A community study of calorie and nutrient intake in drinkers and nondrinkers of alcohol[1-3]

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ABSTRACT Nutrient intake and alcohol consumption were studied in a 15% random sample of a predominately white upper-middle class suburban community in Southern California. Based on 24-h dietary recall, 51% of the 691 men and women aged 30 to 90 yr in the study population had consumed an average of 30 g of alcohol during the preceding 24 h. In general, alcohol-derived calories were added to the diet, and did not replace calories derived from other nutrients. Consequently, alcohol consumers had a significantly higher total caloric intake than did nondrinkers. Dietary differences were greatest in moderate drinkers, who tended to consume fewer nonalcohol-derived calories, and less of most specific nutrients. Although dietary differences in moderate drinkers were similar in men and women, statistically significant differences in women were limited to carbohydrate consumption. Moderate drinking men consumed significantly less protein, fat, carbohydrate, and cholesterol. These dietary differences suggest one mechanism whereby moderate alcohol consumption might reduce the risk of coronary heart disease. Although alcohol intake resulted in an increase in total calories consumed, alcohol drinkers were not more obese than nondrinkers. Since similar proportions of drinkers and nondrinkers exercised regularly, these data may suggest that alcohol calories are not fully utilized. *Am J Clin Nutr* 1982;35:135–139.

KEY WORDS Alcohol consumption, dietary intake, heart disease, population studies

Introduction

Several epidemiological studies have reported a negative correlation between coronary heart disease (CHD) and moderate alcohol consumption (1–11). One possible explanation for the apparent protective effect of alcohol would be quantitative or qualitative differences in nutrient intake according to alcohol usage. Although alcoholics, who often derive as much as 50% of their total caloric intake from alcohol, are known to have diets which differ from the normal population (12, 13), little work has been done to examine the nutrient intake of moderate or social drinkers of alcohol.

We report here total and specific caloric and nutrient intake according to alcohol usage in a population-based sample.

Methods

As part of a national Lipid Research Clinics Program, 82% of residents in a geographically defined suburban community in Southern California participated in a sur-

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[2] Supported by the National Institutes of Health, Contract NIH-NHLBI-HV-1-2160-L.

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Received April 10, 1981.

Accepted for publication July 2, 1981.

vey for heart disease risk factors. Respondents were representative of the total community with regard to age and sex (14), and were predominately white and upper-middle class as defined by Hollingshead codes 1-3 for occupation of head of household. A 15% random sample of this cohort was invited back for a second and more extensive evaluation including a 24-h diet recall; 90% participated and form the basis of this report.

Height and weight were measured in light clothing without shoes. Obesity was estimated by body mass index (weight/height^2 × 100). Regular exercise and current cigarette smoking were determined by standardized interview. A 24-h diet recall was obtained from each participant by one of three trained and certified Lipid Research Clinic dietitians who used standardized forms developed by the Lipid Research Clinic Program. Dietetic models and containers of varying sizes were used to assess the quantity of each food and beverage consumed. Based on a subjective assessment of memory and diet credibility, dietitians judged the 24-h dietary recall to be reliable in 98% of subjects, and all recalls are used in this analysis. Interviews were conducted in the morning, evenly distributed over all days of the week, except Sunday. Nutrient and alcohol intake were determined for the 24 h before a 12-h fast, therefore no recalls related to Friday evening or Saturday daytime intake were obtained. Data on estimated weekly alcohol intake were obtained at the same visit in a separate interview by another interviewer who was not a dietitian.

Specific foods and beverages were classified by caloric, protein, carbohydrate, and fat composition by specially trained nutrition coders using standardized tables according to the NHLBI protocol (15). Agricultural Handbook nos. 8 and 456 (16, 17), Bowes and Church (18) and NHLBI Mixed Drink and Recipe Calculations were used for the nutrient and alcohol data base. The amount of pure ethanol consumed was calculated both as grams and as calories, with calories calculated at 7 cal/g of ethanol.

For analysis, the population was divided into nondrinkers (those who had consumed no alcohol in the preceding 24 h) and drinkers. Drinkers were trichotomized into low (1 to 24 g), moderate (25 to 49 g), and heavy (50+ g) consumers, on the basis of their alcohol intake in the preceding 24 h. Statistically significant ($p < 0.05$) differences between moderate drinkers and all other groups were tested by Student's t test or χ^2 analysis.

Results

There were 315 men and 376 women ages 30 to 90 yr in the population sample. As shown in **Table 1**, 58% of men and 44% of women had consumed alcohol during the preceding 24 h. For both men and women, the 50- to 69-yr age group had the highest percentage of persons that used alcohol. Alcohol consumption varied by sex with fewer heavy drinking women as compared to men. Although the sample sizes were small, alcohol consumption also appeared to vary with age, with fewer drinkers of any amount among the oldest women and fewer heavy drinkers among the oldest men.

Of the subjects 90% rated their 24-h intake as representative of their usual diet. This was certainly true for alcohol intake where the reported 24-h alcohol intake, as determined by the dietitian's interview, was highly correlated (r = 0.6) with the reported weekly alcohol intake obtained in a separate interview by a nondietitian. Women consumed fewer calories overall than men; therefore, as shown in **Table 2**, women in each drinking category derived a higher proportion of total

TABLE 1
Alcohol usage patterns by age and sex in an adult community

Age	Nondrinkers	0–24 g	25–49 g	50+ g
Men				
30–49	41 (51%)	15 (18%)	13 (16%)	12 (15%)
50–69	46 (32%)	30 (21%)	44 (31%)	22 (16%)
70–89	45 (49%)	19 (21%)	23 (25%)	5 (5%)
Total	132 (42%)	64 (21%)	80 (25%)	39 (12%)
Women				
30–49	59 (63%)	20 (21%)	10 (11%)	5 (5%)
50–69	95 (47%)	52 (25%)	44 (22%)	13 (6%)
70–89	55 (70%)	10 (13%)	7 (9%)	6 (8%)
Total	209 (56%)	82 (22%)	61 (16%)	24 (6%)

TABLE 2
Percentage of calories derived from alcohol and from specific nutrients according to alcohol usage

	Non-drinkers	Drinkers		
		0–24 g	25–49 g	50+ g
Men				
Percentage of total calories from alcohol	0	5.0	12.8	20.5
Percentage of nonalcohol derived calories from:				
Protein	16.6	17.1	17.2	17.3
Total fat	41.1	40.9	40.1	42.5
Saturated fat	15.0	14.8	14.3	15.4
Polyunsaturated fat	7.3	7.4	7.6	6.9
Total carbohydrates	42.3	41.8	42.5	40.0
Women				
Percentage of total calories from alcohol	0	6.3	15.4	25.1
Percentage of nonalcohol derived calories from:				
Protein	16.5	17.0	18.6	16.7
Total fat	39.3	41.8	42.9	43.7
Saturated fat	14.3	15.5	15.0	15.5
Polyunsaturated fat	7.0	7.2	8.5	7.8
Total carbohydrates	44.2	40.9	38.2	39.4

calories from alcohol than men. The proportion of nonalcohol calories derived from specific nutrients was similar in men and women.

Total caloric and nutrient specific caloric intake according to alcohol usage is shown in **Table 3**. In both men and women total caloric intake was significantly greater among alcohol consumption groups ($p < 0.001$). Nonalcohol-derived calories were lowest in moderate drinkers, although the differences were statistically significant only for men. Moderate drinking men consumed significantly less protein, total, saturated and monounsaturated fat, cholesterol, and carbohydrate than other men. Moderate drinking men also showed a higher P:S ratio, but this difference was not statistically significant. A similar pattern was observed in women, although only carbohydrate intake differed significantly.

Table 4 shows the distribution of age, obesity, exercise, and cigarette smoking according to alcohol usage in men and women. In

TABLE 4
Average age, obesity index, cigarette smoking, and regular exercise according to alcohol usage

	Non-drinkers	Drinkers		
		0–24 g	25–49 g	50+ g
Men				
Age	58.6	60.1	61.9*	56.1
Obesity index	3.70	3.70	3.64	3.63
Percent cigarette smokers	20	19	19	15
No. cigarettes/day	3.9	5.5	4.2	4.8
Percent with regular exercise	22	17	9*	19
Women				
Age	59.1	58.3	57.9	58.2
Obesity index	3.46	3.35	3.25†	3.24
Percent cigarette smokers	20	24	36*	33
No. cigarettes/day	3.1	2.9	9.4	7.5
Percent with regular exercise	9	10	10	8

* $p < 0.05$, †$p < 0.01$, comparing moderate drinkers with all other groups combined.

TABLE 3
Average total and nutrient-specific calorie intake according to alcohol usage pattern

	Nondrinkers		Drinkers					
			0–24 g		25–49 g		50+ g	
Men								
Total calories	2100	(±730)*	2280	(±720)	2140	(±550)	2730	(±870)
(− alcohol calories)	2100	(±730)	2170	(±720)	1880†	(±550)	2190	(±800)
Protein (g)	85.0	(±34.1)	89.5	(±29.2)	78.9‡	(±25.6)	92.4	(±35.8)
Total fat (g)	96.0	(±39.0)	101.6	(±45.7)	84.1†	(±30.0)	103.2	(±41.3)
Polyunsaturated (g)	16.6	(±9.1)	18.6	(±11.1)	16.1	(±9.9)	16.9	(±8.8)
Saturated (g)	35.5	(±16.6)	36.6	(±17.3)	29.9†	(±11.3)	37.6	(±16.3)
Monounsaturated (g)	36.8	(±16.9)	39.1	(±19.5)	32.1†	(±13.0)	41.2	(±17.8)
Total carbohydrates (g)	223.2	(±95.2)	224.5	(±83.3)	201.9‡	(±77.1)	223.6	(±102.3)
Sucrose (g) (table sugar)	39.4	(±38.0)	41.4	(±33.8)	32.7‡	(±31.5)	40.9	(±40.4)
Starch (g)	92.4	(±40.6)	93.6	(±41.9)	83.1	(±38.7)	83.7	(±40.2)
Other carbohydrates	87.9	(±53.1)	85.3	(±44.5)	82.7	(±41.9)	95.6	(±48.3)
Cholesterol (mg)	429	(±264)	410	(±260)	344†	(±196)	420	(±294)
P:S ratio	0.53	(±0.36)	0.56	(±0.32)	0.60	(±0.46)	0.48	(±0.23)
Women								
Total calories	1600	(±600)	1700	(±490)	1770	(±520)	2280	(±640)
(− alcohol calories)	1600	(±600)	1600	(±490)	1520	(±520)	1770	(±530)
Protein (g)	62.7	(±21.9)	66.3	(±23.8)	69.5	(±26.1)	73.8	(±31.0)
Total fat (g)	72.5	(±37.5)	76.0	(±31.1)	72.6	(±30.0)	88.5	(±39.4)
Polyunsaturated (g)	12.7	(±7.7)	12.8	(±6.2)	14.4	(±8.8)	16.2	(±9.5)
Saturated (g)	26.5	(±14.7)	28.4	(±13.0)	25.7	(±11.2)	31.2	(±15.5)
Monounsaturated (g)	28.1	(±17.0)	29.1	(±13.1)	26.8	(±11.6)	34.8	(±16.8)
Total carbohydrates (g)	173.5	(±71.0)	162.9	(±58.3)	146.4†	(±64.8)	167.6	(±47.3)
Sucrose (g) (table sugar)	32.2	(±36.3)	28.9	(±28.1)	22.4‡	(±24.0)	28.8	(±19.0)
Starch (g)	66.2	(±32.0)	62.5	(±28.7)	61.2	(±31.8)	69.4	(±31.8)
Other carbohydrates	71.8	(±38.7)	68.4	(±28.3)	59.7‡	(±32.9)	66.1	(±30.1)
Cholesterol	281	(±182)	345	(±229)	324	(±210)	343	(±211)
P:S ratio	0.55	(±.37)	0.49	(±0.25)	0.60	(±0.31)	0.56	(±0.35)

* Mean ± SD. †$p < 0.01$, ‡$p < 0.05$, comparing moderate drinkers with all other groups combined.

both men and women moderate and heavy drinkers were leaner than abstainers or light drinkers, although differences by alcohol usage were statistically significant only for women. No consistent pattern of cigarette smoking according to alcohol usage was observed in men, but significantly more moderate drinking women smoked cigarettes. Significantly fewer moderate drinking men reported exercising regularly. Only 10% of women reported regular exercise, and this did not differ significantly with alcohol usage. Because energy expenditure in the form of reported exercise did not increase with increasing alcohol usage, increments in obesity would be expected in relation to increasing caloric intake in drinkers. However, as shown in Table 4, the obesity index did not increase as alcohol consumption increased in this population.

Discussion

At least three prospective studies, Framingham, the Kaiser-Permanente Study, and the Honolulu Heart Study have shown that the risk of myocardial infarction is lower in moderate drinking men than in nondrinkers (2–4). Three recent case control studies, including one of women, support an inverse association of CHD with moderate alcohol intake (5, 11, 19). A comparison of heart disease mortality between countries also suggests a protective effect of alcohol (8).

The biological basis for this putative protective effect of alcohol is unknown, but could be related to the higher levels of high-density lipoprotein-cholesterol, a protective factor for CHD, reported in drinkers (20, 21) or to alcohol-induced altered platelet aggregation (22). Less direct pathways whereby alcohol might prevent CHD include the possibility that alcohol drinking reduces stress or alters personality patterns associated with risk of CHD, that life changes or events alter drinking patterns and the risk of CHD, or that alcohol consumption is associated with changes in diet that thereby reduce the risk of CHD.

Studies of diet and alcohol are complicated by the problems of measuring dietary and alcohol intake. Limitations of cross-sectional studies and of historical recalls to assess diet and alcohol intake are well known. At present a 24-h diet recall is the most efficient method for determining nutrient intake in population samples (23, 24). In this upper-middle class population, where over 90% of individuals reported that their 24-h intake was typical of their usual daily intake, dietary recall should have been as accurate as the methodology permits. (Alcohol intake was not the focus of this research during the data gathering phase; whether this lack of emphasis on alcohol resulted in lesser or greater validity with regard to reported alcohol usage is unknown.) This population was relatively affluent, and food buying power was not restricted by alcohol purchases. The levels of nutrient intake are similar to those reported elsewhere in persons of upper socioeconomic status (25, 26).

Subjects considered to be nondrinkers in this study may not be abstainers, but may be irregular or weekend drinkers whose alcohol intake was missed by the 24-h diet recall methodology. Nevertheless, reported 24-h alcohol intake was highly correlated with reported weekly intake in this population. Also, the proportion of drinkers and the amount of alcohol intake reported by this population are comparable to that reported elsewhere (25–28). The finding that alcohol users add calories to a basic diet agrees with small studies of executives, multiple sclerosis patients, and French miners (27, 29). In these populations proportional intake of carbohydrate and fat also decreased with alcohol consumption, but percentages were based on total calories including those derived from alcohol. Clearly, when alcohol-derived calories are additive rather than replacement calories, this method of analysis automatically results in a reduction in percentage calories derived from nonalcoholic sources. More intriguing is the observation reported here of a reduction in the absolute amount of specific nutrients in moderate drinkers.

Further studies will be required to determine whether the observed differences in nutrient intake explain any of the apparent protection from CHD afforded by moderate alcohol intake. Because high fat diets or high carbohydrate diets are associated with high rate of CHD in cross-cultural comparisons (30, 31), and in some prospective studies (9, 32), the smaller quantity of these nutrients consumed by moderate drinkers is provocative.

The observation that added alcohol-derived calories are not associated with increasing obesity may represent self-selection of drinkers, errors in alcohol, diet, or exercise history, or other unknown biases. Alternatively, alcohol may interfere with the absorption of other nutrients (33), induce metabolic energy wastage (34), or be associated with unexplored behavioral differences that increase energy expenditure.

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