

Consumer Perceptions of the Publicised Link between Cancer and Eating Red and Processed Meat: A Qualitative and Quantitative Study

Abstract

Background – Eating a diet high in red and processed meat has been found to be attributable to an increased risk of some cancers. The aim of the present study was to investigate consumer intakes, beliefs and perceptions of red and processed meat in relation to the cancer risk.

Methods – A cross-sectional self-administered online questionnaire, including quantitative and qualitative questions, was completed by participants recruited from the UK adult population.

Results – The study was completed by n=40 participants. The greatest number of participants felt that limiting their intake of red and processed meat would be not really (n=18) or not at all (n=12) difficult. Qualitative analysis revealed that some participants would find it difficult to limit their intake because of taste, household diet and social norms. Just over 50% of participants (n=21) agreed in some way that cancer risks of red and processed meat were a greater concern to them now than in the past.

Conclusions – The present study suggests beliefs that limiting red and processed meat intake would not be difficult. However, barriers to change exist surrounding red and

processed meat as a staple in the UK diet. The results highlight that more could be done to raise awareness of the cancer risk associated with red and processed meat, which might encourage reduced intakes within the recommended maximum amount. Further research in this area could help to implement future interventions to increase knowledge and awareness of the cancer risk associated with high red and processed meat consumption.

Keywords: Red meat, processed meat, cancer risk

Introduction

Cancer is a leading cause of disease and death worldwide. It has been predicted that if recent trends in major cancers are seen globally in the future the burden of cancer will continue to rise (Cancer Research UK, 2014). In the UK, 42% of cancer cases are reported to be preventable and linked to lifestyle factors, including diet (Cancer Research UK, 2014). Eating a diet high in red and processed meat has been found to be attributable to an increased risk of some cancers (Parkin and Boyd, 2011). The largest body of evidence is for the link between red and processed meat, and colorectal cancer, particularly processed meat. Colorectal cancer is the fourth most common type of cancer and second biggest cause of cancer death in the UK (Bowel Cancer UK, 2017).

Different cancer types have different links with red and processed meat. Research suggests some cancer types have no link, some have a probable link and others have strong link. A report published by the International Agency for Research on Cancer (IARC) (2015) judged processed meat as ‘carcinogenic to humans’ based on sufficient evidence to draw a link

between eating processed meat and colorectal cancer. In comparison they found a limited amount of solid evidence available when assessing red meat, and red meat was therefore classified as “probably carcinogenic” based on associations with colorectal, pancreatic and prostate cancer (IARC, 2015). Evidence that suggests cancer risk increases with the amount of processed meat consumed, also caused the IARC (2015) to conclude that each 50g portion of processed meat eaten daily increases the risk of colorectal cancer by 18%.

Following the IARC (2015) report evaluating the carcinogenicity of processed and red meat, media coverage emerged with headlines such as: ‘bacon, ham and sausages, as big a cancer threat as smoking’ (Telegraph, 2015). WHO (2015) released a statement to clarify that the IARC review does not ask people to stop eating processed meats but indicates that reducing consumption of these products can reduce the risk of colorectal cancer. WHO (2015) also confirmed that although processed meat has been classified in the same category as causes of cancer such as tobacco smoking (IARC Group 1, carcinogenic to humans), this does not mean that they are equally dangerous; the IARC (2015) classifications describe the strength of the scientific evidence about an agent being a cause of cancer, rather than assessing the level of risk.

To put the the risk of eating processed meat into context, about 34,000 cancer deaths per year worldwide are attributable to diets high in processed meat, compared to about 1 million cancer deaths per year globally due to tobacco smoking and 600,000 per year due to alcohol consumption (Lim et al., 2012). If the reported associations of red meat and cancer were proven to be causal, the Global Disease project (Lim et al., 2012) estimates that diets high in red meat could be responsible for 50,000 cancer deaths per year worldwide.

Red and processed meats are a key component of the *Western diet* and consumption of these types of meat are high in developed countries (Durko and Malecka-Panas, 2014). The consumption of red and processed meat can be influenced by many complex factors including culture, taste, cost and socio-economic status. Processed meat is a low-cost source of protein and energy, which can be useful for those on a low income; for whom high intakes of processed meat are evident (Clonan et al., 2016). However, processed meat is usually also high in fat and cholesterol, of which high intakes are associated with poor health outcomes (Rohrmann et al., 2013).

Red meat is a rich source of high quality protein, containing a variety of important nutrients vital for optimal health, including iron, vitamin B12 and other B-complex vitamins, zinc, selenium and phosphorus (Pereira and Vicente, 2013). Red meat can therefore be an important part of a healthy balanced diet and the nutrients it contains provide a useful contribution to the intakes of key nutrients found to be in short supply in the diets of some population groups; particularly young infants, adolescents, women of child-bearing age and older adults (Wyness, 2016).

In the UK red and processed meats are popular. The National Diet and Nutrition survey (NDNS) for the years 2012/2013 – 2013/2014 (Bates et al., 2016) reported that mean consumption of red and processed meat for women aged 19 to 64 years was 47g and in those 65 years and over the mean intake was 57g; meeting the current recommendation that adult average intakes should not exceed 70g per day (DH, 2016). In contrast, it was reported that men were exceeding the current UK recommendation from DH (2016); mean

consumption for men aged 19 to 64 was 84g and in those aged 65 years and over it was 81g (Bates et al., 2016).

Mean consumption of red and processed meat for women aged 19 to 64 years was significantly lower in the NDNS for years 5 and 6 (combined) (47g), than in Years 1 and 2 (combined) (58g), showing a reduction in intakes of red and processed meat among women over time (Bates et al, 2016). However, there were no significant differences in consumption between paired years for men (Bates et al, 2016). One possible explanation for the high and unchanged intake of red and processed meat among men could be cultural behaviour; as eating meat, particularly red meat is perceived as a symbol of masculinity (Sobal, 2005).

The reduction in red and processed meat intakes of women over recent years suggests that widespread media coverage concerning the link between red and processed meat and cancer may have elevated consumer concerns. This could coincide with Mintel (2016) data which reports there has been a recent decline in bacon and sausage sales. However, although there appears to be a reduction in some red and processed meat intakes, Mintel (2016) also reported that processed meat remains a menu staple in the UK diet.

Encouraging new statistics show that an increased number of British adults are now aware of the cancer risks attached to eating processed meat compared to five years ago (WCRF, 2016). There is little specific research to explore recent public perceptions of red and processed meat, also as to why high consumption of these meats continues in certain population groups despite increased awareness of the reported health concerns. There is also a lack of research to highlight any specific changes to dietary habits that have occurred

in light of increased awareness of the cancer risk associated with high intakes of red and processed meat.

The aim of the present study was to investigate consumer intakes, beliefs and perceptions of red and processed meat in relation to the cancer risk.

Methods

Study design

The study design taken to investigate the research question was a cross sectional study. A cross sectional study has previously been used by Garagarza-Antunes (2016) to study perceptions of red and processed meat intake following the publication of the WHO (IARC, 2015) report warning of carcinogenic risk. Acknowledged advantages of cross sectional studies are their ability to determine prevalence and help the researcher identify associations (Mann, 2003). However, a limitation of cross sectional research is it can only give a snapshot at a specific point in time and the situation may provide differing results if another time-frame was to be chosen (Levin, 2016). A cross sectional study also does not show cause and effect and it could be that consumer attitudes and intakes changed, which were then picked up by media.

A self-administered questionnaire was an inexpensive method of surveying a sample of the general population and excludes interviewer bias. Conducting the questionnaire online was of benefit as it allowed messages to be delivered instantly, enabling a wider geographical area and therefore took little time to conduct. Although, conducting a questionnaire online

also has limitations; a constraint of this method is that some older adults have limited or no internet access (Remillard et al., 2014) and this may have had an impact on the age range of participants in the study. Using this method of data collection also meant there was no researcher on hand to help clarify any ambiguity.

Alternatively, a focus group could have been chosen as part of the study design for data collection. Such a method was undertaken by Deliens et al., (2014) when studying determinants of eating behaviour in university students, the researchers found that using a focus group with dynamic group interaction allowed them to get a better insight into the mechanisms behind students eating behaviours. However, as recognised by Smithson (2000) focus groups have the tendency for certain types of socially acceptable opinion to emerge, which may introduce bias into the data collection. Focus groups also require more time and organisation and rely on the attendance of participants whom agree to take part and time was limited for data collection in the present study.

Participants

Participants in the study were a sample of the UK adult population, recruited using a convenience sample of friends and family whom were invited to participate in the study through private social media message. A total of 40 participants took part in the study.

The inclusion criteria consisted of adults who eat meat. The topic of the research tool was based predominantly on red and processed meat and therefore the questions asked would be unsuitable for someone who does not eat meat to answer. The exclusion criteria were those educated to degree level in nutrition because they are likely to be more informed

about health concerns associated with certain foods, which could have increased bias in the results.

The study was approved by the Cardiff School of Health Sciences ethics panel, of Cardiff Metropolitan University. reference number 9234, prior to data collection (see appendix 2).

Materials

The self-administered, anonymous, online questionnaire (appendix 1) designed to gather data in the study, was administered using online survey software Qualtrics. Such online questionnaire software has been found useful in allowing for the creation of relatively customised questionnaires easily (Frankenstein et al., 2016).

The research tool included questions to collect both qualitative and quantitative data. As highlighted by Strolla et al., (2006) combining qualitative and quantitative methods of research can be particularly useful, as the qualitative results help to give meaning and understanding to the quantitative results.

To measure consumer intakes of red and processed meat a food frequency questionnaire (FFQ) was included within the research tool, which was adapted from the European Prospective Investigation into Cancer and Nutrition (EPIC) study (Riboli and Kaaks, 1997), and condensed as to only include foods related to the topic of red and processed meat.

To explore perceptions of red and processed meat and cancer risk some of the questions in the research tool were adapted from existing questions used by Mintel (2015; 2016) in

previous consumer research of red and processed meat. Other questions were designed for the purpose of the study and based on the theory of planned behaviour (Ajzen, 1991) and its links with beliefs about whether an individual thinks they might get cancer, beliefs about the influences of others around them as linked to red and processed meat being eaten more, and control factors that may potentially make it difficult for red and processed meat intake to be reduced.

A pilot study was completed post ethics to pre-test the research tool and ensure unambiguous questions (Fowler, 2002). The pilot consisted of 3 participants whom completed the questionnaire designed for the study. No significant changes to the research tool were required following the pilot and therefore all data collected was included in analysis.

Data analysis

Quantitative data was analysed using Microsoft Excel and Statistical Package for Social Sciences (SPSS), version 22 using the statistical tests chi squared and independent t-test depending on the type of data, to test the significance of specific results.

A scoring system was devised for the standard food frequency questionnaire to estimate intakes (See appendix 3).

Qualitative data was analysed in Microsoft Excel and using thematic analysis. Qualitative thematic analysis has previously been used by Bekeen et al., 2016 in a study of cancer survivors' views on diet and cancer, to identify themes, counts and representative quotes.

Results

A total of 40 participants completed the questionnaire and therefore consented to partake in the study. The composition of the completed response rate was 50% male and 50% female.

Table 1: Red and processed meat intake scores compared by gender

	Men and women	Men	Women
Red and processed meat: total of mean intake scores	0.75	0.86	0.64
Beef: roast, steak, mince, stew, casserole or slices	0.19	0.26	0.13
Beef burgers	0.07	0.08	0.06
Pork: roast, chops, stew or slices	0.06	0.07	0.05
Lamb: roast, chops, stew	0.04	0.04	0.03
Venison	0	0	0
Red meat: total of mean intake scores	0.36	0.45	0.26
Bacon	0.09	0.09	0.10
Ham	0.12	0.14	0.11
Corned beef, Spam, luncheon meats	0.02	0.02	0.02
Sausages	0.08	0.07	0.10
Savoury pies, e.g. pork pie, pasties, steak pie, sausage rolls	0.07	0.09	0.05
Processed meat: total of mean intake scores	0.39	0.41	0.38

Table 1 illustrates that reported intakes of red and processed meat were higher among men who participated in the study, than women. Statistical analysis using Independent t-test however, found that the difference between gender and red and processed meat intake was not statistically significant (Independent t-test, $p=0.132$, $t=1.539$, $df=19$).

Table 2: Health concerns of red meat compared to processed meat

	Statements		
	Health concerns put me off eating red meat more often	Health concerns put me off eating processed meat more often	The potential cancer risks of red and processed meat are a greater concern to me now than in the past
Strongly disagree	15% n=6	7.5% n=3	12.5% n=5
Disagree	32.5% n=13	17.5% n=7	22.5% n=9
Somewhat disagree	7.5% n=3	5% n=2	2.5% n=1
Neither agree nor disagree	7.5% n=3	15% n=6	10% n=4
Somewhat agree	15% n=6	5% n=2	27.5% n=11
Agree	20% n=8	35% n=14	17.5% n=7
Strongly agree	2.5% n=1	15% n=6	7.5% n=3

Table 2 illustrates that health concerns regarding eating red meat more often were less of a concern to participants than eating processed meat more often. A total of 37.5% (n=15) participants somewhat agreed, agreed or strongly agreed that health concerns put them off eating red meat more often, compared to 55% (n=24) processed meat.

The greatest number of participants 52.5% (n=21) agreed in some way with the statement ‘cancer risks of red and processed meat are a greater concern to me now than in the past’, compared to 37.5% (n=15) participants who disagreed in some way with this statement.

Table 3: Have intakes of red and/or processed meat changed at all in light of participants finding out about related health risks (if known)

	Total	Men	Women
Yes	32.5% n=13	12.5% n=5	20% n=8
No	57.5% n=23	35% n=14	22.5% n=9
Unaware of any related health risks	10% n=4	2.5% n=1	7.5% n=3

Table 3 illustrates that the greatest number of participants, 57.5% (n=23), had not changed their intake of red and/or processed meat despite finding out about related health risks.

The results show that a greater number of women 20% (n=8), than men 12.5% (n=5) had made changes to their intake of red and/or processed meat in light of finding out about related health risks. Statistical analysis, however, revealed this result comparing gender was not statistically significant (Chi squared, p=0.249, t=2.779, df=2).

The results also highlight that a total of 10% (n=4) participants were unaware of any related health risks associated with intakes of red and/or processed meat, a higher percentage of which were women 7.5% (n=3), compared to 2.5% (n=1) men.

Qualitative analysis revealed dietary changes in light of participants becoming aware of publicised health risks associated with red and processed meat consumption; of which included themes:

Decreased processed meat (n=4)

"I tend to try to eat less processed red meats now..." (ID 1)

Decreased red meat (n=3)

"...after learning about health problems related to eating too much red meat I cut it down" (ID 29)

Choosing alternatives (n=3)

"I try and choose white meat and fish more often..." (ID 40)

The main theme regarding how participants found out about health risks related to red and processed meat was through the **media (n=4)**.

"...I found out about related health risks through reading newspaper articles and online articles" (ID 40)

Table 4: Susceptibility to health messages regarding red meat in comparison to other health messages (irrelevant of if participants participate in these behaviours or not)

	Health Messages			
	Red and processed meat increases risk of cancer	Smoking increases risk of cancer	Drinking alcohol increases risk of cancer	Eating a healthy balanced diet reduces risk of cancer
0 – Not at all important to me	2.5% n=1	7.5% n=3	12.5% n=5	2.5% n=1
1 – Not important to me	22.5% n= 9	0% n=0	10% n=4	0% n=0
2/3 – Somewhat important to me	45% n=18	0% n=0	50% n=20	25% n=10
4 – Important to me	22.5% n=9	22.5% n=9	17.5% n=7	32.5% n=13
5 - Extremely important to me	7.5% n=3	62.5% n=25	10% n=4	40% n=16

Table 4 illustrates that the highest percentage of participants 62.5% (n=25) perceived the health message smoking increases risk of cancer as extremely important to them; in comparison only 7.5% (n=3) perceived the health message red and processed meat increases risk of cancer as extremely important to them. Most participants, 45% (n=18), rated the health message regarding red and processed meat and cancer risk as somewhat important to them. Similarly drinking alcohol increases risk of cancer which was rated as somewhat important to 50% (n=20) participants.

Table 5: Participant perceptions on whether limiting their red and processed meat intake would be difficult

	Would limiting your intake of red and processed meat be difficult?		
	Total	Men	Women
Not at all	30% n=12	17.5% n=7	12.5% n=5
Not really	45% n=18	15% n=6	30% n=12
Probably	7.5% n=3	7.5% n=3	0% n=0
Yes somewhat	12.5% n=5	5% n=2	7.5% n=3
Yes definitely	5% n=2	5% n=2	0% n=0

Table 5 illustrates that the greatest number of participants thought limiting their intake of red and processed meat would be not really (n=18) or not at all (n=12) difficult. This appeared to somewhat vary with gender, with 5% (n=2) of total participants that were men perceiving limiting their intake of red and processed meat as ‘yes definitely difficult’ compared to 0% (n=0) women. However, a greater number of men, 17.5% (n=7), compared to 12.5% women, thought that limiting their red and processed meat intake would be ‘not at all difficult’. In contrast, a greater number of women, 30% (n=12), compared to 15% (n=6) men thought limiting their intake of red and processed meat would be ‘not really difficult’.

Qualitative analysis revealed why some participants felt it would be difficult to limit their intake of red and processed meat:

Dietary norm (n=5)

“It’s a strong part of my everyday diet” (ID 18)

“Reduces meat options reducing variation in weekly meals” (ID 25)

Taste (n=2)

“I enjoy the taste of it so would miss it from my diet” (ID 15)

Table 6: Impact of family and/or friends on red and processed meat intake

	Do family and/or friends have an impact on your intake of red and processed meat?
Not at all	32.5% n=13
Not really	30% n=12
Probably	10% n=4
Yes somewhat	15% n=6
Yes definitely	12.5% n=5

Table 6 illustrates that the highest number of participants believed that family and/or friends do ‘not at all’ 32.5% (n=13) or ‘not really’ 30% (n=12) impact their intake of red and

processed meat. In comparison 15% (n=6) of participants believed that family and/or friends 'yes somewhat' impact their intake of red and processed meat, followed by 12.5% (n=5) who felt 'yes definitely' and 10% (n=4) probably.

Qualitative analysis highlighted some influences of family on red and processed meat intake including themes such as:

Household diet (n=4)

"My partner likes to eat a lot of red and processed meat, so I tend to eat more of what he eats..." (ID 40)

"My girlfriend is a vegetarian. Therefore, I eat less red and processed meat when sharing meals" (ID 38)

Family cooking (n=4)

"Family sometimes cook for me..." (ID 33).

"Family meals tend to have red meat" (ID 39).

Table 7: Participant beliefs of what would help them to reduce their intake of red and processed meat

Researcher suggested interventions	Total	Men	Women
Price of other foods (such as white meat and fish costing less)	60% n=24	32.5% n=13	27.5% n=11
More guidance on red and processed meat in supermarket meat isles	47.5% n=19	22.5% n=9	25% n=10
Leaflet including tips for cutting down, meal ideas and recipes	22.5% n=9	7.5% n=3	15% n=6
Online resource to learn more about healthy eating	20% n=8	7.5% n=3	12.5% n=5
Phone app that could show if you were eating too much red and processed meat, with alternative food and meal suggestions	20% n=8	7.5% n=3	12.5% n= 5

Table 7 highlights that the greatest number of participants (60% n=24), in both men (32.5% n=13) and women (27.5% n=11), believed the price of other foods such as white meat and fish costing less, would help them to reduce their intake of red and processed meat. The second greatest selection 47.5% (n=17) was more guidance being available in supermarket meat isles, as was also chosen by a similar amount of men (22.5% n=9) than women (25% n=10).

Discussion

The study aimed to investigate consumer intakes, beliefs and perceptions of red and processed meat in relation to the cancer risk.

Limitations of the study include the small sample size (n=40), which meant the study only represented a small sample of the population and overall perceptions of red and processed meat and cancer risk may vary if studied on a larger scale. The use of opportunistic sampling may have also reduced external validity and could have meant the study was skewed more towards participants that are educated and with higher health literacy, than a random sample of the wider public. The study also only highlights perceptions at one point in time and does not show what may have influenced those perceptions. The questions to assess reported dietary intakes were focussed on red and processed meat, and thereby participants were aware of the focus of the investigation, which may have led to underestimation.

In the present study, no statistically significant association was found between gender and red and processed meat intake (Independent t-test, $p=0.132$, $t=1.539$, $df=19$). However, previous data by Bates et al., (2016) found statistically significant results to suggest that men consume more red and processed meat than women. Therefore, perhaps a study with a larger sample size might find statistically significant data in agreement with Bates et al., (2016).

The overall consensus regarding health concerns of red and processed meat consumption, was that eating red meat more often was less of a concern to participants (37.5%) than eating processed meat more often (55%). These findings could be seen to correlate with the IARC (2015) report which classified processed meat as ‘carcinogenic’ to humans and red meat as ‘probably carcinogenic’; as health concerns appear elevated for processed meat in comparison to red meat. Although, this may also potentially reflect that red meat is viewed by the consumer as good, due to containing key nutrients such as protein, iron and B12 (Pereira and Vicente, 2012). Whereas processed meat is generally just viewed as bad, because of long standing health messages about limiting processed foods, of which many are high in fat, sugar and salt (NHS, 2017).

Processed meat safety could also be a concern. The horse meat scandal was widely publicised in the media and was found by the Food Standards Agency (2013) to have had a negative impact on consumer attitudes towards processed meat. This may have influenced health concerns regarding processed meat in the study, of which might not necessarily relate to the carcinogenic properties.

The greatest number of participants (52.5%) agreed in some way with the statement ‘cancer risks of red and processed meat are a greater concern to me now than in the past’, compared to 37.5% participants who disagreed in some way with this statement. This also suggests that the IARC (2015) report and sub sequential media coverage regarding cancer risk and red and processed meat may have elevated concerns. Although, there is potentially more that could be done to raise awareness of red and processed meat as a risk factor for some cancers.

Despite finding out about related health risks, 57.5% of participants stated they had not changed their intake of red and/or processed meat. It is difficult to separate from this result what health concerns are specifically about cancer and which are wider concerns. Although from a health perspective, all concerns may lead to people consuming less. Qualitative analysis revealed a small number of participants were choosing alternatives (n=3) and had decreased their red (n=3) or processed meat intake (n=4) as a result of finding out about related health risks. Choosing alternatives such as white meat and fish more often, and having red and processed meats less often, may also have further health benefits, as well as reducing cancer risk, as these tend to be lower in saturated fat.

Results revealed that most participants believed limiting their intake of red and processed meat would be not really (45%) or not at all difficult (30%). This suggests that many people feel able to reduce their intake, but barriers to change exist, as highlighted in the study as taste, household diet and social norms. These results could have been strengthened in the study by finding out what participants felt they could do to reduce their consumption of red and processed meat; this could help to understand if they felt it was just a matter of swaps to limit their intake of red and processed meat. It could have also been valuable in the study to find out if participants would actually be willing to reduce their red and processed meat consumption due to cancer risk, as this may have potentially highlighted motivation to change to meet the recommendation by DH (2016).

The greatest number of study participants (60%) selected the price of other foods, such as white meat and fish costing less, as the main factor that could be helpful to reduce red and

processed meat consumption. The higher cost of fish compared to lower cost of red and processed meat has previously been highlighted by Tong et al., (2018), which could in part explain why many participants in the present study had not altered their intake of red and/or processed meat, despite finding out about the associated cancer risk.

The second greatest number of participants (47.5%) selected more guidance in supermarket meat aisles as what would be helpful in lowering consumption of red and processed meat. A study by Milliron et al., (2012) tested the efficacy of a similar intervention. A supermarket point-of-purchase healthful shopping programme, including shelf signs identifying healthful foods, sample shopping lists, tips, and in-person nutrition education on the nutrient composition of food purchases, was found to result in some healthier purchasing patterns (Milliron et al., 2012). Such an intervention, however, would require a careful approach, as red meat is a useful source of important nutrients such as iron, vitamin B12 and zinc which are found in short supply in some population groups (Pereira and Vincente, 2013; Wyness, 2016). If people were made fearful of red meat it could cause an increase in deficiencies and have a detrimental effect on health for some. Likewise, for those on a low income who many highly rely on processed meat as a low-cost source of protein and energy (Clonan et al., 2016). Therefore, there would likely need to be education given on alternative low-cost sources of protein to base meals on, if people in this population group were encouraged to buy less processed meat in the supermarket.

The present study found that the health message 'smoking increases risk of cancer' was perceived as being extremely important to 67.5% of participants. Whilst 'red and processed meat increases risk of cancer' was only perceived as being extremely important to 7.5%.

These perceptions may reflect public health campaigns over the years to promote the dangers of smoking and encourage cessation; compared to very little to promote the cancer risk of high red and processed meat consumption. Correspondingly, data from Lim et al., (2012) indicates that a greater number of cancer deaths globally each year are attributable to tobacco smoking than diets high in red and processed meat. This would suggest that participants were within reason to feel red and processed meat intake was less of a risk to them than smoking in regard to cancer. Nevertheless, according to IARC (2015) classification high intakes of red and processed meat should still be considered a risk.

Based on the study findings, future research in this area could involve investigating the potential impact of a health education campaign on red and processed meat intake. To show this, the impact of a particular media coverage on red and processed meats and cancer risk could be measured, through taking baseline consumer views, showing participants a media video, then re-measuring views and revisiting a month later. This could lead to a health education campaign led by dietitians to help to further increase public knowledge and awareness in this area, which might encourage reduced intakes within the recommended maximum 70g per day amount (DH, 2016). A dietitian led health education campaign has previously been proven successful in helping to lower salt and saturated fat intakes (BHF, 2014).

Dietitians are well placed to promote the DH (2016) recommendation for red and processed meat in their practice where appropriate; such as for patients that reveal high intakes in

dietetic consultations, and where reducing red and processed meat would not have a negative impact on a patient's nutritional status.

To conclude, the present study suggests beliefs that limiting red and processed meat intake would not be difficult. However, barriers to change exist surrounding red and processed meat as a staple in the UK diet. The study highlights that more could be done to raise awareness of the cancer risk associated with red and processed meat, which might encourage reduced intakes within the DH (2016) recommended maximum 70g per day amount. Further research in this area could help to implement future interventions to increase knowledge and raise awareness of the cancer risk associated with high red and processed meat consumption and promote a reduction in those consuming high amounts.

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Appendix 1 – Research tool

Questionnaire

For the purpose of this questionnaire:

Processed meat is meat which has been smoked, cured or had salt or chemical preservatives added rather than having just been cooked or reformed; such as sausages, salami, bacon ham, corned beef (or similar) and pates.

Red meat includes beef, lamb, pork and venison.

Food frequency - How often do you eat the following foods (Tick one for each):

Foods	Average use							
	Never or less than once/month	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4+ per day
Red and Processed meat (Medium serving)								
Beef: roast, steak, mince, stew, casserole or slices								
Beef burgers								
Pork: roast, chops, stew or slices								
Lamb: roast, chops, stew								
Venison								
Bacon								
Ham								
Corned beef, Spam, luncheon meats								
Sausages								
Savoury pies, e.g. pork pie, pasties, steak pie, sausage rolls								

To what extent do you agree or disagree with the following statements (Tick one for each):

Health concerns put me off eating red meat more often? (Mintel 2015 – red meat)

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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Health concerns put me off eating processed meat more often? (Mintel 2015 – red meat)

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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The potential cancer risks of red and processed meat are a greater concern to me now than in the past? (Mintel 2016 – processed meat)

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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How important are the following health messages to you? Irrelevant if you participate in these behaviours or not (Tick one for each):

Red and processed meat increases risk of cancer.

1 Not at all important to me	2	3	4	5 Extremely important to me
--	----------	----------	----------	---------------------------------------

Smoking increases risk of cancer.

1 Not at all important to me	2	3	4	5 Extremely important to me
--	----------	----------	----------	---------------------------------------

Drinking alcohol increases risk of cancer.

1 Not at all important to me	2	3	4	5 Extremely important to me
--	----------	----------	----------	---------------------------------------

Eating a healthy balanced diet reduces risk of cancer.

1 Not at all important to me	2	3	4	5 Extremely important to me
--	----------	----------	----------	---------------------------------------

Yes/No and short answer questions: (Tick one for each)

Has your intake of red and processed meat changed at all in light of finding out about related health risks?

Yes	No	Unaware of any health risks
-----	----	-----------------------------

If yes. Explain?

.....
.....

Do you feel that limiting your intake of red and processed meat would be difficult?

Yes	No
-----	----

If yes. Why?

.....
.....

Do others around you impact your intake of red and processed meat?

Yes	No
-----	----

If yes. Explain?

.....
.....

If anything, what would help you to reduce the amount of red and processed meat you eat?

.....
.....
.....

Thank you for your time completing this questionnaire.

Appendix 2 – Ethics approval letter



Wednesday, 28 June 2017

██████████ BSc (Hons) Human Nutrition & Dietetics, Cardiff School of Health Sciences

Dear Applicant

Re: Application for Ethical Approval: Consumer perceptions of the publicised link between cancer and eating red and processed meat: a qualitative and quantitative study

Project Reference Number : 9234

Your ethics application, as shown above, was considered by the Health Care and Food Ethics Panel on 28/06/2017.

I am pleased to inform you that your application for ethical approval was **APPROVED**.

Minor issues may still need addressing before you commence any work – if so these will be listed below.

N/A

Where changes to the information sheet, consent form and/or procedures are deemed necessary you must submit revised versions to the relevant ethics inbox. If you are a student – your supervisor must do this on your behalf.

Note: Failure to comply with any issues listed above will nullify this approval.

Standard Conditions of Approval

1. Your Ethics Application has been given a Project Reference number as above. This **MUST** be quoted on all documentation relating to the project (E.g. consent forms, information sheets), together with the full project title.
2. All documents must also have the approved University Logo and the Version number in addition to the reference and project title as above
3. A full Risk Assessment must be undertaken for this proposal, as appropriate, and be made available to the Committee if requested.
4. Any changes in connection to the proposal as approved, must be referred to the Panel/Committee for consideration without delay quoting your Project Reference Number. Changes to the proposed project may have ethical implications so must be approved.
5. Any untoward incident which occurs in connection with this proposal must be reported back to the Panel without delay.

6. If your project involves the use of human samples, your approval is given on the condition that you or your supervisor notify the HTA Designated Individual of your intention to work with such material by completing the form entitled "Notification of Intention to Work with Human Samples". The form must be submitted to the PD (Sean Duggan), BEFORE any activity on this project is undertaken

This approval expires on **28/06/2018**. It is your responsibility to reapply / request extension if necessary.

Yours sincerely

Prof. [REDACTED] Chair of Department of Healthcare and Food Ethics Panel

Cardiff School of Health Sciences Llandaf Campus Western Avenue, Cardiff CF5 2YB Tel : 029
[REDACTED]

Appendix 3 – Codebook for study dataset

Question	Coding instructions	Data type	SPSS 'friendly' variable name
1. Food frequency scores – red and processed meat	Never or less than once/month 0 1-3 per month 0.07 Once a week 0.14 2-4 per week 0.5 5-6 per week 0.7 Once a day 1.0 2-3 per day 2.0 4+ per day 3.0	Scale	Foodfreq
2. Health concerns put me off eating red meat more often?	Strongly agree 1 Agree 2 Somewhat agree 3 Neither agree nor disagree 4 Somewhat disagree 5 Disagree 6 Strongly disagree 7	Ordinal	HC*red
3. Health concerns put me off eating processed meat more often?	Strongly agree 1 Agree 2 Somewhat agree 3 Neither agree nor disagree 4 Somewhat disagree 5 Disagree 6 Strongly disagree 7	Ordinal	HC*proc
4. The potential cancer risks of red and processed meat are a greater concern to me now than in the past?	Strongly agree 1 Agree 2 Somewhat agree 3 Neither agree nor disagree 4 Somewhat disagree 5 Disagree 6 Strongly disagree 7	Ordinal	C*risk
5. How important to you is the health message... Red and processed meat increases risk of cancer	Not at all important to me 0 Not so important to me 1 Somewhat important to me 2/3 Important to me 4 Extremely important to me 5	Ordinal	Meat*inc
6. How important to you is the health message... Smoking increases risk of cancer	Not at all important to me 0 Not so important to me 1 Somewhat important to me 2/3 Important to me 4 Extremely important to me 5	Ordinal	Smok*inc
7. How important to you is the health message... Drinking alcohol increases risk of cancer	Not at all important to me 0 Not so important to me 1 Somewhat important to me 2/3 Important to me 4 Extremely important to me 5	Ordinal	Alc*inc

8. How important to you is the health message... Eating a healthy balanced diet reduces risk of cancer	Not at all important to me 0 Not so important to me 1 Somewhat important to me 2/3 Important to me 4 Extremely important to me 5	Ordinal	Diet*red
9. Has your intake of red and processed meat changed at all in light of finding out about related health risks?	Yes 1 No 2 Unaware of any health risks 3	Nominal	change
10. Do you feel that limiting your intake of red and processed meat would be difficult?	Yes definitely 1 Yes somewhat 2 Probably 3 Not really 4 Not at all 5	Ordinal	Lim*dif
11. Do family and friends have an impact on your intake of red and processed meat?	Yes definitely 1 Yes somewhat 2 Probably 3 Not really 4 Not at all 5	Ordinal	F+f*impact
12. In your opinion, what would help you to eat less red and processed meat?	Price 1 Leaflet 2 Phone app 3 Online resource 4 Supermarket guidance 5 Other 6	Ordinal	Eat*less
13. Age	18-24 years 1 25-34 years 2 35-44 years 3 45-54 years 4 55-64 5 65-74 6 75+ 7	Ordinal	Age
14. Gender	Male 1 Female 2 Would rather not say 3	Nominal	Gender

Appendix 4 – Summary of data collected (see attached Excel spreadsheet)