MEAT, FISH AND DAIRY PRODUCTS AND THE RISK OF CANCER

WCRF/AICR GRADING		DECREASES RISK		INCREASES RISK	
		Exposure	Cancer site	Exposure	Cancer site
STRONG EVIDENCE	**Convincing**			**Processed meat[1]**	**Colorectum 2017**
	Probable	**Dairy products**	**Colorectum 2017[2]**	**Red meat[3]** **Cantonese-style salted fish[4]**	**Colorectum 2017** **Nasopharynx 2017**
LIMITED EVIDENCE	**Limited – suggestive**	Fish	Liver 2015 Colorectum 2017	Red meat[3]	Nasopharynx 2017 Lung 2017 Pancreas 2012
				Processed meat[1]	Nasopharynx 2017 Oesophagus (squamous cell carcinoma) 2016 Lung 2017 Stomach (non-cardia) 2016 Pancreas 2012
				Foods containing haem iron[6]	Colorectum 2017
				Grilled (broiled) or barbecued (charbroiled) meat and fish	Stomach 2016
		Dairy products	Breast (premenopause) 2017[5]	Dairy products	Prostate 2014[7]
		Diets high in calcium	Breast (premenopause) 2017 Breast (postmenopause) 2017	Diets high in calcium	Prostate 2014
STRONG EVIDENCE	**Substantial effect on risk unlikely**	None identified			

1 The term ‘processed meat’ in the CUP refers to meats transformed through salting, curing, fermentation, smoking or other processes to enhance flavour or improve preservation.

2 The evidence for dairy products and colorectal cancer includes total dairy, milk and cheese and dietary calcium intakes.

3 The term ‘red meat’ in the CUP refers to beef, veal, pork, lamb, mutton, horse and goat.

4 Cantonese-style salted fish is part of the traditional diet consumed by people living in the Pearl River Delta region in Southern China. This style of fish, which is prepared with less salt than is used in the northern part of China, is allowed to ferment, and so is eaten in a decomposed state. This conclusion does not apply to fish preserved (or salted) by other means. Evidence is primarily from case-control studies, there is only one cohort study.

5 The evidence for dairy products and premenopausal breast cancer includes total dairy and milk intakes.

6 The term ‘haem iron’ refers to iron attached to a haemoprotein, which is found only in foods of animal origin. Foods that contain haem iron include red and processed meat, fish and poultry.

7 The evidence for dairy products and prostate cancer includes total dairy, milk, cheese and yogurt intakes.

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Summary of CUP dose–response meta-analyses of red meat intake[1] and the risk of cancer

Cancer	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment / contrast	I^2 (%)	Conclusion[2]	Date of CUP cancer report[3]
Colorectum	14	8	6,662	1.12 (1.00–1.25)	100 g/day	24	**Probable: Increases risk**	2017
Nasopharynx[4]	7	6	1,858	1.35 (1.21–1.51)	<100 vs 0 g/week	–	**Limited – suggestive: Increases risk**	2017
Lung	7	7	9,765	1.22 (1.02–1.46)	100 g/day	66	**Limited – suggestive: Increases risk**	2017
Pancreas	10	8	2,761	1.19 (0.98–1.45)	100 g/day	52	**Limited – suggestive: Increases risk**	2012

1 The term 'red meat' in the CUP refers to beef, veal, pork, lamb, mutton, horse and goat.

2 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'probable' and 'limited – suggestive'.

3 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from those for nasopharynx, cervix and skin, for which the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

4 A dose–response meta-analysis of cohort studies could not be conducted in the CUP as none were identified. Evidence is from a published highest versus lowest meta-analysis of case-control studies [12].

[1] Cancers at the following sites are reviewed in the CUP: mouth, pharynx and larynx; nasopharynx; oesophagus; lung; stomach; pancreas; gallbladder; liver; colorectum; breast; ovary; endometrium; cervix; prostate; kidney; bladder; and skin. CUP cancer reports not are currently available for nasopharynx, cervix and skin.

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Summary of published pooled analyses of red meat intake and the risk of colorectal cancer

Publication	Increment/ contrast	RR (95% CI)	No. of studies	No. of cases
Genetics and Epidemiology of Colorectal Cancer Consortium (GECCO) and Colon Cancer Family Registry (CCFR) [69]	1 serving/day	1.05 (0.94–1.18)	7 nested case-control studies	3,488
Genetics and Epidemiology of Colorectal Cancer Consortium (GECCO) and Colon Cancer Family Registry (CCFR) [70]	Highest vs lowest	1.06 (0.90–1.24)[1]	5 nested case-control studies	2,564
UK Dietary Cohort Consortium [71][2]	50 g/day	1.01 (0.84–1.22)	7 cohort studies	579

1 Relationship was not modified by NAT2 enzyme activity (based on *polymorphism* at rs1495741).

2 The average intake of red meat was low (38.2 grams per day in men and 28.7 grams per day in women controls), and there were a high number of vegetarians in the cases.

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Summary of CUP dose–response meta-analyses of processed meat[1] intake and the risk of cancer

Cancer	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment / contrast	I^2 (%)	Conclusion[2]	Date of CUP cancer report[3]
Colorectum	13	10	10,738	1.16 (1.08–1.26)	50 g/day	20	**Convincing: Increases risk**	2017
Nasopharynx[4]	13	10	5,434	1.46 (1.31–1.64)	<30 vs 0 g/week	–	**Limited – suggestive: Increases risk**	2017
Oesophagus (squamous cell carcinoma)	2	2	322	1.34 (1.00–1.81)	50 g/day	0	**Limited – suggestive: Increases risk**	2016
Lung	9	7	10,292	1.14 (1.05–1.24)	50 g/day	0	**Limited – suggestive: Increases risk**	2017
Stomach (non-cardia)	3	3	1,149	1.18 (1.01–1.38)	50 g/day	3	**Limited – suggestive: Increases risk**	2016
Pancreas	8	7	2,748	1.17 (1.01–1.34)	50 g/day	0	**Limited – suggestive: Increases risk**	2012

1 The term 'processed meat' in the CUP refers to meats transformed through salting, curing, fermentation, smoking or other processes to enhance flavour or improve preservation.

2 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'convincing' and 'limited – suggestive'.

3 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

4 A dose–response meta-analysis of cohort studies could not be conducted in the CUP as none were identified. Evidence is from a published highest versus lowest meta-analysis of case-control studies [12].

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Summary of published pooled analyses of processed meat intake and the risk of colorectal cancer

Publication	Increment/ contrast	RR (95% CI)	p value	No. of studies	No. of cases
Genetics and Epidemiology of Colorectal Cancer Consortium (GECCO) and Colon Cancer Family Registry (CCFR) [69]	1 serving/ day	1.48 (1.30–1.70)	–	7 nested case-control studies	3,488
UK Dietary Cohort Consortium [71]	50 g/day	0.88 (0.68–1.15)	0.36	7 cohort studies	579

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CUP dose–response meta-analysis for consumption of foods containing haem iron[1] and the risk of colorectal cancer

Cancer	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment	I^2 (%)	Conclusion[2]	Date of CUP cancer report[3]
Colorectum	8	6	6,070	1.04 (0.98–1.10)	1 mg/day	0	**Limited – suggestive: Increases risk**	2017

1 The term 'haem iron' refers to iron attached to a haemoprotein, which is found only in foods of animal origin. Foods that contain haem iron include red and processed meat, fish and poultry.

2 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'limited – suggestive'.

3 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

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Summary of CUP dose–response meta-analyses of fish intake and the risk of cancer

Cancer	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment	I^2 (%)	Conclusion[1]	Date of CUP cancer report[2]
Liver	6	4	1,812	0.94 (0.89–0.99)	20 g/day	53	**Limited – suggestive: Increases risk**	2015
Colorectum	11	18	10,356	0.89 (0.80–0.99)	100 g/day	0	**Limited – suggestive: Decreases risk**	2017

1 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'limited – suggestive'.

2 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

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Summary of CUP dose–response meta-analyses of case-control studies for consumption of salted fish (including Cantonese-style salted fish)[1] and the risk of nasopharyngeal cancer

Cancer	Adult/ childhood consump-tion	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment	I^2 (%)	Conclusion[2]	Date of CUP cancer report[3]
Nasopharynx	Adult	28	12	5,391	1.31 (1.16–1.47)	1 time/ week	78	**Probable: Increases risk**	2017
	Childhood	16	9	1,673	1.35 (1.14–1.60)	1 time/ week	83		

1 Cantonese-style salted fish is part of the traditional diet consumed by people living in the Pearl River Delta region in Southern China. This style of fish, which is prepared with less salt than is used in the northern part of China, is allowed to ferment, and so is eaten in a decomposed state. This conclusion does not apply to fish preserved (or salted) by other means. Evidence is primarily from case-control studies, there is only one cohort study.

2 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'probable'.

3 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

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Summary of highest versus lowest analyses from individual published studies for consumption of grilled (broiled) or barbecued (charboiled) meat and fish and the risk of stomach cancer

Cancer	Exposure	No. of cases	Risk estimate (95% CI)/p value	Conclusion[1]	Date of CUP cancer report[2]
Stomach[3]	Grilled fish [95]	79 deaths	1.7 $p < 0.05$	**Limited – suggestive: Increases risk**	2016
	Grilled fish [96]	1,270 diagnoses	0.84 (0.55–1.29)		
	Grilled meat [97]	57 deaths	2.27 (1.06–4.85)		

1 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'limited – suggestive'.

2 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

3 A dose–response meta-analysis of cohort studies could not be conducted in the CUP. Evidence is from three published highest versus lowest meta-analyses [95–97].

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Summary of CUP dose–response meta-analyses for consumption of dairy products and the risk of cancer

Cancer	Type of evidence	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment	I^2 (%)	Conclusion[1]	Date of CUP cancer report[2]
Colorectum	Dairy products	14	10	14,859	0.87 (0.83–0.90)	400 g/day	18	**Probable: Decreases risk**	2017
	Milk	13	9	10,738	0.94 (0.92–0.96)	200 g/day	0		
	Cheese	9	7	6,462	0.94 (0.87–1.02)	50 g/day	10		
	Dietary calcium	20	13	11,519	0.94 (0.93–0.96)	200 mg/day	0		
Breast (premeno-pause)[3]	Dairy products	13	7	2,862	0.95 (0.92–0.99)	200 g/day	0	**Limited – suggestive: Decreases risk**	2017
Prostate[4]	Dairy products	21	15	38,107	1.07 (1.02–1.12)	400 g/day	0	**Limited – suggestive: Increases risk**	2014

1 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'probable' and 'limited – suggestive'.

2 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

3 The evidence for dairy products and premenopausal breast cancer includes total dairy shown in the table and also milk intakes see CUP breast cancer report 2017 for further information.

4 The evidence for dairy products and prostate cancer includes total dairy shown in the table and also milk, cheese and yogurt intakes see CUP prostate cancer report 2014 for further information.

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Summary of published pooled analyses for consumption of milk and the risk of colorectal cancer

Publication	Increment	RR (95% CI)	No. of studies	No. of cases
Pooling Project of Prospective Studies on Diet and Cancer [112]	200 g/day	0.95 (0.92–0.97)	10 cohort studies	4,992

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Summary of published pooled analyses of cheese intake and the risk of colorectal cancer

Publication	Contrast	RR (95% CI)	p value	No. of studies	No. of cases
Pooling Project of Prospective Studies on Diet and Cancer [112]	≥ 25 vs < 5 g/day	1.10 (0.98–1.24)	0.37	10 cohort studies	7,157

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Summary of published pooled analyses of dietary calcium intake and the risk of colorectal cancer

Publication	Contrast	RR (95% CI)	drinking milk p value	No. of studies	No. of cases
Pooling Project of Prospective Studies on Diet and Cancer [112]	Highest vs lowest	0.86 (0.78–0.95)	0.02	10 cohort studies	4,992

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Summary of CUP dose–response meta-analyses of diets high in calcium and the risk of cancer

Cancer	Total no. of studies	No. of studies in meta-analysis	No. of cases	Risk estimate (95% CI)	Increment	I^2 (%)	Conclusion[1]	Date of CUP cancer report[2]
Breast (premenopause)	6	5	2,980	0.87 (0.76–0.99)	300 mg/day	67	**Limited – suggestive: Decreases risk**	2017
Breast (postmenopause)	7	6	10,137	0.96 (0.94–0.99)	300 mg/day	0	**Limited – suggestive: Decreases risk**	2017
Prostate	16	15	38,749	1.05 (1.02–1.09)	400 mg/day	49	**Limited – suggestive: Increases risk**	2014

1 See Definitions of WCRF/AICR grading criteria (**Section 1**: Meat, fish and dairy products and the risk of cancer: a summary matrix) for explanations of what the Panel means by 'limited – suggestive'.

2 Throughout this Third Expert Report, the year given for each cancer site is the year the CUP cancer report was published, apart from for nasopharynx, cervix and skin, where the year given is the year the SLR was last reviewed. Updated CUP cancer reports for nasopharynx and skin will be published in the future.

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