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Australian consumers' willingness to pay and willingness to purchase a hypothetical lower cholesterol pork product

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Abstract

The Australian pig industry is experiencing a period of declining slaughter numbers while facing increasing competition from imports. Simultaneously, the developed world is undergoing what has been described as an 'obesity epidemic', with associated health problems increasing market demand for 'low fat', 'cholesterol reduced' and other 'health enhanced' products. The Pork Cooperative Research Centre recognises the potential that this growing market may offer the Australian pig industry and has R&D projects underway that aim to reduce the cholesterol content of pork. This study investigated whether there would an increase in consumer willingness to pay and purchase if reduced cholesterol pork was introduced to the Australian market.

A stated choice analysis was used, with the following questions addressed. How are current purchases of fresh pork affected by concerns about cholesterol content? What financial premium, if any, would consumers place on reduced cholesterol pork? Would consumers buy more pork if a low cholesterol

option were available? Is there a group of consumers, such as those with high cholesterol, who have an increased willingness to pay for or purchase reduced cholesterol pork when compared to consumers without this health problem?

An online survey with 861 participants conducted in mid 2009 was used to gather data on consumer willingness to pay and purchase, and these stated choice results were analysed with the use of Pearson's Chi-Squared test. The results indicated that at present the majority of consumers are relatively unconcerned about the cholesterol content of fresh pork and that there is a minimal effect of such concerns on fresh pork purchases. However, a niche market was identified: a group of consumers who currently reduce purchases of fresh pork because of concerns about the cholesterol content had a significantly higher willingness to pay than other respondents to the survey, and had a distinctive set of socio-demographic characteristics and shopping habits.

The results also predicted a significant financial premium for the reduced cholesterol product at the retail level, with increased willingness to pay for and consume reduced cholesterol pork by the average pork consuming family. Based simply on what these surveyed consumers said they would do, the possible increase in demand for pork that was low cholesterol by the average pork consuming family was up to 32 per cent and they could spend up to 43 per cent more than they currently do with regular pork. Willingness to pay was found to be significantly higher for females and those aged 65 and above. However, as these results are the product of a stated choice analysis and not a revealed preference study, and therefore simply reasonable expectations, it is likely that the reported increase in demand in both quantity and price by potential consumers is overstated to some extent.

1. Introduction

Global meat consumption is increasing, with more pork consumed than any other meat (Speedy 2003). The Australian pork industry has been experiencing declining pig slaughter and exports and increasing imports (Australian Pork Limited 2009). It is becoming increasingly difficult for Australian producers to compete domestically and internationally. Consequently, production methods that allow Australian pork producers to compete on the basis of quality are becoming more important.

In developed countries, health problems such as obesity, diabetes and high cholesterol are increasing, and so too is awareness amongst consumers of the benefits of reducing cholesterol intake and absorption. This phenomenon presents producers of food with an opportunity to add health attributes to some products.

Australia's Pork Co-operative Research Centre has funded research that aims to reduce the cholesterol content of pork by feeding soya bean lecithin. D'Souza *et al.* (2005) reported that pigs fed a lecithin-supplemented diet at the rate of 75g lecithin/kg ration tended to have lower plasma cholesterol at slaughter compared to pigs fed the non-lecithin control diet. These researchers reported that lecithin has the potential to improve the 'healthiness' of pork.

The question is raised: if this research project discovers how to lower the cholesterol content of pork, will consumers of pork and pork products increase the amount they are willing to buy and the price they are willing to pay for it? The following specific questions are asked:

- How are current purchases of fresh pork affected by concerns about cholesterol content?
- What financial premium, if any, would consumers place on reduced cholesterol pork?
- Would consumers buy more pork if a low cholesterol option were available?
- Is there a group of consumers, such as those with high cholesterol, who have an increased willingness to pay for or purchase reduced cholesterol pork when compared to consumers without this health problem?

Not much is known about consumer behaviour in relation to health properties of pork. Halbrecht, Sterling, Snider and Santoro (1995) showed that United States consumers were willing to pay more for pork with reduced saturated fat, and were prepared to purchase more. An example of a fresh meat product attracting a premium price for health benefits is *Selenpork*, a high selenium fresh pork product now available in South Korea. It is produced with a specific ration and is returning a premium over regular pork because of its appeal to high end consumers: a pork dish at a *Selenpork* restaurant costs about 30 per cent more than for regular pork, and cuts of *Selenpork* retail for around a 20 per cent premium (Mellor 2004).

A sense of the value that such an innovation could offer the Australian pig meat industry can be gained from the results provided by Mounter, Griffith and Piggott (2005) who found that when Australian pork is assumed to be a differentiated product from imported pork, and if domestic demand was able to be increased by 1 per cent, producers would gain \$1.51 million per year, while a 1 per cent shift in export demand would increase producer surplus by only \$0.16 million per year.

2. Research and Analysis Methods

Possible Methods

A common method of assessing consumer willingness to pay is to use market information to infer the value that consumers place on a product characteristic (Hufton *et al.* 2008). As low cholesterol pork is not currently traded, valuing the influence of reduced cholesterol on pork prices is impossible through observational methods. The data in this study had to be collected by using another method.

There are many consumer willingness to pay studies on fresh meat products using surveys and contingent valuation methods. The contingent valuation approach asks the survey participant, through one of several methods, to place a value on the product in question. Although auction-type approaches are sometimes used, more commonly either an *open-ended* or *closed-ended* bid is used. An open-ended bid allows the participant to nominate the price that they would pay for the product, while a closed-

ended bid asks the participant whether they would pay a nominated sum. Mullen and Wohlgenant (1991) used an open-ended bid to investigate willingness of Australian consumers to pay for attributes of lamb, as did Wohlgenant and Lemieux (1991) to study United Kingdom consumers' willingness to pay for leaner pork products. The open-ended bid approach seems to be preferred in studies involving willingness to pay for meat products.

Ideally, any contingent valuation approach would provide an accurate and unbiased result, allowing the average willingness to pay of the sample group to be calculated. However, there are numerous difficulties in survey setup and analysis. An important aspect of survey design is ensuring that the participant adequately understands what it is that they are being asked to value: in this case, a change from pork with standard cholesterol content to pork with a reduced cholesterol level. The reliability of results from the study will be affected if this characteristic is not adequately understood (Mullen and Wohlgenant 1991; Belzer and Theroux 1995). This issue is further complicated by the known effect on results of wording, design and order of questions within the survey. It has been found that even factual questions can be seriously misinterpreted by respondents, or will not be answered correctly when the required information is difficult to recall (Kalton and Schuman 1982).

Another problem with contingent valuation is that the conditions are hypothetical and may be treated as such by participants, causing their behaviour in the simulated situation to differ from how they may actually behave under real shopping conditions. Budget constraints may be paid less regard if the product in question is not regarded as 'real' (Belzer and Theroux 1995). Mullen and Wohlgenant (1991) used photographs of lamb chops with different fat cover to increase the tangibility of the product to the consumer. *Cheap talk design*, explaining the concept of valuing a product above your budget constraint, has been reported to reduce hypothetical bias in willingness to pay studies for food products (Loureiro, Gracia and Nayga 2006).

The literature makes clear the possibility that demographic factors may influence participant responses. Halbrendt, Sterling, Snider and Santoro (1995) proposed a model in which willingness to pay is a function of price, socio-economic and demographic factors. Socio-demographics were found by Lyford *et al* (2009) to have little influence, and age alone was found to have an impact on willingness to pay for beef quality grades. Mullen and Wohlgenant (1991) concluded that socio-economic factors had little influence on willingness to pay for attributes of lamb. It should be noted, however, that while the attributes of lamb in question in the study by Mullen and Wohlgenant (1991) were credence attributes, they were not health properties.

Another possible method for valuing consumer willingness to pay is conjoint analysis. Halbrendt, Pesek, Parsons and Lindner (1994, 1995) used this method to investigate acceptance by consumers of pST-Supplemented Pork. They used ten product profiles with unique combinations of attributes, one of which was price, and asked consumers to rate these from one to six in a multi-step process. Analysis allowed determination of the importance of various attributes (such as cholesterol content) to the consumer relative to price and other factors, without asking them to place a value on the product. Halbrendt *et al.* (1994, 1995) analysed their data by calculating the mean rating for each profile and then the weighted-least-squares estimated parameters and chi-square value. While this approach has the

benefit of better simulating a shopping experience, where consumers base their decision on multiple product attributes, it is problematic in that the product profiles can be extremely difficult to establish.

The Difference between Stated Choice and Revealed Preference: A Caveat

So far we have considered the mechanics of constructing a survey that analyses consumer willingness to pay and purchase through *stated choice*. It is important to note that *revealed preference*, the preference of consumers as revealed by their actual purchasing decisions, often shows quite different results to that predicted by *stated choice* experiments. Lusk and Schroeder (2004) conducted a choice experiment using quality differentiated rib-eye beef steaks, and compared the hypothetical choice responses to purchase choices in a non-hypothetical setting. They found that hypothetical willingness to purchase was overstated by as much as 30 per cent, while hypothetical willingness to pay was around 1.2 times that found in a non-hypothetical setting. Interestingly, when choosing between steaks of different quality, marginal willingness to pay was not found to differ significantly between hypothetical and non-hypothetical settings. Lusk and Schroeder (2004) also found that consumer preferences remained the same regardless of whether the setting was hypothetical or not. Consequently, the results of any stated choice analysis must be approached with caution.

The literature on consumer behaviour in relation to meat purchases shows that either a contingent valuation or a conjoint analysis approach could provide useful information regarding the effect of cholesterol reduction on the value of fresh pork. However, it is also clear that there can be significant limitations to all models, and that data gathered through simulation of a theoretical purchase can be misleading. Providing that the limitations of the model/s can be minimised by an effective survey structure, meaningful results should be possible.

Survey Design

Data for this study were collected by an online survey conducted over 861 respondents Australia wide. The survey consisted of twenty questions, and was developed with reference to recent studies on consumer behaviour when purchasing fresh meat. (A copy is available from the authors).

Demographic questions were included to identify socioeconomic influences on consumer responses, and also to identify demographic characteristics of any particular group of consumers who might have an increased willingness to pay for, or to purchase, reduced cholesterol pork, when compared to the average consumer. Respondents were asked whether they had a household member on a cholesterol restricted diet, knew their blood cholesterol level, and whether they reduced their consumption of pork because of concerns about the level of cholesterol it contains. This was to examine whether those potential consumers on a restricted cholesterol diet, as a group, may be more likely to offer a premium price or increased sales for reduced cholesterol pork, and whether cholesterol concerns currently affect fresh pork sales. Questions about current purchase behaviour were asked to assess whether it was probable that respondents were actually purchasers of fresh pork products, and to enable further analysis of market segments which were found to be significantly more likely to offer opportunities to value add to fresh pork by reducing cholesterol content.

A pack of four loin steaks was used to represent Product A (normal pork) and Product B (the hypothetical low cholesterol pork) as this is one of the most commonly purchased cuts of pork (Walsh 2009), and hence it was expected that the majority of respondents would be able to value it with reasonable accuracy. The realistic valuation for Product A at the time of running the survey was \$6.95, based on a 330g pack of four loin steaks, which were sold for an average price of \$20.35 per kg in Coles and Woolworths stores in Bentleigh and Moorabbin (two south-east Melbourne suburbs) at the time of running the survey.

Coloured photographs of products A and B were used to enhance the understanding by the survey respondent of what had and had not changed about the product. The photographs were identical apart from the label on product B 'Certified 15% less cholesterol compared to ordinary pork', with the aim that differences in appearance, fat cover or apparent freshness would not influence consumers. Respondents were then invited to offer a form of open-ended bid, selecting a price premium for product B between '\$0.00' and 'Greater than \$2.50', rising in \$0.50 increments. Consumers were also asked whether they would actually purchase products A and B.

Respondents were then asked whether they would alter their consumption frequency if reduced cholesterol pork were available, and how their decision would be affected by price.

Survey Administration

The survey was administered online during mid 2009 by a provider of online research services who have an actively managed panel of approximately 400,000 members. Respondents were required to be the primary household grocery shopper, eat pork and be over 18 years of age. The surveyed population had to be a representative sample of the Australian population, covering every state and territory, all age groups from 18 to 65+ years old, households of every size from 1 to 7+ persons, and every income bracket from under \$30,000 to over \$180,000. A dummy run of the survey yielded 100 responses over the course of a few hours. No changes were made to the survey. The remaining 761 responses were gathered over the course of approximately two days. The total sample surveyed has a standard error of 3 per cent at the 95 per cent level of confidence. Note that while the sampling procedures aim to achieve a broadly representative sample, there may be some minor discrepancies because of the element of self-selection inherent in any online survey.

3. Results

The results of the survey provide a significant amount of information regarding current shopping habits and how consumers might change these habits if reduced cholesterol pork were available. Socio-demographic responses, shopping habit responses, health concern responses, and responses regarding willingness to alter purchase behaviour are considered. The interaction between these responses is analysed, the potential increase in market size is calculated, and finally the effect of existing cholesterol health issues on survey participants' responses is examined.

Pearson's Chi-Squared tests are applied to the associations between different variables (say quantity purchased and household size) to determine whether the degree of these associations are statistically

significant or not. The test is summarised by a probability value based on the null hypothesis of no association. Thus ($p = 0.90$) indicates an extremely weak association, with a 90 per cent chance that the two variables are unrelated. On the other hand, ($p = 0.01$) indicates an extremely strong association, with only a 1 per cent chance that the two variables are unrelated. We use the commonly applied standard of ($p = 0.05$, only a 5 per cent chance that the two variables are unrelated) as the cut-off point for whether an association is statistically significant or not. Further, given our large sample, there were no reliability problems with low cell counts for any variable.

Socio-Demographic Responses

The demographic profile of respondents is presented in a series of figures. All of the 861 respondents ate fresh pork and were the primary household grocery shopper. Gender of respondents (Figure 1), age distribution (Figure 2), State or Territory of residence (Figure 3) and household size (Figure 4) were all representative of the Australian population, as per the 2006 census (Australian Census 2006).

Household income of respondents (Figure 5) could not be directly compared to census data. However, all income brackets were represented and on visual inspection the distribution of incomes appears to be reasonable within the context of the Australian population. It is possible that there is a slight over-representation of the \$90,000-\$120,000 bracket. This is a source of potential bias, but we cannot know to what extent it may affect results and conclusions.

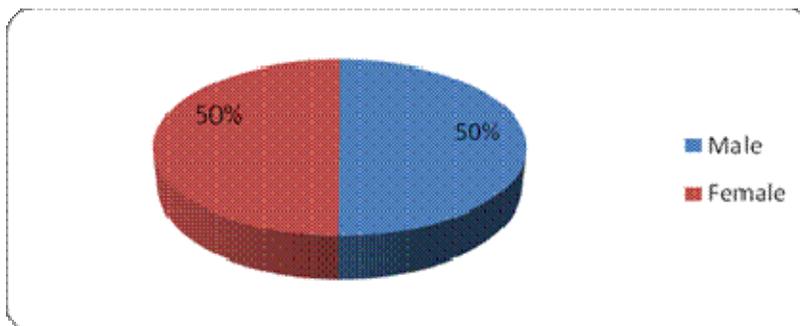


Figure 1. Gender

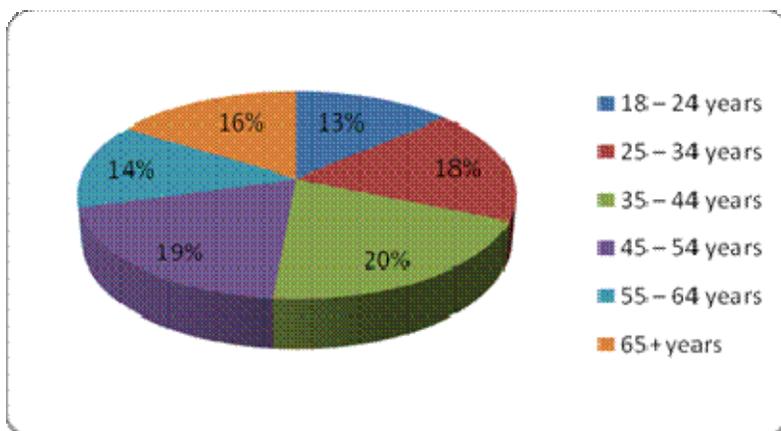


Figure 2. Age Bracket

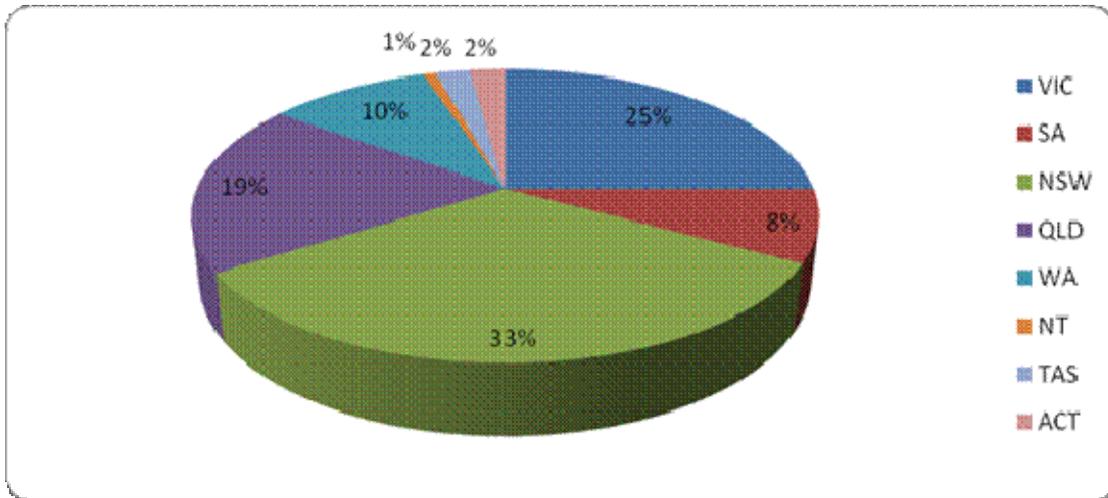


Figure 3. State of Residence

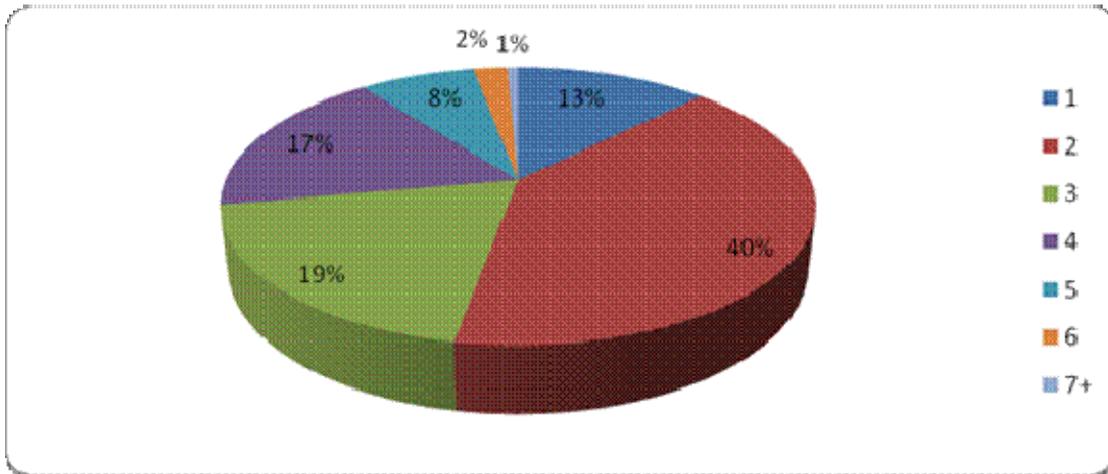


Figure 4. Household Size (1 to 7+ Persons)

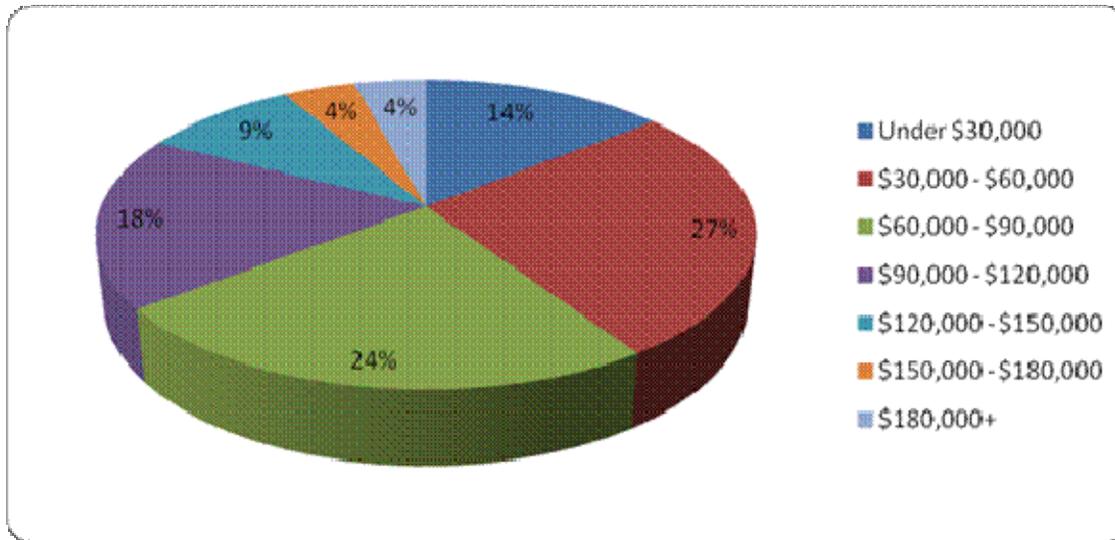


Figure 5. Household Income bracket (from under \$30,000 to over \$180,000 per annum)

Shopping Habit Responses

Respondents were asked questions about their current consumption and shopping habits for fresh pork. Sixty five per cent of respondents shop for fresh meat at the supermarket, and 35 per cent at the butcher (Figure 6). Fifty four per cent of respondents purchase fresh pork only once per fortnight. Thirty three per cent purchase twice per fortnight, 9 per cent three times per fortnight, and 4 per cent four or more times per fortnight (Figure 7). Forty three per cent of respondents reported purchasing between 500g and 1kg of fresh pork per fortnight, 27 per cent under 500g, 19 per cent 1kg- 1.5kg, and 12 per cent 1.5-2kg (Figure 8). The amount of fresh pork purchased per fortnight was found to be dependent on household size ($p < 0.001$). Twenty nine per cent of respondents most frequently purchase pork chops, 22 per cent roasts, 18 per cent steaks and fillets, 12 per cent diced and stir-fry pork, 10 per cent sausages, 8 per cent mince and 4 per cent ribs (Figure 9).

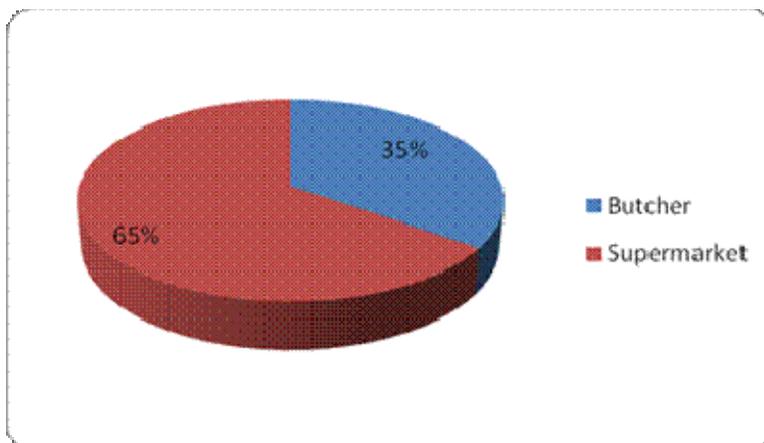


Figure 6. Shops at butcher or supermarket

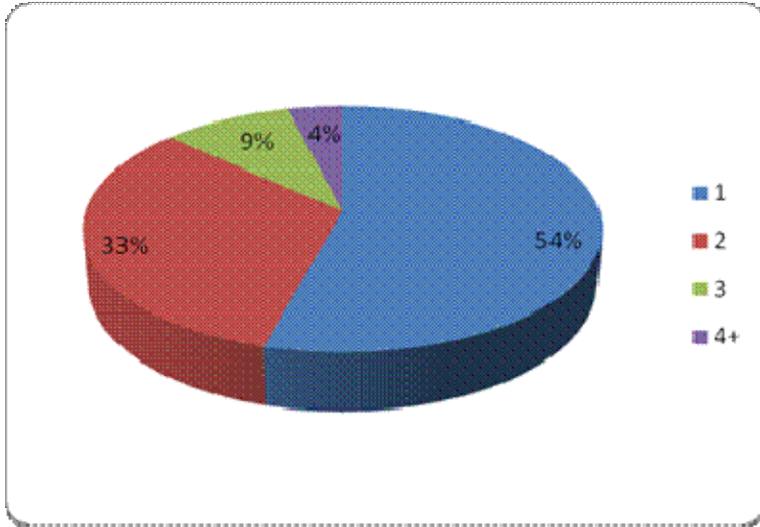


Figure 7. Fresh pork purchases per fortnight (1 to 4+ times)

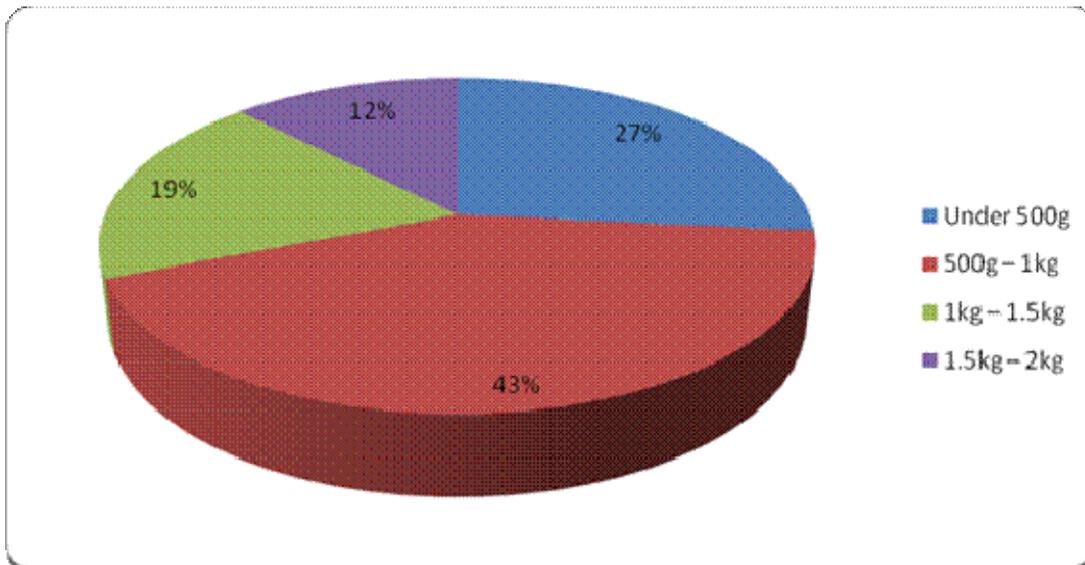


Figure 8. Amount of fresh pork purchased per fortnight (by weight)

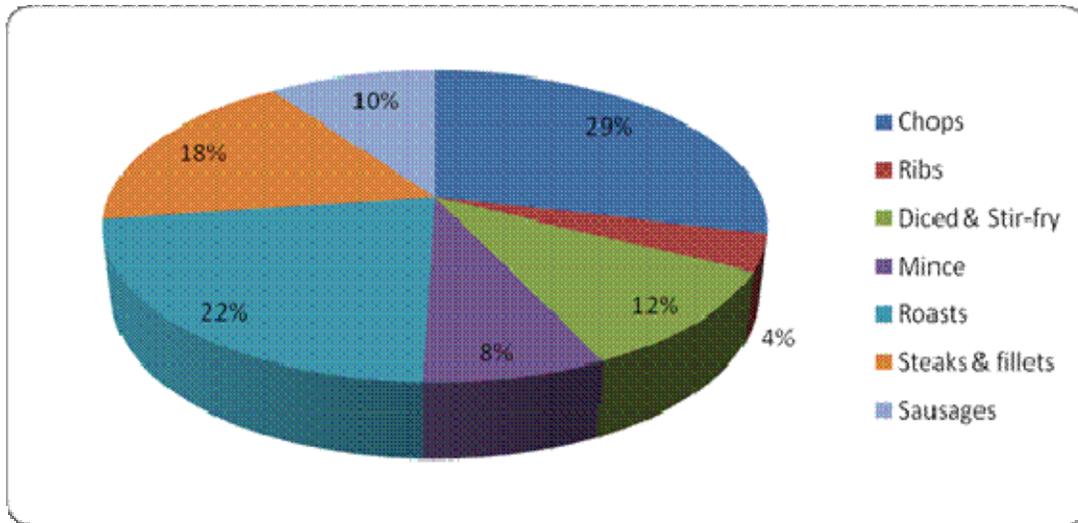


Figure 9. Fresh pork cut most frequently purchased

Health Concerns Responses

Respondents were asked a series of questions regarding cholesterol health concerns. Seventeen per cent of respondents had a household member on a cholesterol restricted diet (Figure 10), 44 per cent knew their blood cholesterol level (Figure 11), and 10 per cent reported that concerns about the level of cholesterol in fresh pork reduced their purchase frequency (Figure 12).

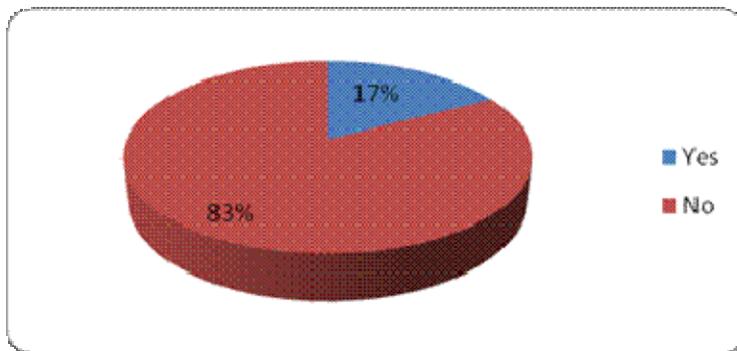


Figure 10. Household member on a cholesterol restricted diet

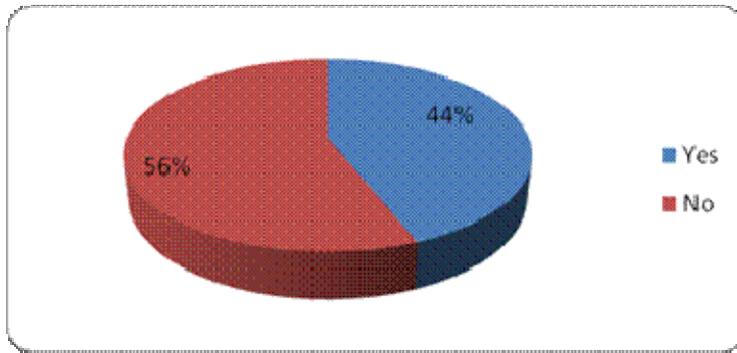


Figure 11. Knows blood cholesterol level

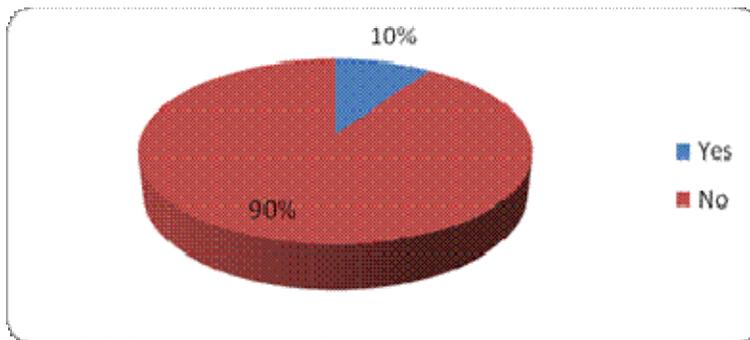


Figure 12. Reduces fresh pork purchase because of concerns about cholesterol content

Willingness to Pay or Alter Purchase Behaviour Responses

Respondents were asked a series of questions regarding their current expectations when purchasing fresh pork, and how they would change their behaviour if fresh pork with 15 per cent lower cholesterol were available. The largest single group of respondents (27 per cent) reported that they would expect to pay \$6.95 for Product A, a realistic valuation as discussed above. Twenty two per cent of respondents reported that they would expect to pay \$7.95, 22 per cent \$8.95, 18 per cent \$5.95, and 11 per cent \$4.95 (Figure 13). Eighty five per cent of respondents reported that they

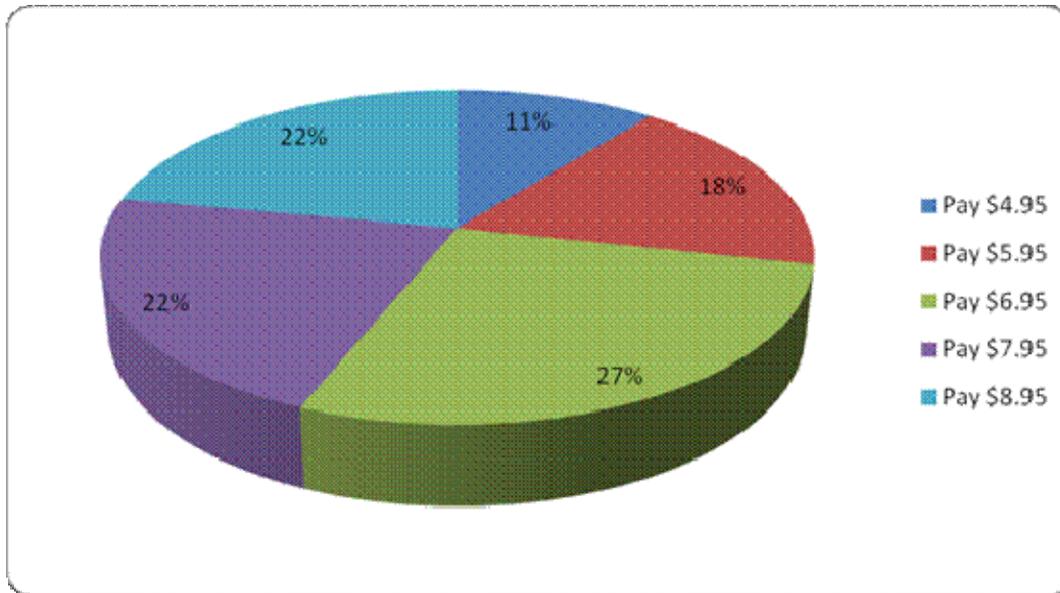


Figure 13. Amount respondent expects to pay for Product A (pack of 4 loin steaks with normal cholesterol content)

would purchase this product. Analysis showed that the respondent's expected base price for Product A depended on the fresh pork cut that they most commonly purchased ($p < 0.001$). Those expecting to pay \$5.95 more commonly purchased fresh pork as diced or stir fry, ribs or mince, while those expecting to pay \$8.95 more commonly purchased fresh pork as roasts, steaks and fillets.

Respondents were asked to select a price premium that they would be willing to pay for Product B (Figure 14). Twenty five per cent of respondents would not pay a premium for Product B. Forty two per cent of respondents would pay \$0.50 or \$1.00, 19 per cent \$1.50 or \$2.00, and 14 per cent \$2.50 or more. Seventy seven per cent of respondents reported that they would purchase this product.

Willingness to pay a premium for Product B was derived as a percentage of the respondent's expected price for Product A (Figure 15). Thirty two per cent of respondents were willing to pay a 10.1 to 20 per cent premium for Product B. Twenty five per cent were not willing to pay any premium. Twenty three per cent were willing to pay a premium of 20.1 to 30 per cent, 11 per cent 0.1 to 10 per cent, 6 per cent 30.1 to 40 per cent, 2 per cent 40.1 to 50 per cent, and 1 per cent over 50 per cent premium.

Analysis showed that willingness to pay for Product B was affected by gender ($p < 0.001$), with females more likely to have a higher willingness to pay than males. Willingness to pay was also dependent on age ($p < 0.001$), with respondents of 65 years of age and older more willing to pay when compared to younger respondents ($p = 0.004$). There was no influence of State or Territory of residence ($p = 0.998$), household size ($p = 0.180$), household income bracket ($p = 0.743$) or place where fresh meat was regularly purchased ($p = 0.957$).

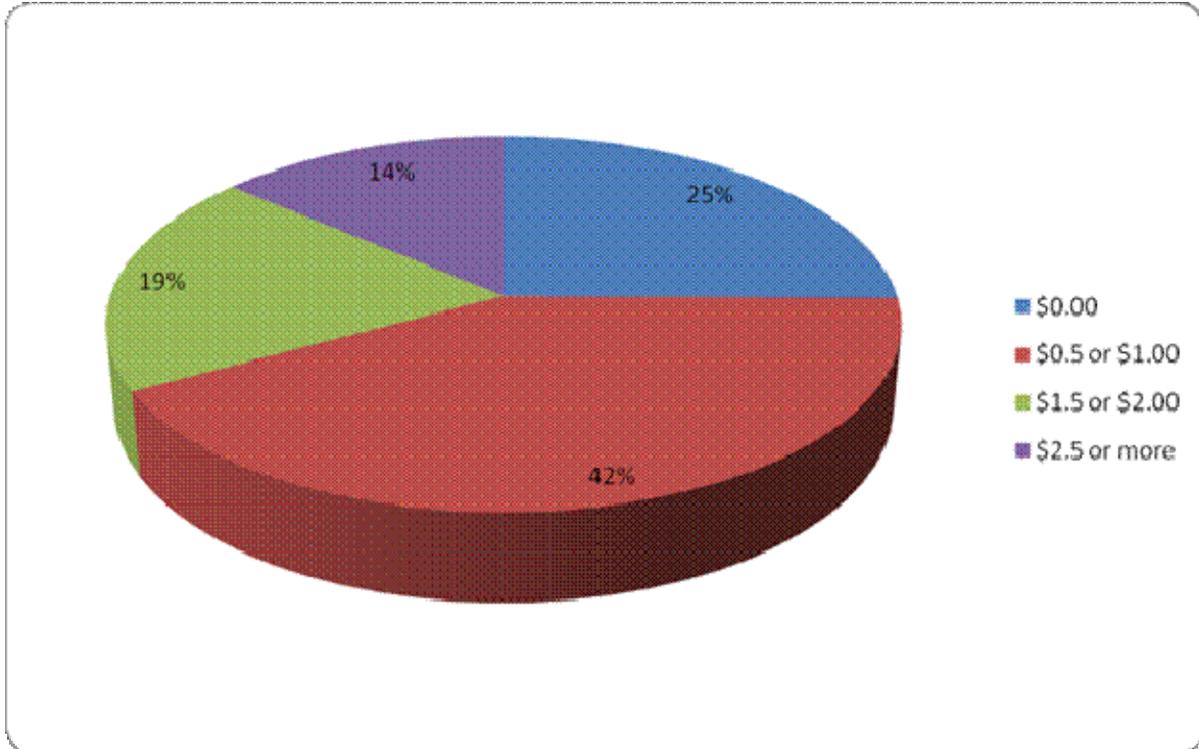


Figure 14. Premium that respondent would be willing to pay for Product B (pack of 4 loin steaks with 15% less cholesterol than Product A)

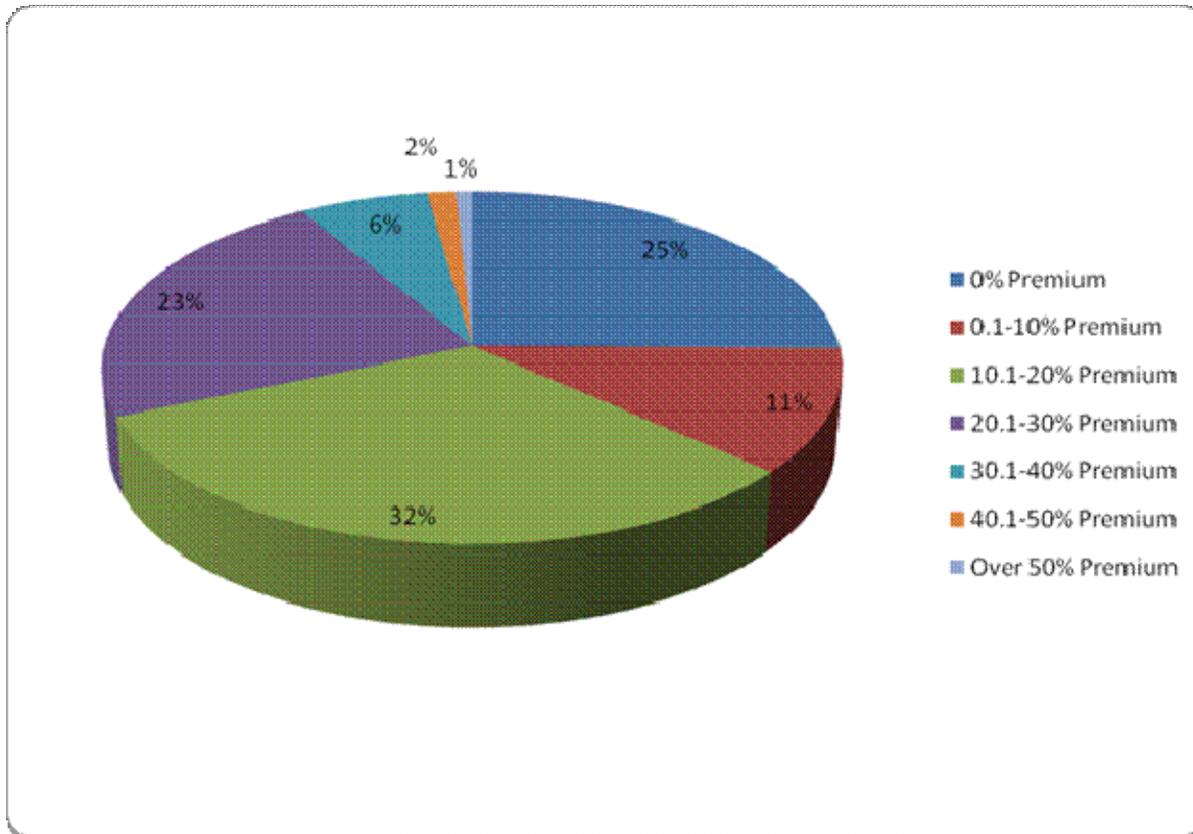


Figure 15. Willingness to pay for Product B as a percentage premium over the expected price for Product A

Analysis showed that willingness to pay a premium for Product B depended on the respondent's expected base price for Product A ($p < 0.001$). The most commonly selected combination was \$6.95 with a \$0.50 or \$1.00 premium (14 per cent of respondents). \$0.50 or \$1.00 was the most commonly selected and \$0.00 the second most commonly selected premium at all base price levels excluding \$8.95. Premiums above \$1.50 appear to be negatively skewed, with willingness to pay increasing as expected base price increases. \$2.50 was the most common premium offered at a base price of \$8.95 (7 per cent of consumers).

In Figure 16 is shown the percentage of respondents prepared to pay a given premium at each expected price level. Forty per cent of respondents who expected to pay a base price of \$4.95 were not willing to pay any premium for Product B, and 49 per cent were prepared to pay a premium of \$0.50 or \$1.00. Fifty four per cent of respondents who expected to pay a base price of \$5.95 were prepared to pay a premium of \$0.50 or \$1.00, 22 per cent no premium, and 17 per cent a premium of \$1.50 or \$2.00. Forty nine per cent of respondents who expected to pay a base price of \$6.95 were prepared to pay a premium of \$0.50 to \$1.00, 22 per cent no premium, and 20 per cent a premium of \$1.50 to \$2.00. Thirty nine per cent of respondents who expected to pay a base price of \$7.95 were prepared to pay a premium of \$0.50 to \$1.00, 26 per cent no premium, and 22 per cent a premium of \$1.50 to \$2.00. Thirty per cent of respondents who expected to pay a base price of \$8.95 were prepared to pay a

premium of \$2.50 or more, 25 per cent a premium of \$1.50 to \$2.00, 24 per cent no premium, and 21 per cent a premium of \$0.50 or \$1.00.

Respondents were asked how their purchase behaviour would change if fresh pork cuts with 15 per cent lower cholesterol were introduced to the market (Figure 17). Forty seven per cent of respondents reported that they would not increase fresh pork consumption. Forty five per cent reported that they would increase fresh pork consumption if there were no price increase. Eight per cent reported that they would increase fresh pork consumption at a premium price. The majority of respondents who stated that they would increase their consumption indicated that they would eat fresh pork once more per fortnight.

There was a significant relationship between willingness to purchase and willingness to pay ($p < 0.001$), with respondents who have a higher willingness to pay also more likely to have an increased willingness to purchase (Figure 18). Seven per cent of respondents would increase consumption at a price premium (4 per cent at \$1.50 or more, and 3 per cent at \$0.50 or \$1.00). One per cent of respondents who indicated that they would increase consumption at a price premium had previously indicated that they were not willing to pay a price premium. Forty per cent of respondents were willing to increase purchase frequency if price did not change, or pay a price premium, but not both (18 per cent at \$1.50 or more, and 22 per cent at \$0.50 or \$1.00).

Five per cent of respondents were not willing to offer a price premium but were willing to increase purchase frequency if price did not change. Twenty eight per cent of respondents would not alter consumption but would pay a price premium (11 per cent at \$1.50 or more, and 17 per cent at \$0.50 or \$1.00). Nineteen per cent of respondents would not pay a premium price for reduced cholesterol pork or alter their purchase behaviour if it were available. The average price for Product A was \$7.22 (\$21.87 per kg) and the average premium for Product B was \$1.02 (\$3.11 per kg).

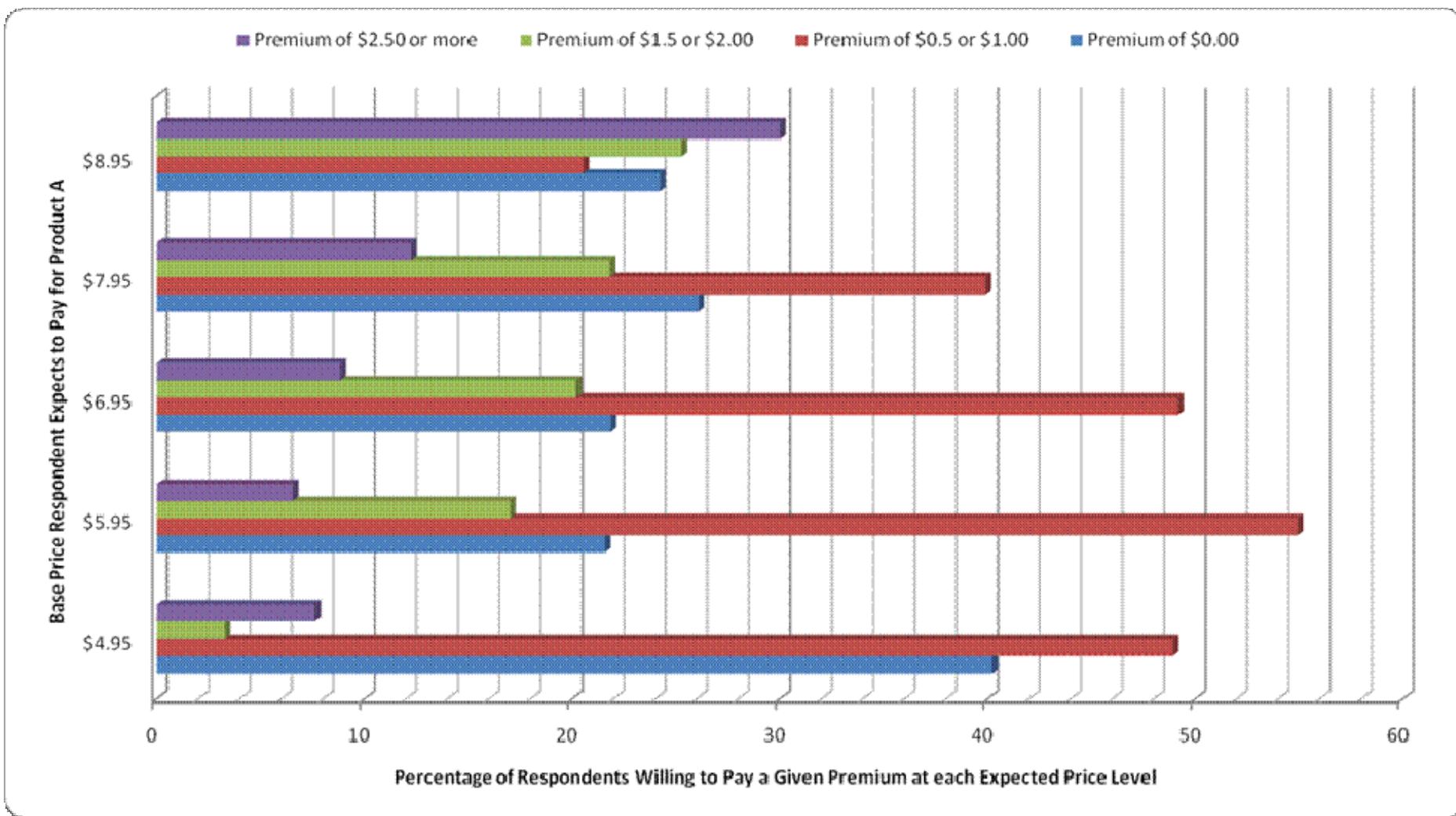


Figure 16. The relationship between expected price for Product A and willingness to pay a premium for Product B: Percentage of respondents who expected to pay a selected base price for Product A, who are willing to pay selected premium for Product B

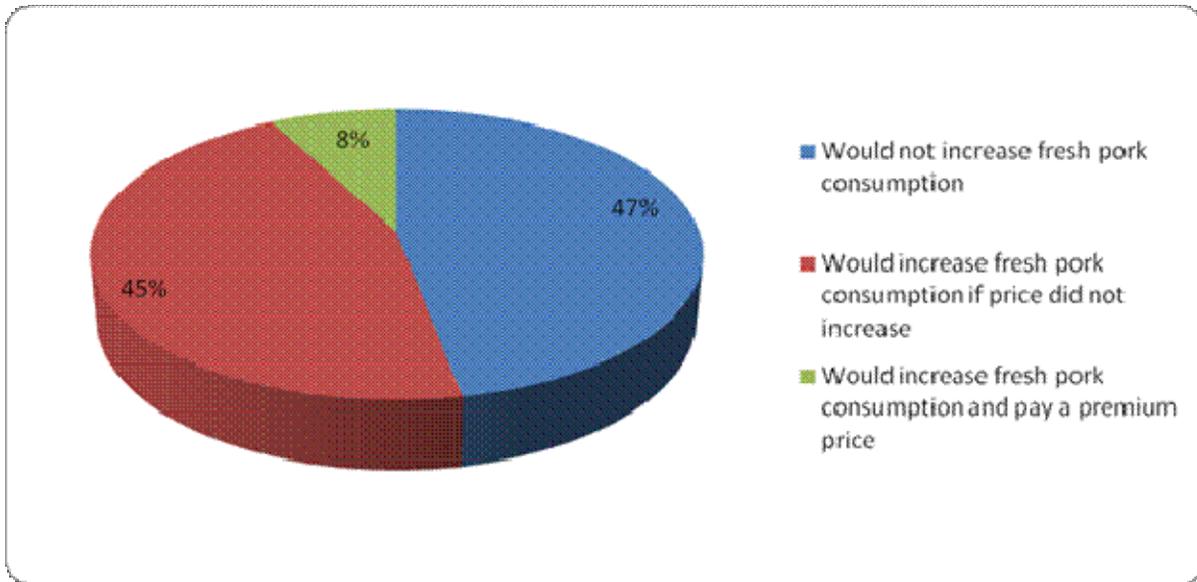


Figure 17. Expected change in consumer purchase behaviour if fresh pork cuts with 15% lower cholesterol were introduced to the market

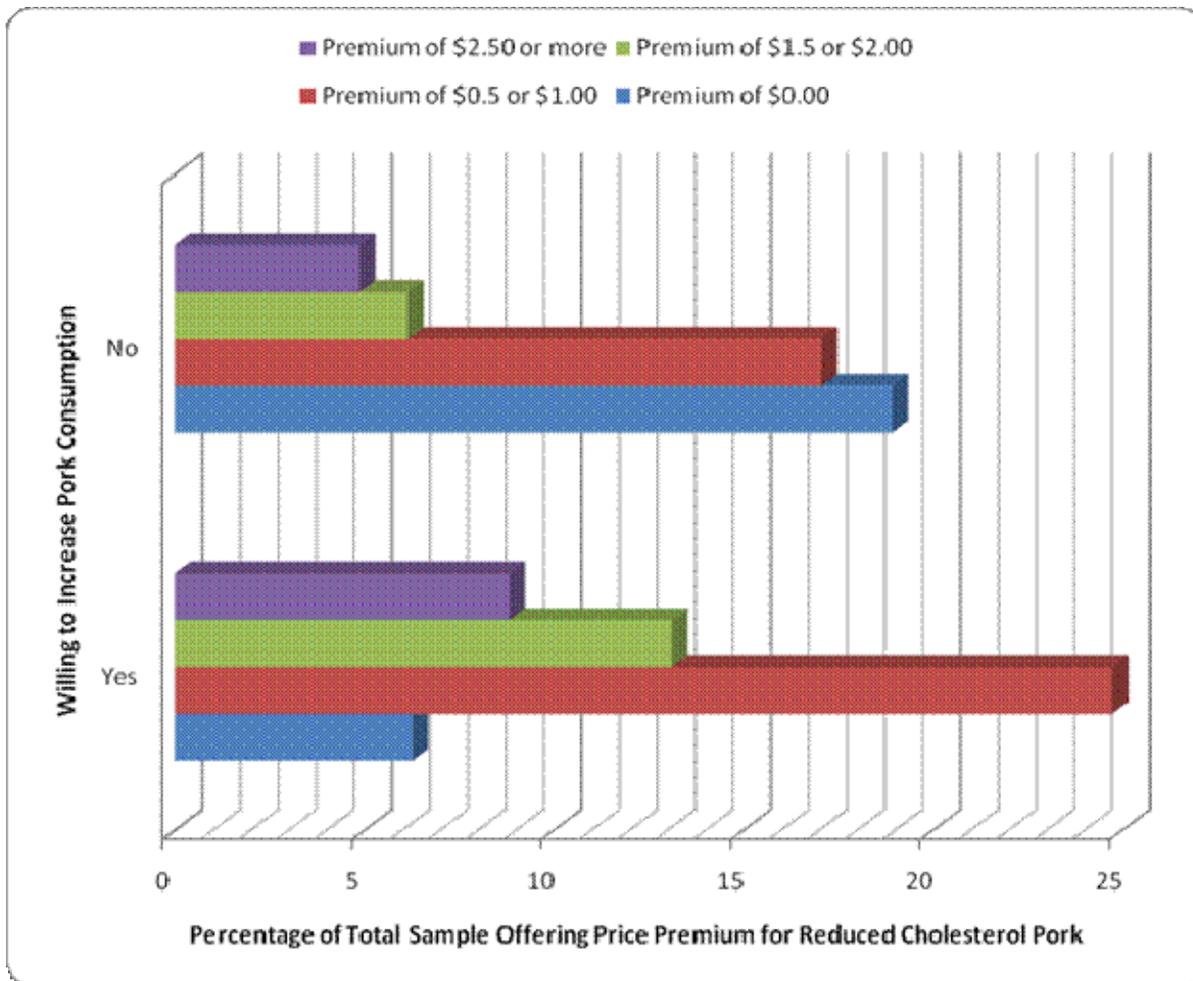


Figure 18. The relationship between willingness to alter consumption behaviour and willingness to pay for reduced cholesterol pork

Effect of Health Problems or Health Concerns

The survey results were analysed to see whether a group of consumers could be identified who were significantly more likely to pay a premium for reduced cholesterol pork. Demographic characteristics of this group could then be analysed.

Respondents with a household member on a cholesterol-restricted diet did not demonstrate purchase behaviour significantly different to those who were not in this situation. There was no significant difference in either the base price that they expected to pay for Product A ($p = 0.258$) or the premium that they were willing to pay for Product B ($p = 0.215$). Their current purchase behaviour in terms of fresh pork purchases per fortnight was not significantly different to that of respondents without a household member on a cholesterol-restricted diet ($p = 0.322$).

Willingness to pay was affected by whether or not a respondent reported reducing pork consumption because of concerns about cholesterol content ($p = 0.001$). Concerned respondents were significantly more likely to offer a premium of \$1.50 ($p = 0.002$) or \$2.00 ($p = 0.011$) for Product B, and significantly less likely to offer no premium ($p = 0.002$) (Figure 19). The expected price for Product A selected by this group was also significantly different ($p = 0.009$): they were significantly more likely to choose a price of \$5.95 ($p = 0.004$) and significantly less likely to choose a price of \$8.95.

The demographic characteristics and shopping habits of the group of respondents who reported reducing pork consumption because of concerns about cholesterol content were compared to the characteristics of respondents who did not share this concern.

Reduced consumption was not affected by gender ($p = 0.359$), State of residence ($p = 0.768$), income bracket ($p = 0.527$) or age bracket ($p = 0.768$). Reduced consumption was affected by household size ($p = 0.013$), with those who reported reducing consumption significantly more likely to have a household size of three ($p < 0.001$), and significantly less likely to have a household size of two ($p < 0.001$). These respondents were significantly more likely to have a household member on a cholesterol restricted diet ($p < 0.001$). There was no significant difference in whether or not they knew their blood cholesterol level ($p = 0.497$).

Current shopping behaviour in terms of the number of times per fortnight the respondent purchases fresh pork was not significantly different for those who responded that they did or did not reduce pork consumption because of concerns about cholesterol content ($p = 0.936$).

However the weight of fresh pork purchased per fortnight was significantly different for the groups ($p = 0.006$) (Figure 20). Respondents concerned about cholesterol content were significantly more likely to purchase under 500g than those who were not concerned ($p = 0.003$), and significantly less likely to purchase between 1.5 and 2kg ($p = 0.012$). Cut most commonly purchased was also significantly different ($p = 0.004$), with 'concerned' respondents significantly more likely to purchase ribs than those who were not 'concerned' ($p < 0.001$). There was no significant difference for place of purchase (butcher or supermarket) ($p = 0.175$).

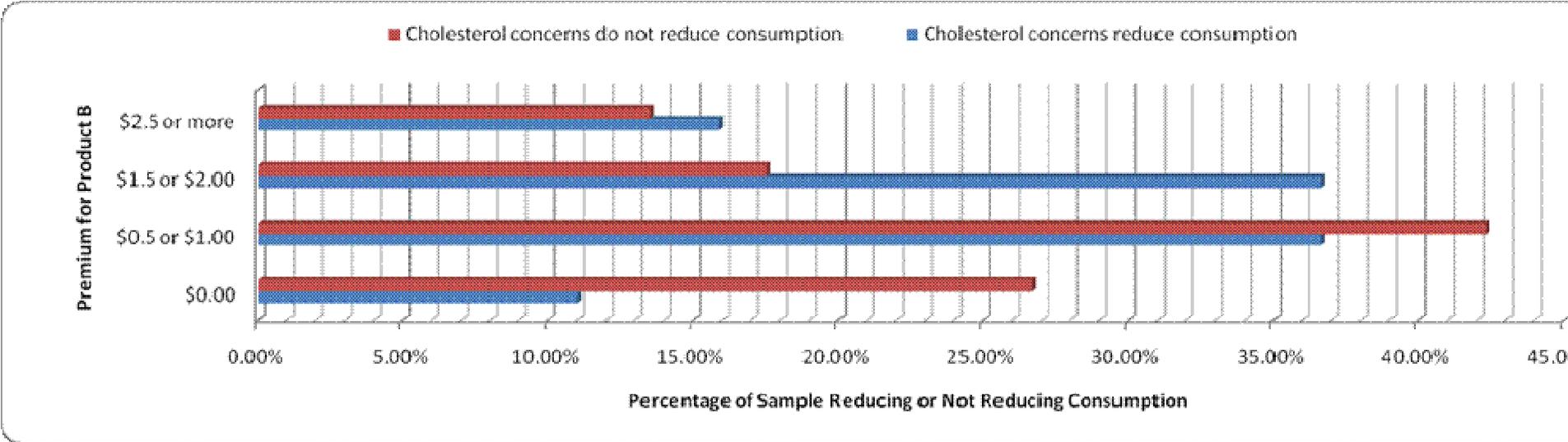


Figure 19. The relationship between concerns over cholesterol content of fresh pork and willingness to pay for Product B

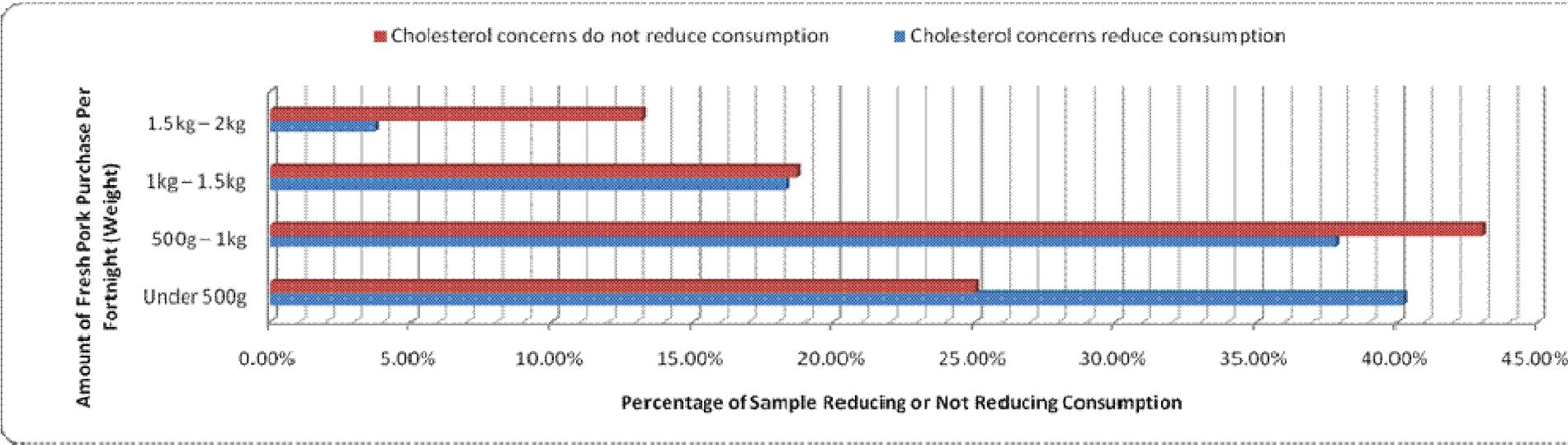


Figure 20. The relationship between concerns over cholesterol content of fresh pork and amount of fresh pork purchased per fortnight

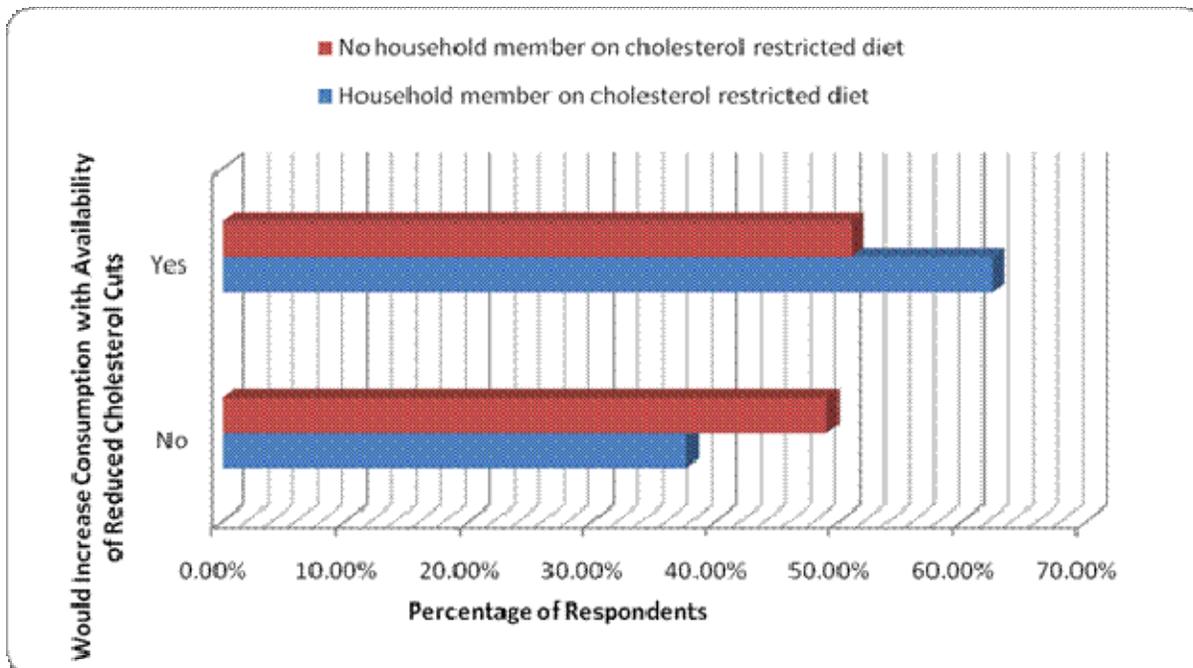


Figure 21. The relationship between having a household member on a cholesterol-restricted diet and willingness to increase consumption of fresh pork if reduced cholesterol pork were available

Willingness to alter purchase behaviour if reduced cholesterol cuts were available was affected by whether or not the respondent had a household member on a cholesterol restricted diet ($p = 0.038$), with such households significantly more likely to answer that they would increase consumption ($p = 0.022$) (Figure 21). There was also an effect if the respondent had concerns about the cholesterol content of pork ($p = 0.002$). The effect on purchase behaviour if reduced cholesterol fresh pork cuts were also more tender and pleasant to eat was independent of whether or not the respondent had a household member on a cholesterol restricted diet ($p = 0.179$) and of whether or not the respondent reported reducing pork consumption because of concerns about cholesterol content ($p = 0.305$).

Summary of Results

In summary, the most notable results found were:

- The sample was representative of the Australian population,
- Ten per cent of respondents would reduce their consumption of pork because of concerns about cholesterol content. This group were more likely to have a higher willingness to pay for reduced cholesterol pork, and have a household member on a cholesterol-restricted diet. These consumers most commonly purchase pork ribs and less than 500g of fresh pork per fortnight,
- Women and those aged 65 and older had a higher willingness to pay for reduced cholesterol pork,
- Average consumption of fresh pork per fortnight could increase from 1.08 to 1.67 kilograms,

· The predicted additional average spend on fresh pork per fortnight could be as much as \$18.50 per household.

4. Discussion

Effect of Cholesterol Concerns on Current Fresh Pork Purchases

There was a high level of awareness in the sample population regarding blood cholesterol level, with 44 per cent of respondents having had this tested. Interestingly, the number of households altering their shopping behaviour by purchasing plant sterol containing margarines considerably exceeded the number of households with a member on a cholesterol-restricted diet, suggesting that the product may be perceived as not just helping to reduce high cholesterol, but also as a preventative. However, households with a member following a cholesterol-restricted diet were significantly more likely to be consumers of such products than households without dietary restrictions.

In Table 1 is shown the comparative level of cholesterol in beef, veal, chicken, lamb, mutton and pork. At present, cholesterol in pork is relatively low, although higher than in beef or veal, and hence it was expected that health concerns would have a minimal impact on current pork purchase behaviour, which was found to be the case. These results seem to indicate an increasingly health-conscious population, who are prepared to pay a substantial premium for products that they perceive as offering significant health benefits when compared to traditional substitutes. Consequently, while it is a positive result that fresh pork is not currently perceived as unhealthy and high in cholesterol, potential exists to increase product value by lifting consumers' perception of the health attributes of pork when compared to other varieties of fresh meat.

Table 1. Average cholesterol concentration (per 100g) of the lean component of Australian beef, veal, pork, lamb, and mutton. Average cholesterol concentration (per 100g) of chicken breast

	Cholesterol (mg/100g)
Beef	50 ¹
Veal	51 ¹
Pork	52 ²
Chicken	59 ³
Lamb	66 ¹
Mutton	66 ¹

Notes:

¹ indicates data from Williams (2007)

² indicates data from Sinclair, Barone, Stobaus, Tume, Beilken, Muller, Cunningham, Barnes and Greenfield (2006)

³ indicates data from Rule, Broughton, Shellito and Maiorano (2002)

Effect of Cholesterol Concerns on Consumer Willingness to Pay and Purchase

Although it might have been expected that households with a member on a cholesterol-restricted diet would be significantly more likely to purchase margarines containing sterols, this was not found to be the case. The group of respondents who indicated that they reduced their fresh pork consumption because of concerns about cholesterol content had a significantly higher willingness to pay when compared to consumers who were not concerned about cholesterol. What makes this more noteworthy is that this group of respondents also had a significantly different expected price for Product A: they were more likely to offer a lower price of \$5.95, meaning that as a group their percentage increase in willingness to pay was substantially higher than for unconcerned respondents.

The potential of a low cholesterol pork product to increase profits and sales for pork producers, means it would be useful to identify socio-demographic characteristics of this group of consumers for marketing purposes. However, there were few significant differences in the socio-demographic profile of these respondents when compared to the broader respondent group. The primary difference was household size, with these respondents significantly more likely to have a household size of three, and significantly less likely to have a household size of two. This result seems counterintuitive unless one speculates that households with children are more health conscious. These respondents were also significantly more likely to purchase less than 500g of fresh pork per fortnight. While the effect on shopping behaviour is not surprising because of the significant relationship found between the amount of fresh pork

purchased per fortnight and household size, it may hold important implications for packaging and marketing. The cut of fresh pork most frequently purchased was significantly different, with these respondents more likely to purchase ribs. This may to some extent explain the lower expected price for Product A selected by these respondents, as expected price depended on most commonly purchased cut, and ribs are one of the cheaper pork cuts available for purchase (see Table 4 below).

When considering this group it should be noted that of the 'concerned' respondents only 33 per cent had a household member on cholesterol-restricted diets, although they were significantly more likely to do so than 'unconcerned' respondents. Furthermore, less than half (48 per cent) knew their blood cholesterol level and there was no significant difference in this respect. It could be speculated that because these consumers most commonly purchase a fattier cut of pork (ribs), they perceive pork consumption to be less healthy than respondents purchasing other cuts, and that this has led to them entering the group of 'concerned' respondents.

Effect of Socio-Demographic Factors

The sample of respondents who completed the survey was representative of the Australian population in respect to gender, age, State or Territory of residence and household size. This, coupled with the large sample size, should ensure that the data obtained accurately reflects the views of the broader Australian population. Although it was not possible to compare the household income data to census data, visually this data appears to be broadly representative of the Australian population. There may be a slight over-representation in the \$90,000 to \$120,000 bracket, a potential source of bias; however, it would reasonably be expected that some slight skewing of demographics would be found regardless of how such a survey was conducted. For example, had respondents been interviewed in a shopping centre, it would be expected that locality may affect household incomes.

Halbrendt, Sterling, Snider and Santoro (1995) found that income influenced willingness to pay for reduced saturated fat in pork, and it could reasonably have been expected to find a similar result for cholesterol content. A slight overrepresentation of higher household incomes in the study would leave open the possibility that an effect of income would have been shown had the socio-economic data been more representative of the Australian population. The possibility would also be raised that willingness to pay may be somewhat overestimated compared to the willingness to pay of the broader Australian population.

The only socio-demographic factors that were found to influence willingness to pay for Product B were sex and age, with females and those aged 65 years and above significantly more likely to have a higher willingness to pay. While a positive effect of age on willingness to pay is not consistent with previous studies (Lyford *et al.* 2009), since elevated cholesterol is a health problem more commonly affecting older members of the community, the result found in this study is not surprising. It should also be noted that Lyford *et al.* (2009) did not include respondents over 60 years of age in their study. The effect of gender is consistent with the finding by Halbrendt, Sterling, Snider and Santoro (1995) that gender impacts on willingness to pay for lower saturated fat in pork, while the finding by Mullen and

Wohlgenant (1991) that socio-economic factors had little influence on willingness to pay for credence attributes of lamb is consistent with the general lack of effect of socio-economic factors in this study.

Potential Increase in Market Size

Reducing the cholesterol content of fresh pork could potentially increase its value in three ways: by increasing consumption, by increasing the price that can be charged, or through a combination of the two. The relationship between willingness to pay and willingness to purchase is shown in Figure 22. Two Scenarios were used to predict the change in market size if these effects were combined.

Under Scenario 1, a model was created in which the willingness to pay and purchase data for each respondent was combined to calculate their current fortnightly spend on fresh pork, and what this was likely to increase to if they had the option to purchase reduced cholesterol pork. This assumed that there would only be a price rise for those respondent groups indicated as A and E in Figure 22, with the majority of the increase in market size coming from increased consumption, and a small proportion coming from a group of consumers prepared to pay a premium for the product.

Such a scenario could be envisaged where, for example, retailers increased the price on specific reduced cholesterol cuts that high-end consumers are most likely to purchase, or where reduced cholesterol pork was sold at a premium in some geographic areas with higher socio-economic standing, but not in others. The model predicts, based on the survey results, that fortnightly consumption for households that eat pork would increase by 32 per cent on average. The average number of times per fortnight that people consume fresh pork is predicted to increase from 1.63 to 2.41 times per fortnight. The average weight of fresh pork consumed per fortnight is predicted to increase from 1.08 kg to 1.67 kg. When this increase in consumption is combined with the information about increased willingness to pay, the model predicts a 42.83 per cent increase in fortnightly sales value per pork consuming household from \$24.03 to \$42.53. The results are summarised in Table 2.

Under Scenario 2, it was assumed that reduced cholesterol pork was introduced to the market at a given premium per kilogram, between \$1.52 and \$7.58, and equivalent to the premiums per package that respondents were asked to choose from in the survey. Information about respondents' willingness to pay and purchase at each premium was combined to predict the change in market size. The results are summarised in Table 3. This strategy appears much less successful in increasing market size than Scenario 1, with the greatest average additional spend being \$5.61 per fortnight, at a premium of \$1.52 per kg (equivalent to \$0.50 per 330g package).

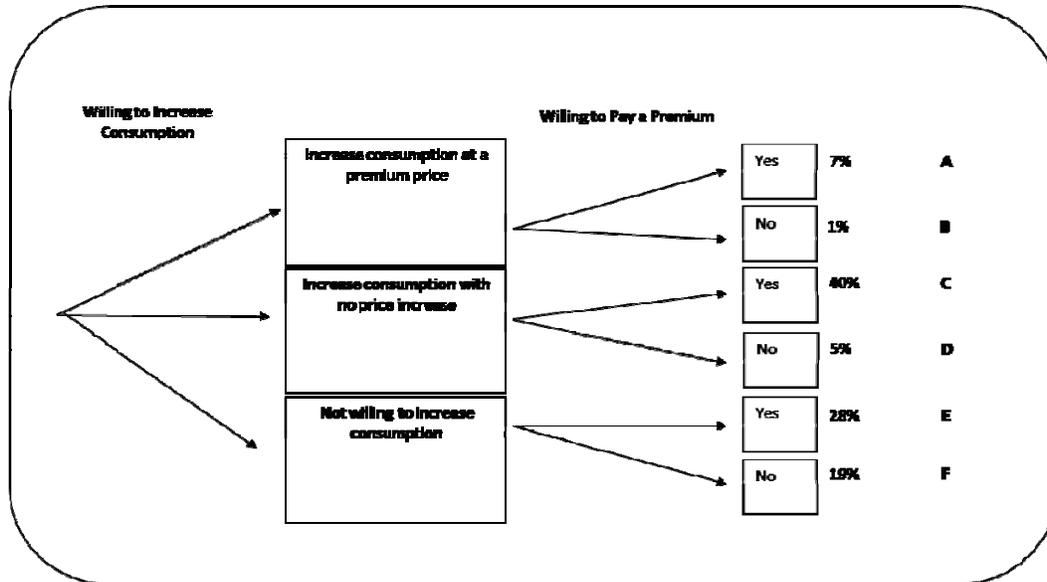


Figure 22. Types of consumers revealed by survey questions 17 and 19

Table 2. Change in market size under Scenario 1

	Regular Pork	Reduced Cholesterol Pork
Times per fortnight household consumes fresh pork	1.63 meals	2.41 meals
Weight of fresh pork household consumes per fortnight	1.08kg	1.67kg
Change in market value	\$24.03	\$42.53

Table 3. Change in market size under Scenario 2

Premium / kg	Regular Pork	Reduced Cholesterol Pork
\$1.52 (\$0.50 per 330g)	\$24.03	\$29.64
\$3.03 (\$1.00 per 330g)	\$24.03	\$25.46
\$4.55 (\$1.50 per 330g)	\$24.03	\$26.90
\$6.06 (\$2.00 per 330g)	\$24.03	\$26.66
\$7.58 (\$2.50 per 330g)	\$24.03	\$25.99

These predictions are made on the assumption that the price that the respondents expected to pay for

Product A can be used as an average price for all of the fresh pork cuts and that the premium for Product B can be used as an average premium for all fresh pork cuts. If these assumptions are not correct, then both the average spend and the average additional spend are likely to be reduced by the same proportion. Therefore, the percentage increase in value is likely to remain about the same, even if this assumption does not hold up. The accuracy of the prediction is supported by the significant relationship between most commonly purchased cut and the expected price for Product A. When this relationship is compared to the prices in Table 4 a clear pattern emerges, with respondents placing a value on Product A similar to the real value of the cut that they most commonly purchase. This suggested that the average price that respondents expected to pay for Product A can be used with some confidence as an average price for all fresh pork cuts.

Table 4. Average price of pork cuts (Coles and Woolworths in Bentleigh and Moorabbin, Victoria, Australia, August 2009)

Fresh Pork Cut	Average Price (\$/kg)
Sausages	\$7.90
Mince	\$9.10
Ribs	\$12.53
Chops	\$16.20
Diced & Stir-fry	\$17.49
Roasts	From \$8.00 to \$21.00
Steaks & Fillets	Fillet steak \$16.99; Loin steak \$20.35

It should be noted that these results are based on a product with 15 per cent less cholesterol. The actual reduction in cholesterol will not be known until the completion of the larger CRC project. It could reasonably be expected that if the reduction were less significant, say 5 per cent, consumers may not be willing to pay such a significant premium. However, given the magnitude of the predicted increase in market size, it would be expected that a significant willingness to pay would still be seen.

5. Conclusions

In this study, stated choice methods were used to assess the potential increase in consumer willingness to pay for, and purchase, reduced-cholesterol pork if it were introduced to the Australian market. The results indicate that at present consumers are relatively unconcerned about the cholesterol content of fresh pork and that there is a minimal effect of such concerns on fresh pork purchases. A significant financial premium is predicted for the reduced-cholesterol product at both the retail and farmgate level, with increased willingness to pay and increased willingness to consume reduced-cholesterol pork by the

average pork-consuming family. Willingness to pay was found to be significantly higher for females and those aged 65 and above. A group of consumers was also identified who have a significantly higher willingness to pay than other respondents to the survey, and have a distinctive set of socio-demographic characteristics and shopping habits.

These results must be approached with a degree of caution as they are the product of a stated choice analysis and not a revealed preference study. Consequently, it can be expected that the predicted increase in demand could be significantly overstated, perhaps by as much as 30 per cent, and willingness to pay by up to 20 per cent. The economic effect for the Australian pork industry as a whole in terms of increased producer surplus could be predicted by applying the results from this study to the model proposed by Mounter *et al.* (2005), representing an opportunity for further research.

Export markets have previously been found to have a higher willingness to pay for premium beef cuts than domestic Australian consumers, suggesting the possibility that a similar effect could be found for reduced-cholesterol pork. Further research will also be required in the area of branding, packaging and labelling, with a certification system to alleviate consumers' perceived risk in purchasing a product for which the prime selling point is a credence characteristic. Marketing and positioning of the product will also be an essential component of how the product is perceived by consumers. Attention must also be drawn to the predicted economic effect on producers of pork who do or do not switch to the reduced-cholesterol product, as well the effect for producers of pork substitutes. Pork can generally be considered a substitute for beef, lamb and chicken, and this study has not taken into account the marketing interactions between these products. As it can reasonably be expected that consumers will not increase their total protein consumption, it is likely that increased demand for pork will equate to reduced demand for pork alternatives. Cross-price elasticities of demand show beef to be the closest substitute for pork (Griffith *et al.* 2001), as a consequence of which the beef industry may experience a decline in demand.

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