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Alcohol Consumption and Breast Cancer: A Cross-National Correlation Study

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Schatzkin A (National Cancer Institute, National Institutes of Health, Bethesda, Maryland 20892, USA), Piantadosi S, Miccozzi M and Bartee D. Alcohol consumption and breast cancer: a cross-national correlation study. *International Journal of Epidemiology* 1989, **18**: 28–31.
The authors examined the cross-national correlation of alcohol consumption (based on food availability data) and breast cancer. Weighted correlation coefficients for alcohol and breast cancer were 0.31 for mortality and 0.65 for incidence; the corresponding unweighted coefficients were 0.50 and 0.45. Correlation coefficients for fat consumption and breast cancer ranged from 0.69–0.89. After adjustment for fat consumption in multiple regression models, the positive alcohol-breast cancer association disappeared, while the fat-breast cancer correlation remained positive and strong. These findings do not support the positive alcohol-breast cancer association that has been suggested by analytical epidemiological studies. The multivariate results, however, should be interpreted with caution due to the potential variation in the extent to which national alcohol data reflect consumption among females.

Evidence in support of the alcohol-breast cancer hypothesis has been mounting. Four cohort studies of this question have shown an elevation in breast cancer risk of between 50 and 100% with moderate alcohol consumption.[1–4] Similar findings have emerged from several (though not all) case-control studies of alcohol and breast cancer.[5–17]

One inconsistency in the evidence on this issue is the lack of a positive correlation between alcohol and breast cancer in earlier cross-national studies. These studies, however, were restricted to 13 European countries plus Australia.[18,19]

In an attempt to resolve this apparent discordance between ecological and individual-level studies, we investigated the association between alcohol and breast cancer in a cross-national study among a larger and more diverse group of countries.

METHODS

Data on alcohol (calories per caput per day) were obtained for 1977 from the Food Balance Sheets of the United Nations Food and Agricultural Organization (FAO).[20] In order to adjust for the well-known cross-national correlation between fat intake and breast cancer,[21] we also obtained information on fat (grams per caput per day and as a percentage of total daily energy intake) from the FAO data base. These FAO data reflect the availability of food (including alcoholic beverages) for human consumption, and are therefore only indirect measures of actual human intake.

We also obtained country-specific alcohol intake data (in litres per capita of absolute alcohol, for 1976) from an independent source.[22] Because the alcohol data from the two data sources were highly correlated, and the correlation results were not materially affected by the choice of alcohol data, we will present only those results based on the FAO data (Table 1).

In an attempt to control for other potentially confounding ecological variables, we obtained country-specific information on protein and total caloric intake from the FAO data base, and on infant mortality, gross national product, life expectancy, average age of menarche, and fertility from readily available sources.[23]

Breast cancer mortality figures for 1978–79, age-adjusted to the 1950 world population, were obtained from the monograph by Kurihara, Aoki, and Tominaga.[24] Data on breast cancer incidence were taken from the publication, *Cancer Incidence in Five Continents*, from the International Agency for Research on Cancer.[25] These incidence data were based on reports from national or regional cancer registries. In the few cases where data from more than one registry within the same country were available, we selected figures from larger registries, those reporting more cases; rates tended to be similar when there was more than one 'large' registry within the same country. For

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TABLE 1 *Alcohol and fat consumption data with figures for incidence and mortality from breast cancer for various countries**

Country	Population	Alcohol	Fat	Mortality	Incidence
Agentina	26.1	236	115.1	20.5	—
Australia	14.1	179	130.2	18.9	53.2
Austria	7.5	247	165.7	18.7	—
Belgium	9.8	241	175.3	25.5	—
Brazil	112.0	45	50.9	—	56.2
Bulgaria	8.8	171	103.9	13.3	—
Canada	23.3	143	150.3	22.8	63.2
Chile	10.7	119	55.8	11.4	—
China	865.0	43	38.9	—	19.6
Colombia	25.1	44	47.1	—	33.2
Costa Rica	2.1	36	62.9	8.1	—
Cuba	9.5	46	54.2	14.5	28.5
Czechoslovakia	15.0	279	127.7	—	30.3
Denmark	5.1	228	161.0	24.7	58.8
Finland	4.7	146	133.1	14.9	40.1
France	53.1	284	144.6	18.1	54.5
Germany (East)	16.8	273	151.3	—	37.4
Germany (West)	61.4	320	158.1	20.5	55.7
Great Britain	55.9	199	141.2	27.7	58.4
Greece	9.2	86	131.7	13.8	—
Guatemala	6.4	28	37.7	2.2	—
Hong Kong	4.4	52	104.1	9.0	31.1
Hungary	10.7	248	135.5	19.9	29.2
India**	626.0	10	30.0	—	21.2
Ireland	3.2	164	137.2	26.5	—
Israel	3.6	57	112.6	23.2	59.9
Italy	56.5	273	120.6	18.5	57.6
Jamaica	2.1	56	64.3	—	39.0
Japan	114.0	145	74.1	5.2	17.5
Netherlands	13.9	188	158.8	25.8	—
New Zealand	3.1	182	139.3	24.4	62.6
Norway	4.0	91	144.8	19.1	49.6
Paraguay	2.8	54	74.4	11.8	—
Poland	—	103	123.4	18.0	36.5
Portugal	9.7	210	112.4	14.5	—
Romania	21.5	122	88.4	12.0	30.1
Senegal	5.1	7	58.2	—	11.8
Singapore	2.3	34	76.8	13.2	21.9
Spain	36.4	204	127.2	13.2	36.5
Sweden	8.3	164	143.0	18.1	55.2
Switzerland	6.3	217	160.3	23.8	76.1
Uruguay	2.8	74	106.0	23.7	—
US	217.0	175	165.9	26.5	77.9
USSR	259.0	105	101.5	—	17.0
Venezuela	12.7	86	64.3	9.5	—
Yugoslavia	21.7	138	90.0	12.2	34.2

* Population is in millions, alcohol in calories per caput per day (with 7.1 calories per gram of ethanol), and fat in grams per caput per day. Mortality and incidence are per 100 000 population.

** Data on alcohol consumption were not available in the FAO data base. Other sources, including,[22] indicate that the average alcohol intake in India is extremely low. We have arbitrarily chosen a figure of 10 (calories per caput per year) for India. The correlation results were essentially unaffected by using even smaller figures.

the US, SEER data for 1978–81 for all registries combined (except Puerto Rico) were used. These data were supplemented with data from the Soviet Union from a separate monograph.[26]

Pearson product-moment correlation coefficients and partial correlation coefficients were calculated using standard statistical software.[27,28] (The partial correlation coefficients can also be estimated by performing two regressions, breast cancer on alcohol and alcohol on fat, and then regressing the residuals of the first regression on those from the second.) Because the precision of estimated rates depends on the sample size, both unweighted and weighted correlations were calculated, with national populations serving as the weights. Approximate 95% confidence intervals and significance levels for the correlation coefficients were calculated by comparing $r\sqrt{n-2}/\sqrt{1-r^2}$ to the t-distribution with n−2 degrees of freedom.[29]

RESULTS

Bivariate correlation coefficients for alcohol and age-adjusted breast cancer rates ranged from 0.31–0.65 (Table 2, Figures 1 and 2). A strong correlation between fat intake and age-adjusted breast cancer rates was observed, with bivariate r-values ranging from 0.69–0.89.

After adjustment for fat intake, no association between alcohol and breast cancer was seen with coefficients ranging from −0.12 to −0.30. Partial correlation coefficients for fat intake, after adjustment for alcohol, were relatively unaffected, with a range of 0.60 to 0.89.

Results were not materially influenced by the substitution of fat as a percentage of total daily energy intake for fat in grams per day.

The partial correlations were essentially unchanged after adjustment in multivariate models for protein and

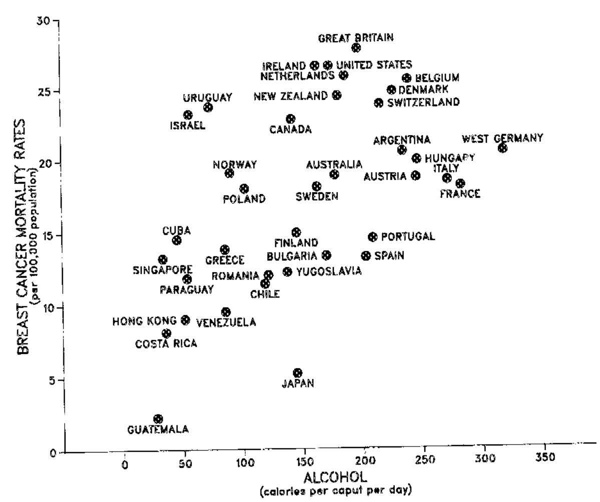

FIGURE 1 *Relation between breast cancer mortality rates (per 100 000 population, adjusted only for age) and alcohol (calories per caput per day) for various countries.*

TABLE 2 *Cross-national Pearson correlations for alcohol and breast cancer*

	Unweighted			Weighted*		
	r	95% CI	p	r	95% CI	p
MORTALITY (n = 37)						
alcohol	0.50	0.21–0.71	0.0015	0.31	−0.02–0.58	0.059
alcohol adj for fat	−0.12	−0.43–0.21	0.476	−0.30	−0.57–0.03	0.102
fat	0.80	0.64–0.89	<0.0001	0.89	0.80–0.94	<0.0001
fat adj for alcohol	0.73	0.53–0.93	<0.0001	0.89	0.80–0.94	<0.0001
INCIDENCE (n = 32)						
alcohol	0.45	0.12–0.69	0.0091	0.65	0.39–0.81	<0.0001
alcohol adj for fat	−0.17	−0.49–0.19	0.347	−0.19	−0.50–0.18	0.329
fat	0.69	0.45–0.84	0.0001	0.78	0.59–0.89	<0.0001
fat adj for alcohol	0.60	0.32–0.78	0.0004	0.60	0.39–0.81	<0.0001

* weight = population of country.
The correlations of alcohol and fat in the mortality data set were 0.48 (0.18–0.70) (unweighted) and 0.48 (0.18–0.70) (weighted).
The correlations of alcohol and fat in the incidence data set were 0.77 (0.58–0.88) (unweighted) and 0.89 (0.78–0.95) (weighted).

total caloric intake, infant mortality, gross national product, life expectancy, average age of menarche, and fertility.

DISCUSSION

In this cross-national study of alcohol and breast cancer, we found a positive correlation between alcohol and breast cancer that disappeared (and even became slightly negative) after adjusting for fat. The ecological association between fat and breast cancer, though, was largely uninfluenced by adjustment for alcohol (or other risk factors). These findings were similar for analyses of both breast cancer mortality and incidence. It thus appears that for these ecological data the positive bivariate association between alcohol and breast cancer can be explained simply on the basis of the covariation of alcohol with fat.

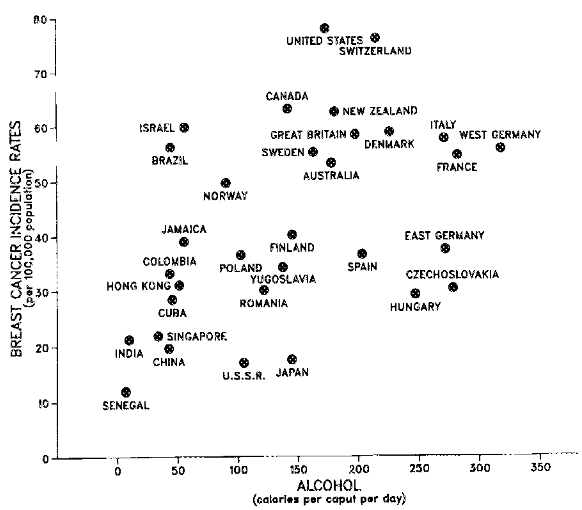

FIGURE 2 *Relation between breast cancer incidence rates (per 100 000 population, adjusted only for age) and alcohol (calories per caput per day) for various countries.*

These data seem to provide support in favour of the breast cancer and dietary fat association and evidence against the role of alcohol in contributing to breast cancer. Two factors must be considered, however, in drawing inferences from this evidence. First, the ecological or aggregated nature of these data do not permit a direct interpretation of effect at the individual level.[30] Second, it is likely that certain variables are subject to non-random measurement error, which could make interpretation of the multivariate correlations problematic. For example, alcohol may be consumed predominantly by men in certain countries, while consumption may be more balanced between the sexes in other countries. If dietary fat behaved differently (for example, were equal for men and women in all countries), the error term for alcohol could be correlated with the fat variable (and with the alcohol variable itself). This non-independence of variables and the error term could distort the group-level estimates substantially.[31] Correlations based on the inclusion of alcohol and fat in the same statistical model therefore should be viewed with considerable caution.

Thus, although we conclude that these cross-national data do not support the individual-level studies linking alcohol and breast cancer, the evidence cannot be judged contradictory until more precise analyses are carried out. The cross-national correlation of breast cancer with alcohol consumption among only women would be of particular interest.

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	p
	0.059
	0.102
	<0.0001
	<0.0001
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