Table 2.2 Case–control studies of aflatoxin exposure and hepatocellular carcinomas measured by metabolic polymorphisms

Reference, study location and period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Odds ratio (95% CI)*	Adjustment for potential confounders	Comments
Sun et al. (2001) Taiwan.	79 HBsAg positive HCC cases (66 male, 3 female).	149 HBsAg positive subjects matched (1-2:1), 127 male, 27 female	Glutathione S-transferase (GST) M1 and T1 polymorphisms	HCC (155)	Aflatoxin-albumin adduct GSTM1 null GSTT1 null Among those with aflatoxin-albumin adduct detectable: GSTM1 null non-null GSTT1 null non null	47/75 26/69 30/67 16/24 25/41 19/29 20/34	2.0 (1.1–3.7). 0.4 (0.2-0.7) 0.5 (0.2-0.9) 2.8 (1.0-7.8) 1.8 (0.8-4.5) 3.7 (1.5-9.3) 0.9 (0.3-2.4)	Age, sex and residence	Study nested within a cancer screening cohort conducted in 7 townships in Taiwan. The interaction between serum AFB(1)-albumin adduct level and GSTT1 genotype was statistically significant ($P = 0.03$)
McGlynn et al. (2003). Haimen, China	231 HCC (male 187, mean age 55.8, female 44, mean age 59.3)	256 Controls matched on age, sex and township of residence to cases	Genetic polymorphisms in carcinogen-metabolizing enzymes.	HCC (155)	EPHX1 – exon 3 EPHX1 – exon 4 EPHX2 GSTA4 GSTM1 GSTT1	NA	1.6 (0.9-2.80) 1.1 (0.7-1.9) 2.1 (1.3-3.3) 0.8 (0.6-1.2) 0.8 (0.6-1.2) 0.9 (0.6-1.3)	Adjusted for multiple comparisons: 2.1 (1.1-3.1)	Study nested within a cohort established in a high-rate area for HCC. For males, OR for EPHX2 2.5 (1.4-4.4) and for GSTA4 1.6 (1.0-2.4)

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Kirk et al. (2005). The Gambia West Africa	216 incident cases of HCC ascertained at three tertiary hospital sites	408 controls without clinical evidence of liver disease and normal alpha-fetoprotein levels were recruited from outpatients	Genetic polymorphisms in carcinogen-metabolizing (GSTM1, GSTT1, HYL1*2) and DNA repair (XRCC1)	HCC (155)	GSTM1			Age, sex, recruitment site and date, ethnicity, socio-economic status, HBV and HCV status, and Tp53 status.	The Gambia is an endemic region for aflatoxin exposure. The risk for HCC with GSTM1 null was most prominent among those with the highest groundnut consumption (OR: 4.7; 95% CI: 1.4–15.1) and was not evident among those with less than the mean groundnut intake (OR: 0.6; 95% CI: 0.2–2.0). The OR among participants who had all three suspected aflatoxin-related high-risk genotypes [GSTM1 null, HLY1*2 (HY/HH), and XRCC1 (AG/GG)] was 14.7 (95% CI: 1.3–169).
					Present	105	1.0		
					Null	44	2.4 (1.2-5.0)		
					GSTT1				
					Present	79	1.0		
					Null	70	1.1 (0.6-2.0)		
					HYL1*2				
					YY	104	1.0		
					YH	36	1.3 (0.6-2.7)		
					HH	9	2.8 (0.8-10.4)		
					YH/H	45	1.5 (0.8-2.9)		
					XRCC1-399G				
					AA	120	1.0		
					AG	26	3.2 (1.4-7.5)		
					GG	3	0.5 (0.0-5.5)		
					AG/GG	29	2.7 (1.2-6.1)		