



RED MEAT AND PROCESSED MEAT

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Table 2.7.4 Case-control studies: Processed meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
Goodman et al. (1992) Hawaii 1983–85	Cases: 326; Population-based cancer registry, histologically verified. Controls: 865; Random digit dialing or random household survey of 2% of residents, matched by age, sex Exposure assessment method: Questionnaire; Home interviews: 130 food items in FFQ plus 3-day measured food records; estimation of intake of nitrite and nitrosamines	Lung	Processed meat: sausage, quartiles	NR	1.6 (0.9–2.9)	Age, ethnicity, smoking, pack-years, β -carotene intake
			Men: Q2 vs Q1			
			Q3 vs Q1	NR	1.6 (0.9–2.9)	
			Q4 vs Q1	NR	3.4 (2–6)	
			Women: Q2 vs Q1	NR	1.3 (0.6–2.7)	
			Q3 vs Q1	NR	1.2 (0.5–2.7)	
	Q4 vs Q1	NR	1.3 (0.5–3.2)			
Hu et al. (2002) Canada 1994–1997	Cases: 161; Population-based. Cancer registry. Women never smokers only Controls: 483; Provincial Health Insurance Plans, Ministry of Finance or random digit dialing Exposure assessment method: Questionnaire; postal questionnaire with telephone follow-up	Lung	Smoked meat (tertile)			Age, province, education, social class and total energy intake
			T1	91	1	
			T2 vs T1	40	1.3 (0.8–2.3)	
			T3 vs T1	23	2.1 (1.1–4)	
			Trend-test p-value: 0.02			
Aune et al. (2009) Uruguay 1996–2004	Cases: 931; Multisite hospital-based case-control study. Incident cases Controls: 2,032; Hospital controls: non-neoplastic diseases not related to smoking, drinking or diet (mainly minor surgery) Exposure assessment method: Questionnaire; 64 food items	Lung	(tertile)			Age, sex, residence, education, smoking, alcohol, income, BMI, food items, energy intake
			Processed meat: tertile 1, (0–10 g/d)	165	1	
			T2 (> 10–40 g/d) vs T1	453	1.17 (0.92–1.5)	
			T3 (> 40–258.8 g/d) vs T1	313	1.7 (1.28–2.25)	
			Trend-test p-value: 0.0001			

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De Stefani et al. (2009) Uruguay 1996–2004	Cases: 846; Hospital-based, same as Aune et al. (2009). Men only Controls: 846; Hospital controls: non-neoplastic diseases not related to tobacco smoking, alcohol drinking or diet Exposure assessment method: Questionnaire	Lung	Processed meat: servings/week ≤ 1.1	187	1	Age, state of residence, education, family history of lung cancer, BMI, smoking status, smoking cessation, number of cigarettes smoked per day among current smokers, age of start smoking, total energy intake, total vegetables and fruits intake, reduced glutathione, nonmeat fatty foods
			1.2–2.5	223	1.06 (0.75–1.5)	
			1.4–2.5	219	1.31 (0.87–1.97)	
			≤ 4.6	217	1.79 (1.22–2.65)	
			Trend-test p-value: 0.001			
Lam et al. (2009) Italy 2002–2005	Cases: 1,903; Population-based incident histologically confirmed cases Controls: 2,073; Regional Health Service, matched by age, residence, gender Exposure assessment method: Questionnaire; self administered 58-item FFQ, plus 24-hour recalls to estimate portion sizes. Mutagens estimated from CHARRED database	Lung	(Tertile)			Age, gender, area of residence, education, BMI, alcohol, smoking intensity in pack-year per day, duration of cigarettes smoking, and years since last cigarettes
			Processed meat T1 (reference)	548	1	
			T2 vs T1	604	1.3 (1.1–1.5)	
			T3 vs T1	721	1.7 (1.4–2.1)	
			Trend-test p-value: 0.001			
Lim et al. (2011) Singapore 2005–2008	Cases: 258; Hospital-based. Non-smoking Chinese women only Controls: 712; Hospital controls with wide range of mainly mild conditions Exposure assessment method: Questionnaire; meats: 18 items in the FFQ	Lung	Processed meats (servings/week)			Age, history of cancer, country of origin, dwelling type, year of education, usual body mass index, and fruit and vegetable intake
			T1 (< 0.3)	73	1	
			T2 (0.30– < 0.70)	100	1.04 (0.71–1.51)	
			T3 (> 0.69)	82	0.83 (0.55–1.25)	
			Trend-test p-value: 0.37			

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		Lung	Bacon (servings/week)			Same as above
			T1 (0)	173	1	
			T2 (> 0)	83	1.51 (1.06–2.16)	
		Lung	Ham (servings/week)			Same as above
			T1 (0)	148	1	
			T2 (> 0–0.10)	67	1.12 (0.77–1.62)	
			T3 (> 0.10)	43	0.81 (0.52–1.26)	
			Trend-test p-value: 0.52			
		Lung	Luncheon meat (servings/week)			Same as above
			T1 (< 5.61)	101	1	
			T2 (> 5.60–12.00)	84	1.53 (1.06–2.22)	
			T3 (> 12.00)	72	1.2 (0.82–1.74)	
			Trend-test p-value: 0.25			
		Lung	Sausages (servings/week)			Same as above
			T1 (< 9.70)	147	1	
			T2 (9.70–19.60)	34	1.2 (0.74–1.93)	
			T3 (> 19.60)	77	1 (0.69–1.43)	
			Trend-test p-value: 0.93			
		Lung	Chinese sausages/waxed meat (servings/week)			Same as above
			T1 (< 2.51)	113	1	
			T2 (> 2.50–10.00)	58	1.54 (1.03–2.31)	
			T3 (> 10.00)	87	1.23 (0.87–1.74)	
			Trend-test p-value: 0.19			

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Deneo-Pellegrini et al. (2015) Uruguay 1995–2004	Cases: 300 SCC; see De Stefani et al. (2012) and Aune et al. (2009). Restricted to squamous cell carcinomas in men Controls: 600; see De Stefani et al. (2012) and Aune et al. (2009). Exposure assessment method: Questionnaire	Lung	Processed meat: tertile 1 (< 17.1 g/d) T2 (17.1–39.2 g/d) vs T1 T3 vs T1 Trend-test p-value: 0.69	176 65 59	1 0.79 (0.53–1.18) 1.09 (0.73–1.64)	Age, residence, education, family history, body mass index, smoking status, smoking cessation, number of cigarettes smoked per day among current smokers, total energy, and total vegetable and fruit intakes

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