

Table 2.1. Case-control studies of Chinese-style salted fish and nasopharyngeal carcinoma

Reference, study location and period	Characteristics of cases	Characteristics of controls	Exposure categories	Odds ratios (95% CI)	Adjustment for potential confounders	Comments
Henderson <i>et al.</i> (1976) ; Henderson & Louie (1978) USA, California	74 Chinese cases.	110 Chinese hospital/clinic controls.	<i>Salted fish</i> Never Any Current Use At least 1/month 1/week >1/week p for trend	1.0 2.1 (0.6–6.3) 1.6 2.1 3.1 0.02		Data on salted fish consumption were only given for Chinese cases and controls, who comprised 47% of the cases and 41% of the controls.
Geser <i>et al.</i> (1978) Hong Kong	150 Chinese cases	150 Chinese hospital controls	<i>Salted fish</i> Never Current use After weaning	1.0 No association 2.6 (p<0.01)		Use around weaning based on interview of senior women in 108 cases and 103 control households.
Armstrong & Eng (1983) Malaysia	100 Chinese cases from General Hospital, Kuala Lumpur	100 Chinese controls selected from the neighbourhood of the case	Salted fish <i>In childhood</i> No Yes Never Less than daily Daily p for trend	1.0 3.0 (P=0.04) 1.0 2.8 17.4 0.001	-	No association between adult consumption of salted fish and NPC risk.
Yu <i>et al.</i> (1986) Hong Kong	250 cases from four hospitals in Hong Kong. 160 men and 90 women. Age < 35 years, mean age 29.2 years. Response rate 94%.	250 controls who were friends of the case. Matched on sex and age. Response rate n.a.	Salted fish <i>Adult consumption</i> Rarely Less than 1/weekly Less than daily Daily <i>Age 10 years</i> Rarely Less than 1/weekly >1/weekly	1.0 2.3 (1.5–3.5) 3.2 (1.7–6.1) 7.5 (0.9–65.3) 1.0 15.0 (6.0–37.2) 37.7 (14.1–100)	Other foods, domestic/occupational exposures to smoke, dust and fumes.	

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Yu <i>et al.</i> (1988) Guangxi Region, China	128 cases from eight hospitals in Yulin. 91 men and 37 women. Mean age 34.6 years. Mothers interviewed on diet in childhood.	174 population controls. 124 men and 50 women. Mean age 35.8 years. Mothers interviewed on diet in childhood.	Salted fish <i>During weaning</i> No Yes <i>At age 10 years</i> Rarely Monthly Weekly	1.0 2.6 (1.2–5.6) 1.0 1.5 (0.9–2.7) 1.5 (0.5–4.3)	Age and sex.	In total, 231 cases and 231 controls, but risk estimates based on cases/controls with mother's interview. Mothers consumption of salted fish during pregnancy and nursing also associated with increased risk of NPC.
Yu <i>et al.</i> (1989b) Guangzhou, China	306 cases from the Tumor Hospital, Sun Yat-Sen University. 209 men and 97 women. Age < 50 years. Mothers of 110 cases interviewed.	306 population controls selected from the patients neighbourhood. Matched on sex and age. Mothers of 139 controls interviewed.	Salted fish <i>During weaning</i> No Yes <i>At Age 10 years</i> Rarely Monthly Weekly Daily <i>Adult consumption</i> Rarely Monthly Weekly Daily	1.0 2.1 (1.2–3.6) 1.0 1.1 (0.7–1.9) 1.4 (0.9–2.2) 2.1 (1.2–3.6) 1.0 0.9 (0.6–1.4) 1.4 (0.9–2.1) 1.8 (0.9–3.6)	-	Mothers consumption of salted fish during pregnancy and nursing also associated with increased risk of NPC. Consumption during weaning reported by mothers; at 10 years and as adults (3 years ago) reported by subjects

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Ning <i>et al.</i> (1990) Tianjin, China	100 cases located from Tianjin Cancer Registry. 68 men and 32 women. Mean age 44.9 years. 98% response rate	300 controls randomly selected from the patients neighbourhood. Matched on age, sex and ethnicity. Mean age 45.2 years. Response rate 97%.	Salted fish <i>First exposure(age)</i> Never ≥21 years 11–20 years 1–10 years <i>At age 10 years</i> Never Yearly Monthly Weekly/Daily	1.0 1.5 (0.7–3.3) 1.9 (0.9–4.0) 2.6 (1.5–4.6) 1.0 1.6 (0.8–3.2) 3.5 (1.6–7.4) 6.7 (2.2–20.7)	-	Salted fish consumption at age 10 years remains a risk factor after adjustment for salted shrimp paste and carrot consumption.
Sriamporn <i>et al.</i> (1992) North-eastern Thailand	120 cases from Srinagarind Hospital, Khon Kaen. 81 men and 39 women. Mean age 47.2 years. 5 cases Chinese (4%).	120 controls recruited among patients with non-malignant and non-respiratory diseases. Matched on sex and age. Mean age 45.9 years.	<i>Fish consumption (adult)</i> Only fresh-water <i>Sea-salted fish</i> <1/week ≥1/week	1.0 1.5 (0.6–3.5) 2.5 (1.2–5.2)	Age, sex, alcohol intake, smoking, occupation, education and area of residence.	Fresh water fish is salted at home.. Sea-Salted fish is purchased from markets and is similar to Chinese-style salted fish.

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West <i>et al.</i> (1993) Phillipines	104 (76 men, 28 women) from Philippine General Hospital, 11-83 years. 7.7% of Chinese heritage. Pathologically confirmed, but histology not specified.	104 hospital controls matched by age, sex and hospital ward type (100% response rate). 101 community controls matched by sex, age and neighbourhood (77% response rate). All controls included in the results.	<i>Salted fish consumption</i> Low tertile Mid tertile High tertile	1.0 1.1 (0.6-2.3) 1.3 (0.7-2.6)	Consumption of processed meat, and fresh fish.	Salted fish grouped, not specified as Cantonese-style. Adult exposure only.

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Huang <i>et al.</i> (1993) Guangzhou, China	306 cases from hospitals in Guangzhou City during 1983-1985; 209 men and 97 women; aged ≤50 years. Pathologically confirmed.	306 population-based controls matched by sex, age and neighbourhood.	<i>Frequency of salted fish</i> Subjects' mother During nursing Seldom Every month Every week Every day Subjects Weaning No Yes 10 years old Seldom Every month Every week Every day 3 years prior Seldom Every month Every week Every day	1.0 0.8 (0.4-1.7) 1.1 (0.6-2.2) 2.3 (1.1-4.6) 1.0 2.1 (1.2-3.6) 1.0 1.3 (0.6-2.8) 1.1 (0.5-2.3) 2.4 (1.0-6.0) 1.0 0.9 (0.6-1.4) 1.4 (0.9-2.1) 1.8 (0.9-3.0)	Adjustment factors not mentioned	The subjects' mothers also were interviewed. No test for trends for reported.
Zheng <i>et al.</i> (1994a) Guangdong Province, China 1985-1989	205 (141 men and 64 women) from Guangdong Provincial Hospital, aged 55 or below. Response rate 88%. Histological confirmed.	205 controls selected from friends of the cases or an individual living in the area. Matched on sex and age. No data on response rates.	<i>Salted fish tough meat the last 7 years</i> Never/yearly Monthly Weekly/daily <i>Salted fish tough meat at age 10 years.</i> Never/yearly Monthly Weekly/daily	1.0 2.2 (1.4-3.6) 11.2 (4.6-32) 1.0 1.9 (1.1-3.3) 9.1 (5.1-16.4)	-	Similar associations for Salted fish soft meat (initially decomposed) and a variable combining all categories of salted fish consumption. Association stronger after adjustment for EBV IgA positivity and familial NPC history (162 cases included)

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Zheng <i>et al.</i> (1994b) Guangxi region, China	88 (64 men and 24 women) from Wuzhou Cancer Institute and NPC Institute of Zangwu. Mean age 41.6 years.	176 neighbourhood controls matched on sex, age and place of residence. Mean age 41.5 years.	Salted fish <i>During weaning</i> No Yes <i>Before the age of 2 years</i> Rarely Monthly and Weekly In rice porridge	1.0 2.4 (p=0.01) 1.0 1.4 (p=0.3) 3.6 (p=0.006)	Three factor sociodemographic score	Consumption of salted fish between the ages of 2 and 10 showed similar associations
Lee <i>et al.</i> (1994) Singapore	200 Chinese (145 men and 55 women) from Singapore General Hospital of 234 approached. 64% below 40 years.	406 Chinese patients with non-malignant conditions from Singapore General hospital of 439 approached.	Salted fish <i>During Infancy</i> Nil <1/month 1+/month <i>At age 10 years</i> Nil <1/month 1-3/month 1-3/week >3/week	1.0 2.1 (0.3-13.0) 1.2 (0.3-3.4) 1.0 0.7 (0.4-1.2) 0.7 (0.4-1.4) 0.6 (0.2-1.3) 0.8 (0.2-2.9)	Age at diagnosis, sex, maternal dialect group and education	Information on consumption during infancy available for only 62 cases and 100 controls. No increase in risk associated with adult salted fish consumption
Armstrong <i>et al.</i> (1998). Federal territory and Selangor, Malaysia	282 Chinese (195 men and 87 women) from 4 radiotherapy centres of 530 identified. Mean age 45.6 (men) and 44.6 years (women).	282 Chinese population controls matched on age, sex and residence history. Selected randomly by multistage area sampling. Overall refusal rate 10%. Mean age 45.1 (men) and 44.2 years (women).	Salted fish <i>Lifetime</i> No Yes <i>Recent</i> No Yes <i>Childhood</i> No Yes	1.0 1.7 (1.4-2.1) 1.0 2.1 (1.5-3.0) 1.0 1.4 (1.0-1.9)	A number of dietary indices, social class and ethnic subgroup	Indices of consumption developed. Multivariate modelling using estimated factor scores supported separate effects of salted foods. Salted fish increases risk in univariate analysis also.

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Zou <i>et al</i> (2000) Yangjiang, China	98 deceased NPC patients (83 men and 15 women) identified from 1987 to 1995	192 controls randomly selected from 4104 deaths matched on sex, years of birth and death, excluding malignant tumors and external causes.	Salted fish (<i>Univariate</i>) Buying <1/market Buying ≥1/market (<i>Multivariate</i>) Buying <1/market Buying ≥1/market A market was held three times every ten days.	1.0 3.6 (2.0–6.3) 1.0 3.2 (1.6–6.1)	The multivariate model not described.	This is a nested case-control study within a cohort established in 1987. 54% of cases histologically confirmed. Salted fish consumption derived from interviews with next of kin. Interviews could not be conducted for 1 case and 2 controls.
Ward <i>et al</i> (2000) Taipei, Taiwan	375 cases (99% response rate) from two hospitals in Taipei.	327 controls (88% response rate) selected from same township matched on gender and age.	Salted fish During <i>weaning</i> 0 grams/week >0 grams/week <i>Age 10 years</i> 0 grams/week >0 grams/week <i>Adult</i> 0 grams/week ≥5 grams/week	1.0 1.7 (0.6–5.1) 1.0 1.5 (0.8–2.8) 1.0 0.8 (0.5–1.2)	Age, gender, ethnicity	Mothers of 96 cases and 100 controls interviewed for consumption in infancy and childhood. For adult consumption, dietary analyses limited to 371 cases and 321 controls. Guangdong salted fish consumption rare, other salted fish more common.
Yuan <i>et al</i> (2000) Shanghai, China	935 cases of 1110 identified through the Shanghai Cancer Registry. 668 men and 267 women. Mean age 50 years.	1032 of 1070 randomly selected population controls matched on sex and age. Mean age 51 years.	Salted fish Less than monthly Monthly Weekly or more p for trend	1.0 1.2 (0.9–1.6) 1.8 (0.9–3.9) 0.07	Age, sex, education, smoking, kitchen fumes, occupational chemical fumes and chronic ear and nose conditions	Salted fish consumption rare (2% of cases and 1% controls ate salted fish at least once a week)

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Yang <i>et al</i> (2005) Taiwan	502 cases from families with two or more NPC affected members identified using a nationwide tumor registry and hospitals/clinics. Dietary information in 82%. Mean age 51.6 years.	1942 unaffected family members. Dietary information in 91%. Mean age 46.5 years.	Salted fish <i>At age <10 years</i> Never <1/weekly ≥1/weekly <i>Early age onset cases (<40 years)</i> Never <1/weekly ≥1/weekly <i>Late age onset cases (≥40 years)</i> Never <1/weekly ≥1/weekly	1.0 0.6 (0.3–1.4) 1.8 (0.8–3.9) 1.0 0.6 (0.3–1.6) 3.9 (1.5–10.6) 1.0 0.3 (0.1–1.5) 0.7 (0.1–3.3)	Age, sex, smoking, betel nut use, wood exposure	203 (42%) NPC cases deceased at time of interview and family members interviewed. 97% controls interviewed in person. Salted fish consumption available for 366 cases and 1636 controls. 93% of controls never consumed salted fish. Non-significant interaction between genetic risk and salted fish consumption in childhood (P=0.23).
Guo <i>et al</i> (2009) Guangxi and Gunagdong, China	1049 cases from Wuzhou Red Cross hospital and Cangwu Institute (82% prevalent). Response rates n.a. Mean age 45 years (8-77)	785 EBV-IgA positive controls from a EBV IgA screening conducted 2 years earlier matched on age, sex and district of residence. Response rates n.a. Mean age 47 years (20-84)	Salted fish Never <3 times/month ≥3 times/month	1.0 1.2 (0.8–1.8) 1.9 (1.0–3.5)	NPC family history, preserved meat smoking, exposure to wood fire, exposure to solvents.	Consumption at the time of the interview. 96.3% of NPC cases and all controls were EBV IgA positive.

Exposure assessment by interviewer-administered questionnaires