on volumes of sales from different countries into the UAE for 2019.

An example of alternative product offerings presented to respondents is shown in Figure 2.1. Each set of offerings comprises three options, of which respondents chose their preferred one. Two options present alternative beef mince products, while the third is a 'none of these' option. Each respondent answered ten choice sets, generating 9,960 completed choice sets over the total sample.

Table 2.2 Beef mince attribute levels used in the choice experiment

Beef tenderloin attributes	Attribute levels						
Enhanced Animal Welfare	No Label	Certified					
Organic Production	No Label	Certified					
GMO-free	No Label	GMO-free					
Social Responsibility	No Label	Certified					
Fat content	No label	Low fat (<5%)					
Additives	No Label	No Added Antibiotics		No Added Hormones			
Animal Housing	No label	100% Pasture Raised		Feed-lot raised			
Animal Feed	No label	100% Grass-fed		Grain-fed			
Freshness	Frozen	Chilled		Fresh			
Environmental Sustainability	No Label	Carbon Neutral		Biodiversity Enhancement		Water Quality Protection	
Origin	No label	South Africa	Brazil	Australia	Pakistan	NZ	Māori
Price ¥ per kg beef mince	AED30	AED60		AED90			

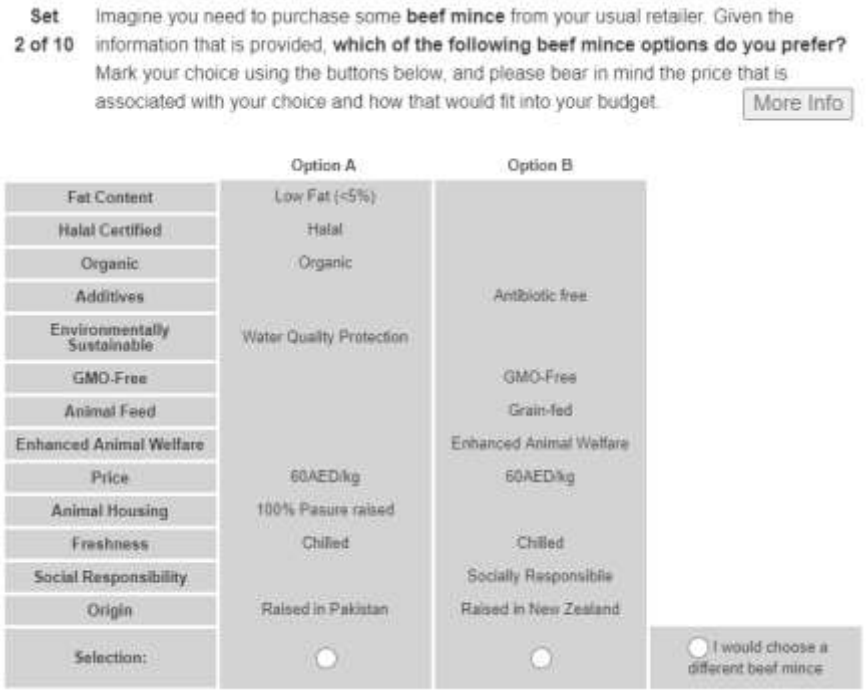


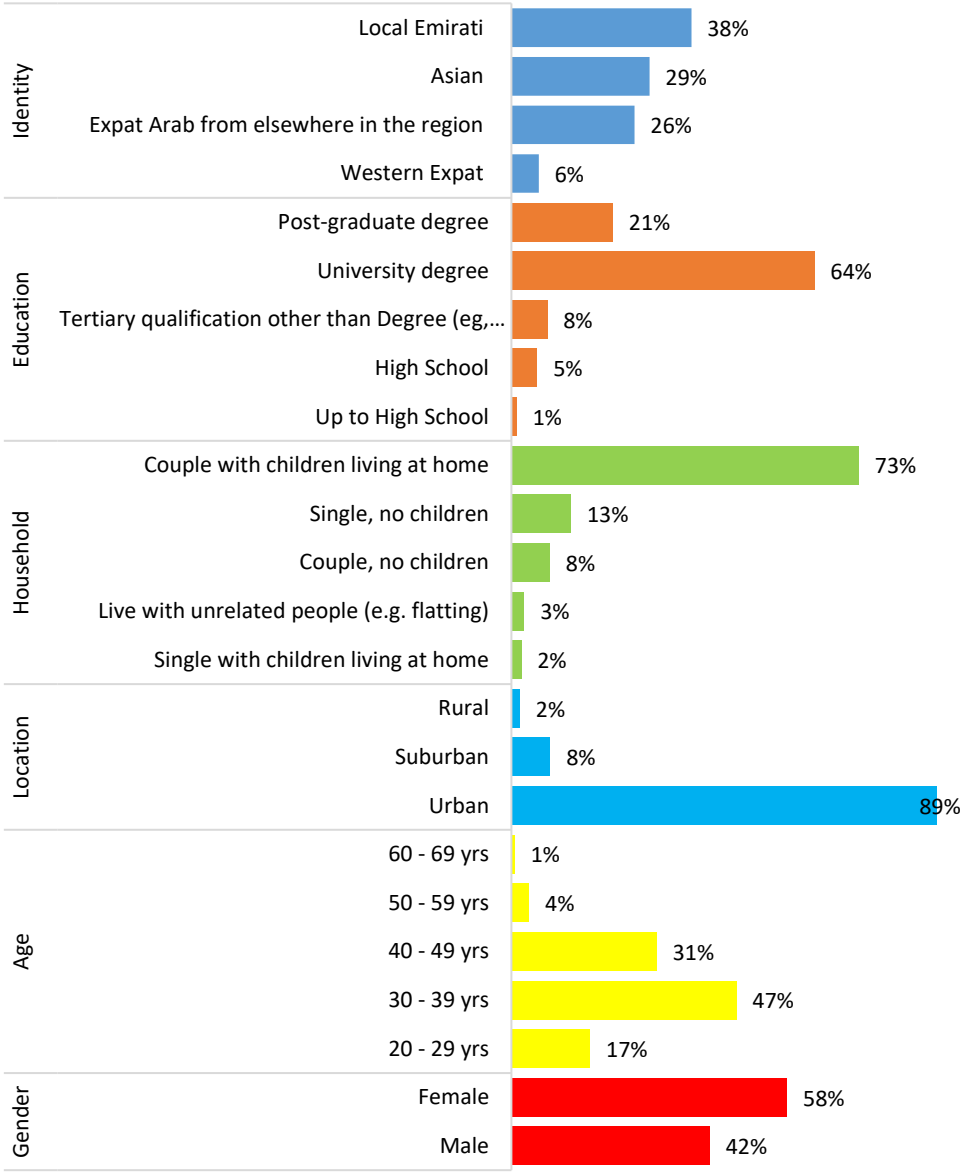
Figure 2.1 Example of a choice experiment question shown to respondents

Product choices are statistically analysed, and consumers' WTP for each attribute is estimated. A more detailed presentation of theoretical foundation and statistical procedure can be found in Appendix A.

Chapter 3
Survey Results

3.1 Sample demographic description

- The sample comprised a wide range of demographics, which is important to ensure that the sampling process has broadly canvased the relevant population (Figure 3.1).
- It is important to note that we are not attempting to represent the overall UAE population, but rather those that purchase beef mince at least fortnightly.



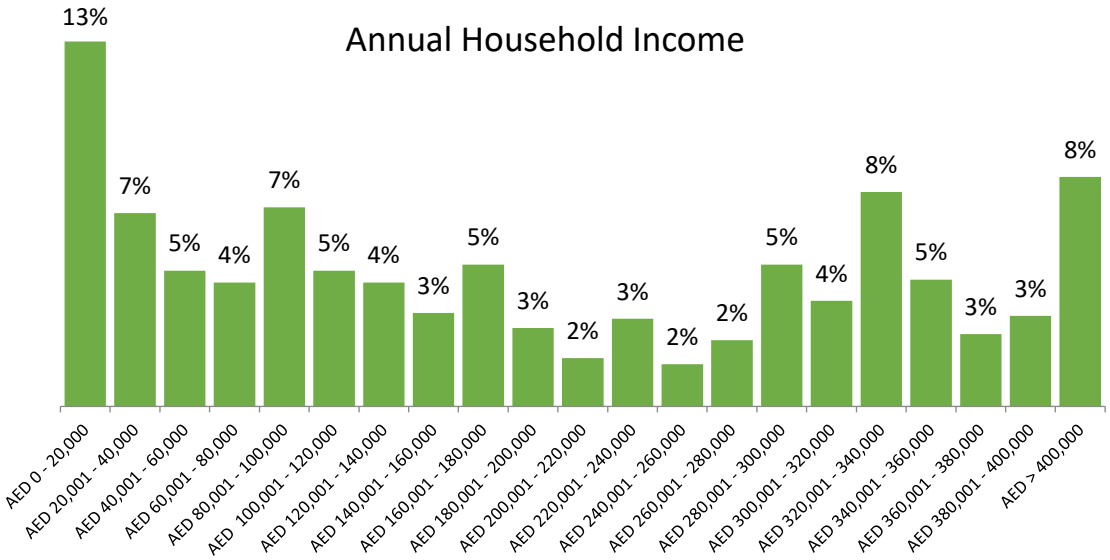


Figure 3.1 Sample demographics

3.2 Purchase and consumption behaviour

- Apart from *mince products*, *burger* was the most often purchased beef product, followed by *beef cubes* and *sausage* (Figure 3.2).

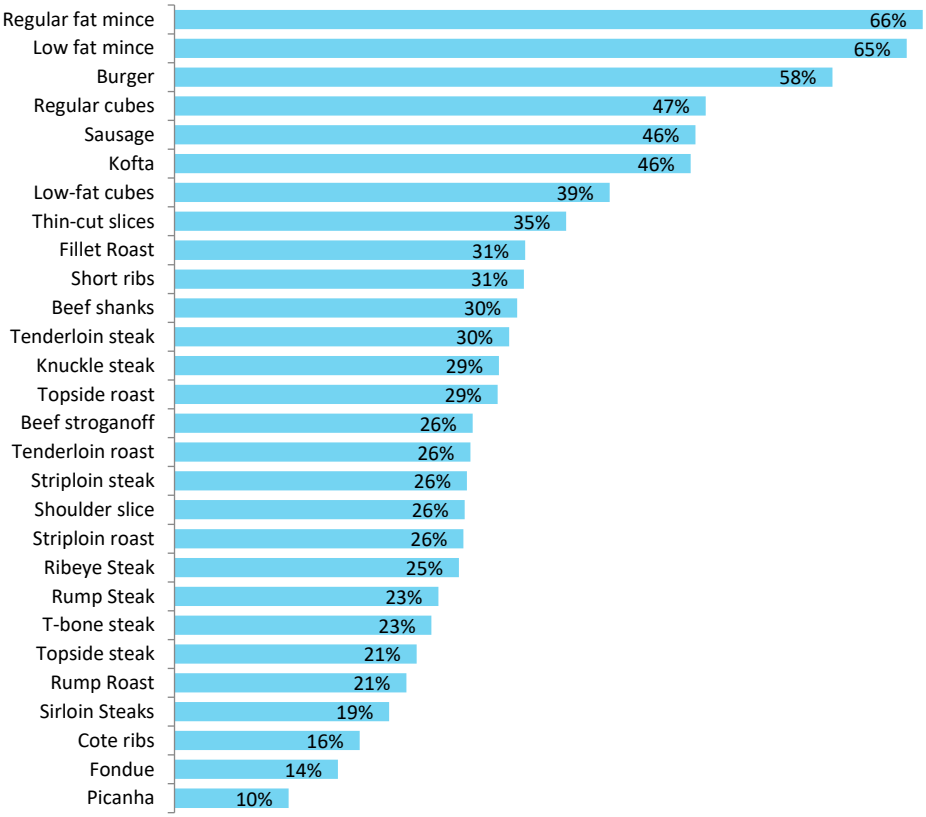


Figure 3.2 Beef product purchases in previous month

- Average price usually paid is highest for *sirloin steak* and lowest for *sausage* (Figure 3.3).

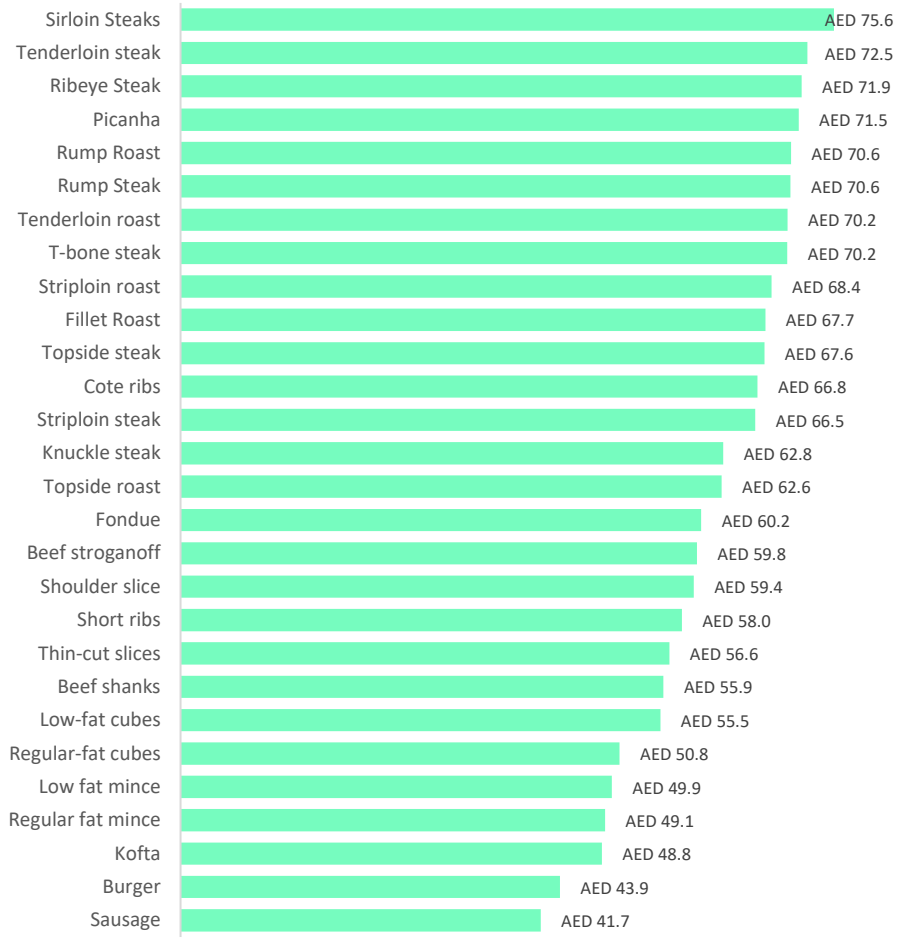


Figure 3.3 Average price per kg usually paid for beef cuts

- Half of respondents usually paid more than AED42/kg for beef mince (both regular and low fat), with a quarter paying more than AED62/kg (Figure 3.4).

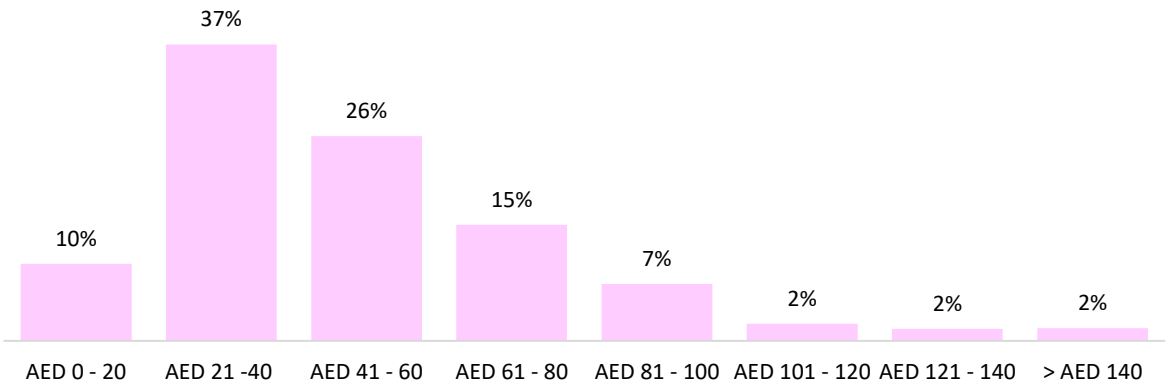


Figure 3.4 Price per kg usually paid for beef mince

- NZ has the second highest country-of-origin beef purchase frequency (Figure3.5).

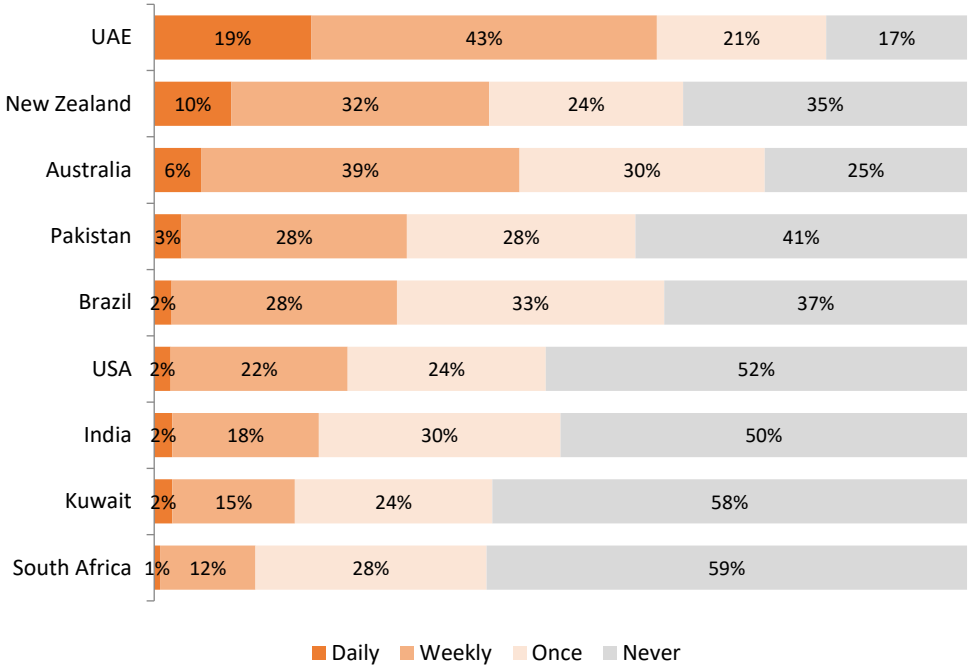


Figure 3.5 Country-of-origin beef purchase frequency in previous month

- Beef raised in NZ has a high quality ranking overall when compared with the other main importing countries considered (Figure 3.6), and is ranked highest by about a quarter of respondents, and in the top three by 54 percent of respondents.

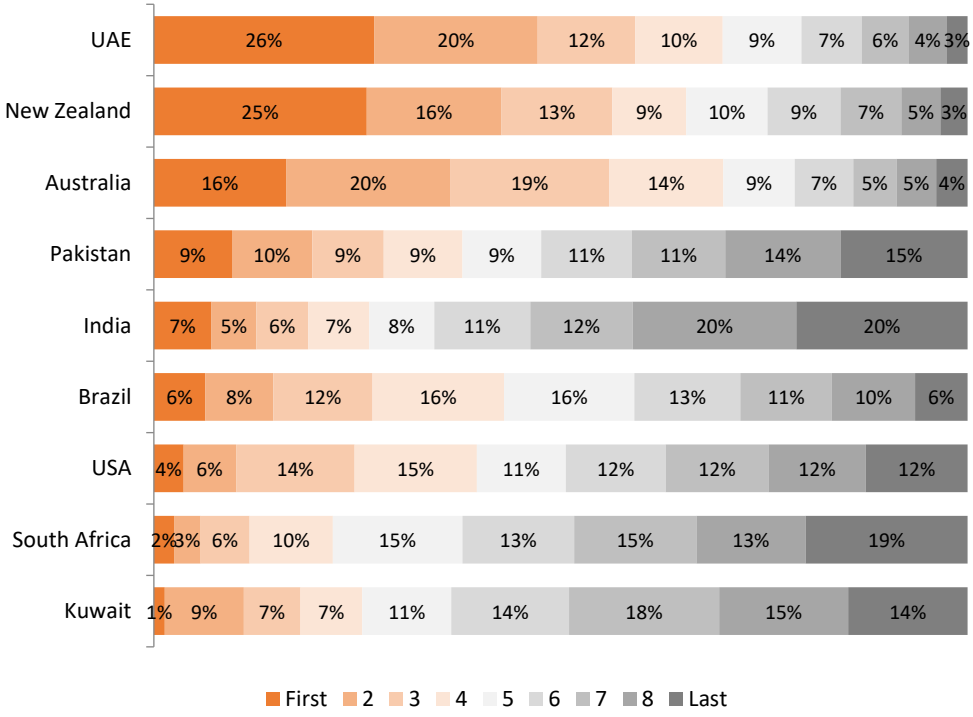


Figure 3.6 Beef country-of-origin ranking

- About half of respndents purchased either low fat or regular NZ beef mince in the previous month (Figure 3.7). Two thirds of respondents bought at least one NZ beef cut, with half of respondents purchasing two or more different cuts.

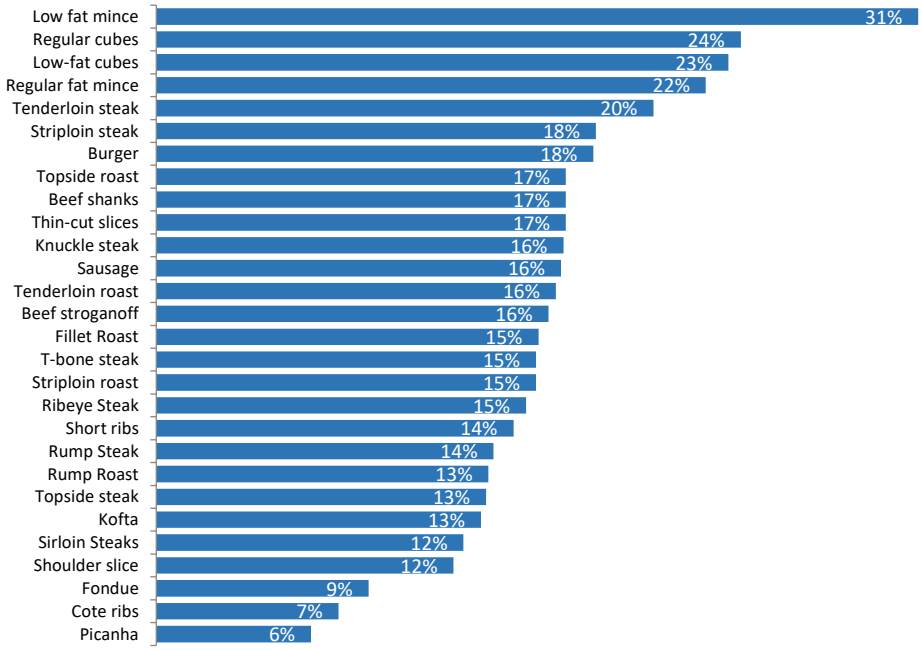


Figure 3.7 NZ beef cuts purchased in previous month

- High *food safety*, *health benefits*, and attributes representing an unadulterated pure product are important reasons for consumers to purchase NZ beef (Figure 3.8).

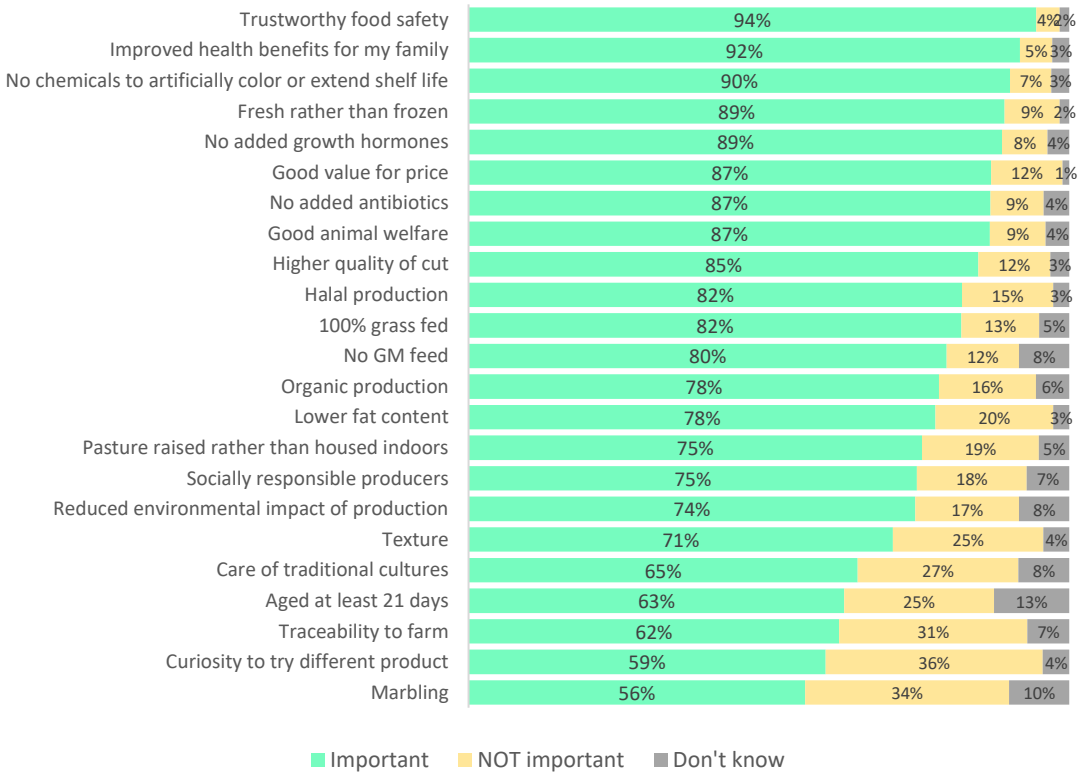


Figure 3.8 Reasons for purchasing New Zealand produced beef

- Poultry and fish have about the same overall purchase frequency as beef, while pork has the lowest (Figure3.9).

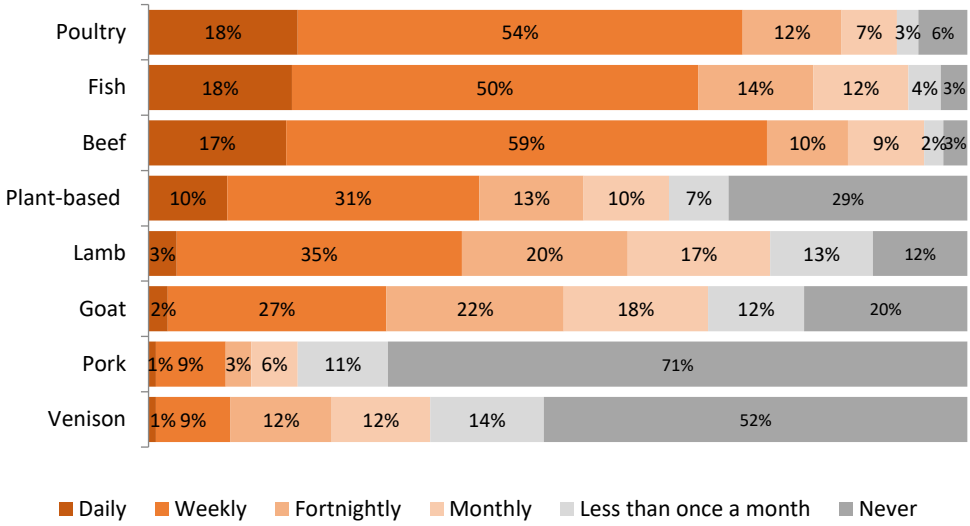


Figure 3.9 Alternative protein type purchase frequency

- For respondents who purchased plant-based protein products at least monthly (64%), *health benefits* are the most important reason (Figure 3.10).

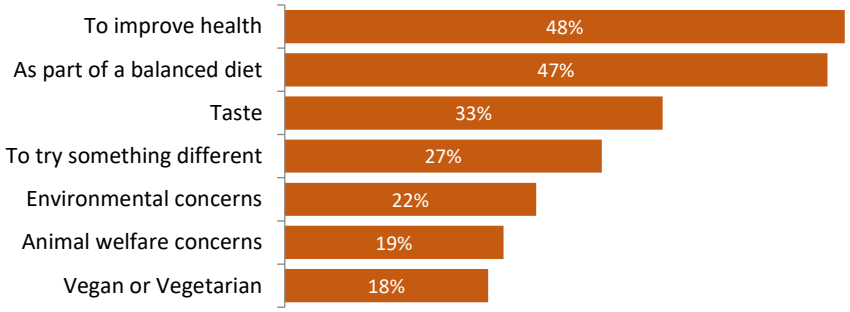


Figure 3.10 Reasons for purchasing plant-based proteins

- An overall preference for animal proteins is the main reason for not purchasing plant-based protein products (Figure 3.11).

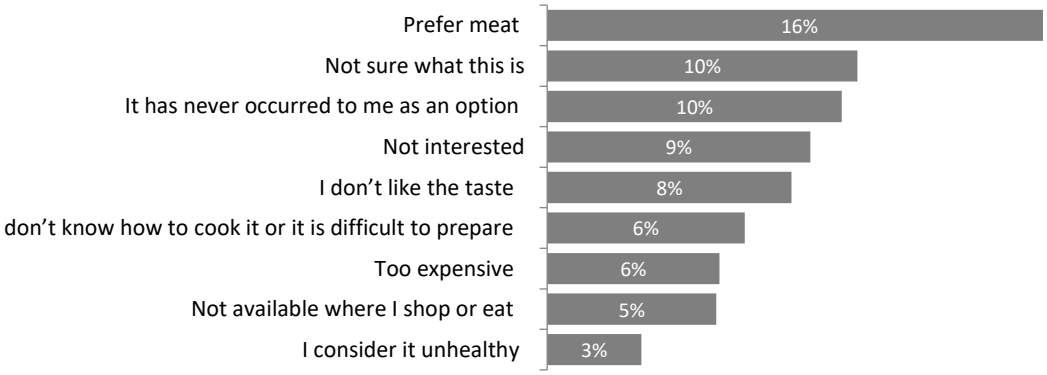


Figure 3.11 Reasons for not purchasing plant based proteins

- Almost all respondents stated they pay careful attention to beef labeling and try to find out as much as they can before trying unfamiliar products. While nine out of ten respondents think beef is healthier than pork, about a third aren't concerned about avoiding it due to African Swine Fever nor do they eat more beef because of this disease. Almost all respondents are worried about the long-term effects of modern beef production practices, or that the environmental impact is well managed (Figure 3.12).

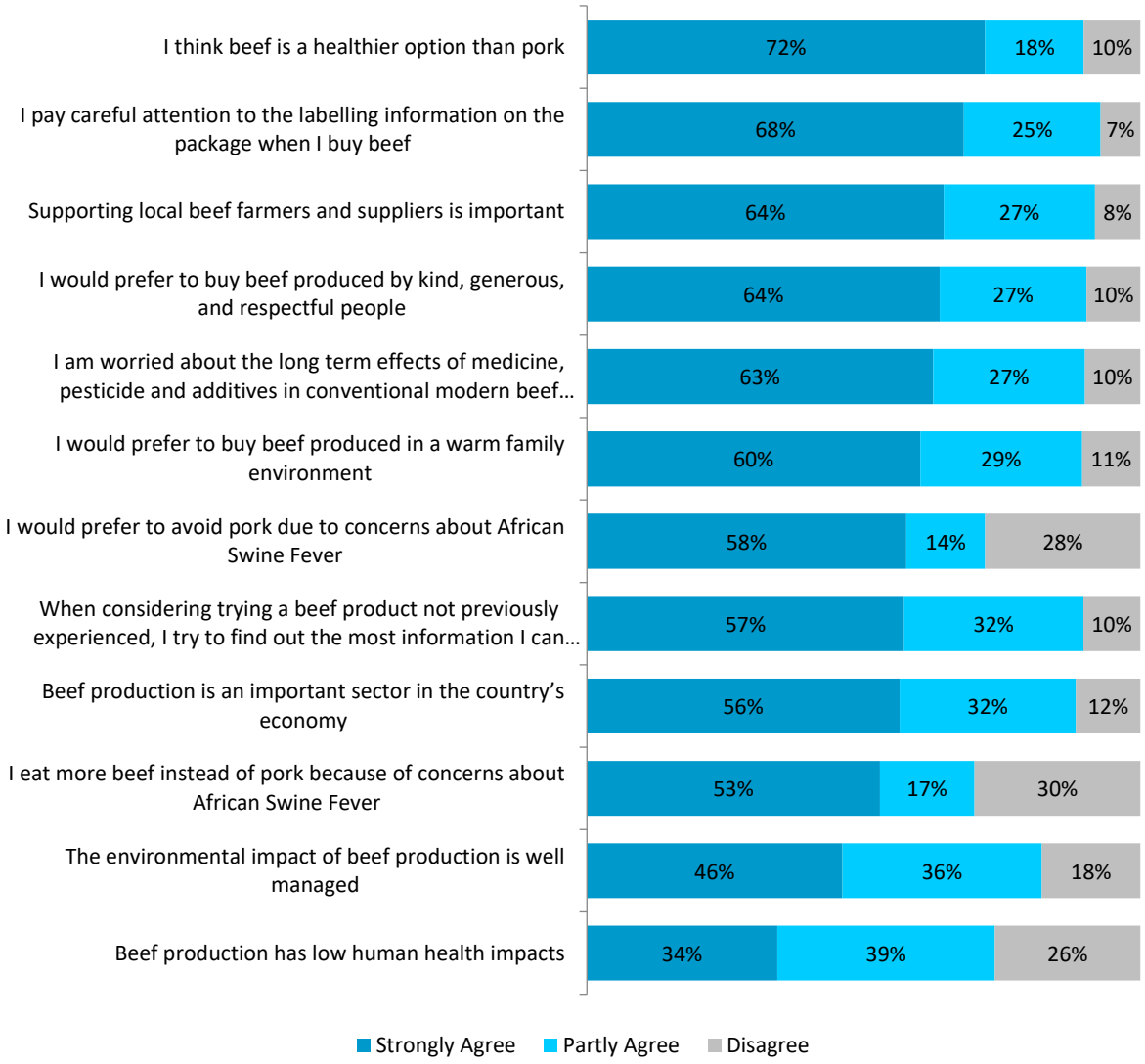


Figure 3.12 Perceptions and attitudes relating to beef production

3.3 Use of digital media and smart technologies for beef shopping

- Use of mobile devices to access the internet far exceeds that of home computers with almost nine out of ten respondents accessing the internet daily using their mobile device (Figure 3.13).

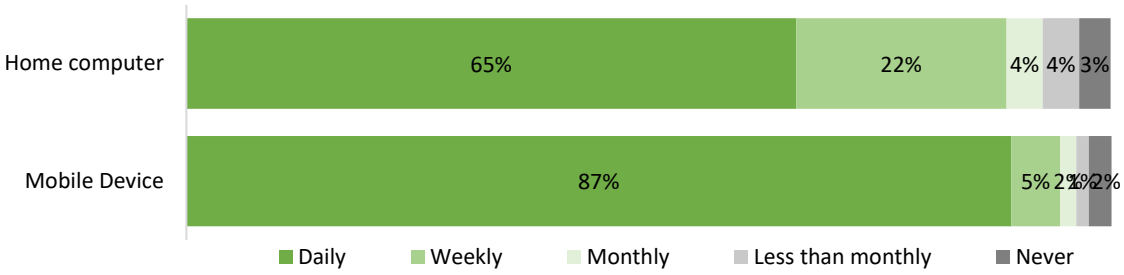


Figure 3.13 Frequency of internet access

- Respondents generally use the same types of digital media to search for how information on how a beef product is produced as they do when deciding which product to purchase (Figure 3.14).

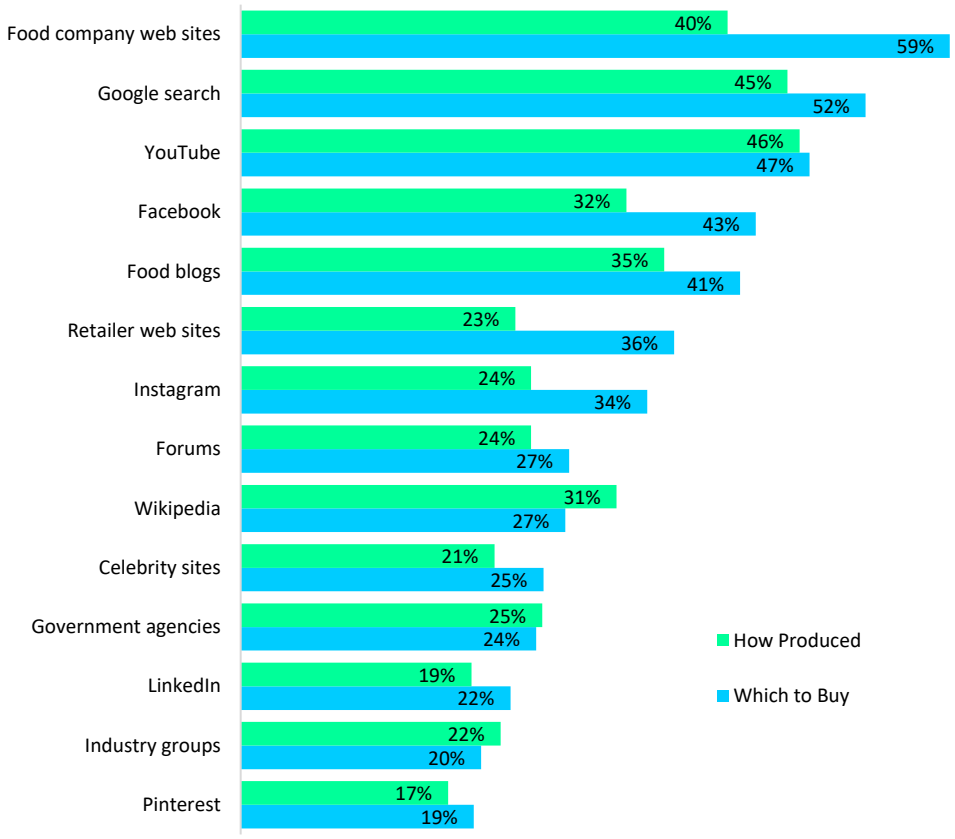


Figure 3.14 Use of digital media for information searching and purchasing.

- Barcodes have the highest use rates for both product purchasing (57 percent) and for product information searching (65 percent) (Figure 3.15).

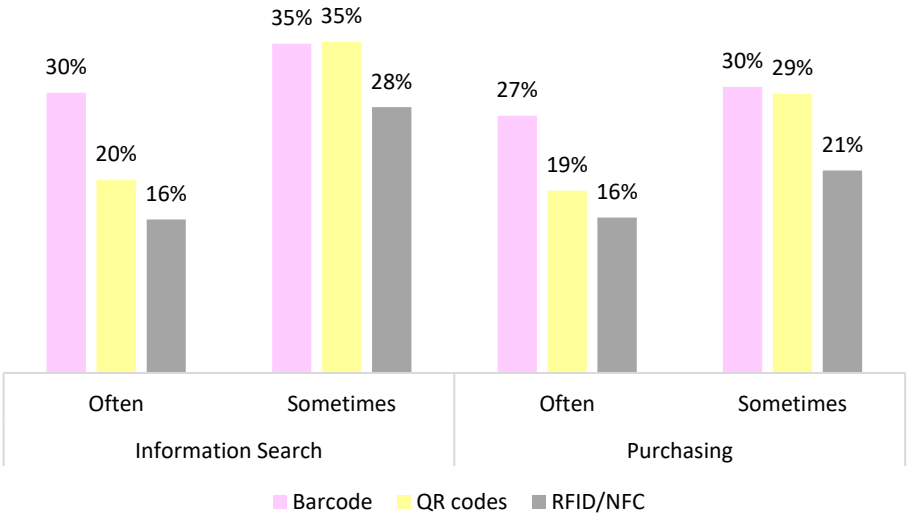


Figure 3.15 Use of smart technologies for information searching and purchasing

- There is a relatively high use of mobile applications across the sample, and high interest in potential uses where current use is relatively low, such as for searching for sustainability and traceability information (Figure 3.16).

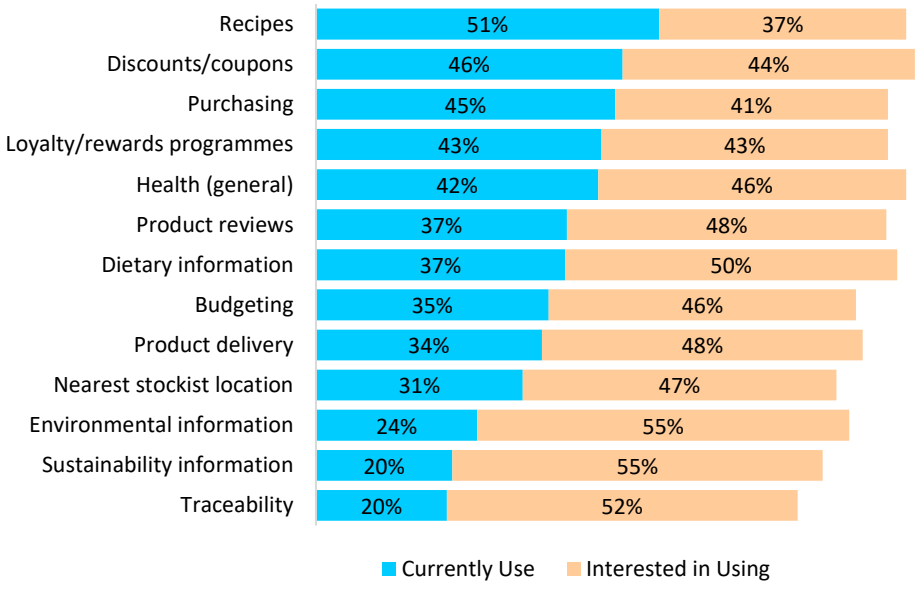


Figure 3.16 Current and potential use of mobile applications

- On average, 23 percent of beef expenditure occurs at hypermarkets, while just 7 percent pf expenditure is done online (Figure 3.17).

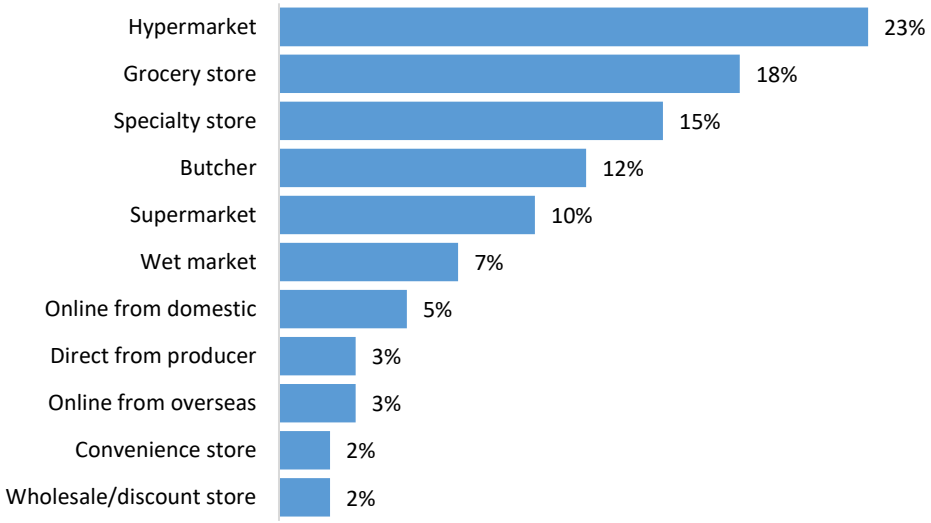


Figure 3.17 Percentage of beef expenditure by retail channel.

- The majority of respondents did not buy any beef online (73 percent), while about one in five respondents spent at least 20 percent of their beef expenditure online (Figure 3.18).

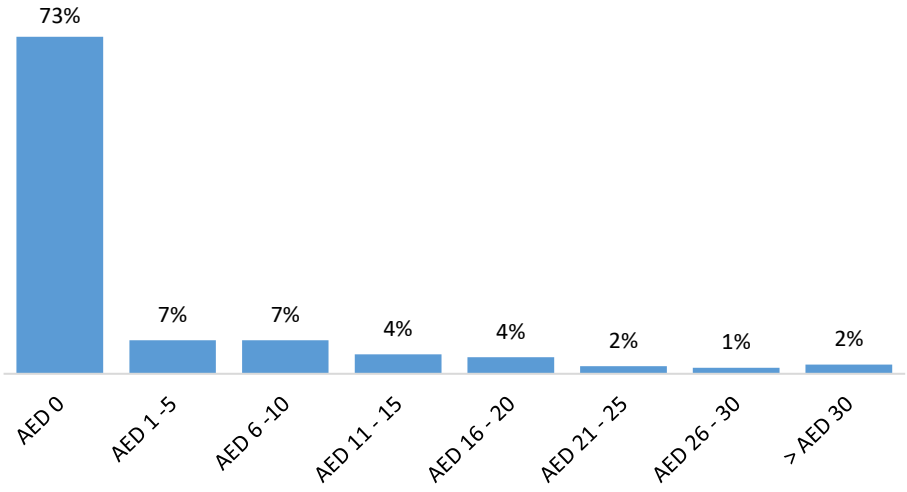


Figure 3.18 Percent of online beef expenditure.

- Convenience of home delivery and access to promotions are important reasons for those choosing to shop for beef online (Figure 3.19).

Figure 3.19 Main reason for shopping online for beef.

- For those shopping for beef online, hypermarkets and supermarkets are the main retail channels used (Figure 3.20).

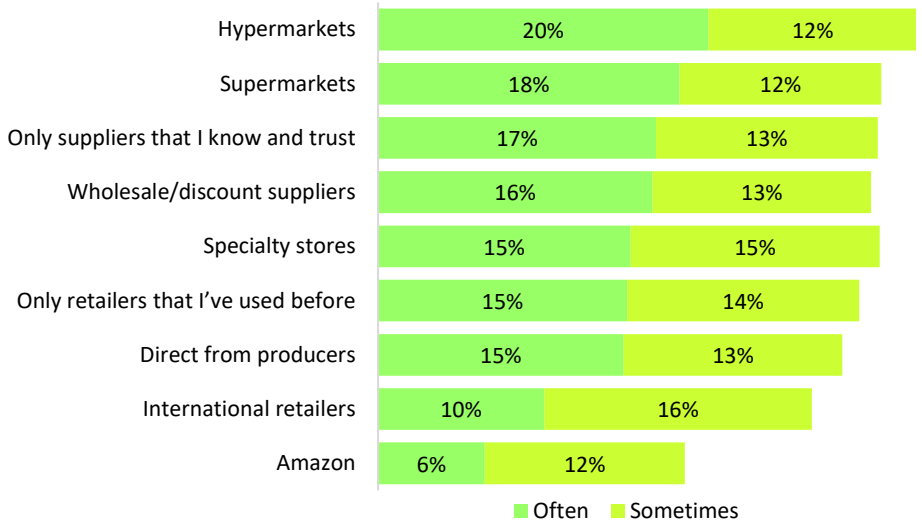


Figure 3.20 Use of online retails channels

3.4 Choice Experiment analysis of beef mince choices

In this section we present findings of the Choice Experiment. Our aim is to identify which beef attributes drive product choices, by how much, and by who. The analysis also segmented the sample of consumers into groups based on which product offerings they preferred (Appendix B). Choice Experiments can be somewhat more difficult to answer compared with the usual question formats that people have typically seen before, so it is important to check whether respondents have been able to complete the exercise reliably. Overall, task and attribute understanding was high, and most respondents felt certain that their responses reflected real-world choices if these beef products were available (Figure 3.21).

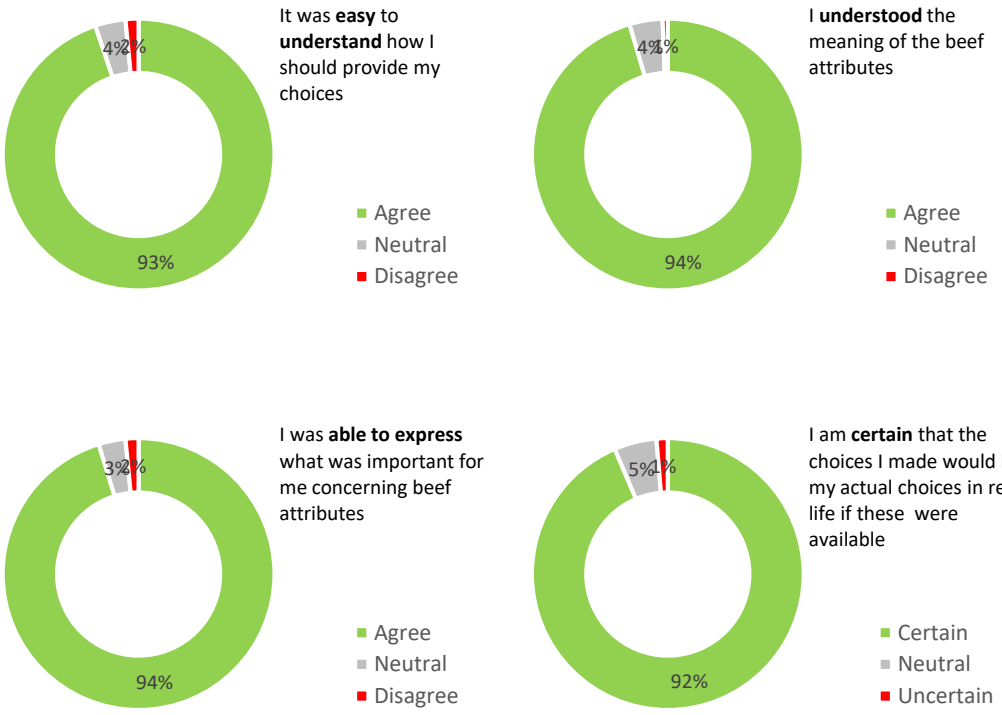


Figure 3.21: Choice experiment debriefing questions: task understanding, attribute understanding, ability to express preferences, certainty of choices made

Therefore, the results present the Willingness to Pay by attribute for the three consumer groups. The WTP tell us how much more the average consumer is willing to pay per kilogram (kg) of beef mince with a particular attribute over mince that does not have this attribute (Table 3.1), (Figure 3.22). For example, members of Group One are willing to pay, on average, AED30.5/kg more for beef mince that is produced organically over mince that is not. This is compared to the current price usually paid of AED 53/kg, a 56 per cent premium. There is some uncertainty in WTP estimates, and the Confidence Intervals reported in Table 3.1 indicate that we can be 95 percent sure that the true WTP falls within this interval.

In regard to country of origin group one prefers New Zealand raised beef and are willing to pay a premium of AED39 for this and even more for beef raised on Māori farms, at AED41. This represents a premium of around 75 per cent. Group two prefers beef raised in Brazil and are prepared to pay a premium of 100 per cent for this. Group three prefer Pakistani raised beef and prepared to pay a premium of 260 per cent.

In Table 3.1, the estimate of each consumer group size is reported under each group's column heading. We can see that three distinct consumer groups have been identified, the first group has an estimated size of 50 percent, the second group's size is 35 percent and the third is 15 percent. These group sizes tell us the probability that a randomly selected UAE beef mince purchaser belongs to that consumer group.

Table 3.1 Beef mince attribute willingness-to-pay by consumer group

Beef mince Attribute	Group One 50%	Group Two 35%	Group Three 15%
Social responsibility		AED22.1 (19, 26)	AED18.5 (-0.7, 37)
Organic	AED30.5 (27, 34)		
Enhanced Animal Welfare	AED4.9 (2, 8)		
Low fat	AED6.4 (5, 8)		
GMO-free	AED11.4 (8, 15)	AED11.6 (8, 15)	
Chilled			
Fresh	AED15.5 (12, 19)	AED13.1 (8, 18)	AED41.4 (22, 60)
No added antibiotics	AED6.2 (-0.9, 13)	AED14.9 (8, 22)	
No added hormones			AED45.3 (9, 81)
100% Grass-fed	AED12.3 (6, 20)	AED21.2 (13, 29)	AED16.7 (-0.1, 33)
Grain-fed	AED4.6 (0.8, 8)		
Feedlot Raised			
100% Pasture Raised	AED7.7 (4, 12)	AED17.1 (13, 21)	AED17.1 (5, 29)
Carbon Neutral		AED28.2 (22, 35)	
Biodiversity Enhancement			
Water Quality Protection	AED7.6 (2, 12)	AED7.7 (3, 12)	
Raised in NZ	AED38.7 (33, 43)		AED28.7 (6, 51)
Raised on Māori farms in NZ	AED41.1 (34, 48)		
Raised in Australia	AED13.9 (8, 20)	AED10.9 (6, 16)	AED27.8 (2, 53)
Raised in Brazil		AED48.6 (41, 56)	
Raised in South Africa		AED12.6 (6, 18)	
Raised in Pakistan	AED8.4 (-0.8, 17)		AED61.0 (26, 95)

Average WTP per kg beef mince (95 per cent Confidence Interval)

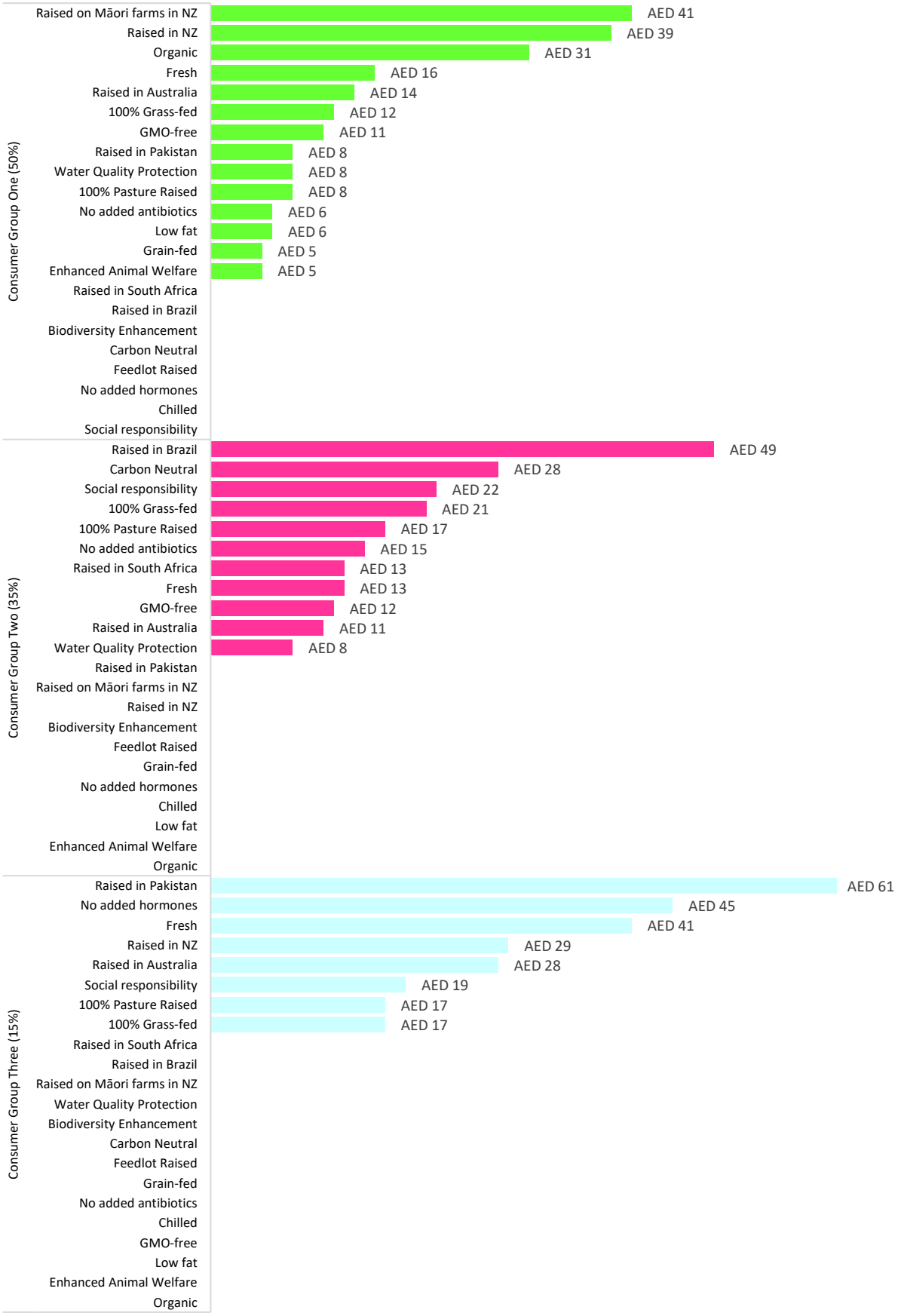


Figure 3.22 Beef mince attribute willingness-to-pay by consumer group

Country-of-origin is the most valued attribute for all consumer groups and the WTP estimates reveal that consumers in each segment have distinct preferences for which country they prefer the most.

- Consumers in Group One have the highest values for Māori and New Zealand origin beef.
- They are the only consumers to value Organic production, enhanced animal welfare, and low fat beef.

- Consumers in Group Two have the highest values for Brazilian origin beef.
- They are the only consumers to value carbon neutral production.

- Consumers in Group Three have the highest values for Pakistani origin beef.
- They are the only consumers to value no added hormones.

3.5 Consumer group descriptions

This section describes each of the three consumer groups identified in the statistical analysis, using the same questions we presented above. The objective is to highlight the differences and similarities between groups, which can be useful in identifying the types of consumers who are willing-to-pay for attributes relevant to an organisation's objectives. For example, those interested in obtaining a premium for New Zealand raised beef will be interested in the characteristics of Group One. Alternatively, an organisation interested in developing into the Carbon Neutral space will be able to use the information below to describe the members of consumer Group Two, who are the group willing-to-pay for this attribute. As we go through the comparisons, the small bar charts on the right hand side will highlight the group with the largest values with a green bar.

- Members of Group One are more likely to be female under 44 and have the highest average number of meals containing beef Consumers in Group Two are more likely to be male, and have a university degree. Group three are least likely to eat non-halal beef which may explain their preference for beef from Pakistan (Table 3.2).

Table 3.2 Describing consumer groups: Demographics

Demographics	Group One	Group Two	Group Three	
Female	62%	51%	63%	
< 44 years old	91%	91%	84%	
> 65 years old	0%	0%	0%	
Suburban	7%	8%	13%	
Have children	76%	74%	71%	
University degree	83%	88%	85%	
Average meals containing beef per week	5.45	4.66	3.32	
Will eat non-Halal beef	33%	31%	18%	

- Consistent with their relatively higher number of beef meals, members of Group One have the highest overall beef cut type purchases of the three groups (Table 3.3).

Table 3.3 Describing consumer groups: Beef Product Purchases

Purchase **in last month**	Group One	Group Two	Group Three
Sausage	50%	47%	29%
Knuckle steak	33%	28%	14%
Low fat mince	65%	67%	58%
Regular fat mince	70%	61%	66%
Beef stroganoff	31%	23%	17%
Thin-cut slices	37%	36%	22%
Low-fat cubes	39%	40%	33%
Regular cubes	49%	48%	39%
Fondue	13%	19%	8%
Tenderloin roast	34%	22%	8%
Tenderloin steak	37%	26%	13%
Short ribs	34%	33%	15%
Beef shanks	34%	32%	13%
Topside roast	37%	26%	9%
Striploin steak	31%	25%	11%
Striploin roast	32%	23%	10%
T-bone steak	26%	23%	10%
Cote ribs	20%	15%	5%
Shoulder slice	28%	26%	18%
Topside steak	27%	18%	10%
Fillet Roast	37%	31%	11%
Picanha	11%	13%	1%
Rump Steak	29%	21%	9%
Ribeye Steak	30%	23%	13%
Rump Roast	26%	18%	7%
Kofta	46%	46%	45%
Burger	58%	61%	53%
Sirloin Steaks	24%	17%	6%

- Group One consumers pay higher prices on average than the other two groups (Table 3.4).

Table 3.4 Describing consumer groups: Beef Product Prices Usually Paid (AED)

Average price/kg	Group One	Group Two	Group Three
Sausage	42.96	41.17	36.30
Knuckle steak	66.41	59.90	44.06
Low fat mince	53.75	47.84	40.35
Regular fat mince	53.05	47.75	36.54
Beef stroganoff	62.27	60.71	38.59
Thin-cut slices	59.57	54.27	42.83
Low-fat cubes	58.82	54.18	45.24
Regular cubes	54.29	49.52	37.91
Fondue	60.74	60.79	45.20
Tenderloin roast	75.05	61.43	50.20
Tenderloin steak	75.10	68.74	63.13
Short ribs	62.51	54.12	39.76
Beef shanks	59.10	53.13	42.17
Topside roast	66.59	57.29	40.82
Striploin steak	67.43	67.77	46.00
Striploin roast	71.13	65.00	56.31
T-bone steak	75.95	62.56	54.08
Cote ribs	70.67	60.27	55.17
Shoulder slice	64.99	55.01	40.57
Topside steak	71.96	63.85	38.25
Fillet Roast	71.90	60.35	61.08
Picanha	68.90	74.82	58.00
Rump Steak	73.67	66.95	50.33
Ribeye Steak	78.74	62.85	52.00
Rump Roast	73.32	67.62	44.00
Kofta	51.73	48.28	38.77
Burger	46.69	42.25	36.96
Sirloin Steaks	81.55	67.11	49.22

- Group One consumers are more likely to purchase NZ beef weekly and to rank NZ beef quality higher than other countries (Table 3.5). Besides mince, tenderloin steaks are the next most often purchased NZ beef cut for Group One, beef cubes for Group Two and for Group Three. Trustworthy food safety is the top reason to purchase NZ beef for Groups One and Two, and value for price for Group Three.

Table 3.5 Describing consumer groups: New Zealand Beef Purchasing

	Group One	Group Two	Group Three
Buy NZ beef at least weekly	46%	39%	26%
NZ produces the best beef	30%	21%	16%
Rank NZ in top three best beef producers	59%	51%	48%
NZ beef products purchased			
Sausage	17%	18%	11%
Knuckle steak	21%	15%	6%
Low fat mince	33%	32%	21%
Regular fat mince	24%	21%	20%
Beef stroganoff	19%	14%	8%
Thin-cut slices	18%	18%	6%
Low-fat cubes	24%	25%	15%
Regular cubes	24%	26%	15%
Fondue	8%	12%	4%
Tenderloin roast	21%	13%	6%
Tenderloin steak	26%	17%	8%
Short ribs	18%	14%	4%
Beef shanks	18%	19%	6%
Topside roast	21%	15%	4%
Striploin steak	22%	17%	4%
Striploin roast	20%	13%	2%
T-bone steak	19%	15%	4%
Cote ribs	7%	10%	2%
Shoulder slice	14%	12%	4%
Topside steak	18%	10%	1%
Fillet Roast	18%	15%	5%
Picanha	6%	9%	1%
Rump Steak	18%	12%	3%
Ribeye Steak	18%	13%	7%
Rump Roast	17%	13%	3%
Kofta	12%	15%	12%
Burger	17%	19%	15%
Sirloin Steaks	17%	10%	4%
Important reasons for purchasing NZ beef			
100% grass fed	57%	56%	31%
Good animal welfare	61%	58%	32%
Good value for price	58%	58%	43%
Curiosity to try different product	43%	40%	17%
Reduced environmental impact of production	55%	47%	24%
Trustworthy food safety	65%	63%	41%
Socially responsible producers	53%	50%	26%

Lower fat content	55%	51%	32%	
Higher quality of cut	60%	53%	38%	
No added antibiotics	60%	57%	36%	
No GM feed	55%	53%	31%	
No added growth hormones	61%	58%	40%	
Traceability to farm	42%	44%	17%	
Texture	45%	49%	32%	
Pasture raised rather than housed indoors	52%	51%	28%	
Fresh rather than frozen	62%	58%	37%	
Organic production	55%	52%	28%	
No chemicals to artificially color or extend shelf life	63%	59%	41%	
Halal production	58%	53%	34%	
Aged at least 21 days	44%	43%	22%	
Care of traditional cultures	46%	47%	17%	
Improved health benefits for myself	63%	61%	37%	
Improved health benefits for my family	64%	60%	38%	
Marbling	39%	38%	18%	
Grass fed	56%	55%	35%	

- Chicken is the most often purchased animal meat protein by all groups (Table 3.6). Group One consumers have the highest purchased frequency for alternative plant-based protein compared to both other groups. A balanced diet and health improvements are the main reasons for these consumers to purchase plant-based proteins.

Table 3.6 Describing consumer groups: Alternative Proteins Purchase Frequency

At least weekly	Group One	Group Two	Group Three
Lamb	41%	38%	30%
Chicken	72%	72%	76%
Alternative plant-based protein	45%	39%	30%
Venison	10%	13%	3%
Fish	74%	64%	52%
Pork	9%	12%	3%
Beef	28%	34%	23%
Why do you eat plant-based proteins			
Animal welfare concerns	24%	16%	6%
Environmental concerns	26%	22%	7%
Taste	34%	35%	21%
As part of a balanced diet	52%	45%	34%
To try something different	32%	27%	11%
To improve health	52%	48%	37%
Vegan or Vegetarian	22%	17%	4%
Why **don't** you eat plant-based proteins			
Not sure what this is	8%	8%	22%
Not available where I shop or eat	4%	6%	10%
I don't know how to cook it or	7%	5%	9%
Prefer meat	14%	17%	23%
I don't like the taste	8%	7%	10%
Too expensive	4%	6%	8%
Not interested	6%	11%	11%
I consider it unhealthy	2%	3%	5%
It has never occurred to me as an option	8%	9%	15%

- Members of Group Three are more likely to be concerned about human health and environmental effects for beef production, and about the long term effects of modern beef production practices (Table 3.7).

Table 3.7 Describing consumer groups: Attitudes towards health, environment and beef production

Agree	Group One	Group Two	Group Three
Beef production is an important sector in the country's economy	91%	89%	77%
Supporting local beef farmers and suppliers is important	94%	91%	87%
The environmental impact of beef production is well managed	85%	83%	69%
Beef production has low human health impacts	77%	77%	52%
I am worried about the long term effects of medicine, pesticide and additives in conventional modern beef production	91%	92%	82%
When considering trying a beef product not previously experienced, I try to find out the most information I can about the product before I try it	93%	88%	83%
I pay careful attention to the labelling information on the package when I buy beef	95%	92%	88%
I would prefer to buy beef produced in a warm family environment	91%	89%	82%
I think beef is a healthier option than pork	91%	90%	85%
I would prefer to avoid pork due to concerns about African Swine Fever	74%	74%	59%
I eat more beef instead of pork because of concerns about African Swine Fever	74%	71%	54%
I would prefer to buy beef produced by kind, generous, and respectful people	92%	90%	85%

- Use of home computers is significantly less than for mobile devices for all groups (Table 3.8).

Table 3.8 Describing consumer groups: frequency of internet access

Daily Access	Group One	Group Two	Group Three
Mobile device e.g. smartphone	89%	85%	87%
Home computer e.g. desktop	64%	68%	56%

- For all consumer groups, food company websites are the most often used digital media source when looking to inform product purchase decisions (Table 3.9).

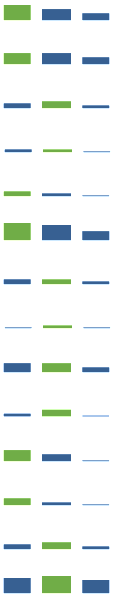
Table 3.9 Describing consumer groups: Use of digital media for product purchasing

Which to buy	Group One	Group Two	Group Three
Food company web sites	63%	59%	42%
Food blog	45%	39%	33%
Forums	28%	28%	23%
LinkedIn	21%	27%	15%
Celebrity sites	24%	30%	15%
YouTube	51%	45%	38%
Retailer web sites	33%	39%	37%
Pinterest	21%	20%	11%
Wikipedia	25%	29%	27%
Industry groups	19%	23%	13%
Facebook	46%	42%	33%
Instagram	39%	32%	19%
Government agencies	21%	31%	22%
Google search	50%	55%	52%

- When looking for information on how a product is produced, members of all groups use YouTube the most, followed by food company websites (Table 3.10).

Table 3.10 Describing consumer groups: Use of digital media for information on how a product is produced

How a product is produced	Group One	Group Two	Group Three
Food company web sites	46%	36%	29%
Food blog	37%	35%	27%
Forums	23%	28%	19%
LinkedIn	19%	20%	16%
Celebrity sites	25%	19%	11%
YouTube	49%	47%	35%
Retailer web sites	23%	23%	21%
Pinterest	16%	21%	11%
Wikipedia	32%	32%	24%
Industry groups	20%	27%	16%
Facebook	38%	30%	15%
Instagram	28%	20%	16%
Government agencies	24%	29%	18%
Google search	45%	48%	42%



- While Group One and Two have similar levels of smartphone technology use, Group Three members have significantly lower use overall (Table 3.11).

Table 3.11 Describing consumer groups: Use of smart technologies for information searching and purchase

Use Often	Group One	Group Two	Group Three
Information Searching			
Barcodes	32%	33%	11%
QR Codes	23%	24%	2%
RFID/NFC	17%	20%	4%
Product Purchasing			
Barcodes	31%	28%	12%
QR Codes	23%	19%	8%
RFID/NFC	19%	17%	6%

- Accessing recipe information is the highest use of apps on smart phones across all groups. Group Three consumers have lower use of phone apps overall (Table 3.12).

Table 3.12 Describing consumer groups: Use of phone applications

Currently use	Group One	Group Two	Group Three
Health (general)	45%	46%	23%
Dietary information	40%	38%	22%
Sustainability information	22%	23%	8%
Environmental information	28%	25%	8%
Budgeting	39%	34%	19%
Purchasing	48%	46%	27%
Nearest stockist location	32%	32%	22%
Product reviews	42%	36%	25%
Traceability	22%	20%	9%
Recipes	57%	49%	37%
Loyalty/rewards programmes	45%	43%	32%
Discounts/coupons	50%	44%	33%
Product delivery	35%	36%	22%

- Hypermarkets are the main retail channel for all groups (Table 3.13).

Table 3.13 Describing consumer groups: Percentage of beef expenditure by retail channel

Average percent	Group One	Group Two	Group Three
Grocery store	17.5%	20.1%	16.4%
Specialty store	15.3%	14.2%	17.5%
Online from domestic	5.0%	5.8%	3.3%
Online from overseas	2.5%	3.0%	1.5%
Hypermarket	22.1%	24.1%	26.1%
Wet market	7.0%	6.3%	7.8%
Butcher	12.0%	11.6%	15.1%
Wholesale/discount store	2.2%	2.0%	1.4%
Direct from producer	3.2%	1.7%	1.3%
Supermarket	10.2%	9.6%	8.9%
Convenience store	2.9%	1.5%	0.6%

- For those shopping online for beef, the main reason for shopping online differs across the three groups with convenience important for Group One consumers, and access to specials mainly important for Group Three (Table 3.14).

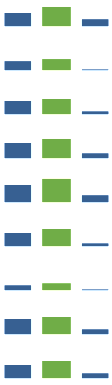
Table 3.14 Describing consumer groups: Main reason for shopping online for milk

	Group One	Group Two	Group Three
I like the convenience of having products delivered to my home	7%	7%	5%
I have access to special offers and promotions	6%	7%	7%
There is a greater variety of products	4%	7%	1%
Products are generally higher quality	4%	5%	1%

- For those shopping online, hypermarkets are the most often used online retailer for all groups (Table 3.15).

Table 3.15 Describing consumer groups: Use of online retail channels

Use Often	Group One	Group Two	Group Three
Wholesale/discount suppliers	15%	22%	8%
International retailers	10%	13%	2%
Direct from producers	16%	18%	4%
Supermarkets	18%	22%	8%
Hypermarkets	19%	26%	9%
Specialty stores	15%	20%	4%
Amazon	6%	9%	1%
Only suppliers that I know and trust	18%	18%	7%
Only retailers that I've used before	15%	19%	6%



Chapter 4
Conclusions

This report presents the results of a survey of beef mince consumption in the UAE. The survey was of just under 1,000 respondents who were selected as purchasing beef at least once a month.

The survey assessed purchase behaviour and the reasons for purchasing beef by country of Origin. New Zealand beef mince was the second most purchased by country of origin, and ranked second in quality, with the UAE first, Australian and Pakistani sourced beef were the third and fourth respectively in purchase frequency and quality. The main reasons for purchasing New Zealand sourced beef were food safety, improved health, no chemicals used, fresh and then no GMOs.

Respondents were asked series of question re their use of digital media and purchasing decisions. Between 40 and 46 per cent of the sample used food websites, google search and You tube to assess information on how the product was produced. Whereas 59 per cent used food web sites to determine which to buy followed by 52 per cent using google search. Most beef is purchased at hypermarkets at 23 per cent with 5 per cent on line from domestic suppliers and 3 per cent from on line overseas suppliers.

The survey included a choice experiment to assess the Willingness to Pay by consumers for different attributes associated with beef mince. The consumers were then segmented, using a latent class model, into 3 classes each with different characteristics and preferences.

The results showed that consumer group one (the largest at 50 per cent of the sample) were willing to pay the most for beef mince from New Zealand, with a premium of 75 per cent, and slightly more for New Zealand beef raised on Māori farms. They also were willing to pay more for organic beef. These consumers were typically female, under 44 years old, had the highest consumption of beef and pays higher prices than the other two consumer groups. Therefore, this would be potentially the demographic that New Zealand exporters could target.

Group two prefers beef from Brazil but is also willing to pay for carbon neutral beef. Group three is willing to pay the most for beef from Pakistan, followed by no added hormones and then fresh.

Appendix A
Statistical Method

This appendix provides technical details of statistical analysis of choice data. The appendix includes a brief description of the theoretical foundations of choice analysis followed by statistical probability estimation approaches, focusing on contemporary models applied in this report. Lastly, the method used in generating monetary estimates is described.

A.1 Conceptual Framework

In Choice Experiments (CEs), researchers are interested of what influences, on average, the survey respondents' decisions to choose one alternative over others. These influences are driven by people's preferences towards the attributes but also the individual circumstances such as their demographics or perceptions of the choice task (e.g., the level of difficulty or understanding) (Hensher et al. 2015).

Each alternative in a choice set is described by attributes that differ in their levels, both across the alternatives and across the choice sets. The levels can be measured either qualitatively (e.g., poor and good) or quantitatively (e.g., kilometres). This concept is based on the characteristics theory of value (Lancaster 1966) stating that these attributes, when combined, provide people a level of utility[1] *U* hence providing a starting point for measuring preferences in CE (Hanley et al. 2013; Hensher et al. 2015). The alternative chosen, by assumption, is the one that maximises people's utility[2] providing the behavioural rule underlying choice analysis:

$$U_j > U_i \tag{0.1}$$

where the individual *n* chooses the alternative *j* if this provides higher utility than alternative *i*. A cornerstone of this framework is Random Utility Theory, dated back to early research on choice making (e.g., Thurstone 1927) and related probability estimation. This theory postulates that utility can be decomposed into systematic (explainable or observed) utility *V* and a stochastic (unobserved) utility ε (Hensher et al. 2015; Lancsar and Savage 2004).

$$U_{nj} = V_{nj} + \varepsilon_{nj} \tag{0.2}$$

where *j* belongs to a set of J alternatives. The importance of this decomposition is the concept of utility only partly being observable to the researcher, and remaining unobserved sources of utility can be treated as random (Hensher et al. 2015). The observed component includes information of the attributes as a linear function of them and their preference weights (coefficient estimates).

$$V_{nsj} = \sum_{k=1}^{K} \beta_k x_{nsjk} \tag{0.3}$$

with *k* attributes in vector x for a choice set s. Essentially, the estimated parameter β shows "the effect on utility of a change in the level of each attribute" (Hanley et al. 2013, p. 65). This change can be specified as linear across the attribute levels, or as non-linear using either dummy coding or effect coding

[1]Related terminology used in psychology discipline is *the level of satisfaction* (Hensher et al. 2015).
[2] In choice analysis, utility is considered as *ordinal utility* where the relative values of utility are measured (Hensher et al. 2015).

approaches. The latter coding approach has a benefit of not confounding with an alternative specific constant (ASC) when included in the model (Hensher et al. 2015).

A.2 Statistical Modelling of Choice Probabilities

The statistical analysis aims to explain as much as possible of the observed utility using the data obtained from the CE and other relevant survey data. In order to do so, the behavioural rule (eq. 1.1) and the utility function (eq. 1.2) are combined (Hensher et al. 2015; Lancsar and Savage 2004) to estimate the probability of selecting an alternative *j*:

$$\Pr_{nsj} = \Pr\left(U_{nsj} > U_{nsi}\right) = \Pr\left(V_{nsj} + \varepsilon_{nsj} > V_{nsi} + \varepsilon_{nsi}\right) = \Pr\left(\varepsilon_{nsi} - \varepsilon_{nsj} < V_{nsj} - V_{nsi}\right) \forall j \neq i \quad (0.4)$$

where the probability of selecting alternative *j* states that differences in the random part of utility are smaller than differences in the observed part. A standard approach to estimate this probability is a conditional logit, or multinomial logit (MNL) model (McFadden 1974). This model can be derived from the above equations (1.2 and 1.3) by assuming that the unobserved component is independently and identically distributed (IID) following the Extreme Value type 1 distribution (see e.g. Hensher et al. 2015; Train, 2003). Although the MNL model provides a "workhorse" approach in CE, it includes a range of major limitations (see e.g. Fiebig et al. 2010; Greene and Hensher 2007; Hensher et al. 2015):

- Restrictive assumption of the IID error components
- Systematic, or homogenous, preferences allowing no heterogeneity across the sample
- Restrictive substitution patterns, namely the existence of independence of irrelevant alternatives property where introduction (or reduction) of a new alternative would not impact on the relativity of the other alternatives
- The fixed scale parameter obscures potential source of variation

Some or all of these assumptions are often not realised in collected data. These restrictive limitations can be relaxed in contemporary choice models. In particular, the random parameter logit (RPL) model (aka, the mixed logit model) has emerged in empirical application allowing preference estimates to vary across respondents (Fiebig, et al. 2010; Hensher et al. 2015; Revelt and Train, 1998). This is done by specifying a known distribution of variation to be parameter means. The RPL model probability of choosing alternative *j* can be written as:

$$\Pr_{nsj} = \frac{\exp(\beta_n' x_{nsj})}{\sum_J \exp(\beta_n' x_{nsj})} \quad (0.5)$$

where, in the basic specification, $\beta_n = \beta + \eta_n$ with η being a specific variation around the mean for *k* attributes in vector *x* (Fiebig, et al. 2010; Hensher et al. 2015). Typical distributional assumptions for the random parameters include normal, triangular and lognormal distributions, amongst others. The normal distribution captures both positive and negative preferences (i.e., *utility* and *disutility*) (Revelt and Train, 1998). The lognormal function can be used in cases where the researcher wants to ensure the parameter has a certain sign (positive or negative), a disadvantage is the resultant long tail of estimate distributions (Hensher et al. 2015). The triangular distribution provides an alternative functional form, where the spread can be constrained (i.e., the mean parameter is free whereas spread is fixed equal to mean) to ensure behaviourally plausible signs in estimation (Hensher et al. 2015). Further specifications used in modelling include parameters associated with individual specific characteristics (e.g, income) that can

influence the heterogeneity around the mean, or allowing correlation across the random parameters. The heterogeneity in mean, for example, captures whether individual specific characteristics influence the location of an observation on the random distribution (Hensher et al. 2015). In this study, the frequency of visits to rivers, streams and lakes was used to explain such variance.

Another way to write this probability function (in eq. 1.4) (Hensher et al. 2015) involves an integral of the estimated likelihood over the population:

$$L_{njs} = \int_{\beta} \Pr_{nsj}(\beta) f(\beta|\theta) d\beta \tag{0.6}$$

In this specification, the parameter θ is now the probability density function conditional to the distributional assumption of β. As this integral has no closed form solution, the approximation of the probabilities requires a simulation process (Hensher et al. 2015; Train, 2003). In this process for data *X*, *R* number of draws are taken from the random distributions (i.e. the assumption made by the researcher) followed by averaging probabilities from these draws; furthermore these simulated draws are used to compute the expected likelihood functions:

$$L_{nsj} = E(\Pr_{nsj}) \approx \frac{1}{R} \sum_{R} f(\beta^{(r)}|X) \tag{0.7}$$

where the $E(\Pr_{nsj})$ is maximised through Maximum Likelihood Estimation. This specification (in eq. 1.6) can be found in Hensher et al. (2015). In practice, a popular simulation method is the Halton sequence which is considered a systematic method to draw parameters from distributions compared to for example, pseudo-random type approaches (Hensher et al. 2015).

A.3 Econometric Extensions

Common variations of the RPL model include specification of an additional error component (EC) in the unobserved part of the model. This EC extension captures the unobserved variance that is alternative-specific (Greene and Hensher 2007) hence relating to substitution patterns between the alternatives (Hensher et al. 2015). Empirically, one way to explain significant EC in a model is SQ-bias depicted in the stochastic part of utility if the EC is defined to capture correlation between the non-SQ alternatives (Scarpa et al., 2005).

Another extension which has gained increasing attention in recent CE literature, is the Generalized Mixed Logit (GMXL) model (Czajkowski et al. 2014; Hensher et al. 2015; Juutinen et al. 2012; Kragt 2013; Phillips 2014). This model aims to capture remaining unobserved components in utility as a source of choice variability by allowing estimation of the scale heterogeneity alongside the preference heterogeneity (Fiebig et al. 2010; Hensher et al. 2015). This scale parameter is (inversely) related to the error variance, and in convenient applications such as MNL or RPL, this is normalised to one to allow identification (Fiebig et al. 2010; Louviere and Eagle 2006). However, it is possible that the level of error variance differs between or within individuals, due to reasons such as behavioural outcomes, individual characteristics or contextual factors (Louviere and Eagle 2006).

Recent GMXL application builds on model specifications presented in Fiebig et al. (2010), stating that β_n (in eq. 1.4) becomes:

$$\beta_n = \sigma_n \beta + \gamma \eta_n + (1-\gamma)\sigma_n \eta_n \tag{0.8}$$

where σ is the scale factor (typically = 1) and $\gamma \in \{0,1\}$ is a weighting parameter indicating variance in the residual component. In the case the scale factor equals 1, this reduces to the RPL model. The importance of the weighting parameter is the impact on the scaling effect on the overall utility function (population means) versus the individual preference weights (individual means): when *γ* parameter approaches zero the scale heterogeneity affects both means, whereas when this approaches one the scale heterogeneity affects only the population means (Hensher et al. 2015; Juutinen et al. 2015). Interpretation of these parameters includes

- If *γ* is close to zero, and statistically significant, this supports the model specification with the variance of residual taste heterogeneity increases with scale (Juutinen et al. 2012); and
- If *γ* is not statistically significant from one, this suggests that the unobserved residual taste heterogeneity is independent of the scale effect, that is the individual-level parameter estimates differ in means but not variances around the mean (Kragt, 2013)

The scale factor specification (eq. 1.7) can also be extended to respondent specific characteristics associated with the unobserved scale heterogeneity (Hensher et al. 2015; Juutinen et al. 2015):

$$\sigma_n = \exp\{\bar{\sigma} + \tau\omega_n\} \tag{0.9}$$

where $\bar{\sigma}$ *is* the mean parameter in the error variance; and ω is unobserved scale heterogeneity (normally distributed) captured with coefficient *τ* (Hensher et al. 2015; Juutinen et al. 2015; Kragt, 2013). Juutinen et al. (2012), for example, in context of natural park management found that respondents' education level and the time spent in the park explained the scale heterogeneity ($\tau > 0$, p-value < 0.01). In this study, the respondents indicated levels of choice task understanding and difficulty were used to explain scale heterogeneity.

A.4 Estimation of Monetary Values

Typically the final step of interest in the CE application is the estimation of monetary values of respondent preferences for the attributes considered in utility functions. These are commonly referred to as marginal willingness-to-pay (WTP). WTP estimation is based on the marginal rate of substitution expressed in dollar terms providing a trade-off between some attribute k and the cost involved (Hensher et al. 2015) and is calculated using the ratio of an attribute parameter and the cost parameter. WTP can take into account interaction effects, if statistically significant, such as with the respondent demographics. WTP of attribute *j* by respondent *i* is calculated as the ratio of the estimated model parameters accommodating the influence of the random component (Cicia et al. 2013) as:

$$WTP_i^j = -\left(\frac{\beta_j + \varepsilon_{ij}}{\beta_{price} + \varepsilon_{ip}}\right) \tag{0.10}$$

The estimated mode parameters can also be used to estimate compensating surplus (CS) as a result of policy or quality change in a combination of attributes, using (Hanemann, 1984):

$$\mathbf{CS} = \frac{-1}{\beta cost}\left[\ln\sum_{j=1}^{J}\exp\left\{V_j^0\right\} - \ln\sum_{j=1}^{J}\exp\left\{V_j^1\right\}\right] \tag{0.11}$$

which calculates the difference in utilities before the policy or quality change (V_0) and after the policy or quality change (V_1) (Hanley et al. 2013; Lancsar and Savage 2004). Similar to WTP, the monetary estimation of this change is possible by using the estimate for the monetary attribute $\beta_{cost.}$. Lastly, there are some challenges associated with the empirical estimation of the WTP in the RPL based models. One approach is to use a fixed cost, which simplifies the WTP estimation (Daly et al. 2012) but which may not be as behaviourally a plausible consideration as allowing heterogeneous preferences towards the cost attribute (Bliemer and Rose, 2013; Daziano and Achtnicht, 2014). Conceptually, the estimated cost parameter is a proxy for the marginal utility of income for respondents and economic theory suggests individuals will respondent differently to varying income levels. The use of a random cost parameter however, presents complications in deriving population distribution moments from the ratio of two random parameters.

Appendix B
Latent Class Model of Beef Mince Choices

Table B.1 UAE beef mince choice Latent Class model

Utility parameters[1]	Class 1	Class 2	Class 3
Social responsibility	-0.14***(0.03)	0.60***(0.05)	0.10* (0.05)
Organic	0.59***(0.04)	-0.81***(0.07)	0.08 (0.06)
Enhanced Animal Welfare	0.09***(0.03)	-0.05 (0.05)	-0.02 (0.05)
Low fat	0.25***(0.03)	-0.34***(0.06)	0.05 (0.05)
GMO-free	0.22***(0.04)	0.32***(0.05)	0.03 (0.05)
Chilled	-0.15** (0.07)	-0.71***(0.14)	0.11 (0.09)
Fresh	0.60***(0.07)	0.71***(0.15)	0.46***(0.10)
No added antibiotics	0.12* (0.07)	0.40***(0.11)	-0.02 (0.07)
No added hormones	0.15 (0.12)	0.16 (0.20)	0.25***(0.10)
100% Grass-fed	0.52***(0.15)	1.15***(0.20)	0.19** (0.09)
Grain-fed	0.18** (0.08)	-0.89***(0.11)	0.01 (0.08)
Feedlot Raised	-0.17 (0.14)	0.15 (0.23)	-0.02 (0.10)
100% Pasture Raised	0.30***(0.08)	0.93***(0.11)	0.19***(0.07)
Carbon Neutral	-0.52***(0.12)	1.54***(0.18)	0.03 (0.11)
Biodiversity Enhancement	0.14 (0.11)	-2.40***(0.21)	-0.21* (0.12)
Water Quality Protection	0.30***(0.11)	0.42***(0.14)	0.14 (0.10)
Raised in NZ	1.50***(0.13)	-1.58***(0.18)	0.32** (0.13)
Raised on Māori farms in NZ	1.60***(0.15)	-1.84***(0.25)	-0.49***(0.16)
Raised in Australia	0.53***(0.11)	0.60***(0.15)	0.31** (0.14)
Raised in Brazil	-0.31***(0.14)	2.65***(0.29)	-0.21 (0.16)
Raised in South Africa	-1.92***(0.13)	0.68***(0.16)	-0.05 (0.14)
Raised in Pakistan	0.32* (0.19)	-0.77***(0.22)	0.68***(0.18)
Price /kg mince	-0.039***(0.00)	-0.054***(0.00)	-0.011***(0.00)
Average class probability	0.50	0.35	0.15
Model Fit Statistics			
Log Likelihood function	-8,282		
Log Likelihood chi^2 stat (43 d.f.)	5.320***		
McFadden Pseudo R^2	0.27		
Number of observations	9,960		
Number of respondents	996		

***, **,* denote statistical significance at the 1%, 5% and 10% levels respectively for the null hypothesis that a parameter estimate is not significantly different from zero.

Standard errors in brackets.

[1] Parameter mean estimates indicates the estimated average value in the model for each different parameter