

**Table 2.3 Case-control studies of hepatocellular carcinoma and aflatoxin biomarkers of exposure**

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		
Omer et al. (2001). Sudan.	150 HCC patients age 21-70 from two regions of Sudan, referred to 5 hospitals in Khartoum, with diagnosis histologically verified in 95%.	205 community-based controls age 25-70 recruited in a ratio of 1:3 women to men from the two regions. Blood samples obtained from 119 of them.	Standardized questionnaire administered to cases in hospital and controls at home. Peanut butter consumption ascertained as surrogate for aflatoxin exposure.	HCC (155)	<i>Peanut butter consumption:</i>						
					In season:						
					< 3 times/week	76	1.0				
					≥3 times/week	70	2.7 (1.7-4.2)				
					Average consumption (g./month)						
					<70	22	1.0				
					71-150	25	1.3 (0.6-2.5)				
					151-300	36	1.7 (0.9-3.2)				
					>300	63	3.0 (1.6-5.5)				
					In those GSTM1 null:						
<70	NA	1.0									
71-150		2.8 (0.4-19.5)									
151-300		4.1 (0.7-25.5)									
>300		16.7 (2.7-104.8)									

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Omer et al. (2004). Sudan.	114 HCC patients from Omer et al (2001)	198 Controls from Omer et al (2001)	Standardized questionnaire administered to cases in hospital and controls at home. Peanut butter consumption as surrogate for aflatoxin exposure. HBSAg status determined by the National Health Virology Department	HCC (155)	<i>Average peanut butter consumption:</i> (g./month) In those HBV negative: <70 71-150 151-300 >300 In those HBV positive: <70 71-150 151-300 >300	8 11 16 30 6 10 10 23	1.0 1.9 (0.6-6.0) 2.7 (0.9-7.9) 5.1 (1.8-13.9) 32.2 (4.0-257) 46.5 (6.8-317) 35.0 (5.9-209) 41.5 (11.2-155)		Further analysis of data from Omer et al (2001)  Only 14 controls in all were HBV positive.  If a multiplicative model is assumed for interaction, approximately 60% of cases were computed to be attributable to aflatoxin exposure. With an additive assumption, the combined effect of aflatoxin exposure and HPV infection was 80%.
Liu et al. (2008). Guangxi, China	71 HCC, a subset of 561 patients from Guangxi hospitalized between December, 1998 and July, 2005, confirmed by pathology.	695 healthy subjects (530 males, 165 females, age 36.6 ± 15.6 yrs) recruited from three regions of PR China.	Aflatoxin albumin adducts in serum and protein carbonyl oxidative stress marker.	HCC (155)	Aflatoxin albumin adducts.				Plasma level of AFB1-albumin-adducts (AAA) and protein carbonyl content (PCC) were significantly higher in the 71 HCC cases than in any of four age/sex matched HBV sero-status control sub-groups ( $P < 0.001$ ).