Volunteer's attitudes towards consumption of fresh Australian pork.
Can participation in a dietary intervention trial change perceptions leading to greater pork consumption?
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Final Report prepared for the
Co-operative Research Centre for High Integrity Australian Pork

By

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Executive Summary

Pork is the most widely eaten meat in the world, yet Australians are low pork consumers and nobody is sure why. Evidence from our previous 9 month human dietary intervention trial comparing regular consumption of lean fresh pork, beef and chicken on body composition showed that, although not statistically significant (P=0.229), pork was preferred to chicken and gave significantly greater satisfaction than beef (P=0.018). In fact the most enjoyed type and cut of meat was pork steak.

The aim of the present study was to determine if voluntary participation in dietary intervention trials where pork was provided together with pork recipes, cooking advice and education on pork's potential health benefits had altered volunteers' perceptions and consumption of pork.

A total of 193 male and female volunteers had previously participated in one or both of two Pork CRC funded dietary intervention trials which required them to eat pork or other meat for at least 3 months. A total of 71 volunteers who had not received pork (controls) and 122 volunteers who had received pork were identified from the two trials. Between one and 3 years after completing these trials volunteers were posted a food frequency questionnaire to collect information on current dietary intake, including pork consumption, together with a survey requesting information relating to a variety of factors which were considered likely to influence pork consumption for the purposes of the current follow-up study. These factors included demographics, ethnicity, religion, education, income and sociological aspects and were presented in three main categories relating to influence on pork consumption including: 1) beliefs and influences: attitudes, personal values, sensory attributes; 2) perception of pork: negative, positive; 3) demographics: age, education, marital status, employment, occupation, ethnicity, religion. Volunteers were asked to respond to questions 1 and 2 by thinking about their beliefs and perceptions prior to initially participating in a trial and after participating. Food frequency data was compared with baseline intakes reported prior to participating in the initial study.

Of the 193 questionnaires sent out, a total of 104 were returned (n=70 intervention and 34 control questionnaires) providing a response rate of 54%. The food frequency questionnaire data indicated that pork consumption had increased from 67g to 90g per week in participants who consumed pork during the dietary interventions and from 60g to 101g per week in participants who acted as controls and did not consume pork. Most volunteers, including controls, felt the opportunity to learn more about the health benefits of pork contributed to their increase in pork consumption. In addition, those who had been required to consume pork during the intervention trials indicated that while learning more about the potential health benefits of pork had contributed to their increased consumption, so had receiving recipe books which had allowed them to prepare and consume different cuts of pork as part of tasty and enjoyable meals.

Overall, pork was seen in a positive light, but more so after participation in the dietary intervention trial. Nearly half of the intervention group and a third of the control group felt they ate more pork AFTER participating in the intervention. This was supported by food frequency questionnaire data which showed that, for all volunteers combined, overall pork intake increased from 9g/d before participation to 13g/d after participation. Pork consumption increased in the both the intervention and control groups but only reached statistical significance in the controls. Taste, tenderness and juiciness of pork were the major characteristics considered when purchasing pork. Interestingly most people felt that pork had much less media/advertising presence compared with other meats like lamb, chicken and beef.

These data provide possible targets for the Pork Industry to focus on when planning marketing campaigns to encourage greater consumption of Australian pork. It appears from this study that exposure to pork and/or information relating to health benefits of pork positively influences consumers' attitudes and feelings towards pork, resulting in increased consumption.

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1.   Introduction

Lean cuts of pork are a nutritious food containing nutrients including thiamine, niacin, B12, zinc, folate, antioxidants, fatty acids and protein. The Australian Dietary Guidelines recommend 1 serve of lean meat (~100g) daily as part of a balanced diet to deliver the types of nutrients that are present in pork. Pork is the most widely eaten meat in the world, however Australians eat very little pork and according to the 1995 National Nutrition Survey [1] beef and chicken are the most commonly eaten meats. We know from our recent Pork CRC funded trials that Australians are eating around ~8g/d of pork compared with ~53g/d and ~40g/d of beef and chicken, respectively [2, 3].

In Australia pork consumption is not as high as in other parts of the world, and this may be due to a number of reasons. Beliefs and attitudes towards food determine behavior and choice and there are a number of interlinking factors that determine how pork may be perceived which in turn may affect consumption. Major drivers for pork consumption include intrinsic and extrinsic characteristics including price, brand, product quality and convenience [4], sensory properties such as flavor, tenderness, juiciness and aroma [5], and consistency of product which influence consumers re-purchase of the product and sociological aspects including culture, beliefs, and religion [6].

In addition to these typical characteristics that influence food purchasing and consumption behavior, consumer behavior in relation to pork consumption may also be influenced by misconceptions about the health effects of consuming pork, as well as concerns about animal welfare and animal cleanliness. There appears to be a common misconception that pork is a less healthy meat than beef or chicken, where in contrast recent evidence has shown that lean fresh pork, like lean red meat may in fact improve cardiometabolic health rather than increasing risk factors of cardiovascular disease [3, 7]. Frequent comments our research group have heard when screening volunteers for our pork trials include 'pigs are filthy animals', 'the pig industry uses hormones to fatten up pigs...' and 'pigs suffer...'. Similarly many volunteers have the perception that pork is a tough and dry meat but in fact they might just not know how to cook pork and as a result cook the meat until it is dry and tough which negatively impacts on eating quality and influences re-purchase of the product. Information from our recent trial [2] shows that when volunteers were provided with different meat cuts, recipe booklets and advice on how to cook the meat to produce a tender and tasty product, pork was more preferred than beef and chicken, the two main meats in the Australian diet, although it was not significantly different.

Evidence from our previous research comparing regular consumption of pork, beef and chicken (Murphy 3A-111) showed that pork was the most preferred meat, the most enjoyed meat, the best tolerated for three months and according to their follow up exit survey, many volunteers found their pork consumption had increased within a month following completion of the study. Few people found eating pork for three months a struggle compared to beef or chicken and the survey indicated the pork quality was the best and serving size was adequate. In fact the quality of the beef was the most criticized.

It is not well understood why pork consumption in Australia is low compared to consumption of beef and chicken. We have a unique opportunity to explore volunteer's attitudes and perceptions of pork in a specific population of low pork consumers who volunteered to participate in one of two dietary intervention trials to investigate the health benefits of regular lean pork consumption. This can be explored before and after participation in the dietary intervention trials. These data will provide several reasons as to what influences pork consumption, purchasing of pork and if exposure to pork and related health information through trial participation influences attitudes, perceptions and consumption patterns. This information may also help the pork industry plan marketing campaigns, develop research programs and formulate strategies to encourage pork consumption.

2.   Methodology

TARGET POPULATION

A total of 193 volunteers (n=39 men and 65 women) had previously participated in our Pork CRC funded research (projects 3-104 and 3A-111). Generally volunteers were overweight/obese (body mass index, ≥ 25 kg/m^2), habitually ate ≤ 100g pork per week and participated in one or both of our randomised, controlled, dietary intervention trials.

SURVEY DEVELOPMENT

A survey was designed according to the method of Dillman [8]. The content of the questionnaire was based on discussions with previous trial volunteers i.e. asking what type of questions would be appropriate to ask to gather information on beliefs, attitudes and perceptions of pork, how they feel about pork and what influences their pork consumption, information from similar styles of questionnaires such as the Australian survey on meat consumption and attitudes [9] and the cognitive contexts of beliefs about the healthiness of meat [10] and the literature i.e. style of questioning for qualitative research associated with meat consumption. The questionnaire was designed to request information relating to a variety of factors which are likely to influence pork consumption, viz. demographics, ethnicity, religion, education, income and sociological aspects including:

- overall attitude, belief and perception of pork
- sensory attributes – taste, taint, eating quality
- animal welfare and concerns with the pig industry
- perceived health benefits
- importance of price and quality
- product familiarity – how to cook pork
- cultural, religious influences
- any other misconceptions volunteers may have

These were presented in three main categories relating to influence on pork consumption:

1. beliefs and influences – attitudes, personal values, sensory attributes etc.
2. perception of pork – negative, positive
3. demographics – age, education, marital status, employment, occupation, ethnicity, religion.

Volunteers were posted a questionnaire and food frequency questionnaire in the mail with a cover letter explaining the aim of the survey and instructions to complete the questionnaires. A number of follow-up reminders were sent to ensure the best possible response rate was achieved according to the method of Lea & Worsley [11].

We have no information on attitudes and perceptions of pork of volunteers prior to commencing the research trials and because the first trial commenced in 2009, nearly four years ago, we asked volunteers to reflect on their attitudes and perception of pork prior to undertaking their study. Because attitudes and perceptions form behavior and behavior is developed over many years we believed that volunteers would be able to provide useful information relating to their perception of pork and what influenced it in the past. We then asked volunteers how they perceive pork currently, and what has influenced their current attitudes and perceptions of pork including influence from participating in our research.

PILOT TESTING, VALIDATION AND RELIABILITY OF THE SURVEY

Dillman's [8] recommended methodology for surveys formed the basis of questionnaire design and administration. The survey underwent reliability testing using a panel of three expert scientists who were asked to provide a validation score (e.g. did each question make sense or no sense), redundancy of questions and any missing areas which are vital for answering the research questions (Appendix 1). The questionnaires were then pilot tested for responses using four individuals who were low pork consumers and had similar

characteristics to the trial population. To ensure the questionnaire was a reliable tool, eight volunteers completed the questionnaire on a second occasion, two weeks after completing the initial questionnaire. Validity was determined using Pearson's correlation and a correlation co-efficient of ≥0.7 was considered reliable. A correlation r value of 0.7 or more was considered a very strong positive correlation. Between 0.4-0.69 is considered strong and <0.4 was considered moderate to weak. If the r value was <0.4 any differences between pre and post study participation questions were not considered reliable.

FOOD FREQUENCY QUESTIONNAIRE (FFQ)

Information on total energy and nutrient intake, meat consumption including pork and pork products was collected using the Cancer Council of Victoria's validated FFQ [12]. Information collected included portion size and frequency of consumption. These data were collected at the start of each intervention trial and were repeated for this follow-up study, allowing for evaluation of changes in pork consumption that occurred as a result of participating in the intervention.

INFORMATION FROM CONTROL VOLUNTEERS WHO DID NOT RECEIVE PORK IN THE TRIALS

A total of 71 volunteers acted as controls in one of the studies and did not receive pork, pork recipes or cooking tips. Information from control volunteers was collected and compared with volunteers who consumed pork.

STATISTICAL ANALYSES

Descriptive statistics are presented as mean ± SD. All survey answers were coded numerically. For questions which were repeated in the survey for pre- and post-study attitudes the mean values were calculated and compared using dependent sample paired t-tests separately for those in the study who consumed pork (intervention) and those that did not (controls). The change in the numerical value for the answers between the retrospective pre-study section and the post-study section was then compared between the control and intervention groups to assess the effects of pork consumption in the study using an independent samples t-test. For all other questions, based on the numerical code, percentages and mean responses were calculated. Pearson's correlation coefficient was calculated to determine the correlation between the test-retest sub-sample. Significance was set at 0.05. All data were analysed using SPSS Statistical software version 21.

3. Outcomes

RESPONSE RATE

193 volunteers were identified from the previous PHS and PBCS studies and sent questionnaires. A total of 104 questionnaires were returned providing a response rate of 54%. Ten participants were sent a re-test questionnaire to test for reliability and a total of 8 participants returned the questionnaires.

BASELINE CHARACTERISTICS AND DEMOGRAPHIC INFORMATION

This information reflects the characteristics of volunteers at the end of the dietary intervention study with the exception of age (updated to current age). Demographic information reflects volunteer's current situation.

61% of the target population were female and mean age and BMI were 55±11years and 32±5kg/m^2, respectively (Table 1). 67% of the population participated in 3-104 (PHS), 16.4% participated in 3A-111 (PBCS) and 16.4% of the participants participated in both trials.

Table 1 - Characteristics and demographic information.

	Intervention (n=70)	Control (n=34)	All (n=104)
Age (years) (mean ± SD)	56.5 ± 10.4	53.3 ± 10.7	55.4 ± 10.5
BMI kg/m^2 (mean ± SD)[1]	31.3 ± 4.7	32.3 ± 4.3	31.64 ± 4.5

	Intervention (n=70)	Control (n=34)	All (n=104)
Gender (% Female)	62	60	61
W:H Ratio (mean ± SD)[2]			
Males	1.00 ± 0.08	0.98 ± 0.06	0.99 ± 0.07
Females	0.85 ± 0.08	0.85 ± 0.06	0.85 ± 0.07
Previous study participation (%) PHS[3]			
PBCS[4]	51.4	100	67.3
Both studies	24.3	0	16.4
	24.3	0	16.4
Level of education (%)			
To year 10	14	3	11
To year 11	6	6	6
To year 12	4	21	11
Trade/Technical qualification	17	27	20
University	51	41	48
Other	6	3	5
Religious Affiliation (%)			
Catholic	17	12	16
Anglican	12	15	13
Uniting	19	15	18
Presbyterian	1	3	2
Greek orthodox	3	3	3
Buddhist	1	0	1
Baptist	1	0	1
Islam	0	0	0
Lutheran	6	3	5
Other	39	52	42
Country of birth (%)			
Australia	71	88	77
England	16	3	12
Other	13	9	12
Household income (%)[5]			
<$20,000	14	6	12
$20,000-$40,000	25	21	24
$40,000 - $60,000	17	9	15
$60,000-$80,000	9	6	8
$80,000-$100,000	12	15	13
$100,00-$120,000	9	12	10
$120,000-$140,000	9	3	7
$140,000 - $160,000	3	9	5
$160,000 - $180,000	1	9	4
$180,000-$200,000	0	0	0
>$200,000	1	9	4
Employment status (%)			
Employed full time	36	49	40
Employed part time	11	21	14
Casual	3	15	7
Home duties	10	3	8
On leave	0	3	1
Looking for work	4	0	3
Retired	34	9	26
Student	1	0	1

[1]Body mass index as at end of study participation. [2]Waist to hip ratio as at end of study participation. [3]Pork health study. [4]Pork beef chicken study [5]n=69.

SAMPLE DEMOGRAPHICS

Table 2.1 - Contribution to main household shopping, number of respondents, n (%).

Who does the main household shopping?	Intervention n=70 n (%)	Control n=34 n (%)
I do	49 (70)	24 (71)
My partner	14 (20)	7 (21)
My parents	1 (1)	0
Others living with me	1 (1)	0
Shared with others	8 (11)	6 (18)

Table 2.2 - Meat purchasing habits, number of respondents, n (%).

Who does the main purchasing of meat?	Intervention n=70 n (%)	Control n=34 n (%)
I do	50 (71)	24 (71)
My partner	15 (21)	5 (15)
My parents	1 (1)	0
Others living with me	1 (1)	0
Shared	5 (7)	6 (18)

Table 2.3 - Place of meat purchase, number of respondents, n (%).

Where do you purchase meat from?	Intervention n=70 n (%)	Control n=34 n (%)
Butchers	35 (50)	26 (77)
Deli section at the supermarket	13 (19)	7 (21)
Meat section at the supermarket	55 (79)	22 (65)
Specialty Shop	4 (6)	4 (12)
Other	5 (7)	1 (3)

Table 2.4 - Cooking habits, number of respondents, n (%).

Who does the majority of the cooking?	Intervention n=70 n (%)	Control n=70 n (%)
I do	47 (67)	25 (74)
My partner	16 (23)	7 (21)
My parents	1 (1)	0
Others living with me	1 (1)	0
Shared	5 (7)	3 (9)

Results are presented below for Section 1 of the survey outlining volunteer's attitudes <u>BEFORE</u> participating in the studies.

Question 1. Before participating in the study, how often did you consume pork?

The inclusion criteria for participation in any of the pork studies were low habitual pork consumption. Overall, the majority of participants stated that before the study began, they habitually ate pork less than once a month (25%).

Table 3 - Frequency of pork consumption before participation in the study (% of respondents)

	Intervention (n=70)	Control (n=34)	All (n=104)
Once a year or less (%)	7.1	2.9	5.8
Once every 6 months (%)	10.0	11.8	10.6
Less than once a month (%)	27.1	20.6	25.0
More than once a month but less than once	25.7	11.8	17.3

	Intervention (n=70)	Control (n=34)	All (n=104)
per fortnight (%)			
Once a fortnight (%)	12.9	29.4	18.3
Once or more per week (%)	15.7	14.7	15.4
Two or more times per week (%)	1.4	5.9	2.9

Question 2. What kind of meat did you eat most before participating in the study?

Chicken and beef were the most often consumed meat, pork being consumed slightly more in the control group than the intervention group. Overall pork intake was low.

Table 4 - Type of meat most frequently consumed before participation in the study (% of respondents).

	Intervention n=70	Control n=34	All n=104
Beef	52.9	44.1	50.0
Chicken	74.3	70.6	73.1
Lamb	15.7	2.9	11.5
Pork	5.7	8.8	6.7
Veal	1.4	5.9	2.9
Other	5.7	5.9	5.8

Question 3. Why did you eat this meat more than others?

Most people felt price, taste, versatility and convenience were the most important reasons they purchased meat. This could indicate that beef and chicken are perceived as being cheaper, better tasting, more versatile and more convenient than the other meats. The only major difference between the control and intervention groups was the perception that convenience was an important factor – 47% of the control group felt this was one of the main reasons they chose their most eaten meat, compared to 34% of the intervention group.

Table 5 - Reasons behind specific meat selection for consumption (% of respondents).

	Intervention n=70	Control n=34	All n=104
Price	47.1	47.1	47.1
Taste	50.0	58.8	52.9
Versatility	55.7	52.9	54.8
Health	18.6	23.5	20.2
Convenience	34.3	47.1	38.5
Prefer white meat	7.1	5.9	6.7
Catch fish self	4.3	0.0	2.9
Other	2.9	11.8	5.8

Question 4. What kind of fish did you eat most?

By far the most commonly consumed fish was canned tuna, followed by white fish for all groups (control, intervention, and all respondents).

Table 6 - Type of fish commonly consumed before participation in the study (% of respondents).

	Intervention n=70	Control n=34	All n=104
Fresh tuna	1	3	2

	Intervention n=70	Control n=34	All n=104
Canned tuna	60	50	57
Fresh salmon	10	9	10
Canned salmon	6	6	6
White fish	37	32	36
Takeaway/crumbed fish	14	6	12
Other seafood	7	3	6
Don't eat fish	3	6	4

Question 5. Why did you eat this fish more than others?

Amongst the control group, convenience was the most commonly cited reason for fish consumption. The intervention group also said convenience was the most important reason, however this was much lower than in the control group (difference of approx. 40%). The most commonly consumed fish was canned tuna. Other common reasons for fish choice included price, taste, and health. Compared to the reasons for meat choices, health was a more prominent reason for choosing to eat fish. Price and taste were slightly less important (Table 7).

Table 7 - Reasons behind choosing type of fish commonly consumed (% of respondents).

	Intervention n=70	Control n=34	All n=104
Price	30.0	41.7	29.8
Taste	41.4	41.7	37.5
Versatility	11.4	25.0	13.5
Health	25.7	29.2	24.0
Convenience	45.7	87.5	51.0
Prefer white meat	4.3	0.0	2.9
Catch fish self	11.4	0.0	7.7
Other	7.1	4.2	5.8

Question 6. Which of the following best summarises your overall attitude towards pork before you started the study?

A greater proportion of the control group had positive and very positive attitudes towards pork before starting in the study (64.7% compared to 41.4% in the intervention) (Table 8), which probably explains why they were willing to volunteer for a dietary intervention involving pork consumption.

Table 8 - Overall attitude towards pork before participation in the study (% of respondents).

	Intervention n=70	Control n=34	All n=104
Very negative	4.3	0.0	2.9
Negative	7.1	2.9	5.8
Neutral	47.1	32.4	42.3
Positive	35.7	44.1	38.5
Very positive	5.7	20.6	10.6

Question 8. In your opinion prior to the study, did you think pork was....?

Question 8 asked volunteers to tick a series of questions if they agreed with them relating to the fat content of pork in relation to other meats and fish.

Prior to participating in the studies, 57 and 41% of intervention and control respondents, respectively, were unsure about the fat content of pork compared to beef and chicken. 40% of the intervention group and 41% of the control group thought that pork was fattier than beef and chicken while 40% of the intervention and 56% of the control group thought pork was fattier than fish. 15% from each group were unsure about the fat content of pork compared to fish. Only one respondent from the intervention group thought that pork was leaner than fish, while 7% of the intervention and 9% of the control thought pork was leaner than beef and chicken.

It appears that most people are either unsure or feel pork is fattier than beef or chicken. We as nutritionists and scientists know that the fat content of lean pork, beef and chicken are comparable however it appears the general public is not. Education about the fat content of lean pork as compared to beef or chicken may help people make more informed choices about their meats and dispel common myths that pork may be seen as a fatty meat.

Question 9. Did you think pork was less healthy, about the same or healthier compared to other meats?

The majority, (61% of intervention and 59% of the control) thought that pork was about the same as beef and chicken in terms of subjective healthfulness which is interesting given the responses to question 8 (pork is thought to be fattier than beef and chicken). 21% of the intervention group and 29% of the control group thought it was less healthy, while 7% and 3% of the intervention and control group, respectively, thought it was healthier. 10% and 9% of the intervention and control groups were unsure.

RESULTS ARE PRESENTED BELOW FOR SECTION 2 OF THE SURVEY OUTLINING VOLUNTEER'S ATTITUDES AFTER PARTICIPATING IN THE STUDIES.

Question 10. Do you feel differently about pork since participating in the study?

67% of the intervention group compared with 24% of the control group reported feeling differently about pork after completing the study. Whereas, 65% of the control group compared with 27% of the intervention group reported feeling no different about pork after completing the study. The remaining respondents were not sure if they felt differently (6% intervention, 12% control).

Question 11. In what way do you feel differently about pork since being in the study?

Table 9 - Feelings towards pork following study participation (n (% of respondents))

	Intervention n=70	Control n=34
Much more negative	0	0
More negative	1 (1.4%)	0
No difference	19 (27%)	22 (65%)
More positive	29 (41%)	8 (24%)
Much more positive	21 (30%)	4 (12%)

In accordance with responses from question 10, 71% of the intervention group felt more and much more positive about pork since being involved in the study, compared with 36% of the control group. The majority of control participants (65%) felt no difference.

In comparison with question 6, which requested participants overall attitude towards pork prior to the study, it appears that there was a shift in attitudes meaning the majority of intervention group fell more positive about pork after being involved in the study.

Question 12. There are many factors that may influence the way you think about pork. Since participating in the study, please show whether the reasons listed in the table below apply to you, by circling the number where 1 = Not at all my view, 3 = no view, and 5 = very much my view.

This question consisted of 10 statements relating to why attitudes might have changed regarding pork after the study. Therefore this question is more relevant for those who felt their opinions or attitudes have changed. Again, participants were asked to select an answer from 5 options, where 1 is 'not at all my view' through to 5, which was 'very much my view'. The mean response for each statement is shown below in table 4.

Table 10 - Question 12: Mean score for reasons for changed attitude towards pork after participating in the study (mean±SD).

Statement	Intervention n=70	Control n=34
I received information on the potential health benefits of pork.	4.0±0.8	3.4±1.2
I had the opportunity to taste pork and different pork cuts	4.5±0.6	2.6±1.2[1]
I received recipes and instructions of how to cook pork	4.3±0.9	2.9±1.3[1]
I did my own research about pork on the internet	2.7±1.4	2.4±1.1
I found that I can enjoy pork	4.4±0.9	4.0±1.1
Some of the common misconceptions about pork were explained	3.8±1.0	3.3±1.2
I found out where I can buy pork	3.2±1.1	2.7±0.9
I found out I can afford pork	3.5±1.2	2.7±1.1
I now enjoy pork as much as other meats	4.0±1.1	3.6±1.1
I now enjoy pork more than other meats	3.1±1.1	2.9±0.9

[1]n=33

1= not at all my view, 2= not really my view, 3= no view, 4= similar to my view, 5= very much my view.

Most people agreed with the above statements. The lowest mean score was for 'I did my own research on the internet', indicating most people probably did not take have enough interest to do this. Highest score was for 'I found that I can enjoy pork'. Almost all participants said this was either similar to their view or very much their view, indicating exposure to pork through the study has resulted in a discovery of pork enjoyment.

The participants were also given the opportunity to list any other reasons they felt their attitude has changed. 13 participants gave an additional response. Only one of these were negative in nature, the participant indicating they were sick of pork after the study. Another stated they never had the opportunity to eat pork on the study so the question was irrelevant. The rest were generally positive, one person stating it had become habit to consume pork, another stating the whole family realised how nice pork could be after the study.

Question 7 and 13: Please show whether each of the following statements represents your attitude towards pork before the study where 1= Not at all my view, 3=No view and 5 = Very much my view.

Question 7 and question 13 were a repeat of exactly the same question to gather attitudes before and after participation in the study. Question 7 was asked as a retrospective question, referring to participants attitudes towards pork before they started in the study. Question 13 asked them to answer the same questions now, after, having participated in one or more pork studies. There were 16 statements about pork which might reflect attitudes. Responders rated their agreement with each statement from 1 to 5, 1 indicating strong disagreement, 5 total agreement. Therefore, higher scores reflect more agreement. Table 8 shows the mean response to each of the 16 statements from question 7 and 13. For the majority of statements, the mean response declined – indicating a move towards more disagreement with the statement and hence improved attitudes towards pork. Only statement 6 was on average, more closely agreed with than not.

The below table shows the mean scores for each statement given after study participation, compared to those from question 7. Where scores are lower for question 13 than for question 7, this indicates more people disagreed with the statement after participating in the study.

Table 11 - Mean response scores for each statement regarding attitudes towards pork before (Question 7) and after (Question 13) participating in the study (mean±SD).

Volunteers were asked to choose one of the following statements for each question: 1= not at all my view, 2= not really my view, 3= no view, 4= similar to my view, 5= very much my view. Scores were tabulated and average to obtain mean score presented in table 11.

Statement	Mean response score question 7 Before participation	Mean response score question 13 After participation	Mean response score question 7 Before participation	Mean response score question 13 After participation
	Intervention n=70		Control n=34	
Pork products are more expensive than other meats	2.5 ± 1.0	2.3±1.0	2.2 ± 0.9	1.7±0.9
Pork is not readily available for purchase	2.0 ± 1.0	2.0±1.0	2.1±1.3	1.6±0.8
I can't find a supermarket or butcher which sells lean pork	1.8 ± 1.0	1.9±1.1	1.4 ± 0.8	1.4±0.6
Pork does not taste/smell nice	1.8 ± 1.1	1.6±0.8	1.2 ± 0.6	1.4±0.7
Pork is tough and dry	2.0 ± 1.1	1.8±1.0	1.7 ± 0.8	1.6±0.7
Beef chicken or other meats are more accessible	2.8 ± 1.3	2.7±1.4	2.5 ± 1.2	2.4±1.2
I already eat enough meat without pork	2.3 ± 1.1	2.1±1.1	2.3 ± 1.1	2.2±1.1
Pork is higher in saturated fat than other meats	2.4 ± 1.1	1.9±0.8	2.1 ± 1.0	2.0±1.0
Pork is unhealthy	1.9 ± 1.1	1.5±0.8	1.7 ± 0.9	1.6±0.9
Pork is high in chemicals, antibiotics and hormones	2.1 ± 0.9	1.8±0.8	1.8 ± 0.9	1.6±0.8
I have an ethical standpoint against the slaughter of pigs	1.7 ± 1.0	1.6±1.1	1.4 ± 0.7	1.4±0.7
My family never ate pork, so neither do I	1.7 ± 1.0	1.5±0.7	1.6 ± 1.0	1.3±0.6
My family dislike pork so I never buy it	1.7 ± 1.1	1.5±0.8	1.7 ± 1.2	1.5±1.0
It is against my religion to consume pork or pork products	1.4 ± 0.8	1.3±0.7	1.1 ± 0.4	1.2±0.7
Pigs are unclean/filthy animals	1.5 ± 0.9	1.5±0.9	1.2 ± 0.5	1.3±0.8
Pork is difficult to cook/there are less recipes for pork meals	1.9 ± 1.1	1.8±1.0	1.5 ± 0.9	1.5±0.9

Most scores decreased slightly after study participation. Because most of the statements were phrased so that pork was negative, this indicates most peoples' opinions of pork seemed to have improved after the study. It should be noted that for question 7 and 13, overall the statements were disagreed with. There were some statistically significant differences in these statements pre and post study participation which have been described below.

For question 7.4 and 13.4, 'Pork does not taste/smell nice' there was a significant change in attitude between the intervention and control groups (P=0.022), meaning the control group felt more positive about this statement than the intervention group after participating in the study. There was no significant different between attitudes pre and post intervention in either the control (P=0.07) or intervention group (P=0.146).

For question 7.10 and 13.10, 'Pork is high in chemicals, antibiotics and hormones' there was a significant improvement in attitude toward this statement in the control group (P=0.027) pre and post study participation and in the intervention group (P=0.012) pre and post study participation, but was not different between groups.

For question Q7.8 and 13.8, 'Pork is higher in saturated fat than other meats', there was a significant improvement in attitude in the intervention group (P=0.004), meaning the group disagreed with this statement more after participating in the study. There was no statistical difference for the control group or between groups.

For question Q7.9 and 13.9 'Pork is unhealthy' there was a significant improvement in attitude in the intervention group (P=0.003), meaning the group disagreed with this statement more after participating in the study. There was no statistical difference for the control group or between groups.

For question Q7.12 and 13.12 'My family never ate pork, so neither do I' there was a significant improvement in attitude in the intervention group (P=0.018), meaning the group disagreed with this statement more after participating in the study. There was no statistical difference for the control group or between groups.

For question Q7.13 and 13.13 'My family dislike pork so I never buy it' there was a significant improvement in attitude in the intervention group (P=0.03), meaning the group disagreed with this statement more after participating in the study. There was no statistical difference for the control group or between groups.

Question 14. Compared to before participating in the study, do you think you eat more, less or about the same amount of pork? Please do not include bacon, ham or products that contain pork when thinking about your answer.

Equal numbers of intervention participants thought they ate more pork since participating in the study (46%) and the same amount since participating in the study (46%). 9% of the intervention group thought they ate less pork since participating in the study.

Whereas 68% of the control group thought they ate the same amount of pork since participating in whereas 29% thought they ate more and 3% thought they ate less pork since participating in the study.

Responses from this question highlight the benefit of exposing consumers to pork and to information about the potential benefits of lean pork consumption. Nearly half of the intervention group and a third of the control group felt they ate more pork AFTER participating in the intervention. This outcome identifies potential targets for the Pork CRC for marketing campaigns to increase pork consumption.

Question 15. If you think your pork consumption has changed, would you consider this a direct result of the study?

59% of intervention group participants felt their pork consumption had changed as a direct result of the study while 13% thought their consumption had changed due to reasons not directly related to the study.

This was in contrast to the control group responses where 18% thought their pork consumption had changed as a direct result of the study while 32% thought their consumption had changed due to reasons not directly related to the study.

Question 16. Please indicate how often you currently eat pork (do not include bacon or ham when thinking about your answer).

There were 9 possible answers for this question, ranging from 1, which corresponded to once per year or less, through to 9 which corresponded to once per day. 27% and 29% of intervention and control group participants, respectively, reported consuming pork once or more a week since participating in the study.

Table 12 - Frequency of pork consumption, number of respondents, n (%).

	Intervention n=70	Control n=34
Once a year or less	3 (4)	1 (3)
Once every 6 months	3 (4)	2 (6)
Less than once a month	14 (20)	3 (9)
More than once a month	14 (20)	7 (21)
Once a fortnight	15 (21)	9 (27)
Once or more per week	19 (27)	10 (29)
Three or more times per week	2 (3)	2 (6)
Five or more times per week	0	0
Daily	0	0

Comparing question 16 (after participation) with question 1 (before participation, there was a significant increase in reported pork consumption in the control group (P=0.022) and intervention group (P<0.0001) after participating in the study, but this was not significantly different between the groups (P=0.64).

Question 17. What would you consider one serving of pork to be?

The majority of participants in the intervention group (49%) and control group (35%) thought that a serving of pork was approximately 100-120g. The average response was 2.8±0.9 for the intervention group and 3.0±1.0 for the control group, which would indicate the average perception of a serve of pork is somewhere between 100 and 150 grams.

Table 13 - Beliefs of pork serving sizes, number of respondents, n (%).

Single serving size of pork	Intervention n=70	Control n=34
50 grams or less	1 (1)	1 (3)
100-120 grams	34 (49)	12 (35)
150 grams	18 (26)	10 (29)
200 grams	15 (21)	10 (29)
250 grams	2 (3)	0
More than 250 grams	0	1 (3)

Question 18. Has the amount of beef, chicken, lamb or other meat you personally eat changed since participating in the study?

Answers of 1 corresponded to 'eat less', 2 corresponded to 'eat more' and 3 corresponded to 'eat the same'.

49% of the intervention group and 56% of the control group reported eating the same amount of beef, chicken and lamb or other meat since participating in the study.

Table 14 - Has the amount of beef, chicken, lamb or other meat you personally eat changed since study participation, number of respondents, n (%).

	Intervention n=70	Control n=34
Yes I eat less	28 (40)	9 (27)
Yes I eat more	8 (11)	34 (49)
No I eat the same	6 (18)	19 (56)

Question 19. When choosing to eat pork, how important is the quality of each of the following? Where 1 = Not important at all, 3= does not impact and 5 = very important.

This question was designed to determine what aspects of meat quality are important in the buying process. The 6 quality indicators were taste, tenderness, juiciness, smell, colour and portion size. For each of these 6 indicators the participants had to circle a number from 1 to 5, where 5 would suggest the indicator was very important to them when purchasing meat, while was not at all important.

For the intervention group, it appears all indicators were somewhat important when purchasing pork. For the control group taste, tenderness and juiciness were very important indicators when purchasing pork and smell, colour and portion size were somewhat important (Table 15).

Table 15 - Reported importance of attributes considered when purchasing pork (mean±SD).

	Intervention n=70	Control n=34
Taste	4.4±0.8	4.6±0.6
Tenderness	4.4±0.8	4.6±0.5
Juiciness	4.3±0.8	4.6±0.6
Smell	4.0±1.0	4.3±1.0
Colour	3.9±1.0	4.4±0.6
Portion size	3.9±1.0	3.9±0.9

Question 20. When you are purchasing meat, how important are each of the following?

Ten key factors were listed which might be considered important in purchasing meat. The table below summarises the average response for each factor along with the numbers for each response. 1= not important at all 2= not very important 3= does not impact 4= somewhat important 5= very important.

Table 16 ranks the most important to least important factors for purchasing meat.

It is clear that taste is the most important consideration when purchasing meat. Other important characteristics include quality and healthiness of the product are the two other most important considerations when purchasing meat. Fat content, convenience, price and ease of preparation are also important considerations. In this cohort religious or cultural beliefs were not important at all.

Table 16 - Ranking of importance of attributes considered when purchasing meat (mean±SD).

Factor	Intervention n=70	Control n=34
Price	3.8±1.1	3.8±0.8
Quality	4.4±0.6	4.5±0.6
Taste	4.6±0.6	4.6±0.7
Convenience	3.8±1.0	4.0±0.8
Animal welfare	3.2±1.3	3.3±1.2
Healthiness of the product	4.2±0.8	4.3±0.8
Fat content	3.9±0.9	3.9±0.8
Family needs or approval	3.3±1.3	3.4±1.3

Factor	Intervention n=70	Control n=34
Ease of preparation	3.5±1.2	3.7±1.1
Religious or cultural beliefs	1.5±1.1	1.3±0.8

1= not important at all 2= not very important 3= does not impact 4= somewhat important 5= very important.

Question 21. Drawing on your experiences and knowledge form the study, please indicate whether you agree with the following statements where 1= do not agree, 3 = neither disagree or agree, and 5 = agree completely.

This question asked the participants' opinions regarding the healthiness of pork. Participants had to indicate their agreement with a series of 10 statements relating to the nutritional value and versatility of pork. The table below shows the average scores for each statement (5 represents the most agreement, 1 representing no agreement).

Most participants were in agreement that pork is a versatile meat suitable for many recipes that pork is an excellent source of protein and that pork is low in saturated fat.

Table 17 - Reported responses on healthiness of pork following study participation (mean±SD).

Factor	Intervention n=70	Control n=34
1. Lean pork may help with weight loss as part of a balanced diet	4.1±0.9	4.0±0.9
2. Pork is an excellent source of lean protein	4.6±0.7	4.6±0.7
3. Pork may improve heart health	4.1±0.8	3.9±0.9
4. Pork is high in thiamine and other B vitamins	3.9±0.8	4.0±0.8
5. Lean pork is low in saturated fat	4.4±0.7	4.3±0.8
6. Lean pork is a source of essential fatty acids (e.g. omega-3)	4.0±0.9[1]	3.9±0.9
7. Pork is a versatile meat suitable for many recipes	4.5±0.8	4.5±0.6
8. Pork has about the same fat content as beef and chicken	3.4±1.1	3.7±1.0
9. Pork has less saturated fat content than beef or chicken	3.3±0.9	3.9±0.9
10. Pork has more saturated fat than beef or chicken	2.8±1.0	2.7±1.0

[1]n=69

1= do not agree, 2= slightly disagree, 3= neither disagree nor agree, 4= slightly agree, 5= agree completely

Question 22. How great a presence do you think the following meats have in the media? Each 15 cm line shows a scale from completely absent in the media to a very strong presence. Please mark each line as shown in the example.

This question was designed to assess how much advertising the participants felt pork had, compared to beef, chicken, lamb, fish and smallgoods. They each marked a 15 cm line scale, anchored at the low end with 'absent' and at the upper end with 'very strong presence'. Where they placed the mark was measured in cm and divided by 1.5 to get a score out of 10. The below table shows the average scores for each meat, and the rank out of the 6 meats (number 1 being the strongest presence).

The control group perceived lamb as having the strongest media presence followed by chicken, beef, fish and smallgoods. The intervention group perceived chicken as having the strongest media presence followed by beef, lamb, fish and smallgoods. Both groups felt pork had the least amount of media presence (Table 18).

Table 18 - Presence of meat in the media, average scores out of a maximum 10 (mean±SD).

Meat	Intervention n=70	Control n=34
Beef	9.3±3.4	8.2±3.6
Lamb	9.2±3.4	9.5±3.1
Chicken	9.4±3.5	8.4±3.7[1]

Pork	5.3±3.0	6.1±2.6
Fish	6.6±3.4	6.7±3.5
Smallgoods	6.5±3.2	6.2±2.6

[1]n=33

Question 23. Please show using the table which meat you think costs the environment more to produce, that is, which has a bigger carbon footprint?

Participants could select one of 5 options for each meat (beef, pork, chicken, lamb, veal, fish), including 'very small carbon footprint', 'small carbon footprint', 'medium carbon footprint', 'large carbon footprint' and 'very large carbon footprint'. Their average responses are shown in table 5.

Table 19 - Average score for size of carbon footprint of 6 different meats (mean±SD).

Meat	Intervention n=70	Control n=34
Beef	4.1±1.2	4.1±0.8
Pork	3.0±0.9[1]	3.3±0.7
Chicken	2.7±1.0	2.8±0.8
Lamb	3.2±1.0	3.5±0.7
Veal	3.5±1.2	3.6±0.9
Fish	2.0±1.1	2.3 ±1.2

[1]n=69

Both groups through beef had the greatest carbon footprint followed closely by veal. Pork was thought to have a medium carbon footprint whereas fish was thought to have a small carbon footprint.

Question 24. In your current opinion, is pork healthier, less healthy or about the same as other meats?

Scores of 1 represent 'healthier', 2 represents same, 3 represents less healthy and 4 represents unsure.

62 and 65% of intervention and control participants, respectively, through that pork was equally healthy as other meats. 30% of the intervention group and 21% of the control group thought that pork was healthier than other meats, whilst only 1 participant from each group thought pork was less healthy than other meats. 6% and 12% of the intervention and control groups were unsure of pork's healthiness in comparison with other meats.

Question 25. Please tick how you would normally cook/eat each of the foods listed across the table. You can pick more than one for each food and you don't have to tick any if not relevant.

Participants had to select how they usually cooked/ate each meat, from a list of 10 options for cooking methods or cut of meat. The options included BBQ, roast, ribs, steak/fillet, stir-fry, casserole, mince meat dishes, sausages, rissoles/patties and chops. They could pick more than one answer for each meat. The percentage of responses for each meat is shown below in the following table.

The most popular method of cooking pork appeared to be roasting, stir-frying and eaten as chops and sausages; for beef eaten as mince meat and steak, casseroles and cooked on the BBQ; chicken, eaten as roast chicken or cooked by stir-frying; lamb, cooked as a roast and for fish eaten as a fillet or cooked on the BBQ.

Table 20 - The ways in which participants consume their meat, number of respondents, n (%).

Method of cooking	Intervention n=70					Control (n=34)				
	Pork	Beef	Chicken	Lamb	Fish	Pork	Beef	Chicken	Lamb	Fish
BBQ	30 (43)	50 (71)	37 (53)	47 (67)	19 (27)	22 (65)	28 (82)	20 (59)	26 (77)	16 (47)
Roast	58 (83)	46 (66)	48 (69)	54 (77)	8 (11)	29 (85)	26 (77)	27 (79)	29 (85)	6 (18)
Ribs	27 (39)	9 (13)	1 (1)	2 (3)	0	21 (62)	8 (24)	0	1 (3)	0
Steak/fillet	31 (44)	54 (77)	24 (34)	8 (11)	25 (36)	20 (59)	32 (94)	9 (27)	10 (29)	8 (24)
Stir-fry	45 (64)	44 (63)	54 (77)	7 (10)	9 (13)	25 (74)	26 (77)	30 (88)	5 (15)	6 (18)
Casserole	20 (29)	53 (76)	32 (46)	25 (36)	5 (7)	11 (32)	29 (85)	18 (53)	13 (38)	3 (9)
Mince meat dishes	31(44)	56 (80)	17 (24)	9 (13)	0	15 (44)	30 (88)	14 (41)	8 (24)	0
Sausages	41 (59)	42 (60)	22 (31)	11 (16)	0	24 (71)	26 (77)	16 (47)	9 (27)	0
Rissoles/patties	19 (27)	42 (60)	25 (36)	7 (10)	5 (7)	10 (29)	25 (74)	16 (47)	7 (21)	5 (15)
Chops	44 (63)	12 (17)	1 (1)	52 (74)	0	25 (74)	12 (35)	5 (15)	27 (79)	1 (3)

Question 26. Why did you decide to participate in the study?

Responders could tick as many reasons for participating from the list provided or provide their own reasons. The most commonly selected reasons wanted to learn more about health and current health issues and the enjoyment of being involved in studies.

Table 21 - Reasons for study participation, number of respondents, n (%).

Reason	Intervention n=70	Control n=34
I enjoyed eating pork in the first study	26 (37)	3 (9)
I missed out on eating pork in the first study and wanted to try it	8 (11)	3 (9)
I enjoy beef and chicken	25 (36)	6 (18)
I enjoy the savings from being given free meat	35 (50)	4 (12)
I enjoy being involved in studies	49 (70)	26 (77)
I wanted to lose weight	37 (53)	12 (35)
I enjoy meeting new people	16 (23)	5 (15)
I wanted to learn more about my own health and current health issues	49 (70)	23 (68)
The university staff encouraged me to participate	15 (21)	4 (12)
A friend/family member/partner asked me to participate	9 (13)	3 (9)

Pork Intake – Data from the food frequency questionnaire

Mean pork intake before the study was 9.6 g/day and 8.4g/day in the intervention and control groups, respectively. After the study pork intake increased to 12.8g/day and 14.4g/day in the intervention and control groups, respectively. This increase was despite a reduction in total meat in both the intervention and control groups. Prior to the study pork was contributing ~7% of total meat intake in both groups whereas current intakes reflect pork constitutes ~10% and 12% of total meat intake in the pork and control groups, respectively.

There was no difference in pork intakes according to the FFQ between the control and pork groups prior to the dietary intervention trials (P=0.581).

Table 22 - Comparison of meat intakes for the pork group and control group before participation in a dietary intervention trial and current intakes, according to the Food Frequency Questionnaire.

	Mean intake ± SD g/day			
	Pork Group n=72		Control n=36	
	Baseline intake	Current intake	Baseline intake	Current intake
Pork	9.6±12.2	12.8±9.8	8.4±6.8	14.4±11.9
Beef	62.5±63.4	38±28.7	45.1±28.0	54.2±50.8
Chicken	44.5±34.0	36±26.4	39.1±30.9	35.2±29.5
Lamb	21.3±20.3	14.4±13.3	18.2±18.9	19.6±19.2
Veal	9.5±16.7	6.2±12	8.2±9.4	5.1±7.0
Total fish	45.1±54.9	39.4±34.1	38.8±40.5	39.1±38.3
Total smallgoods	31.2±35.7	17.1±19.6	23.6±24.5	22.8±21.4
Total other meat	25.6±27.9	12.8±12.9	17.2±14.2	17.6±18.7
Total meat	147.5±108.1	130.6±77.3	119±56.1	117.9±94.4

Total smallgoods (sum of bacon, ham, salami, sausages); Total fish (sum of fried, tinned, fish); Total other meat (sum of hamburgers and meat pies); Total Meat (sum of pork, beef, chicken, lamb, veal).

According to FFQ intake data, there was a significant increase in pork intake pre and post study participation from 8g/d to 14g/d in the control group (P=0.024). There was also an increase in pork consumption from 10g/d to 13g/d in the intervention group but this was not statistically different (P=0.161). In the intervention group, there was a significant decrease in total meat consumption (P=0.008) and in other meat consumption (P=0.015) after

participating in the study. There was no difference in the change in pork consumption (before vs. after participation) between groups (P=0.34).

Table 23 - Baseline and current meat intakes of meat for all volunteers (pork and control groups combined according to the food frequency questionnaire.

Meat product	Mean intake±SD g/day	
	Baseline (n=108)	Current (n=69)
Pork	9.2±10.7	13.3±10.5
Beef	56.7±54.7	43.2±37.8
Chicken	42.7±32.9	35.7±27.3
Lamb	20.3±19.8	16.0±15.5
Veal	9.1±14.7	5.9±10.7
Total fish	43.0±50.4	39.0±35.2
Total smallgoods	28.6±32.4	23.0±22.2
Total other	22.8±24.4	17.2±15.9
Total meat	191.3±132.4	156.3±87.5

Total smallgoods (sum of bacon, ham, salami, sausages); Total fish (sum of fried, tinned, fish); Total other meat (sum of hamburgers and meat pies); Total meat (sum of pork, beef, chicken, lamb, veal).

Reliability

Test-Retest

Pearson's correlation coefficient was calculated to determine the correlation between the test-retest sub-sample. To ensure the questionnaire was a reliable tool, eight volunteers completed the questionnaire on a second occasion, two weeks after completing the initial questionnaire. Validity was determined using Pearson's correlation and a correlation co-efficient of ≥0.7 was considered reliable. A correlation r value of 0.7 or more was considered a very strong positive correlation. Between 0.4-0.69 is considered strong and <0.4 was considered moderate to weak. If the r value was <0.4 any differences between pre and post study participation questions were not considered reliable. Correlations are presented in table 24.

Table 24 - Pearson's Correlations for test re-test mean scores

Question	Original Mean	Test-Re-test Mean	Pearson's Correlation Coefficient
1. How often consume pork?	4.9	5.0	0.72
2. Meat eaten most: First answer	1.6	1.8	0.75
3. Why did you eat this meat more than others: first answer	2.0	2.0	0.43
4. Fish eaten most	3.5	3.4	0.99
5. Why this fish: first answer	2.7	2.1	0.49
6. Overall attitude towards pork	3.9	3.9	1.0
7. Attitudes towards pork	27	28.9	0.78
8.Fat content of pork first answer	5.0	5.3	-0.15
9. Healthiness of pork compared to other meats	2.1	2.0	0.76
10. Do you feel differently about pork after study?	1.5	1.5	0.5
11. In what way do you feel differently?	3.6	3.9	0.60
12. Factors influencing opinion of pork sum	36	36.9	0.18
13. Sum of answers	28.1	28.9	0.87
14. Do you eat more, less or same amount of pork	1.8	1.6	0.75
15. Is this because of the study?	2.4	1.9	0.82
16. How often eat pork after study	5.6	5.3	0.50

Question	Original Mean	Test-Re-test Mean	Pearson's Correlation Coefficient
17. Serving of pork	3	2.6	0.39
18. Amount of beef/chicken changed?	1.8	2	0.87
19. Quality of pork: Taste	4.8	4.8	0.33
Tenderness	4.9	4.5	-0.27
Juiciness	4.4	4.1	0.09
Smell	4.1	4.3	0.11
Colour	4.1	4.3	-0.23
Portion size	3.9	3.6	-0.09
20. Meat purchasing behaviour:			
Price	3.8	3.8	0.88
Quality	4.7	4.4	0.42
Taste	4.4	4.4	0.32
Convenience	4.4	3.9	0.76
Animal welfare	3.6	3.8	0.67
Healthiness of product	4.1	4.1	0.64
Fat content	4.1	4	0.34
Family needs/approval	3.6	3.1	0.34
Ease of preparation	3.6	3.6	0.59
Religious or cultural beliefs	1.8	1.3	0.34
21. Health and versatility of pork:			
Lean pork may help with a balance diet	4	4	0.5
Pork is an excellent source of lean protein	4.6	4.6	1.0
Pork may improve heart health	4.4	4.1	0.79
Pork is high in thiamine and other B vitamins	3.9	3.6	0.83
Lean pork is low in saturated fat	4.6	4.5	0.26
Lean pork is a source of essential omega-3 fatty acids	3.7	3.9	0.35
Pork is versatile	4.4	4.4	1.0
Pork has about the same fat content as beef/chicken	3.8	3.4	0.51
Pork has less saturated fat than beef or chicken	3.78	3.4	-0.16
Pork has more saturated fat than beef or chicken	2.9	2.5	0.74
22. Mean beef	8.7	9.7	0.68
22. Mean lamb	9.0	8.6	0.76
22. Mean chicken	8.8	9.0	0.66
22. Mean pork	6.4	5.4	0.54
22. Mean fish	7.6	6.7	0.41
22. Mean small goods	7.8	10	0.81
23. Carbon footprint: beef	4	4.1	0.51
Pork	2.8	2.5	0.27
Chicken	3	3	-0.76
Lamb	3.6	3.6	0.61
Veal	3.1	3.4	0.53
Fish	1.8	1.6	0.27
24. Is pork healthier, same or less healthy?	1.8	2	-0.30
25. Pork	5.1	5.8	0.62
Beef	5.8	6.1	0.06
Chicken	3.3	3.6	0.06
Lamb	3.3	3.3	0.59
Fish	0.8	0.8	0.89
27. Household income	3.6	3.4	0.92
28. Level of education	3	3.3	0.52
29. Religious affiliation	4.9	3.9	0.33
30. Country of birth	2.3	2.3	1.0

Question	Original Mean	Test-Re-test Mean	Pearson's Correlation Coefficient
31. Current occupational status	4	4.3	0.97
32. Household shopping	1.3	1.6	-0.06
33. Purchasing of meat	1	1	1.0
34. Where buy meat from?	2.1	2.1	0.63
35. Cooking	1.1	1.5	-0.14
Average correlation positive values			0.59
Average correlation negative values			-0.27

4.   Application of Research

Meat consumption patterns of the general consumer are influenced by a number of factors including price, taste, quality, and animal welfare, and health perceptions [4].

In Europe from the 1960s to 1990s there was an increase in the supply of meat, particularly pork. However post 1990 the availability of meat decreased in some European countries due to changes in consumer taste and preference and concerns about safety of the meat supply [13]. These are contributors to consumer's quality expectations and perceptions and if consumers are not satisfied with the product then it is unlikely that they will purchase and consume the product in the future. Consumers choose products based on extrinsic (price and brand) and intrinsic (appearance, taste) cues [14]. Despite pork being the most widely eaten meat in the world, in Australia despite a slow increase in the consumption since the mid 1940's, beef and chicken remain the most commonly consumed meats [1]

We know from our recent Pork CRC funded trials that typical volunteers are eating around ~8g/d of pork compared with ~53g/d ~40g/d of beef and chicken, respectively [2, 3], and while we cannot be certain that these volunteers constitute a representative sample of the entire population in terms of meat consumption, it is clear that their consumption patterns are in accord with general meat consumption trends. We can speculate regarding the many reasons that may be behind Australia's low pork consumption rates. It may be due to the negative attention meat consumption has received in relation to cancers [15], people may be unsure how to cook pork, certain beliefs including religious practices, taste, price, availability and influences from family eating habits. Upon entry into the study, 42% of volunteers had a neutral attitude towards pork, whereas 39% felt quite positive towards pork. Ten percent of volunteers felt negative or very negative towards pork. The majority of respondents were unsure about the fat content of pork compared with meat and fish, however 40% thought that pork was fattier than beef and chicken. This clearly identifies the need to educate the general public on the fat content of pork to highlight that lean pork is nutritionally equal to lean beef and chicken.

Chicken and beef were the most commonly consumed meats prior to and after participation in the study. Reasons behind choosing beef and chicken were related to versatility, taste, price and convenience. Most people ate pork less than once a month prior to the study with a mean intake of 9g±11g/d (total 63g/wk) whereas after the study they reported eating more, dietary intake data from the FFQ indicating an increase in consumption to 13g±11g/d (total 91g/wk). This is despite volunteers overall intake of meat decreasing from 191g±132g/d to 156g±88g/d. Nearly half of the intervention group and a third of the control group volunteers felt their pork intake had increased since participating in the study. Interestingly nearly 60% of the intervention group volunteers reported that their consumption had increased as a direct result of participating in the study. This highlights a potential target area for the Pork CRC to focus marketing campaigns on to help increase the awareness of potential health benefits of pork as well as pork consumption.

The reasons participants reported why pork may not be consumed as much as beef or chicken, ranged from cost, availability, taste, smell, fat content, ethics, religion, and cleanliness. In general, attitudes toward pork were seen in a positive light prior to study participation which was not unexpected otherwise volunteers would not have likely volunteered their participation in a study which might result in them having to consume pork. Following participation, attitudes towards pork seemed to improve. There were some statistically significant differences in several statements before and after participation in the study including change in thought that pork does not smell or taste nice, pork is high in chemicals, antibiotics and hormones, pork is unhealthy and pork is high in saturated fat, indicating that participation in the trial positively influenced the attitudes of both the intervention and control group towards pork.

It appears that being in the intervention group significantly changed the belief that pork is higher in saturated fat than other meats and that pork is unhealthy. Volunteers most likely benefitted from receiving information on the health benefits of pork, they had the opportunity to taste different cuts of pork, they received recipes and instructions on how to prepare and cook pork and they had common misconceptions about pork explained.

Following study participation, nearly three quarters of the intervention group and a quarter of the control group reported feeling differently about pork. The intervention group felt more positive while the majority of the control group felt either no different or more positive towards pork which appears to be due to participating in the study and receiving information on the health benefits of pork and having common misconceptions about pork explained, but particularly for the intervention group, having the opportunity to taste pork cuts, receiving recipes and cooking instructions may have influenced their attitudes.

All volunteers reported they found out they can now enjoy pork and enjoy it as much as other meats. When purchasing and consuming pork, the most important characteristics were taste, tenderness, quality and healthiness of the product and the most common method for cooking pork was roasting, stir-frying and eating as chops or sausages. Taken together, these outcomes highlight a potential opportunity for the Pork CRC together with APL to promote the consumption of pork as part of a healthy diet. If a marketing campaign could be designed to promote the health benefits of pork (based on previously funded Pork CRC projects), dispel common misconceptions about pork, provide easy to understand information on preparing and cooking pork, provide healthy pork recipes together with tasting opportunities in butchers or supermarkets, this may reach the broader population and encourage consumers to purchase and enjoy pork. It is evident from our data that consumers need to be exposed to pork and or health information relating to pork to encourage consumption levels.

The major findings that have been identified in this population of consumers are:
- Pork was seen overall quite positively, but more so after participation in the dietary intervention trial;
- Half of the intervention group and a third of the control group reported their pork intake had increased since being involved in the study;
- Participation in a dietary intervention trial where pork was provided together with health information and recipes or where volunteers were exposed to potential health benefits of lean pork, appears to have increased habitual consumption of pork by approximately 29g/wk in low pork consumers;
- Taste, tenderness and juiciness of pork are important attributes considered when purchasing;
- Religion did not impact on consumption in these volunteers;
- Pork was perceived equally healthy as beef and chicken;

- Volunteers were unsure about the saturated fat content of pork in comparison with beef and chicken;
- Volunteers ranked pork as having the least amount of exposure in the media.

The major opportunity that has been uncovered by this research is the need for a marketing campaign to:
- promote the health benefits of pork (based on previously funded Pork CRC projects);
- dispel common misconceptions about pork;
- provide easy to understand information on preparing and cooking pork;
- provide healthy pork recipes perhaps together with tasting opportunities in butchers or supermarkets to 'expose' consumers to pork;
- increase the presence of pork in the media.

This marketing campaign is needed to educate and inform consumers that pork is nutritionally equal to lean beef and chicken, it can be just as versatile and it can be incorporated into meals as part of a healthy balanced diet. It is evident that consumers are not informed and have not been exposed to pork and with attention and pork eating experience consumers may well increase their intakes.

5.   Conclusion

Australians are low pork consumers and consume predominantly beef and chicken however we do not have a detailed understanding as to why this is. Our data have identified the general perceptions of a group of low pork consuming volunteers have towards pork. We identified that taste, tenderness and juiciness of pork are important attributes considered when purchasing pork. More importantly we have identified that exposure to pork in the form of providing pork together with health information and pork recipes has altered the way these volunteers feel about pork which is reflected in their increased consumption of pork post participation in our dietary intervention trials in both the intervention and control groups. Marketing campaigns should be focused on disseminating positive information surrounding the potential health benefits of pork together with addressing common misconceptions of pork to help encourage the purchase and consumption of pork.

6.   Limitations

There are some limitations that need to be acknowledged when considering the outcomes.

Firstly, we need to acknowledge that this is not a random sample of the Australian population and may not reflect overall attitudes of the population at large. This was a population who might be more receptive to pork than the average consumer because they volunteered to participate in a study that might require them to consume pork regularly. Secondly, the questionnaire was designed to request information relating to a variety of factors which are likely to influence pork consumption from volunteers prior to and following participation in the dietary intervention trial. We have no information on attitudes and perceptions of pork of volunteers prior to commencing the research trials and because the first trial commenced in 2009, nearly three years ago, we asked volunteers to reflect on their attitudes and perception of pork prior to undertaking their study. Because attitudes and perceptions form behavior and behavior is developed over many years we believed that volunteers would be able to provide useful information relating to their perception of pork and what influenced it in the past. We acknowledge that the data relating to perceptions prior to participation may not be a true indicator of their perceptions.

Thirdly, the reliability of the study needs to be interpreted with caution. There were a number of questions that reported a correlation co-efficient of <0.7. This may be because the final number of respondents to the reliability testing was n=8. A larger number of volunteers completing the reliability study may have improved the correlation co-efficient. The reliability testing period was organised to be done within 2 weeks of sending the first questionnaire, however in fact after multiple reminders some of the questionnaires were not returned until 6-8wks which may have affected the responses.

7.   Recommendations

As a result of the outcomes in this study the following recommendations have been made:

Design a marketing campaign to:

- promote the health benefits of pork (based on previously funded Pork CRC projects);
- dispel common misconceptions about pork;
- provide easy to understand information on preparing and cooking pork;
- provide healthy pork recipes together with tasting opportunities in butchers or supermarkets;
- increase the presence of pork in the media.

8.   References

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